CHANGING PRIORITIES

3rd VIBRARCH

NOVEMBER 9-11, 2022

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INTRODUCTION

CHANGING PRIORITIES

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The 2010s constituted a fruitful decade for architectural research. From one hand, it was undoubtedly the time when almost all institutions devoted to the teaching of architecture managed to mobilize a fair percentage of their teaching staff in terms of research. Only a few decades ago, the number of schools, faculties, and departments of architecture with significant research activity was scarce and located primarily in North America, Western Europe and the British Isles, and Japan. But with the turn of the century, the commitment to research became more widespread and more fruitful. On the other hand, this flourishing of research activity also led to the emergence of a new generation of relevant topics which entered the scene to meet the traditional ones, gradually enough so as to be tackled by this growing community of academics and practitioners.

The consequences of the intense activity of the planet's growing population began to be unquestionably felt in the second half of the 20th century. Cultural landmarks such as the photograph "The Blue Marble" (fig. 1), taken on December 7, 1972, by the Apollo 17 crew on their way to the Moon when the spacecraft was 29,000 kilometers from Earth, constituted the foundations of the progressive collective awareness of the fragility of our planet. Public awareness in economically developed regions all over the world of the subsequent climate change would irrupt in the late 1980s. However, the unprecedented increase of social concern on this matter turning it into apparently the most imperative priority would not arrive until the end of the 2010s. Society, led by the youth, began to take to the streets demanding a paradigm shift to avoid what was already considered a climate crisis or, at the very least, minimize its most serious consequences. And this concern soon reached the institutions engaged in architectural research, which addressed it from multiple points of view, both analytical and proactive.

Figure 1. The Earth seen from Apollo 17 on December 7, 1972, also known as "The Blue Marble"

But on January 30, 2020, everything changed abruptly. The World Health Organization declared the coronavirus disease 2019 a public health emergency of international concern on January 30, 2020, and a pandemic just forty days later (fig. 2). During more than two years almost all the countries on the planet have devoted their efforts and most of its resources to control the malady and to overcome the frequent and meaningful consequences of the necessary isolation and even lockdowns on the economy. Architectural researchers have not been insensitive to this emergency and many have adapted their agenda in order to be helpful.

Figure 2. Tedros Adhanom Ghebreyesus, the World Health Organization's Director-General, declares the coronavirus disease 2019 a pandemic on March 11, 2020. (Source: New York Times)

By January 2022, the pandemic was in clear remission, its effects were increasingly under control, and daily life had returned to the previous normal in almost all countries of the world. There was nothing to suggest that the world was about to face another critical situation with global consequences. Unfortunately, the history of mankind has always had war conflicts going on. But the Russian invasion of Ukraine came as a real shock to world public opinion (fig. 3) because of the speed and forcefulness with which it unfolded at the beginning and because of the harshness of the images that television stations around the world broadcast. Concern about this conflict extends to all segments of society and that obviously includes those involved in research on architecture. A new script change in less than two years, a new priority to direct our attention to, because when the conflict is over there will be a whole country almost completely destroyed.

Has the world ever changed so rapidly? What is undeniable is that while still necessarily devoting our attention to those matters which became indispensable to us previous to these unexpected events such as poverty and migration, commonwealth and right to progress, feminism and inclusivity, interculturality and multiculturality, childhood and elderly, affordable housing and right to the city; and having rediscovered the need for combining these commendable ambitions with the rational use of raw materials and energy sources, and the adequate management of the built environment in order to make a feasible tomorrow for our planet; researchers on architecture have assumed our responsibility in assisting humanity to overcome the sanitary crisis and must be prompt to rebuild a whole country. While we were involved in participating in the universalization of the multiple derivatives that the right to happiness and to a dignified and satisfactory life entail, we are forced to dedicate a greater or lesser part of our efforts to making life itself possible.

Figure 3. Protest against the Russian invasion of Ukraine in Helsinki, Finland, on February 26, 2022

As a result, research on architecture must focus on a variety of topics whose priority has proved to be changeable depending on the geographical, economical, and temporary context. Indeed, current research on architecture seldom has a unique and linear approach to a single matter. On the contrary, multidisciplinary approaches for multipurpose goals are becoming more and more frequent. This trend is providing research on architecture with a noticeable resiliency and capability to adapt itself to changing scenarios and to develop aptitudes and proposals for immediately combating unexpected situations.

Paradoxically, all the skills we acquire to face the new situations of this time of change, will provide us with the best capabilities to face these changing priorities that force us to constantly rearrange our agendas.
The third edition of the Valencia International Biennial of Research in Architecture welcomed keynote speakers and papers on developing initiatives, ongoing activities and findings which made architecture and neighboring disciplines research adaptable, resilient, and essential for a variety of changing scenarios, especially for those matters with a current or imminent relevance. When the call for the conference was disseminated, the conflict in Eastern Europe had not begun yet. But it is undoubted that the capabilities of research in architecture for confronting a diversity of changing scenarios are the adequate ones for confronting this one as well. Hosted at the Higher Technical School of Architecture, the event took place from 9 to 11 November 2022 (fig. 4).

Figure 4. Corporate image of the 3rd Valencia International Biennial of Research in Architecture when the call for papers was formalized on February 22, 2022.

The organization committee agreed that in order to warrant a good present a better future for people around the planet and to safe the care of the Earth itself, research in architecture had to release all its potential. Therefore, the aims of the 3rd Valencia International Biennial of Research in Architecture were:

- To focus on the most relevant needs of humanity and the planet and what architectural research can do for solving them.
- To assess the evolution of architectural research in traditionally matters of interest and the current state of these popular and widespread topics.
- To deepen in the current state and findings of architectural research on subjects akin to post-capitalism and frequently related to equal opportunities and the universal right to personal development and happiness.
- To showcase all kinds of research related to the new and holistic concept of sustainability and to climate emergency.
- To place in the spotlight those ongoing works or available proposals developed by architectural researchers in order to combat the effects of the COVID-19 pandemic.
- To underline the capacity of architectural research to develop resiliency and abilities to adapt itself to changing priorities.
- To highlight architecture's multidisciplinarity as a melting pot of multiple approaches, points of view and expertise.
- To open new perspectives for architectural research by promoting the development of multidisciplinary and inter-university networks and research groups.

For all that, the 3rd Valencia International Biennial of Research in Architecture was open not only to architects, but also for any academic, practitioner, professional or student with a determination to develop research in architecture or neighboring fields. The event encouraged the submission of papers concerning up to nine thematic

areas aiming to accommodate as many approaches as possible.
"Representation and quantifying" was the first thematic area or block. Graphic expression has proved itself as both a stimulating and fruitful field for architectural research and experimentation along with many other neighboring disciplines. Frequently used as a means for documenting and transferring information integrated in more complex processes, graphic words have occasionally become final results themselves and even cult objects. Quantifying and databases might play a similar role when it comes to portray situations and processes (fig. 5). In both cases, drawings and numbers are not just indispensable and inspiring tools, but also genuine reflections of our interests and occasionally, premonitory foresights of our aspirations. This thematic area welcomed papers from different fields of graphic expression and data gathering and processing which focused on the changeable priorities of architectural research nowadays.

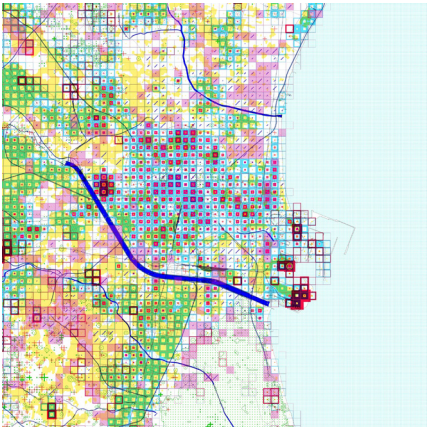

Figure 5. Urban expansion, population growth and forest gain for Valencia, Spain, during the last 45 years by 300.000 km/s Studio

The second thematic area or block was devoted to "City, territory and landscape". With their own internal and external dynamics and with their different scales, city, territory, and landscape constitute exciting scenarios to start work on from multidisciplinary and interdisciplinary points of view. Among these contexts, urban fabrics and public space constitute a base for research from morphological, functional, social, and environmental perspectives. This thematic area encompassed papers on the geographic field of the city, the territory, and the landscape. Among many others, topics addressed may included human scale, morphology and activity in the city, occupation, permanence, transformation, mobility, and obviously landscape as cultural heritage and daily life stage, through the point of view of the most relevant burning issues of the current context.
"Innovative practices and projects" was the name of the third block or thematic area. Design can be defined in many different manners, but one of the most popular options is the one describing it as an open answer to a complex question, which needs to be tested with more or less successful results when confronted with the different circumstances and boundary conditions of the particular case. The attitude of a designer when tackling a commission is decisive and a true announcement of the kind of outcome to be expected. Human life and the necessary habitat to conveniently develop it are nowadays more complex than ever and recently subjected to changing priorities and unexpected emergencies. This thematic area included papers on innovative practices and ways of doing when undertaking a commission in the architectural context, and papers on innovative projects capable of solving needs or offering options in unexpected and/or brand-new manners.
The fourth block or thematic area was booked for "Technology and materials". The ever more demanding social needs and

ambitions and comfort levels are mostly satisfied by innovative evolved materials and building technology. It is absolutely undeniable that the last century really passed the baton to the current one when it comes to go in innovating in products, building techniques, structural systems and conditioning. Accessing the right technology is frequently a determining factor when ambitioning to ensure the success of an urban or architectural project. This thematic area welcomed papers on, among many other topics, innovative materials for the building industry, building techniques for a better building and a better living, creative assessment or development of structural analysis and design, and improvement in conditioning techniques.

"Theory, criticism, narratives and ethics" was the fifth thematic area or block. The current architecture context demands a thorough reflection upon the role of theory and criticism in order to determine strong foundations for knowledge, judgement and design in architecture. On one side, reviewing the nowadays validity of contributions in theory and criticism on architecture and a variety of neighboring disciplines is a must. On the other side, it is always interesting to track links between theory and criticism with the current architectural practice and the ambitions, needs and priorities of contemporary society. Likewise, the lack of universalizable certainties and principles makes architectural narratives and ethics on architecture absolutely necessary. This thematic area encompassed papers of any kind related to theory, critical thinking, narrative and ethics in architecture and encourages all necessary debates, especially those introducing changing priorities as a decisive factor.

The sixth thematic area or block was devoted to "Heritage, restoration, conservation, and renovation". The interpretation of history has traditionally opened new ways to build the future. Geographical and timescales frameworks are vast enough to cover stages which compromise from ancient cultures to contemporary times, being a transversal and multidisciplinary approach and an interesting endeavor. Likewise, the way that we relate to our heritage has meaningfully evolved during the last decades with innovative results which can be framed within the categories of restoration, conservation, and renovation (fig. 6). This thematic area encouraged papers on the critical reading of history of architecture, heritage, restoration, conservation, and renovation as a matter for any architectural research. These fields constitute an amazing window of opportunity in modern practices that has inducted the development of many fascinating research lines.

Figure 6. New access to the Camí d'Onda Air Raid Shelter in Borriana, Spain

"Participation, diversity and inclusiveness" provided the subject for the seventh block or thematic area. As previously mentioned, our society nowadays witnesses a process of reflection, reconsideration and even suppression of many traditional concepts and values such as hierarchical governance,

adequacy or even normality. People are increasingly claiming their rights to take command of whatever has a decisive influence on their lives and to be happy and accepted despite their features, preferences, and circumstances. Participation processes, diversity, inclusiveness and many other neighboring concepts have also arrived in daily architecture practice and are having an incipient bud deciding influence on how the discipline responds to the challenges of our needs and changing priorities. This thematic area welcomed papers dealing with new societal dynamics, their irruption in architecture professional practice and their influence on the architectural output. Examples of previous pioneering examples and study cases of any period will also be welcome.

The eight thematic area or block focused on "Sustainability and climate crisis". Initially related merely to energy and natural resources, the concept of sustainability has evolved and incorporated many other facets. Architectural production and building industry have a meaningful influence in several of these facets and convenient knowledge and practical implementation become a must for any practitioner in order to safe a logical present and a feasible tomorrow for the planet. Climate crisis is not a premonition anymore. Its effects and consequences can be assessed in too many aspects of our daily lives and in the environment. This thematic area welcomed papers on sustainability and/or climate crisis under the spotlight of research in architecture and neighboring disciplines, as one of the most relevant priorities of the current international context.

Finally, the ninth thematic area meaning the last block was kept for "Health and pandemic". The irruption of the COVID-19 pandemic shocked the world, hit the economy and completely changed our lives three years ago. Home lockdown turned architecture into an indispensable prevention tool in order to keep under control the expansion of the disease and save our lives. This unexpected and sudden home-isolation endowed us with a different perception of our places (fig. 7). Likewise the rediscovery of public buildings and outdoor spaces provided us with renewed expectations and a firm commitment of overcoming the sanitary crisis more resilient. But this has not been the first pandemic which has shaken humanity along history. Previous episodes caused by other maladies had a meaningful influence in how we designed and used architectural output. This thematic area welcomed papers on the influence of health issues and pandemics, with a special focus on the COVID-19 pandemic, on architecture and neighboring disciplines.

Figure 7. Prototype of an extendable wooden balcony developed by the Maderamen Chairship at the Polytechnic University of Valencia, Spain, in November 2021

Despite not evenly, all nine thematic areas were successful. Up to sixty papers made it through the Scientific Committee reviews and judgements. The conference proceedings compile all these works. Therefore, this book constitutes a privileged outlook of the research done by some of the best academics in architecture and neighboring fields in the world. It provides a valuable picture of nowadays state of the art, a fertile source supply for further research and an unbeatable testimony for the future.

1

REPRESENTATION AND QUANTIFYING

PAPER #1.01

HOW DOES HOUSEHOLD INCOME AFFECT ACCESS TO HOUSING?

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ABSTRACT

Accessing to housing, in addition to being a right, should be part of a market sufficiently accesible and diverse so as not to generate excessive expenses for households, which do not allow other necessities to be met or may jeopardisee the quality of life.
This article considers the issue of access to housing by analysing the relationship between the average net income per household and the housing rental cost index, with the aim of quantifying the extent to which housing costs affect household income within the Comunitat Valenciana. It focuses especially on the rental system, regarded as the tenure regime prevailing for the most vulnerable households.
A compilation of the available data is undertaken, and with this information, the percentage of the average household income of families that must go to rent payment is calculated, and to what extent this economic effort is excessive. Different income brackets are established to analyse which sectors of the population have trouble accessing a home.
The results obtained suggest that a high percentage of households have to spend over 30% of income on paying rent, and it is in households with lower income in which this percentage soares, emphasising the situation of vulnerability.
Due to a lack of available data, it was not possible to geographically locate the areas with a *strained residential market*, defined by the *Draft Law on the Right to Housing*, from which it can be deduced that adding data collection mechanisms to existing ones is necessary to achieve a detailed analysis, essential to implement more effective housing access policies in highly vulnerable areas.

KEYWORDS

Rental housing; rental charge; overstrain economic effort in households; strained residential market areas; rental household income.

1. INTRODUCTION

The European Parliament approved on January 21st, 2021 a resolution (European Parliament Resolution, 2021) calling on the Commission and the Member States to ensure that the right to adequate housing is recognised and enforceable, as a basic human right; to guarantee equal access for all to decent housing; and to include housing sector as a social service of general concern, and not just social housing.
Also, it points out that 25.1% of European tenants that pay market rent spend over 40% of their income on rent and, on average, rents are constantly increasing; therefore it calls on Member States and regional and local authorities to establish legislative provisions,

including clear rental regulations so as to protect the rights of tenants and owners.

Spain is one of the EU countries in which the largest percentage of the population lives in an owned home. It is for this reason that a large part of the economic efforts data obtained from public and private statistics has traditionally focused on learning about the purchase and sale market, at the expense of the rental market. Therefore, it is essential, to have data sources that enable rental housing market to be analysed, in order to set mechanisms that help guarantee access to housing (INE, 2022).

Various studies suggest that rental housing has worse economic conditions, and tenants make an overstrain economic effort to pay rent. Rental housing is a limited market in which owners can easily put pressure on prices and raise rents, thus creating what is called a *strained residential market area* that the *Draft Law on the Right to Housing* defines as the average burden of the mortgage cost or rent in the individual budget or in the family unit, plus basic expenses and supplies, exceeds 30% of average income of households, and also those areas in which the rent has risen 5% over the CPI in the last five years.

In order to set adequate policies that guarantee access to housing, it is necessary to know in depth and analyse the rental market, since it is the most affordable and effective way of access to housing for those sectors of population with very unfavorable economic conditions. For all these reasons, an effort must be made to ensure the availability of objective data in the housing rental market, which allow a valid analysis and diagnosis.

2. GOALS

The main goal of this study is to quantify the economic effort that families or cohabitation units must make to access a home, focusing the analysis on the rental system within the Comunitat Valenciana. Specifically, to quantify the percentage of household income for rent payment of primary residence.

The first purpose is to collect available data on rental prices, as well as that available on net income of households in the Comunitat Valenciana. This way, it will be feasible to determine what type of analysis is currently possible, and what type of data should be collected in the future, in order to analyse the rental housing market effectively and objectively.

According to the available sources, the following goal is to examine the rental housing market to the extent that current data allows: type of tenure according to household income, extra economic effort that families must make according to income, size of the municipality, location and all those available variables that can be relevant.

3. RESULTS

3.1. Available data

Data sources on net household income in the Comunitat Valenciana:

- The National Statistics Institute (INE):
- Average net income per household by census sections, 2019.
- Living Conditions Survey (ECV).
  Variable HY020: Total household available income (for rent) in the year prior to the survey, by Primary Sampling Unit (anonymised census section), by regions, 2019 and 2021.

Sources of data on housing rental prices in the Comunitat Valenciana:

- The National Statistics Institute (INE):
- Living Conditions Survey (ECV).
  Variable HH060: Current rental price for occupied housing, by Primary Sampling Unit (anonymised census section), by regions, 2019 and 2021.
- The Ministry of Transport, Mobility and Urban Agenda:

- Housing rental index 2015-2020: result of the exploitation of tax sources within the framework of the development of the State system of reference for housing rental prices. Territorial-based data: census section, district, municipality, province and region.

OHsu Study on Housing Rental Prices in the Comunitat Valenciana 2020:

-Reference price: €/m^2 for studied areas smaller than the municipality, according to three sections of housing surface, and according to five construction periods.

Quarterly report on rental prices of the real estate agency Pisos.com, March 2021:

- Monthly rental price according to number of bedrooms (1, 2, 3, and 4), by province.

Some clarifications are included below in order to provide more information on the origin of the data and thus ease the understanding of the following analyses conducted.

Living Conditions Survey (ECV):

- The Living Conditions Survey (ECV), in English, European Statistics on Income and Living Conditions (EU-SILC) (Eurostat Statistical Office, 2022), belongs to the set of harmonised statistical operations for the EU countries.
- The key objective pursued with the ECV is to have a reference source on comparative statistics of the distribution of income and living conditions in Europe.
- In Spain, the survey has been conducted since 2004 on an annual basis, mainly through personal interviews with the population living in family homes. The data related to household income is based on a combination of the information provided by household respondents and administrative records.
- The sample size is around 13,000 households and 35,000 respondents.

Reference Index of Housing Rental Price:

- The second additional provision of the Royal Decree 7/2019, of March 1st, on urgent measures in the field of housing and rent, establishes the creation of the *State System of reference rates for housing rental prices*. In order to comply with this provision, a Technical Group was set up to develop the system, coordinated by the Ministry of Transport, Mobility and Urban Agenda.
- The development of the system responds to the lack of official statistics on prices, at the state level, as a reference for individuals and the different agents operating in this market.
- The scope is made up of the entire common fiscal territory, and the analysis of data is conducted in a disaggregated way at five administrative levels: census section, district, municipality, province and region.
- The information to be operated, originates from the IRPF model 100 of exercises corresponding to 2015, 2016, 2017, 2018, 2019 and 2020, and the information of the database of the General Directorate of Cadastre.

OHsu Study on Housing Rental Prices in the Comunitat Valenciana 2020:

- This study reflects the real cost of rent in the free market and is based on objective data from the rental finance register in the Comunitat Valenciana. It is built on real data forks of rental prices, grouped according to geographical areas, from which the evolution in the last three years is obtained.
- The monthly rental price in euros per square meter is calculated based on three variables that affect its amount: size of dwellings, construction period of buildings and location of dwellings. Likewise, the evolution of the rental price between 2016 and 2018 is calculated, and four evolution ranges are established: less than 10%, between 10% and 15%, between 15% and 20% and over 20%.

3.2. Rental price analysis

The different sources from official entities provide with similar data on the monthly rental price in the Comunitat Valenciana, in a range between 420 euros per month and 437 euros per month, although it must be considered that data sources are from different annuities.
On the other hand, the data from the real estate Internet portal Pisos.com is much higher, since it is not about final data of rental contracts but advertising data. So, this source is discarded because it does not adjust to the market reality.

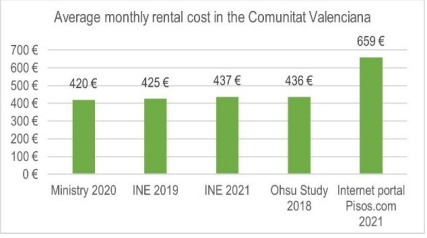

Figure 1. Average monthly rental price €/month in the Comunitat Valenciana, according to different sources

When analysing the data by provinces, only the data from the Ministry and those from the *OHsu Study on Housing Rental Prices in the Comunitat Valenciana* can be compared. The INE data from the *Living Conditions Survey* (ECV) can only be extracted according to regions, since the primary sampling unit is the anonymous census section.

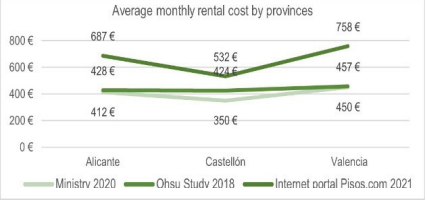

Figure 2. Average monthly rental cost €/month by provinces, according to different sources

3.3. Analysis feasibility of the available data

So as to analyse the extent to which income affects access to housing, and to quantify the overstrain economic effort that families must make to access it, focusing on the rental regime, the first obstacle spotted is the lack of data that allow to disaggregate the income of dwelling owners from those that rent dwellings.
The distribution of household income (ADRH) provided by the INE does not allow a breakdown of household income based on the housing tenure regime. Data is available at census section level, but counting on the result of all households.
If this household income (ADRH) is compared with the rental prices provided by the Ministry, the results are distorted, since the average household income includes the data of the highest incomes that generally own the home. In contrast, the lowest incomes, not being able to access the property, have rental housing.
The only source that enables to directly compare household income with tenancy regime, the rental price, etc., is the *Living Conditions Survey* (ECV) of the National Statistics Institute (INE). The issue lies in the fact that geographically, data can only be obtained at a regional level, since the primary sampling unit is anonymised.
For all these reasons, the analysis below is located in the geographical area of the Comunitat Valenciana, without being able to detail results by provinces or municipalities.

3.4. Analysis on type of housing tenue according to household income.

Based on the data from the ECV 2019 and 2021 within the Comunitat Valenciana, it is possible to analyse how household income affects the type of housing tenure: owned or rented.
Significantly, households with lower incomes are those with a higher percentage of rental system, whereas households with higher incomes tend to owned housing.

- Between 66-69% of rental housing in the Comunitat Valenciana have income ≤ 25,000 euros per year.
- In households with incomes over 25,000 euros, the rental cost is between 34-35%, compared to 51-54% of owned housing.
- A rising trend in rent system is evident in the last two years, in households with lower income, whereas in those with higher income, the rising trend is in owned housing.

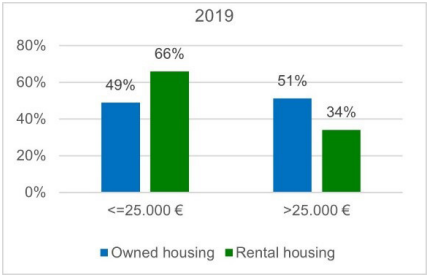

Figure 3. Type of home ownership according to average household income €/annual. 2019

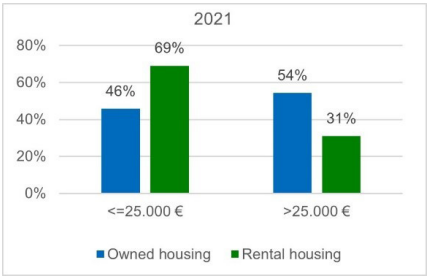

Figure 4. Type of home ownership according to average household income €/annual. 2021

If the data is analysed by narrower income brackets, interesting results can be obtained in the extreme brackets.

- Households with incomes ≥ 40,000 euros represent only 7-8% of rental housing, and the proportion between ownership and rental has remained stable in the period analysed.
- Households with incomes ≤ 15,000 euros represent 32-40% of rental housing, and have significantly risen, whereas home ownership remains stable.

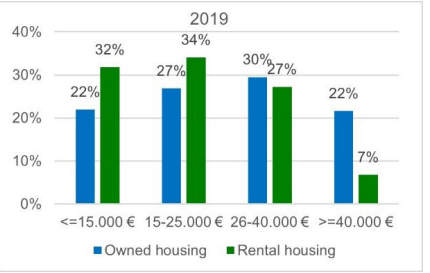

Figure 5. Type of home ownership according to average household income €/annual. 2019

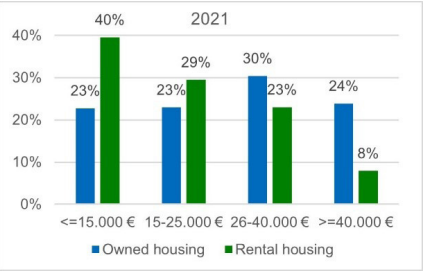

Figure 6. Type of home ownership according to average household income €/annual. 2021

If the average income per household in the Comunitat Valenciana is compared according to the housing tenure regime, a gap of 35-44% is obtained between the income of rental housing with respect to the income of owned housing. Noticeably, this gap has widened for the last two years.

Figure 7. Type of home ownership according to average household income €/annual. 2019 and 2021

If the analysis is focused on income in rental housing, which is the subject of this article, and five economic brackets are established, the following distribution is obtained:

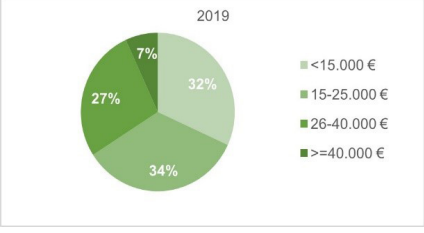

Figure 8. Percentage of rental housing according to average household income €/annual. 2019

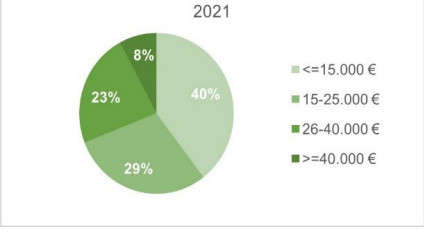

Figure 9. Percentage of rental housing according to average household income €/annual. 2021

3.5. Analysis of the relationship between income per household and rental cost

Based on the data from the ECV 2019 and 2021, the economic effort that households must make to pay the rent is analysed, that is, what percentage of the household income goes to rent payment of primary residence, within the total scope of the Comunitat Valenciana. As mentioned above, the data provided by the available sources does not allow to detail this analysis on a smaller scale, provincial- or municipal.

In addition, this analysis is detailed according to income brackets and other indicators that do appear in the survey, such as the size of municipality and the number of bedrooms in homes.

The *Draft Law on the Right to Housing* sets the *strained residential market areas* when the average burden of the mortgage cost or rent in the individual budget or in the cohabitation unit, plus basic expenses and supplies, exceeds 30 % of the average income in households, and also those areas in which the rent cost has risen by 5% over the CPI for the last five years.

Based on this *Draft Law*, in this study overstrain economic effort caused by rent payment is considered when the percentage of income required is ≥ 30%. Due to lack of data, basic expenses and supplies cannot be taken into account.

Economic effort in households to pay rent

Based on data from the ECV 2019 and 2021 in the Comunitat Valenciana, the percentage of household income for paying rent is analysed. In order to quantify this analysis, four groups concerning percentage of economic effort are established: those below 10%, between 10-20%, between 21-30%, and those ≥ 30% of income.

In the following graphs it can be clearly seen that this huge economic effort affects approximately 40% of households, so it can

be concluded that rental costs are currently excessive for most families.

- Between 38-42% in rental households within the Comunitat Valenciana spends ≥ 30% of their income on paying the rent of primary residence.
- In addition, there is a noticeable upward trend of overstrain economic effort, 5 percentage points, in the last two years.

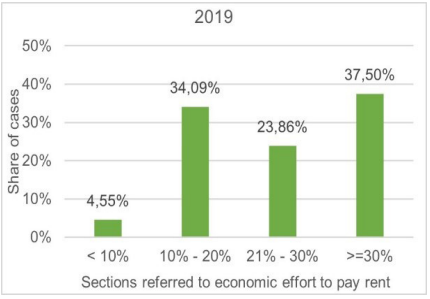

Figure 10. Percentage of households according to sections of overstrain economic effort to pay rent. 2019

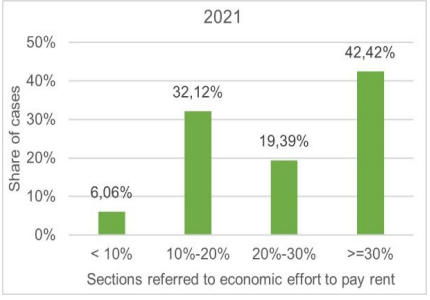

Figure 11. Percentage of households according to sections of overstrain economic effort to pay rent. 2021

Economic effort to pay rent according to household income

The previous section analyses the percentage of household income spent on paying rent cost, considering the overall income. This section aims to assess whether and to what extent this effort to pay the rent depends on household income.

In this section, those sections referred to economic effort are reduced to three: ≤ 20%, 20-30%, and ≥ 30%. For this, four income ranges per household are established: ≤ €15,000/year; €15,000-25,000/year: €25-40,000/year; and ≥ €40,000/year.

The results are quite significant, almost all households with lower income spend over 30% to pay the rent, whereas households with higher incomes never reach this percentage of economic effort.

When considering that the average net income per household within the Comunitat Valenciana is around €25,000 per year, it can be confirmed that households below that income are making an excessive economic effort to pay the rent, and those over that income have more reasonable percentage of economic effort.

Between 82-91% of rental households with income ≤ 15,000 euros spend 30% or more on rent cost, which is an excessive economic effort. Furthermore, the scenario has worsened since 2019.

- Most households, 67-73%, with income over 40,000 euros, spend less than 20% on paying the rent. Likewise, most households, 79-75%, with income over 25,000 euros, spend less than 20% on paying the rent. In both cases, these figures have remained stable for the last two years.
- In the intermediate section €15-25,000/year, the distribution is more proportional, equaling in 2021 a third for each economic effort section.

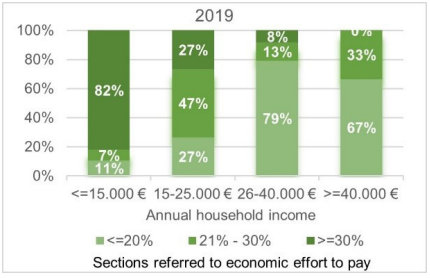

Figure 12. Percentage of households according to brackets of economic effort to pay rent, and according to brackets of household income. 2019

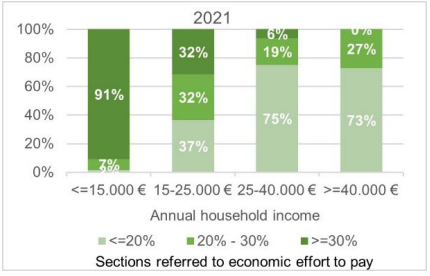

Figure 13. Percentage of households according to brackets of economic effort to pay rent, and according to brackets of household income. 2021

Economic effort to pay rent according to size of municipality

This section aims to analyse how the variable referring to the size of the municipality influences the economic effort in households to pay rent. In this case, only the data from the 2019 ECV can be studied, since in the following years this indicator was not considered in the survey.

The economic effort in paying the rent is greater in large municipalities over 100,000 inhabitants, since almost half of households spend over 30% of income. In municipalities with fewer than 10,000 inhabitants, more than half of households spend less than 20% on paying rent.

- In municipalities over 100,000 inhabitants, 42% of households spend over 30%, and only 25% spend less than 20%.
- In municipalities with less than 10,000 inhabitants, 55% of households spend less than 20%.
- In municipalities with 10,000 to 100,000 inhabitants, the percentages are similar (32-36%) for the three sections referred to economic effort.

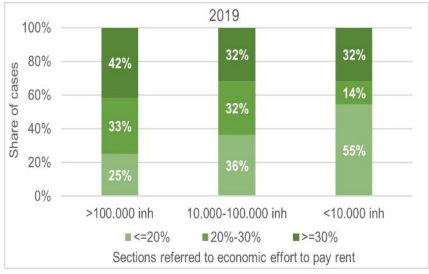

Figure 14. Percentage of households according to sections referred to economic effort to pay rent, by number of inhabitants of municipality. 2019

Economic effort to pay rent according to size of dwellings

This section aims to analyse how the variable referred to the size of dwellings influences the economic effort in households to pay rent. Based on the ECV data, a variable is established to indicate the number of bedrooms. Data from 1 or 2 bedrooms are neglected since the sample size was null or very small. Only the ECV 2019 is analysed.

The results do not show significant data, except for in rental dwellings with 5 or more bedrooms, the economic effort is less. This result may be associated with the fact that larger dwellings are rented by families with higher incomes.

Figure 15. Percentage of households according to sections referred to economic effort to pay rent, according to the number of bedrooms in the dwelling. 2019

3.6. Comparison at European and national level

Economic effort to pay rent according regions

In order to analyse the scenario in the Comunitat Valenciana within a national context, the data published by the *Report on Rental Housing in Spain*, by the Spanish Trade Union Comisiones Obreras, is considered (Comisiones Obreras, 2021), including data from the 2019 ECV.

An analysis is made on the percentage of the population that spends over 30% of income on rent cost, according to regions. The variations with respect to the previously described data prepared by the authors are due to the fact that, in this case, percentages of population are used instead of number of households.

Economic effort to pay rent according to different European countries and tenure regime

The data analysed in this section comes from Eurosta (Eurostat, 2022) the EU Statistical Office. Eurostat is responsible for publishing high-quality statistics and indicators at European level, which enable comparisons to be made between countries and regions.

The *Income and Living Conditions* section covers four subjects: citizens at risk of poverty or social exclusion, income distribution and monetary poverty, living conditions and material deprivation, which are again structured into collections of indicators on specific matters.

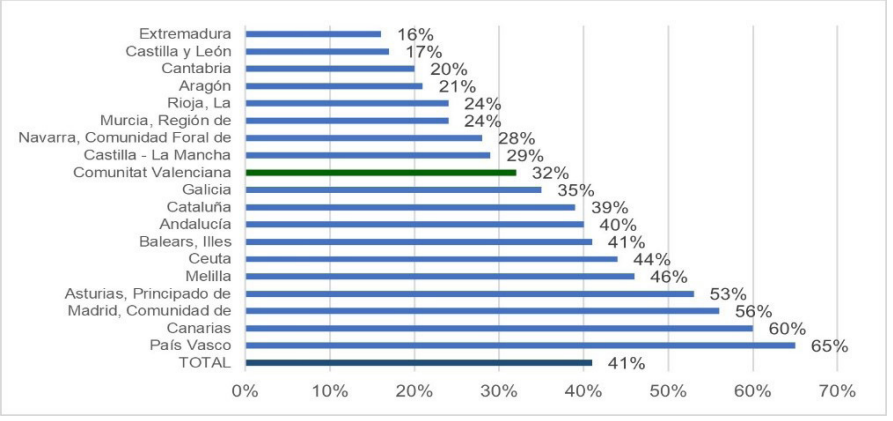

Figure 16. Percentage of population with rental cost over 30% of income, according to regions, in 2019. Source: Report on Rental Housing in Spain, by the Spanish Trade Union Comisiones Obreras

The *Living Conditions* section contains indicators related to features and living conditions in households, particular characteristics of the population according to various breakdowns, health and labour conditions, housing conditions and indicators related to child care. In this section the data on housing to be analysed below is collected.

- According to an analysis of the evolution of the excessive overstrain rate in housing rent cost in Spain in the last four years, the result is as follows:

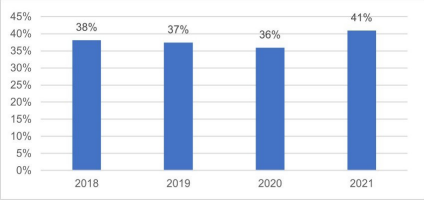

Figure 17. Evolution of overstrain rate in rental cost in Spain. Eurostat 2018-2021

- Distribution of the population, in percentage, according to housing tenure regime, whether owned or rented, in European countries. Spain is above average, with home ownership, 76%, compared to 24% for rent.
- The percentage of the population living in a household with an excess overstrain rate, that is, when total rental housing costs represent more than 40% of the household total disposable income. The cost of housing refers to the monthly rental costs, plus the costs of public utilities resulting from use of water, electricity, gas and heating. According to these figures, in Spain 37% of the population under rental status has an excessive overstrain rate, and it is over the European average.

4. CONCLUSIONS

The *Draft Law on the Right to Housing* determines the *strained residential market area* based on two variables, one in the event that the average economic effort on housing exceeds 30% of household income, and another that considers the evolution of the rental costs in the last five years.

- Currently, no data is available to analyse the economic effort in households to pay the rent in a localised way, census section or municipality, which was the subject of this research.
- As a consequence of not having this data, it is not possible to define the areas with a strained residential market based on household economic effort (≥ 30%) within the Comunitat Valenciana.
- The alternative is to base it on the evolution of rental prices, as proposed in the *OHsu Study on Housing Rental Prices in the Comunitat Valenciana.*
- It is necessary to generate a source of data on the income in households for rent according to census section, comparable with the data currently provided by the *Ministry of Transport, Mobility and Urban Agenda* with the *Housing Rental Index* resulting from the exploitation of tax statistics and with data at the territorial level, census section, district, municipality, province and region.

Through the analysis conducted within the Comunitat Valenciana, the following conclusions can be drawn.

- Household income influences the housing tenure regime. If the stock of primary residence for rent is examined, almost half of it is occupied by households with income that does not exceed 15,000 euros per year, whereas households with incomes over 40,000 euros per year only represent 8% of this market. Furthermore, 66% of tenants live in households with income below 25,000 euros per year.

Figure 18. Distribution of the population according to tenure regime in Europe. EU-SILC Eurostat Survey 2019

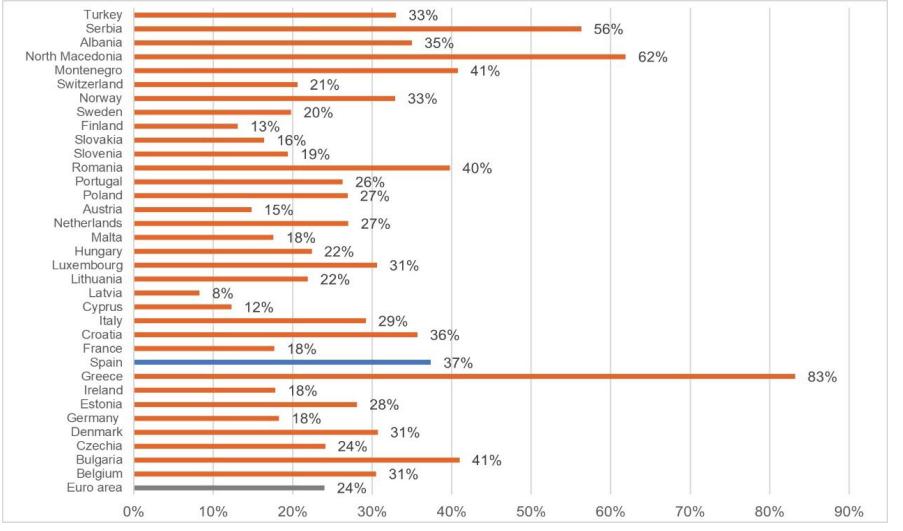

Figure 19. Percentage of the EU population with rental costing cost over 40% of income. EU-SILC Eurostat Survey 2019

- This data is confirmed in the event that the average income is compared according to tenure regime, which reflects a gap of 35-44% between income in rental households with respect to income in owned homes. In addition, this gap has increased in recent years.
- It is noted that a high percentage of households, around 40%, spend over 30% of income on paying rent, that is, they are located in *strained residential market areas*, although they cannot be localised geographically. This percentage has increased by 5 points in the last two years.
- In households with lower income, the economic effort to pay the rent soares, which sets them in a scenario of great vulnerability, since they must use most of their low income to pay rent. Between 80-90% of households with income below 15,000 euros per year spend over 30% on rental costs.
- Most of households with income over the average, 25,000 euros per year, spend less than 20% on rent cost, and only a percentage of 6-8% is regarded as overstrained.
- If the variable of the size of municipalities is considered, the economic efforts of families are greater in municipalities over 100,000 inhabitants. This information could not be cross checked with data from several annuities.

Compared to the rest of regions, the Comunitat Valenciana is slightly below the national average in terms of percentage of population spending over 30% of income on rent cost, 32% in the Comunitat Valenciana, compared to 41% in Spain.

If a parallel is drawn at a European level and the rate of overstrain economic effort is analysed, that is, when the total cost of rental housing is over 40% of the total disposable income in households, Spain is 12 points over the European average, 37%, that is to say, more than a third of the Spanish population living under rental status spends over 40% of income on housing costs.

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PAPER #1.02

VISUALIZATION RESEARCH: SCOPING REVIEW ON DATA VISUALIZATION COURSES

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ABSTRACT

Understanding data visualization as one of the foundational skills of the 21st century, this research aimed to define up-to-date guidelines to effectively teach data visualization courses and–from there–developed the first version of a new data visualization course. To do so, it faced the following questions: What is the current role of data visualization in higher education? What have been the main trends in data visualization courses in higher education? What methodologies have been used to teach data visualization courses? What difficulties have been identified in data visualization courses? What recommendations have been offered by previous professors that have taught this kind of courses? Considering this broad set of questions, the research was developed as a scoping review that served to collect hundreds of publications from where 22 peer-reviewed articles published between 2008 and 2021 were finally selected and analyzed. Among the most important results, the research found that data visualization interest in higher education has been growing exponentially and data visualization courses prioritize practical exercises over theoretical content. Some of the most common recommendations synthetized through the review suggested to select topics that the students should find interesting to promote their engagement. Also, several authors recommended to start the visualization process as soon as possible and spend the least possible time on learning tools. Finally, the results of this review should be useful to support and promote new data visualization courses while they were already used to create the first iteration of a graduate and upper-level undergraduate professional elective course on data visualization under the title *Visualization Research*. The review and assessment of this course will be the next step of this research process.

KEYWORDS

Information representation; graphing; mapping; design studies; higher education.

1. INTRODUCTION

"We live in a data-saturated moment, in which [visualizations] distill complex realities into seemingly palpable truths" (Battista and Conte 2017, 147–48). This information representation process can improve people's lives by making it easier for them to access relevant information. But, unless it is communicated in a clear, engaging, and effective way, is very difficult for the message to reach the recipient. Furthermore, nowadays the amount of data and information grows exponentially, as well as the communication channels, which makes the whole process of representation and understanding more complicated. Even so,

images remain one of the clearest and most powerful means of communication, especially in a globalized world with different languages, disciplines, and perspectives in close contact.

> "Generally, people, even without specific training, can still understand meanings graphs refer to. Considering the speed and efficiency, it is easier for people to memorize graphs than mass textual data. If a graph can exactly express the meaning, less explanation and shorter thinking process will be needed to understand. Compared with regionalism in language and character as well as obscurity in science and interdisciplinary knowledge, graphic symbols containing metaphor content can resolve the foothold of information in the communication of cross-cultural information (Yunqing, Linglin, and Yanzi 2016, 698)."

This almost universal condition is combined with the trust that society usually has on data, often understanding it as an irrevocable truth. The development of technology has made information visualization become involved in "every aspect of our life before we come to realize it" (Yunqing, Linglin, and Yanzi 2016, 696). Thus, there is a constant and growing demand for visualization design that must be addressed in higher education by training professionals with these skills. In this sense, it is important to study, develop and share experiences of visualization courses for "instructors to improve their teaching materials and help students achieve desired learning outcomes" (Lo, Ming, and Qu 2019, 11).
So, understanding data visualization as one of the foundational skills of the 21st century, this research aims to define up-to-date guidelines to effectively teach data visualization courses. Complementary, the research expects to support the creation of the first version of a data visualization elective course to be implemented in the Louisiana State University School of Architecture. As this course will be available to undergraduate and graduate students in the College of Arts & Design, the research focuses on data visualization for design related students. To achieve these objectives, the research seeks to understand what the current role of data visualization is in higher education? More specifically, what have been the main trends in data visualization courses in higher education? What methodologies have been used to teach data visualization courses? What difficulties have been identified in data visualization courses? What recommendations have been offered by previous professors that have taught this kind of courses?

2. METHODOLOGY

To address these questions, the research was based on a literature review focused on peer reviewed results of data visualization courses. Being this a topic-based search with several broad questions that could also include other reviews, it has been defined as a *scoping review*. The search centered on the term *data visualization,* being this a specific term that clearly identifies this area of knowledge. But the term *information representation* was also considered due to the well-known fact that it has been widely used to treat these topics. Thanks to the specificity of these terms, no more keywords were deemed necessary to define the topic. But the search also included the terms *learning* and *teaching* to focus on higher education. These two were favored over others such as *university*, *pedagogy*, and *course*, because they represented a simple solution that included any part of the educational process. It wasn't necessary to include any specific keywords about higher education because data visualization courses have mostly (if not only) been implemented in higher education scenarios. These keywords were organized in the following equation: TI/AB/KEY= ("data visualization" OR "information representation") AND TI/AB/KEY= ("learn*" OR "teach*"), which was adapted and implemented to three available databases: Web of Science, WorldCat, and Google Scholar. Combining the

results, 874 papers were initially collected, but after duplicates were removed, papers were screened by abstract and titles, and full text assessed for eligibility, the research identified only 22 papers that focused on data visualization courses (Table 1). These documents were later analyzed in relation to the proposed research questions.

Title	Year	Authors
Innovative Pedagogy for Teaching and Learning Data Visualization	2021	Byrd, Vetria L.
Experience of Teaching Data Visualization using Project-based Learning	2021	Kammer, Dietrich; Stoll, Elena; Urban, Adam
Remote Instruction for Data Visualization Design—A Report from the Trenches	2021	Aerts, Jan; Peeters, Jannes; Bot, Jelmer; Kafetzaki, Danai; Lamqaddam, Houda
What more than a hundred project groups reveal about teaching visualization	2020	Burch, Michael; Melby, Elisabeth
Information Visualization in the Educational Process: Current Trends	2020	Liu, Zhi-Jiang; Levina, Vera; Frolova, Yuliya
Introducing information visualization to design students	2020	Mauri, Michele
Teaching Data Visualization as a Skill	2019	Ryan, Lindy; Silver, Deborah; Laramee, Robert S.; Ebert, David
Learning Vis Tools: Teaching Data Visualization Tutorials	2019	Lo, Leo Yu-Ho; Ming, Yao; Qu, Huamin
Teaching Data Visualization in/nFirst-Year Courses	2019	Clement, Ryan
Teaching News Design and Data Visualization	2019	Britt, Rebecca Katherine
Creative Data Literacy: A Constructionist Approach to Teaching Information Visualization	2018	D'Ignazio, Catherine; Bhargava, Rahul
Teaching with data: Visualization and information as a critical process	2017	Battista, Andrew; Conte, Jill A
Teaching and Learning Data Visualization: Ideas and Assignments	2016	Nolan, Deborah; Perrett, Jamis
Teaching data visualization in evl's cyber-commons classroom	2016	Johnson, Andrew
Tool for teaching visualization techniques: Learning and homework assignments for multivariate data visualization	2016	von Landesberger, Tatiana; Brodkorb, Felix; Schneider, Philipp; Ballweg, Kathrin
Using pedagogic design patterns for teaching and learning information visualization	2016	Craft, Brock; Emerson, R-m; Scott, Taylor Jackson
The Application of Information Visualization Design in Teaching Field	2016	Yunqing, Wan; Linglin, Tu; Yanzi, Liu
Teaching Students to Focus on the Data in Data Visualization	2015	Wolfe, Joanna
Teaching Information Visualization via Creative Design	2014	Spence, Bob
Aligning trends in mainstream media and data visualization with teaching practice	2012	Chong, Alan
Teaching Information Visualization	2008	Kerren, Andreas; Stasko, John T.; Dykes, Jason
What ordinary people need most from information visualization today	2008	Few, Stephen; Edge, Perceptual

Table 1. Documents selected for analysis.

3. RESULTS

The review served to identify several important issues such as the role of data visualization in higher education, teaching methodologies, and specific issues and recommendations. These results are organized below following the same order presented by the research questions.

3.1. The role of data visualization in higher education

The analyzed documents that mentioned the topic agreed that the importance of data visualization has been growing exponentially in all areas. "Data visualization has rapidly become a standard approach to interrogating and understanding the world" (D'Ignazio and Bhargava 2018). Its application has spread in research, business, journalism, etc., which is why "knowing how to collect, find, analyze, and communicate with data is of increasing importance in society" (D'Ignazio and Bhargava 2018). Recent research showed that in the US the demand for this skill grew 1500% in the last decade, from "1888 jobs in 2010 to 30327 jobs in 2018" (Ryan et al. 2019, 97).

Data scientists are increasingly valued in all kinds of industries to analyze exponentially growing information. But this is only part of the process. Today it is possible to observe governments, organizations, communities, that make decisions related to the way in which the information provided is presented. In other words, the good representation of information can increase the influence that it has on the audience (Yunqing, Linglin, and Yanzi 2016, 696), for better or worse.

Graphic representation allows to emphasize "statistical thinking over calculations" which, combined with the creation of beautiful and useful visualizations, "can be very rewarding for students" (Nolan and Perrett 2016, 15). It is important to prioritize teaching the thought process over the use of specific tools because tools and trends change rapidly (Lo, Ming, and Qu 2019, 14). Likewise, data visualization is not a mechanical process in which certain numbers are expressed, it requires analyzing said data and understanding that its processing is not neutral, but rather requires taking decisions about the ideas that will be communicated (Wolfe 2015, 345–47).

Considering its recent expansion, the wide variety of industries and disciplines where it is applied, and its importance in research, data visualization have a great influence in today's world. The appropriate representation of information can solve many of the problems and opportunities that people face today, a representation that in turn becomes the tool to facilitate deeper thinking (Few and Edge 2008).

> "Critically, the technical knowledge of how to work effectively with data is in the hands of a small class of specialists (D'Ignazio and Bhargava 2018)."

This is one of the reasons why it is necessary to train more people capable of appropriately representing information that can help others achieve their goals or understand concepts or ideas that could change their lives, or everyone's lives.

3.2. Two main trends in visualizations

Although some authors understand visualization as a "subfield of computer science" (Ryan et al. 2019, 95), it has been accelerating and diversifying thanks to multidisciplinary and technology. But many efforts around data visualization are still related with coding and using specific software to generate a spectrum of charts. This approach is leaving aside many other possibilities of analysis and representation. In this context, design–understood as the "the way in which something is planned and made" (Cambridge University Press n.d.)–has to play an important role.

> "However, teaching data literacy to computer scientists and statisticians is a different proposition than teaching data literacy to non-technical, adult newcomers such as humanities scholars, journalists, educators, artists and non-profit staff (D'Ignazio and Bhargava 2018)."

The reviewed documents clearly identified these two general trends. Data visualization understood as a big data programming exercise, and data visualization as a manual process where the author and his interpretation take on greater importance. The first option usually has a more standardized range of solutions, where the representation is chosen from a catalog of possibilities, while the second option usually generates specific solutions or at least specific variants from existing solutions.
usually generates specific solutions or at least specific variants from existing solutions.
Although both approaches are complementary, they are sometimes understood as opposed solutions. For example, design students sometimes "tend to see data as something far from their practice and related to other fields" (Mauri 2020, 4442), while students in statistics and data science often have trouble embarking on the creative process of developing appropriate designs (Aerts et al. 2021, 15).

> "Data visualizations can consist of generic plots such as scatterplots and barcharts, but more novel visual designs might be necessary to allow reasoning on complex data (Aerts et al. 2021, 15)."

Therefore, it is necessary to establish symbiotic relationships between these two trends. But this interaction should try to simplify the processes and results to made them useful to the public that need them. Many of the problems that the potential target audience is currently facing "can be handled by a broad range of people using fairly simple visualization techniques" (Few and Edge 2008). It is important to oppose the unnecessary sophistication that focuses on a specialized audience, to be extended to people who need help to understand the world around them (Few and Edge 2008). Connecting with the previous point, the training of new professionals with knowledge in data visualization requires a combined effort from different disciplines, not exclusively from programming or data science.

3.3. Data visualization pedagogy

The studied documents demonstrated different ways of teaching data visualization. A 2008 survey of 19 data visualization courses in Europe and the US found that 72% of the courses used textbooks, 68% assigned required reading articles, but 95% included practical exercises (Kerren, Stasko, and Dykes 2008, 67–72). Following the position taken by more recent paper, the latter seems to also be the most important trend nowadays.
Several of the consulted cases included lectures added to a combination of short exercises and a final exercise. For example, Britt (2019, 2) divides her course into three parts "data visualization, photo visualization, and an integrated final project," but each class has lectures and discussions before moving on to a lab space where they practice the topics they have learned. Craft, Emerson, and Scott (2016) also have lectures and reading-supported group discussion sessions, but have an important web-based visualization exercise. Lo, Ming, and Qu (2019, 11) follow a similar pattern, guided lectures and tutorials that are complemented by hands-on exercises and a group project. Mauri (2020, 4443) is another example where theoretical lessons, group sessions for creation and peer-review, and tutorials are organized. In many cases, whether in the lectures or in the tutorials, an important time dedicated to teaching software tools of a different nature is usually included. In this sense, several cases were observed, such

as that of Kerren, Stasko, and Dykes (2008, 74), where the practical exercises are associated with a particular software.

Although supported by theoric content, the courses tend to have a big practical component. This can be observed through approaches such as learning by doing. This is clearly seen through remarks such as Spencer's (2014, 3) "the best way to become educated in Information Visualization […] is to do it" or Jason Dykes (Craft, Emerson, and Scott 2016, 83–84) when he talks about "emphasis on 'learning through doing' as opposed to a transmissive approach to learning". Likewise, several courses fundamentally use the project-based learning (PBL) approach. For example, Kammer, Stoll, and Urban (2021) state that PBL helps deal with how overwhelmed students often feel when faced with course content. The system itself serves to engage students with all stages of the process, rather than embarking on isolated exercises.

> "Finally, a project-based learning approach to information visualization scaffolds learners through the whole data analysis and visualization pipeline rather than using different datasets and subjects at each stage. In this way, the process becomes iterative, rather than idealized and procedural, and the learners may return to prior stages as they encounter hurdles or identify better questions to ask (D'Ignazio and Bhargava 2018)."

In addition, Spence (2014, 3) proposes the use of a workshop format that allows breaking the traditional teaching format and strengthening relationships between students.

Regarding the organization of the weeks in which the course takes place, the reviewed cases allowed us to identify two main trends. The most common considers that the beginning of the course is mainly characterized by lectures and tutorials and then they move on to the practical part. In the other, shorter cycles are built in which lectures and exercises are mixed throughout the course.

3.4. Problems and recommendations

Series of problems and recommendations were recognized that are important to take into consideration. A problem that was mentioned in several cases was the difficulty of finding datasets to be used by the students. Datasets are often large and complicated (Kerren, Stasko, and Dykes 2008, 74), and cleaning and preparing existing datasets can take much of the course. Associated with this point "[t]oo often, students think of data as pure, unmodifiable fact" (Wolfe 2015, 357). Therefore, it is necessary to teach students that the process of reading and preparing the data includes subjective actions that can open to different interpretations. Another common problem is that some authors faced difficulties in getting students to read the readings assigned to them. (Kerren, Stasko, and Dykes 2008, 74). Regarding the tools, it was observed that students could spend much of their time learning new tools instead of addressing the course content (von Landesberger et al. 2016) and some tools are only available through the payment of a license.

Among the recommendations collected, some authors emphasized the importance of starting projects as soon as possible (Lo, Ming, and Qu 2019, 12), this contributes to developing learning by doing and PBL strategies. Some authors recommended staying flexible in order to monitor the speed with which conditions around the teaching of these topics change (Kerren, Stasko, and Dykes 2008, 86). While others pointed out that the course requires a balance between freedom–so that students can explore and progress–with the activities and requirements that keep them busy in a regulatory framework that guarantees reaching the proposed objectives (Burch and Melby 2020, 896). Lo, Ming, and Qu (2019, 12) also recommended using tools with minimal setup to be useful to students with different backgrounds. On the other hand,

Kammer, Stoll, and Urban (2021) point out that "[s]tudents should work scientifically and individually acquire knowledge about a specific topic" and that the instructor should prioritize the adaptation of existing materials.

Two important recommendations that emerged from the review of these cases have to do with the nature of the studied topics and its communication process. Regarding the topics, it is recommended that students "ask questions that have meaning for themselves and their communities" which contributes to their motivation (D'Ignazio and Bhargava 2018), but also promotes the communication of relevant and pertinent information.

In the same sense, Lo, Ming, and Qu (2019, 12) recommend using "non-trivial, manageably sized, real-world and engaging datasets" since the information is authentic and contributes to stimulating students. For example, Battista and Conte suggest selecting a social justice issue with "clear implications for the politics of gender, race, class, sexuality, or geography" (Battista and Conte 2017, 149).

Regarding communication, Ryan et al. (2019, 99)–who reviewed thousands of job offers associated with data visualization–noted that 47% also required communication skills, which is usually an important differentiating aspect among candidates, since only 10% said they have this skill. Precisely, the central axis of data visualization is to face the communication difficulties that authors and institutions are having with rapidly diversifying media (Chong 2012).

4. CONCLUSIONS AND PROPOSED COURSE

This research has contributed to update and understand the current existing knowledge around teaching data visualization. More specifically, a series of interesting conclusions can be defined from the proposed questions. First, two main trends in data visualization courses have been identified, those focused on coding and directed to data scientist and those multidisciplinary courses where a broader range of tools are used, and design tends to have a predominant role. These trends showed complementary and both necessary. Second, data visualization interest in higher education has been growing exponentially, recognizing the need to prepare the work force in this requested skill. The review found documented cases from different countries since 2008, but most of them were published in recent years. Third, an incredibly predominant number of the data visualization courses prioritize practical exercises over theoretical content. Using approaches such as learning by doing and PBL some of them organize a series of shorts exercises while other focus only in one or a couple of them. To these, lectures, tutorials, and discussions are complementary. Fourth, the difficulties that some of these courses found are also common to other disciplines such as lack of interested in readings or students without experience in the required tools. Other were much more specific such as the difficulty of finding datasets to be used by the students. Fifth, among the clearest and most common recommendations the authors pointed at looking for interesting topics for the students to promote their engagement that also are relevant for the society in other to get meaningful results. In the same way, the authors also recommended to start the visualization process as soon as possible and spend the least possible time on learning tools. Some of them recommended to also include the development of complementary skills for data visualization such as communication.

Starting from these findings, a three-credits, graduate and upper-level undergraduate professional elective was created under the title *Visualization Research*. The course is offered by the School of Architecture but

open to all the students in the College of Arts and Design at Louisiana State University, which includes Architecture, Arts (Art History, Digital Art, Graphic Design, and Studio Arts), Landscape Architecture, and Interior Design.

Following the recommendations of most of the examples studied, *Visualization Research combines content-oriented sessions* and *project-oriented sessions*, but practical learning by doing and PBL exercises are predominant. For this reason, two thirds of the contact hours have been formulated in studio format, where the students can work in class with immediate feedback from the instructor and their peers. While the first sketches of the visualizations begin the first week of the course, to encourage learning by doing and make the best possible use of the time available.

The content sessions include lectures, criticizing provided visualizations by groups, and in-class exercises oriented to develop specific skills, practice new tools, or address common difficulties. At the beginning of the course, content sessions are devoted to topics such as finding reliable information, formulating research questions, and introduction to the basics of the scientific method. Subsequently, among the broad range of topics considered in the analyzed courses, *Visualization Research focuses on the* visualization process, visualization techniques, color usage, visual perception, accessibility, and copyrights in order to better respond to the students' design background. In the same line, the course defined four learning outcomes: Learners will be able to identify and organize useful data for visualization; Learners will understand the fundamental design principles and different types of data visualization; Learners will understand how to apply their design skills to represent and communicate data; Learners will be able to design compelling, complex, and diverse data visualizations.

Several authors mentioned that the students should be exposed to all the stages of the process, thus *Visualization Research* requires working individually to make a visualization from the beginning to the end. This process is divided into four stages: Research, First visualization, Second visualization, Final visualization, and Portfolio. The first stage is dedicated to defining the topic and searching for the data to be used. As recommended by several studied research, the definition of the theme is free, so the student can find a topic of interest, but it must be pertinent to the local context, improving its relevance.

As many authors had issues with students don't reading the given materials, in this case they are provided with a selection of videos from existing internet resources. They only had to read the documents that contained the data needed to develop their visualizations. Following other comments, to avoid having to deal with complex raw databases, the use of clean and organized data presented in reports from recognized organizations or scientific publications is prioritized.

Also considering the results obtained during the review, the course emphasizes communication as a commonly needed skill for data visualization experts. As example of this effort, the course was certified in the LSU's Communication across the Curriculum program, in which the university organizes courses where this skill in profoundly taught and developed. To get this certification, the course fulfilled the following objectives: instruction and assignments emphasizing informal and formal visual and technological communication; teaching of discipline-specific communication techniques; use of feedback loops for learning; 40% of the course grade rooted in communication-based work; and practice of ethical and professional work standards (LSU's Communication across the Curriculum program n.d.).

Visualization Research has been taught twice, both in 2022. First, in a 16-weeks spring semester (in-person with 17

students) and then in a 5-weeks intensive summer (online with 6 students). Below, two examples of the students' work (Fig. 2 and 3). The course is still under development and its results are still to be analyzed.

Finally, the results of this review and the proposed course are expected to be useful to other similar initiatives. Looking forward, this research will focus on further developing the Visualization Research course. As first step, it plans to evaluate the preliminary results obtained until now to contrast them with the conclusion defined from the scoping review to continuously refine and improve the learning experience. At the same time, the research expects to delve into issues that have not been included in this publication, such as the differences between the objectives and tools defined in the analyzed courses.

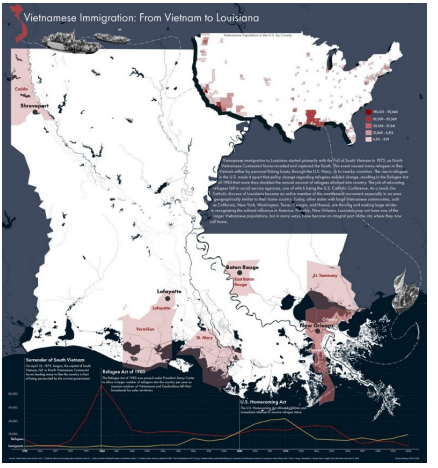

Figure 2. Vietnamese Immigration: From Vietnam to Louisiana. Student: Victoria Cheung

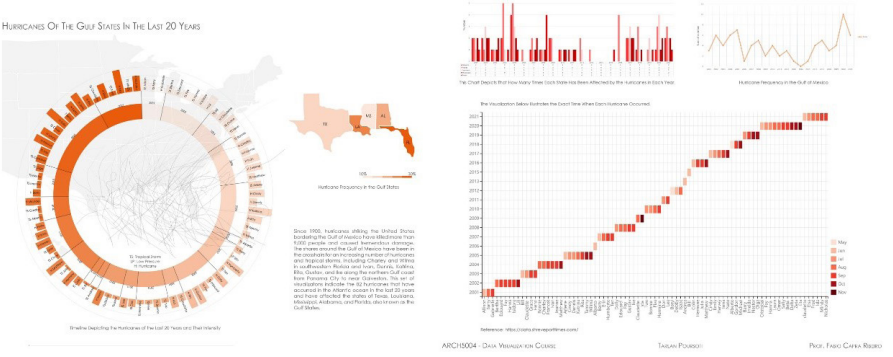

Figure 3. Hurricanes of the Gulf States in the last 20 years. Student: Tarlan Poursoti

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2

CITY, TERRITORY AND LANDSCAPE

PAPER #2.01

GORDON CULLEN IN VALENCIA: FOUR URBAN LANDSCAPES

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ABSTRACT

The Concise Townscape, by Gordon Cullen, was initially published in English in 1971, and it is a key work in urban design. The Spanish edition was published some years later, in 1974, with the title *El paisaje urbano. Tratado de estética urbanística*.
Gordon Cullen introduced in *The Concise Townscape* different concepts to describe the visual experience of townscape, showing through drawing and photographs how urban environments could be experienced as a pictorial and temporal sequence.
In this communication, we will analyze the presence in *The Concise Townscape* of four images of urban landscapes of Valencia, which Gordon Cullen used to illustrate different concepts of visual and spatial perception related to urban design. The images show the *Plaza de la Virgen* with its textile roof, a stone sculpture of the *Puente del Real*, the shop frontage of the *Platería del Sol*, and the facade of the *Lonja* with a tree located in front of it. We will examine, first of all, the relationship between these urban landscapes and the four urban design concepts associated with them in *The Concise Townscape*: "the outdoor room and enclosure", "looking into the enclosure", "handsome gesture" and "trees incorporated". We will add a comparative analysis of the current situation and the changes these urban landscapes have undergone since the moment Cullen took the photographs for his book.

KEYWORDS

Gordon Cullen; Valencia; townscape; urban landscape; urban design.

1. INTRODUCTION

Gordon Cullen (1914-1994) may be considered one of the best architectural drafters of the last century. In 1961 he published Townscape, an essential work in the field of urban design, where he synthesized with an excellent graphic quality many of the ideas presented jointly with Cronin Hastings in *The Architectural Review* in the fifties. As of 1971, the book was published in an abbreviated version, entitled *The Concise Townscape*, whose Spanish edition was published some years later, in 1974, with the title *El paisaje urbano. Tratado de estética urbanística*.
In the introduction of this book, Cullen proposed one of the most straightforward definitions of urban design: "One building standing alone in the countryside is experienced as a work of architecture, but bring half a dozen buildings together and an art other than architecture is made possible" (Cullen, 1971:7). For Cullen, that art, which we call urban design, is an art of relationship. To show these relationships, *The Concise Townscape* introduces different concepts to describe the visual experience of townscape, showing through drawing and photographs how to experience urban environments as a pictorial and temporal sequence.

2. IMAGES OF URBAN LANDSCAPES OF VALENCIA IN *THE CONCISE TOWNSCAPE*

In this communication, we will analyze the presence in *The Concise Townscape* of four images of urban landscapes of Valencia, which Gordon Cullen used to illustrate different concepts of visual and spatial perception related to urban design. Those four images, in order of appearance in the book, correspond to *Plaza de la Virgen* (Virgin Square) and its textile roof, an edicule of the *Puente del Real* (Royal Bridge), the shopfront of the *Plateria del Sol* (Sun Silversmith) and the facade of the *Lonja de la Seda* (Silk Exchange Hall). All of them are photographs, accompanied by drawings only in one case, that of the image of the *Lonja*.

2.1. The *Plaza de la Virgen* and its textile canopy: the outdoor room and enclosure

The first image of Valencia in *The Concise Townscape* is a view from the *Plaza de la Virgen* (Virgin Square), with its extended textile canopy. This image appears in the lower half of page 29, dedicated to the theme of "the outdoor room and enclosure". The book refers to the two upper images on that page as two entrances to the same square at Bourdeaux, but it does not identify the city´s location where the square of the lower image belongs. The squares are used here as examples of enclosure of the outdoor room, which, for Cullen, is perhaps "the most powerful, the most obvious, of all the devices to instill this sense of position, of identity with the surroundings "(Cullen, 1971: 29). This type of space embodies the idea of "Hereness", an idea that Cullen will develop throughout the book.

The person´s sense of position is his unspoken reaction to the environment, which, according to Cullen, might be expressed as

> "...I am in IT or above IT or below IT, I am outside IT, I am enclosed or I am exposed. These sensations are basically interlocked with human behavior and their morbid expression is demonstrated in claustrophobia and agoraphobia (Cullen, 1971:29)."

Figure 1. The Plaza de la Virgen and its textile canopy, Valencia. a) Image that appears in The Concise Landscape (Cullen, 1971). b) Current state (Photographic archive of the author, 2002)

Concerning the Virgin Square and its textile canopy, Cullen states it is "a near-perfect example of the outdoor room with three-dimensional wallpaper" (Cullen, 1971:29). We can consider that much of that perfection is due to the singular canopy: providing a roof contributes significantly to completing the spatial envelope of the square that results from the facades of the surrounding buildings and the plane ground.

The canopy that we can see in Cullen´s book, of 1,200 square meters, is the one that was built in the 60s to cover the *Plaza de la Virgen* for certain special events such as the Offering of flowers (in the feast of *Fallas*) or during the feast of Corpus Christi. The textile canopy, therefore, was not a permanent covering element. Its author was the Valencian Ricardo Cánoves Marcía, known as "El Pernales", who, although without any formal training in engineering, was a recognized specialist in complex works involving the handling and transporting of heavy elements.

The canopy of Cánoves of the 60s, although it resisted half a century, was already significantly deteriorated when, in 2011, its complete renovation was proposed. New porous textile material was then used to replace the old canvas, and modern anchoring techniques for fastening cables to the facades to avoid damage.

In recent years, however, it has not been possible to extend the textile canopy due to the refusal of the neighbors of the building located in the opposite part of the Virgin´s Basilica to authorize new anchors fastening to the facade. It is hoped that this difficulty can be overcome soon to recover the "near-perfect example of the outdoor room" Cullen pointed out in his book.

2.2. The edicule of the *Puente del Real:* looking into enclosure

The second image of Valencia that appears in Cullen's book corresponds to a carved stone edicule of the *Puente del Real* (Royal Bridge).

Figure 2. Stone edicule of the Puente del Real, Valencia. a) Image that appears in The Concise Landscape (Cullen, 1971). b) Current state (Photographic archive of the author, 2019)

It is shown in the lower half of page 36, in the section entitled "looking into enclosure", and is the only one of the four images taken in Valencia in which the name of the city is expressly mentioned (Fig. 2.a).
Cullen saw great potential to stimulate the imagination in this edicule that protects a sculpture with a tile roof resting on three columns:

> "Anything that may be occupied either by oneself or by one´s imagination, which here lifts us into a carved stone edicle in Valencia, becomes to that extent of interest a warm colour in the greys of the inhospitable (Cullen, 1971: 36)"

The edicule that captured Cullen's attention is one of the two *casilicios* existing on the *Puente del Real*, one on each side of the bridge. The *casilicios* were characteristic constructions of the Italian baroque, whose purpose was to cover a religious image located outdoors. The images of the *Puente del Real* represent San Vicente Mártir and San Vicente Ferrer, and this second one is the one that appears specifically in *The Concise Townscape*. The sculpture that Cullen photographed is the current one, one of the replicas made in 1936 to replace the originals, sculpted in 1602 by Vicente Leonart Esteve, and placed a year later. The original sculptures had no cover until 1683, when the *casilicios* to protect them were erected, paid for by the archbishop of Valencia Juan Tomás de Rocaberti. The *casilicios* of the *Puente del Real* are triangular in the plan because they are built on the bridge's cutwaters. They are composed of a three-sided roof of glazed tiles, supported by three columns with a shaft of Alcublas black stone, a material that has come out to light after a recent restoration in 2016.
Because of its architectural configuration, the *casilicio* of the *Puente del Real* is considered by Cullen as an urban landscape element, similar to others such as porticos, balconies, and terraces. All of them allow creating exterior spaces framed by architectural elements that, thanks to their transparency, can "draw us outwards" (Cullen, 1971:36).
In the image of Cullen, we can see on the left, behind the bridge, the silhouette of the disappeared Ripalda Palace, designed by the architect Joaquín Arnau, a remarkable example of the Valencian eclectic architecture from the end of the 19th century, which was demolished in 1967-1968 to expand the Exhibition Fair that occupied the adjacent plots. The Fair, however, moved shortly after that to its current location, outside the city, and, on the site of the Ripalda Palace, the housing tower known as *La Pagoda*, designed by the architects Escario, Vidal, and Vives, was built.
Cullen's photograph is taken from the right parapet of the Turia River, looking north. A current image of the stone edicule taken from the same point of view shows us in the background a very different urban skyline, due to the massive volume of *La Pagoda*. The foreground is also very different today when we look at it from the river parapet. The *Puente del Real* and its arches are hidden by the already grown vegetation of the Turia Gardens, a large urban park built in the old riverbed in the eighties, on whose plant mass the stone edicule still emerges (Fig. 2.b).

2.3. The shopfront of the *Platería del Sol*: a handsome gesture

The third image of Valencia, which appears on page 42 of *The Concise Townscape*, belongs to an urban element that unfortunately no longer exists today: the shopfront of the *Platería del Sol* (Sun Silversmith). Cullen uses this example to illustrate a design concept that he calls "handsome gesture":

> "Considering that so much of urban landscape consists of the quiet street, the simple backwater, the humdrum and ordinary, it is perhaps useful to utilize to the full what local talent there is, as this modest little scene shows. A fine display of, I hope, gilt lettering, to illuminate the narrow street (Cullen, 1971:42)"

Figure 3. Shop front of the Plateria del Sol, Valencia. a) Image that appears in The Concise Landscape (Cullen, 1971). b) Current state (Photographic archive of the author, 2019)

The narrow street to which Cullen refers is the street of Martín Mengod, which starts perpendicular to the Market Square and ends up facing down with the facade where the *Plateria del Sol* was once. The signs of its shopfront would never, of course, be authorized today by a heritage commission. However, for Cullen, these signs were a valuable resource to enhance the perspective end of a secondary street, using elements of popular architecture to set up a modest urban scene, unpretentious of monumentality but bright and attractive (Fig. 3.a).

In the place occupied by the shopfront of the *Platería del Sol* with its golden lettering on a black background, we can see today a newly constructed facade of a public building, preserving the proportion of the windows of the original facade and the arrangement of the balconies. However, this new facade, neutral and correct, no longer can "illuminate a narrow street" (Fig. 3.b).

2.4. The *Lonja de la Seda* facade: trees incorporated to the gothic tracery

The fourth and final image of an urban landscape of Valencia that appears in Cullen´s book corresponds to the *Lonja de la Seda* (Silk Exchange Hall). This magnificent 15th-century building is considered one of the world´s most relevant civil gothic buildings and has been declared a World Heritage site by UNESCO. At the bottom of page 82, a photograph shows a fragment of the main façade of the building, adjacent to the Market Square: the flared front door of the *Lonja*, with a slightly pointed arch, and one of the large tracery ogival windows that flank it (Fig. 4.a).

This image, along with others, is used to illustrate the "trees incorporated" section, in which Cullen states that the tree is undoubtely the most ubiquitous of all the natural aids to townscape, and the relationship between trees and towns has a long and honorable history. In this relationship, the focus has moved from a conception of trees as formal structures to a more recent one in which the

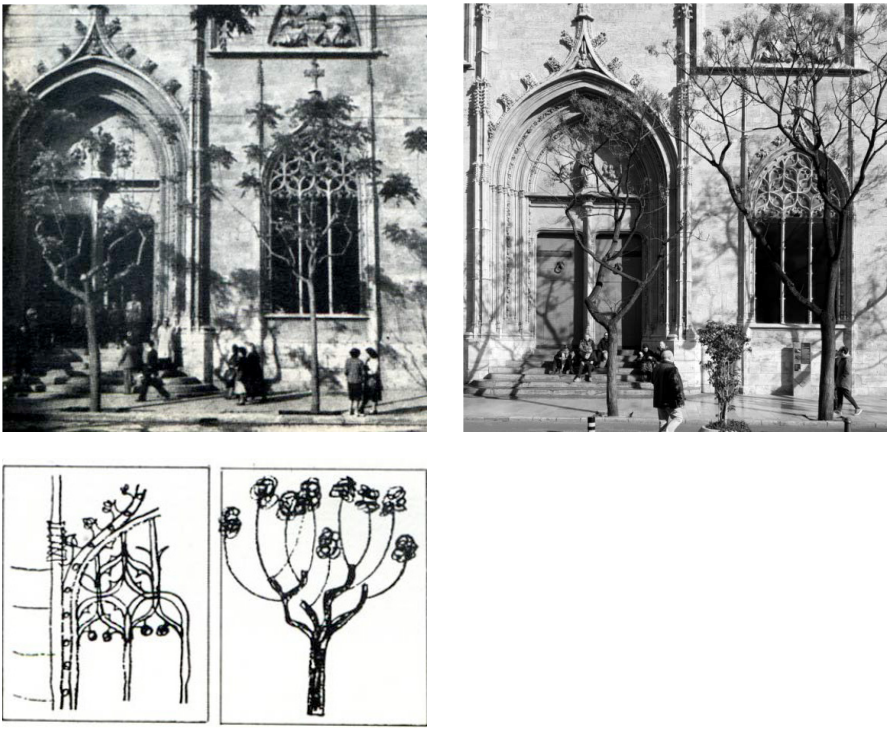

Figure 4. The trees and the gothic facade of the Lonja de la Seda, Valencia. a) Images that appear in The Concise Landscape (Cullen, 1971). b) Current state (Photographic archive of the author, 2019)

tree "is more usually accepted in its own right as a living organism which is pleased to dwell among us" (Cullen, 1971: 82). Only from this perspective is it possible, according to Cullen, to establish new relationships between our own organic architecture and the natural structure.

The photograph of the façade of the *Lonja* is accompanied in *The Concise Townscape* by two drawings, representing what caught Cullen's attention: the formal resemblance between the gothic tracery of the ogival window of the *Lonja* and the branches of the cinnamon trees (Melia azedarach) in front of the facade.

> "The parallel of foliage and tracery in this Spanish scene, below, produces a momentary and transient synchronization which asserts a community of interest beyond the normal and is to that extent remarkable. There is a whole field of study of the textures and habits of growth of trees which can be exploited (Cullen, 1971:82)."

Although Cullen does not point it out, in addition to the synchronization between the tree branches and the gothic ogival traceries, we can affirm that there is an added tuning, which underlines and reinforces the previous one and is clearly visible both in the photograph

of the book and in the one corresponding to the current state: it is the tuning between the tracery and the shadows that the branches of the cinnamon trees project on the facade of the building.
In the photograph of *The Concise Townscape* the cinnamon trees are still young, with a reduced size. Today we can see in front of the Lonja main facade the same trees, already grown, with branches that have acquired a size comparable to that of the gothic tracery of the large windows. However, the asymmetric pruning shows low sensitivity for the structure of branched forms typical of this particular tree type, making difficult the synchronization pointed out by Cullen between foliage and tracery, tree and architecture (Fig. 4.b).

3. CONCLUSIONS

In this communication, we have examined first the relationship between four urban landscapes of Valencia included in *The Concise Townscape* and the four urban design concepts with which they are associated in the book: "outdoor room and enclosure", "looking into the enclosure", "handsome gesture" and "trees incorporated". We have added a comparative analysis of the current situation and the changes these urban landscapes have undergone since Cullen took the photographs for his book.
The simultaneous consideration of the two examined parameters -design concepts and changes undergone over time- allows us to identify four different types of transformation of the analyzed urban landscapes, which are those indicated below:

a) Preservation of the spatial design concept set out in Cullen's book, with the material transformation of some of its elements. It is the case of the *Plaza de la Virgen* textile canopy, which has been renewed in terms of materials but maintains its visual role as a ceiling of the outer room.

b) Preservation of the spatial design concept, although with substantial changes in the context. It is the case of the *Puente del Real* edicule, whose intrinsic visual values still exist, although framed now in a very different environment, both in the foreground and the background.
c) Disappearance of the spatial design concept due to the absence of the element that represented it. It is the case of the showfront of the *Platería del Sol*, erased from the urban landscape of Valencia.
d) Preservation of the spatial design concept with minor distortions in some design elements. It is the case of the *Lonja*, where the forms of the gothic tracery remain immutable over time, as it is foreseeable, because they are stone-built, while the trees in front of its facade grow as living beings, and suffer due to pruning some modification in the shape of its branch structure, affecting its harmony with architecture.
As we can see, only the complete disappearance of the element makes the design concept associated with it cease to be present in an urban landscape. In the other three cases, the spatial design concept expressed by Cullen is still present in today´s urban landscape, even if there have been changes to a greater or lesser extent in the components or the environment.

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PAPER #2.02

MEASURING GENTRIFICATION IN THE RUSSAFA NEIGHBORHOOD

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ABSTRACT

Gentrification is a global phenomenon, affecting a large number of cities. It involves the displacement of neighbourhood resident by new residents of a higher socioeconomic status. This article aims to highlight the characteristics of the phenomenon in the Russafa neighbourhood, in the city of Valencia. The paper focuses on two aspects: changes in the socioeconomic characteristics of the resident population and physical changes in the housing stock. The data were collected from the Population and Housing Census, the Municipal Register of Inhabitants and other statistical information compiled by the Valencia City Council. The neighbourhood's socioeconomic status is approximated through three variables: educational level, vehicle fleet and income, based on the analysis of housing prices. The results obtained show physical and social transformations typical of gentrification phenomena. On the one hand, from the physical point of view, the data indicates that an important real estate activity of renovation, rehabilitation and construction of new housing is carried out. On the other hand, the results indicate that at the end of the analysed period, the socioeconomic level of the population has increased considerably. Thus, the paper supports previous approaches in the literature on the effects of gentrification.

KEYWORDS

Gentrification; housing markets; Russafa; València.

1. INTRODUCTION

Gentrification processes have aroused great interest in the literature. The phenomenon has been analysed in many cities around the world. However, empirical studies on the subject are not so abundant. The Russafa neighbourhood, in the city of Valencia, shows the characteristics of gentrification phenomena. It presents an important dynamism, forming a space that concentrates cultural and leisure activities in the city, in addition to having an important tourist attraction. As occurs in gentrification processes, there has been a change in the characteristics of the resident population and in economic and commercial activity. The aim of this paper is to analyse the magnitude of the changes produced in the neighbourhood and to contrast these changes with those described in the literature.

The paper begins with a brief review of the literature on the phenomenon of gentrification and the studies carried out in different cities in Spain. Data from the Housing Population Census, the Municipal Register of Inhabitants, and other information provided by the Valencia City Council, such as the Census of Economic Activities and the Municipal Vehicle Tax, are used to carry out the analyses. Gentrification

implies a change in the resident population in the neighbourhood. The initial residents with a lower income level are expelled and a population with higher income levels now occupy these spaces. Although there is no information on income by neighbourhood, the socioeconomic level of the population has been approximated based on three variables, education level, number of vehicles and housing pricing, as an asset of urban income. The analyses carried out show the social transformations typical of gentrified neighbourhoods with an increase in the socioeconomic level of the population.

2. THEORETICAL FRAMEWORK

The term gentrification, first used by the sociologist Ruth Glass in 1964, describes an urban phenomenon characterized by the displacement of the original inhabitants of a neighbourhood or urban area by population groups with higher income levels. Despite the simplicity of this idea, the characterization of the phenomenon is complex due to the wide variety of urban processes. In the 1980s and 1990s, those interested in these spaces were the new professional classes, the yuppies; already entered the 21st century, globalization, the knowledge society and transformations in the organization of production, causes new classes or groups to feel attracted to these spaces as places of production, residence and consumption, (Florida 2005, Del Romero and Lara 2015). In addition, the transformations in consumption patterns derived from globalization make various spaces in the city especially attractive as places of leisure, culture and tourism, activities that stimulate the gentrification process. From a physical point of view, the process involves the renovation and/or rehabilitation of the housing stock that initially shows a high level of deterioration. The explanatory causes of the emergence of gentrification processes have been approached from two main currents: on the demand side and on the supply side.

In the demand approach, gentrification is a consequence of sociocultural changes. The phenomenon is a consequence of new residential preferences resulting from sociocultural changes. The origins of gentrification are linked to new tastes and cultural orientations of the new social classes arising from structural transformations in the economy leading to changes in the socioeconomic residents' profile (Law 1980, 1986, 1996 and Hammet 1984). In this period, there is a trend contrary to that of previous decades, with a significant part of the middle classes preferring to live in inner city instead of seeking peripheral locations far from the centre. For this approach, social changes are the trigger that initiates the gentrification process, Law (1980). The demand approach has been criticised for considering the emergence of new social classes and lifestyles as the sole explanatory cause of the phenomenon, pointing out that there is no extensive empirical evidence to support this premise.

In 1979, the geographer Neil Smith developed a supply-side theory approach. He considers that the determinant of gentrification processes is the difference or gap between the current value of the property and the potential rent of the land. The deterioration of these spaces causes the interest of investors to diminish even further, which puts downward pressure on the value of the properties and allows the appearance of the gap. For this approach, the key lies in the appearance of an undercapitalized ground rent together with a high growth potential, this gap makes the investment and transformation of the spaces interesting. As the process consolidates, property rents increase and rent differential disappears. The catalyst of the process is capital in search of profitability (Smith 2002). Gentrification is seen as a phenomenon related to the profitability possibilities of new urban spaces. Critics point out that the premise of potential profitability is insufficient to explain the phenomenon (Clark 1992). Moreover, individual actors do not play any significant role in this model. Hammet (1991) proposes an approach to the phenomenon by introducing supply and

demand behaviours. Unlike Smith's theory, it is not oriented to the potential value of the properties, it focuses on the gap between the "investment rental value" (current value of the properties based on their rental income) and the "vacant possession value" (potential value if converted to acquire property) (Hammett 1984). If the rental investment value is less than the vacant possession value, there is a mismatch that constitutes pressure to change the tenancy regime, renovate and sell the property. According to Hammet (1984) gentrification should be considered simultaneously as a physical, economic, social and cultural phenomenon.

A third interpretation of gentrification processes is related to urban renewal actions derived from urban policy. The resurgence of the role of the city in the current economic context, its importance in economic growth, has generated an increase interest of administrations in their cities. Renovation actions make rehabilitated or newly built homes more expensive and therefore more affordable for the higher income levels of the population.

In some cases, capital acts proactively to accelerate the process, in others, properties reach high levels of deterioration and abandonment and become occupied by low-income marginalised populations before gentrification begins. From a systemic approach, gentrification arises whenever a catalyst appears, which would be the income gap. However, the gap can arise for a variety of reasons, either from the demand side, the supply side or both, and it will occur with different intensity, given the different characteristics of the actors involved in the different processes.

Many studies have examined the phenomenon of gentrification in cities and neighbourhoods. Studies initially focused on European and American cities. Later, from the 21st century onwards, they spread to cities in other continents. Duque (2010) provides an extensive review on the subject. In Spain, the works of Vázquez (1996), Janoschka and Sequera, J. (2005), Sequera, J. (2020), Muñoz (2009) and Renaud (2013) in the city of Madrid stand out; Sargatal (2001), Hernandez (2015) and López Gay (2008, 2016) and Crespi-Vallbona (2018) in Barcelona; Gómez and González (2001) and Vicario and Martínez-Monje (2003) in Bilbao; Diaz (2009, 2015) in Seville and in Granada, Duque, R (2010, 2016). Among the various studies carried out, some focus on commercial gentrification, as is the case of gentrification related to that generated from market renovation, González and Waley (2013). Hernández-Cordero, (2014) and Díaz (2015).

3. GENTRIFICATION IN RUSSAFA NEIGHBORHOOD

The origins of Russafa date back to the 9th century when an Umayyad prince, following the custom of the leaders of the time, built his palace, an *almunia*. Centuries later, the construction of the medieval wall determined an intramural space and an extramural periphery in which various municipalities were located, including Russafa, (Cortes 2014). The neighbourhood maintained its hegemony until the 18th century. In the 19th century, with the rise of the bourgeoisie, the need for interventions and transformations in the city gained strength. In 1877 the neighbourhood was integrated into the city of Valencia and in 1907, the Mora's Expansion Project integrated Russafa into the regular layout of the expansion, preserving the most representative buildings of the neighbourhood. During the Second Republic, the neighbourhood experienced a period of cultural splendour and progress. It was consolidated as a popular neighbourhood of workers, peasants and shopkeepers, with important commercial activity centred on small workshops and shops, and an intense social and political life (Torres, 2007 and Del Romero and Lara 2015). From the 1960s onwards, the industrialization process took place, with a phase of urban growth in generally pre-industrialised geographical areas. Spanish cities such as Valencia grew significantly in an uncontrolled stage (Teixidor and Boira 1991). Despite the population growth,

the central spaces lose population in line with the loss of relative quality with respect to the new developments in the periphery. At the end of the 1980s, Russafa was a neighbourhood with an old housing stock and significant equipment deficiencies. A stock of empty cheap housing is generated and, in many cases, deteriorated, in a highly accessible space. The houses will soon be reoccupied by citizens from other countries with low income levels (Table 1).

Variation rates

	70/81	81/91
Russafa	-25,3%	-14,4%
Distrito L'Eixample	-24,0%	-15%
Ciudad de València	13,2%	1,1%

Table 1. Population evolution (1970-1990). Source: Prepared by authors based on INE, Censos de población y vivienda

"From 1981 to 2001, the Russafa neighbourhood lost more than 25% of its inhabitants" (Del Romero and Lara 2015). In 2006, the Urban Vulnerability Observatory included Russafa in the list of Vulnerable Neighbourhoods (Jimenez 2014). In the early 2000s, Russafa was a neighbourhood with a declining population with a large number of empty flats and shops. This demographic trend, however, had begun to change in the 1990s when the first immigrants began to settle, attracted by the centrality, accessibility and the availability of cheap rents (Torres 2007). In the 1990s, Russafa consolidated as one of the city's immigrations neighbourhoods, initiating that multicultural aspect that would characterize it. This characteristic would become an attraction of the neighbourhood, especially for new social groups related to culture, art and the creative industry (Florida 2002). Entering the 21st century, important urbanisation works within the framework of the Riva Plan, Trust Plan; and works in the Central Park that provide a high-quality green urban environment and the possibility of housing social facilities. The intervention creates an urbanization, with large sidewalks and chamfers which enhances the profitability of restoration activities. Capitals related to the commercial and services sector became interested in the neighbourhood and began to invest in it. Thus began a process of replacement of traditional commerce and local businesses opened by immigrants in the previous two decades. Modern restaurants, galleries and other spaces related to culture increased. The commercial substitution process accelerated, generating an excessive saturation of cafeterias, restaurants and cocktail bars. In 2014, faced with the saturation of the restaurant business, the Valencia City Council decided to apply restrictions on hotel and leisure-related activity.

4. RESULTS. MEASURING GENTRIFICATION

The evolution of the population that we already pointed out in the previous section, comparing the Russafa neighbourhood and the overall population of the city of Valencia, shows that both dynamics are clearly different (Fig. 1). Since the 1970s, the neighbourhood has lost population, as is the case in other central areas of the city that have an old housing stock and a deficient level of facilities and urban quality. At that time, new urban developments of higher residential quality, propitiate the abandonment of these central spaces by the residents. It can be seen how in the 1990s, the population dynamics changed, reaching, reaching a certain stability from that moment onwards. At the end of the 1990s, the departures of previous residents was compensated by the entry of new residents, mostly from other countries and with lower income levels.

Looking at the physical changes in the neighbourhood, data on the age of the dwellings highlights a decrease in the number of old dwellings, especially those between 100 and 120 years old, and an increase in new construction since the beginning of the 21st century (Fig. 2). The reduction in old dwellings has generated new sites for new construction or renovation. The information obtained is consistent with the physical transformations typical of gentrification processes.

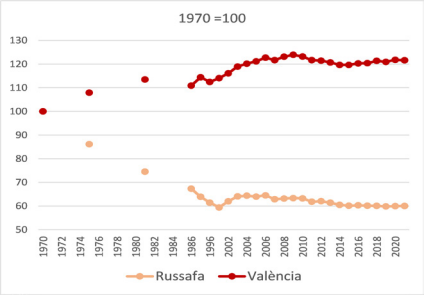


Figure 1. Evolution of the population in Valencia City and Russafa Neighbourhood. Source: Prepared by authors based on Padrón Municipal de Habitantes

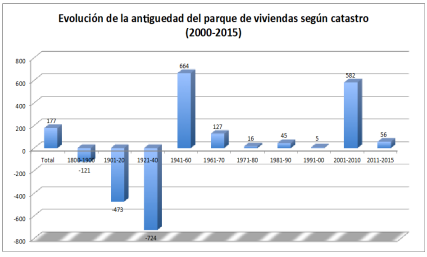
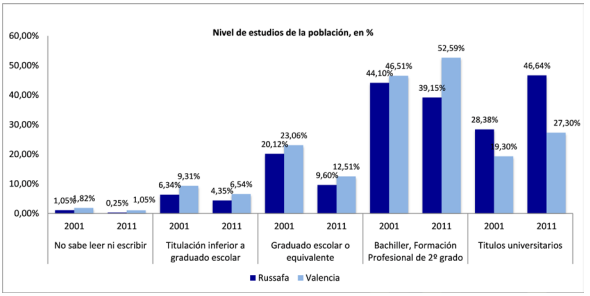


Figure 2. Evolution of the age of the housing stock (2000-2015). Source: Prepared by authors based on Catastro

Gentrification involves a change in the socio-economic structure of the population. Lower income residents are, to some extent, displaced by new residents with a higher socio-economic status. To demonstrate this change, since data on income levels are not available, but an approximation of the socioeconomic status can be made on the basis of educational attainment, the taxable power of the vehicle fleet and the evolution of real estate income, as a function of household prices. The level of education was obtained from the information provided by the last two available Population Censuses, 2001 and 2011. The data indicate that the proportion of the population with a university degree is growing significantly more in Russafa than in the city as a whole (Fig. 3). The variable fleet of vehicles has been chosen under the consideration that a population with a higher taxable vehicle fleet corresponds to a population with a higher level of income and socioeconomic level. The data indicates that the residents of Russafa have a higher proportion of vehicles with high fiscal potential (20CV) than the city as a whole. In addition, this difference grows over time (Fig. 4).



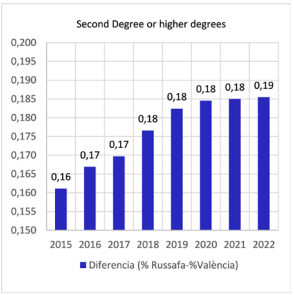


Figure 3. Educational level of the population. Source: Prepared by authors based on Censo de Población y viviendas, 2001 y 2011 y Padrón Municipal de Habitantes.

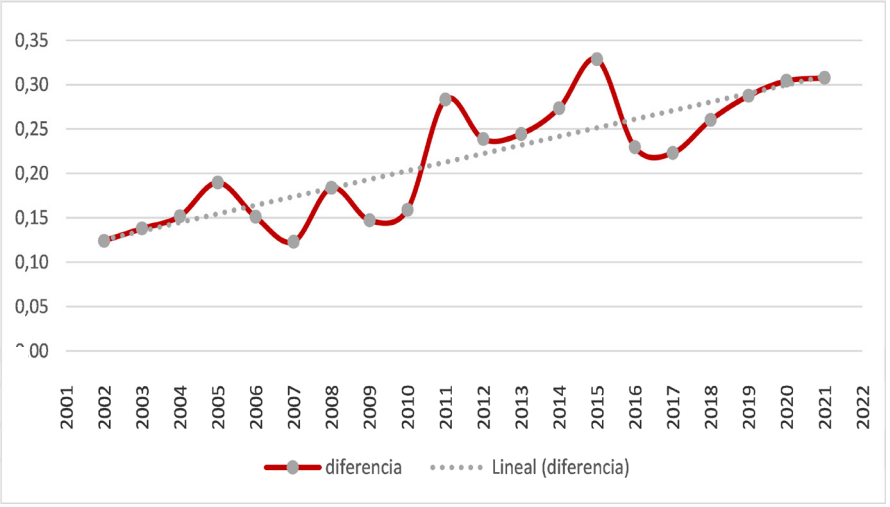


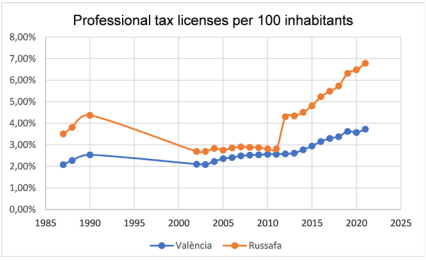
Figure 4. Number of vehicles with more than 20 CV per 100 inhab. Russafa-Valencia difference, Year 2021. Source: Fuente: Prepared by authors based on Impuesto municipal de Vehículos, Ayuntamiento de Valencia. Elaboración propia

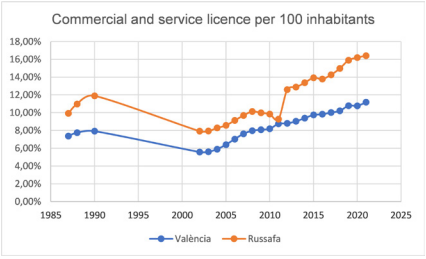
The third variable considered was housing prices, as it is a variable that approximates urban income and therefore the socioeconomic status. To this end, the average house prices per square meter in each neighbourhood were analysed at two separate points in time. They have been ordered in ranking from highest to lowest price. Thus, the neighbourhood that occupies the first position is the one with the highest average price per square metre. Of the total of 70 neighbourhoods, Russafa is the second neighbourhood that has climbed more positions 32 positions (Table 2). The data allows us to affirm that in Russafa housing prices have risen above the city average, settling in a neighbourhood occupied by residents who can afford to pay higher prices. The available information also allows us to analyse changes in the economic activity of the neighbourhood based on the activity license data. Specifically, we analyse the activity licenses per 100 inhabitants for the groups of professionals, commerce and services, and within these the group of shops, restaurants and hotels. Particularly significant is the increase in the number of professionals who have registered their activity in the neighbourhood (Fig. 5). The increase in commercial and services activities, as well as hotels and restaurants, is also very significant. It is known that gentrification is often accompanied by the intensification of activities related to leisure and tourism. As can be seen, for the different activity groups, the percentage of neighbourhood activity licenses per 100 inhabitants is higher than for the city as a whole. In addition, this proportion has grown at a higher rate over the last decade than for the city as a whole.

Precio medio metro cuadrado			
BARRIOS	Posición 2008	Posición 2022	Cambio de posición 2008-2022
1. Ciutat Vella			
1. la Seu	11	7	4
2. la Xerea	3	4	-1
3. el Carme	15	17	-2
4. el Pilar	12	14	-2
5. el Mercat	6	12	-6
6. Sant Francesc	2	3	-1
2. l'Eixample			
1. Russafa	43	11	32
2. el Pla del Remei	1	1	0
3. Gran Via	5	5	0
3. Extramurs			
1. el Botànic	21	20	1
2. la Roqueta	20	10	10
3. la Petxina	27	29	-2
4. Arrancapins	19	25	-6
4. Campanar			
1. Campanar	26	23	3
2. les Tendetes	38	54	-16
3. el Calvari	52	58	-6
4. Sant Pau	14	8	6
5. la Saïdia			
1. Marxalenes	46	47	-1
2. Morvedre	31	36	-5
3. Trinitat	24	28	-4
4. Tormos	61	59	2
5. Sant Antoni	49	46	3
6. el Pla del Real			
1. Exposició	4	6	-2
2. Mestalla	16	15	1
3. Jaume Roig	9	16	-7
4. Ciutat Universit	10	19	-9
7. l'Olivereta			
1. Nou Moles	54	51	3
2. Soternes	51	53	-2
3. Tres Forques	66	66	0
4. la Fontsanta	63	69	-6
5. la Llum	39	50	-11
8. Patraix			
1. Patraix	55	41	14
2. Sant Isidre	53	63	-10
3. Vara de Quart	59	57	2
4. Safranar	44	45	-1
5. Favara	32	56	-24

Precio medio metro cuadrado			
BARRIOS	Posición 2008	Posición 2022	Cambio de posición 2008-2022
9. Jesús			
1. la Raiosa	47	48	-1
2. l'Hort de Senab	56	61	-5
3. la Creu Coberta	45	52	-7
4. Sant Marcel·lí	60	64	-4
5. Camí Real	37	62	-25
10. Quatre Carreres			
1. Montolivet	22	42	-20
2. En Corts	34	40	-6
3. Malilla	42	32	10
4. la Fonteta Sant	62		
5. na Rovella	25	65	-40
6. la Punta	13	21	-8
7. Ciutat de les Art	8	13	-5
11. Poblats Marítims			
1. el Grau	28	38	-10
2. el Cabanyal	70	31	39
3. la Malva-rosa	67	37	30
4. Beteró	50	33	17
5. Natzaret	69	68	1
12. Camins al Grau			
1. Aiora	30	43	-13
2. Albors	57	35	22
3. la Creu del Grau	36	48	-12
4. Camí Fondo	29	34	-5
5. Penya-roja	7	2	5
13. Algirós			
1. l'Illa Perduda	33	30	3
2. Ciutat Jardí	23	24	-1
3. l'Amistat	48	39	9
4. la Bega Baixa	18	26	-8
5. la Carrasca	35	9	26
14. Benimaclet			
1. Benimaclet	41	27	14
2. Camí de Vera	58	22	36
15. Rascanya			
1. Orriols	68	67	1
2. Torrefiel	64	60	4
3. Sant Llorenç	17	18	-1
16. Benicalap			
1. Benicalap	40	44	-4
2. Ciutat Fallera	65	55	10

Table 2. Ranking housing Price per square meter in the City of Valencia Source: Prepared by authors based on real estate portal Idealista.





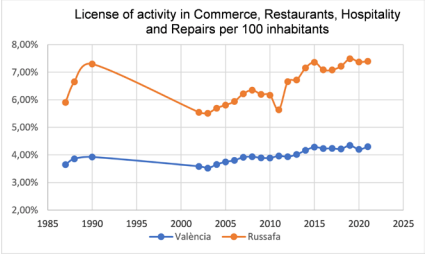


Figure 5. Economic Activities in Russafa Neighborhood. Source: Ayuntamiento de Valencia, Prepared by authors based on Censo de Actividades Económicas

5. CONCLUSIONS

The phenomenon of gentrification is present in many cities around the world and has been the subject of much academic literature. Gentrification implies a renewal of city spaces and a change in the population structure, as the initial population with lower income levels is replaced by a population with higher income levels. Although we do not have data on the income level of the neighbourhood, studies show that the neighbourhood has undergone both a physical and social transformation.

On the one hand, the physical transformation is substantial, there has been a renewal of the housing stock, improvements in infrastructures and facilities, as well as in the quality of urbanization. These improvements come both from actions by the administration in the case of urbanization and new infrastructures and facilities, and from private investment through the rehabilitation and new construction of housings.

With regard to the characteristics of the population, it is evident that the level of education of the residents of the neighbourhood is above that of the city as a whole and, furthermore, in the period analysed it improves to a greater extent than for the city. The difference widens over time. The second variable used, the number of vehicles with high tax power, more than 20 CV, also grows above the city as a whole. The third variable used to approximate the socioeconomic level is the price of housing as an indicator of urban income. The data shows that housing prices grow significantly. Based on the ranking of housing prices per square meter per neighbourhood, the offer price in the Russafa neighbourhood climbs 32 positions with respect to a total of 70 neighbourhoods, rising from 43rd place in 2002 to 1th place in 2022.

Beyond questions related to the characteristics of the residents, focusing on economic activity, based on the data provided by the City Council by the census of economic activities, the neighbourhood shows a great dynamism with a significant increase in the number of professionals and activities related to commerce and leisure.

We can conclude that the analysis carried out provides relevant evidence endorsing that the physical and social transformations typical of the gentrification processes indicated in the literature are present in the Russafa neighbourhood. Future research will focus on the problems arising from gentrification processes related to tenure regime and access to housing.

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PAPER #2.03

GROWING FAST, INNOVATING SLOWLY. INFORMAL AHMEDABAD BETWEEN PAST AND FUTURE

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ABSTRACT

The fast urban development in India is making evident many social, cultural, and economic complexities reproduced in the city's planning and design. The drive for modernization is becoming the central topic in the national and political debate and becomes more urgent every day. Among these contexts, urban fabrics in-between developing cities, heritage roots, "smart city" missions and "kinetic" cities constitute a framework for research on morphological, functional, social and environmental perspectives. This paper investigates contested locations in Ahmedabad, where informality finds space between heritage structures and recent beautification projects, such as the Sabarmati riverfront. The paper understands how a holistic approach is essential in rethinking and upgrading the spatial and urban conditions of informal settlements in the city and therefore highlights the relevance of adequate lenses to understand these complexities. Like many other cities in India, living in slums or informal settlements is a common phenomenon in Ahmedabad, as they provide affordable housing close to job opportunities. In 2009, AMC (Ahmedabad Municipal Corporation) identified 834 slums, sheltering 23 per cent of the total population of the city. Several conditions and features characterize these settlements since their communities are often from the same region, class, caste, or religion. This paper will analyze case studies in Ahmedabad, where the friction between informality, preservation of heritage structures and new smart city developments is evident. The paper will question various assumptions regarding the informal environment and analyze their cultural and architectural identities, the domestication of heritage structures, and vulnerability within the idea of a smart and globalized Ahmedabad.

KEYWORDS

Heritage; smart city; informality; India.

1. INTRODUCTION

Today, as other countries on Global South, India faces a constant population growth, especially in the urban environment.[1] The rising of the service sector and the location of manufacturing companies on the periphery of the major cities have contributed over the years to a migratory flow from rural areas, with a resulting wide-scale impact on the social fabric. The fast urban growth, combined with urban economic modernization (Fernandes 2004, 2415–2430), has created an exacerbation of problems related to various aspects of social, economic, and political exclusion and the invisibility of marginalized groups.

In 2020, 35% of the Indian population lived in cities (Worldmeters.info), and according to an Indian Urbanization Econometric model report of 2010, most of the states would become majorly urban in 2030 - Tamil Nadu (67%), Gujarat (66%) (McKinsey Global Institute, 2010), bringing economic opportunities as well as a high pressure on the planning and governance institutions to manage urban growth. Nowadays, most Indian urban settlements expand haphazardly, without a masterplan and following decades-old urban and building regulations (Government of India New Delhi, 2021). Moreover, a strong political agenda to transform India into a world economic power (Pande 2020), is creating a demand on urban settlements to be competitive and globally visible, bringing new logics and aesthetics to urban spaces and built forms.

K. T. Ravindran (2017, 15-16) draws attention on how in the past seven decades, interest in urban development in India has focused on large cities or their rapidly expanding peripheral areas.[2] However, most urban centers include historic cores of ancient formation, characterized by an intrinsic cultural and identity value. Still today, no specific guidelines have been identified for buildings in which the historical features can be embedded in the future change.

Industrialization emerges as the only path for the economic development of society and the classification of Indian cities, and the distribution of their resources is also based on it.[3] The master plans as well as the national and international funding have focused on infrastructure development to support industrial growth. Moreover, the same planning approach is applied to historic cities recognized as India's cultural heritage.

This approach is a restricted vision which does not consider the requirements of Indian historic cities: cultural value, tangible and intangible, is not considered as a significant part within the transformation process of integrated development projects.

In heritage precincts, such as the city of Ahmedabad, the ancient traces are not only imprinted in the architecture and urban fabric, as testimony of the communities' history, but even more visible in the city's cultural and traditional legacy, which is expressed in rituals and festivals, including urban space as an integral part of the communities themselves.[4] The place's bond with the people who still actively live in it, shaping an ever-evolving city form in which new elements are juxtaposed in the older fabric, adding a new phase to the centuries of past histories.

Figure 1. Abandonments and encroachments in the Walled City of Ahmedabad This situation in the Indian historic districts highlights how the definition of specific guidelines for preserving the traditional buildings of the historical fabric, which can be incorporated into the future change of cities, is still weak. (©Authors 2019)

2. INDIAN URBAN EXPERIENCE "IN BETWEEN"

2.1. The negotiation of space

Indian urban spaces result from a cross-cultural, religious, gendered, and caste trade-off, which culminates in a temporary and informal appropriation of space. To emphasize the features permeating Indian urban culture, three main characters are recognized as distinguishing the intricate and diverse Indian environment, which cannot be overlooked even within the strategic framework for the protection of India's historical heritage. These characteristics must be considered when defining future scenarios for planning Indian cities, both in their public spaces and in the modernization drives: static/kinetic city, formal/informal, insurgent public space.

The continuous negotiation of space by diverse groups and activities has an important impact in the production of space in the city and on the experience of its identity. The flexible and temporal spatial manifestations of complex social, economic, political, and cultural dynamics represent a fundamental characteristic of the Indian city. Mehrotra (2008) refers to the relationship between "kinetic" and "static" to define the Indian urban experience. The "kinetic city" is temporary in nature, constantly modifying and reinventing itself, a city that is elastic, adaptable and malleable, made of canvas, plastic sheets and wood (Mehrotra 2008, 206). Many times, associated with informality and poverty, the kinetic city is a condition of negotiation of space in dense urban settlements: festivals, processions, weddings, street vendors, encroachments, religious rituals create a city in constant flux, that gets built and rebuilt over time. On another end is the static city, defined as formal, more permanent and built with stronger materials. It is a condition dependent on the spectacle of architecture.

The second character is the relation "formal/informal". Informality, according to Ananya Roy (2009), is an ever-shifting status between legal/illegal, legitimate/illegitimate, authorized/unauthorized. Even if this status is not exclusively associated with poverty, that is the perception (Roy 2009, 80). In 2018, 90% of all workers were somehow part of the informal economy (Raveendran, Vanek, 2020), and 35% of the Indian urban population lived in informal settlements (worldbank.org).[5]

Slums are the most evident spatial manifestation of informality (or of the relationships between formal and informal) in the urban fabric. They are spread out in different areas of the city, with a close relation with wealthier neighborhoods, and in vulnerable areas such as riverfronts, low-lying areas, and vacant lands of private or public ownership (Bobbio 2015, 118). Morphologically, they can be easily identifiable as enclaves of high-density low rise construction, with an intricate network of streets and open spaces. As cities expand and rethink their urban spaces, these settlements are interpretable as ghettos, unsuitable for the imagination of a 'Global City' (Mahadevia, Desai, Bhatia 2018, 21). The legibility of these settlements as 'informal' creates not just physical but social boundaries between slum dwellers and the remaining citizens (Bobbio 2015, 119). Informal settlements are unmapped areas of the city, waiting for investment or displacement. The perception of temporality, associated with informal settlements, creates zones of disinvestment, by slum dwellers that avoid investing on the improvement of their houses, threatened by displacement (Marnane, 2019), and by public governance, that holds these central plots for future development (Bobbio2015, 125) (Fig. 2).

Moreover, the informal economy is visible in the use of public space by commercial and service activities as street vendors, cobblers, tailors, or bike repairing workshops (Fig. 3). The National Association of Street Vendors of India (NASVI) estimated that in 2015 the number of street vendors was about 2% of

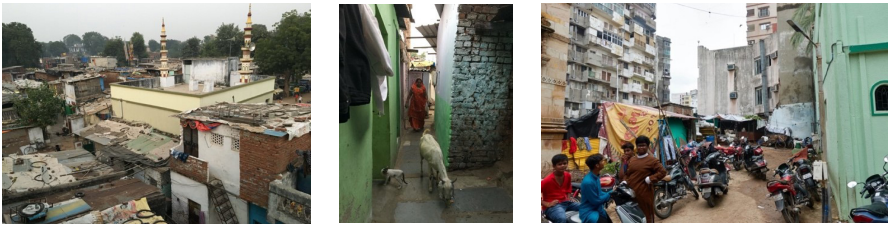

Figure 2. Informal settlements in Ahmedabad located between the right bank of the Sabarmati River and the historical walls at Shapur: Shankar Bhuvan with the high density of buildings (left), the intricate network of alleys between the houses (middle), informality between Khanpur Gate and new apartment blocks outside the walls. © authors 2019

the entire population, 200 000 in Mumbai and 127 000 in Ahmedabad.[6] The occupation of public space by these activities is diverse and complex. While some vendors are mobile and have different routes through the city to sell their products, others are stationary, with a fixed location and a tentative time schedule. Some vendors work in isolation, while others gather in clusters or markets. The markets involve other suppliers of essential services to the vendors, such as water, electricity, and storage, and agglomerate many consumers. One of the largest street markets in Ahmedabad, the Sunday market, had between 150000 to 200000 visitors every Sunday (Mathur 2012). These activities provide an important contribution to the urban economy, creating employment and bringing affordable products to the urban population. Moreover, they organize public space with their structures, producing landscapes of commercial and social transactions.

The third characteristic is what Jeffrey Hou (2010) defines as "insurgent public space," describing actions that articulate alternative social and spatial relationships, in which the public realm becomes a support for "a more diverse, just, and democratic society" (Hou 2010, 12). This view of public space highlights the capacity of civic groups and individuals to play a role in shaping the contemporary urban environment, with alternatives to the conventional urban planning practice, and despite official rules and regulations.

Figure 3. Commercial activities and street vendors along the historical masterpieces: a tailor with his shop near the old city wall (left), and the Sunday Market along the western Wall. © authors 2019

2.2. Heritage VS modernization

Referring to Mehrotra's insightful observations, Indian cities are the expression of decades-long transitions in India: the built environment is a physical tangle in which fractured fabric, bizarre overlaps, and different stories clash in the same space (Mehrotra 2019, 9-11).

Political intentions and rhetoric are focused on "building a global city," feeding the urgency of a world capital. On one side stands the private business interests of multinational corporations and the Indian state. On the other, the civil society of intellectuals, NGOs, trusts, associations, cooperatives, and trade organizations, seeking for more inclusive policies. The spatial elements of these two dichotomous visions are, on the one hand, airports, motorways, luxury hotels, congress centers, subways, railway systems and a modernization of the streetscape according to imported models from the Western world. The architectural output shows an alienation from tradition, material, and craftsmanship in which the community is located, as well as from a critical adaptation to standardized architectural patterns. The projects are big-scale infrastructure, capable of providing stable and reliable facilities for capitalist profit. In this situation, wealthy people establish "safe" enclaves, like archetypical crystal towers[7] or new suburban complexes, and become more and more clusterized from the city.[8]

This scenario is also characterized by a preservation of historical buildings which are interpreted and used as symbols to represent national and local identity, and, on another hand, by a progressive vacancy resulting from weak public actions, as Mehrotra (2019) states.

As the socialist logic of a state-controlled economy is lost, the everyday space is turned into a landscape of DIY settlements and into suburbs sprawling on the edges of the state controlled urban boundary. These suburbs are characterized by tower blocks with eclectic languages, squeezed into a minimal plot, where the land's highest profit is the rule. The layout of these cities is a bazaar with informal settlements, where economic and cultural challenges are expressed by the population. The projection within this framework is an exponential boom of urban areas with more than a million inhabitants (and perhaps more) in the upcoming years.[9]

The "Strategic Plan of Ministry of Urban Development for 2011-16" by the Ministry of Urban Development stipulates that to improve the cities' competitiveness and to provide essential facilities to the citizens, urgent actions are required. To tackle this, the former Planning Commission of India planned the creation of the first Indian 'smart' city model. In 2015, the Central Government of India launched the "Smart city mission" (smartcities.gov.in), an initiative that, through a phase-wise process, meant to select 100 cities and help financing its "smart" development, in partnership with other state and central programs, as the Swachh Bharat Mission or the National Heritage City Development and Augmentation Yojana.[10]

The loose framework of the initiative and definition of smart-city resulted in the integration of a large variety of projects throughout different cities without a common clear vision of "smart" urban development. According to Prasad et al. (2020) the projects funded were mainly: piece-meal placemaking projects, knowledge-based employment amenities, and data-driven urban management projects. Various cities selected in the initiative have historical cores, however the question of preservation and management of heritage is mostly not addressed.

These 'smart' cities have been promoted by the government as a prototype for pioneering development (Bholey 2016, 2394–3351), in which infrastructure improvements are identified. Similarly, digital ICT is seen as tools to deal with the lack of infrastructure and to promote sustainable development.[11]

3. THE AHMEDABAD' CASE

3.1. The soul of paradox

More than in any other Indian city, the past and present can be clearly seen in Ahmedabad. The city was able to adapt itself to different historical periods, developing commercial and industrial skills, and traditional patterns of social organization, while keepingits own identity (Gillion 1968, 2). Several myths and beliefs are told about its foundation, examining the reasons why the city was established where it is today, on the eastern bank of the flowing Sabarmati River. Different enchanted visitors sing of its carved architecture, as its location was along the trade routes and it was a city of strategic importance, in the central heart of Gujarat, where temporary markets took place (Chokshi, Trivedi 1961, 1). Moreover, the proximity of water sources ensured prosperity and was the reason for its fortune. It remained the capital of Gujarat from the 15th Century until almost the present day, with only sporadic gaps.[12]

Thus, Ahmedabad's soul has its roots in the history of the geographical area in which the city is anchored, where different religions such as Buddhism, Jainism, Zoroastrianism[13] and Islamism predominated over different times and where centuries of domination by kings, mostly Hindus, anticipated the Islamic rule.

Ahmedabad embodies all these features in its experience and reflects them in its architecture, mosques, temples, mills, thanks to its million inhabitants who live there today. An indepth multitude of tangible elements, attested by their landmarks and the monumental architecture reveals the series of ages within its historical layers.

Historically, Ahmedabad has always been in the middle of one of the most important trade routes in western India. As the industrial era dawned, it turned into the so-called "Manchester of India" by Spodeck (2011), due to its high growth in manufacturing and its social and political environment.

Still today, the city embodies two interlaced souls in a single physical body. In the oriental part, the walled city, deeply rooted in tradition, with its suburbs dotted with textile factories (mills) and chaals, marked by the working and industrial class. On the western bank of the Sabarmati, new neighborhoods of the Hindu middle class cluster with cultural institutions, universities, and masterpieces of modern architecture (Yagnik, Sheth 2016, 257-258). Moreover, Ahmedabad also has become well-known for Indian independence history, establishing it as the freedom movement's headquarters.

Today, Ahmedabad is the seventh largest metropolitan city in India and the largest in the state of Gujarat, with a population of almost eight million inhabitants.[14] A vibrant city animated by a hybrid soul in a symbiotic relationship between ancient urban fabric, heritage monuments, examples of remarkable architectural modernism and a strong tendency towards globalized development and transformation.

Currently, Ahmedabad is a prominent industrial and financial hub, contributing about 14 percent of all stock market investments in India and 60 percent of the state's total productivity (Bhatt 2003). Several scientific and educational institutions of national, regional, and global importance have been established in the city, attracting a wide range of highly qualified young professionals. Moreover, in 2016 Ahmedabad has been selected as one of the first 20 Smart Cities in India (http://ww.smartcities.gov.in/) and the present size of the urban area is twelve times the size of the Walled City (AUDA 2021), with a steadily growing trend.

In common with other cities in recent years, Ahmedabad has faced increasing pressure in the pursuit of globalized development, highlighting the deep fragility of the Old City squeezed by the pressures of rapid urbanization. This condition has been creating a strong pressure upon the city and the planning of public spaces, increasing urban congestion and chaos, exacerbating social

inequalities, intensifying property erosion, and reducing public land in the future planning of the city. Over the past two decades, this rapidly changing condition has seen the exacerbation of conflicts (Jaffrelot 2003), echoing similar inequalities in various historic cities of the developing world, and at the same time an overwhelming social movement to save the priceless heritage in danger of destruction.[15]
In contrast to the overall population growth, due to the rural-urban migration phenomenon, the Walled City has a depopulation trend, causing the abandonment of traditional Pols, as the inhabitants move into new houses in the city's modern districts.[16] The Walled City reveals heavily congested traffic, narrow streets, polluted air, lack of water provision, poor maintenance of traditional houses and a fragile society, which has been intensified by riots in the recent past, mainly due to religious conflicts,[17] which have caused further insecurity.

3.2. Permanence VS transformation

Over the six hundred years of its history, the city of Ahmedabad has alternated between glory phases, which have adorned the city with superb architecture and scenic beauty, and periods of decay, which have compromised the preservation of its architectural heritage and urban fabric.

Since the foundation in 1411 on the eastern bank of the Sabarmati by the Sultan Ahmed Shah, Ahmedabad remained a city enclosed within irregularly shaped semi-circular fortification walls that played an important role in the city's defense. Ahmedabad has passed through a chain of events and multiple histories, which have crossed over the walls of the city, shaping its identity and genius loci. Gillion (1968) identifies the tradition and corporate spirit of its inhabitants, a middle-class élite connected to the history of local financial, commercial, and manufacturing enterprises, and able to evolve to a modern industrialization. Ahmedabad's prosperity, compared to some other cities in India, was derived from trade and manufacturing, and not from the exploitation of the farmlands; its craftsmen were independent of governmental rule; and its merchants and financiers formed an upper class, a widely heritable plutocracy (Gillion 1968, 14). The richness of the city impressed western voyagers, and Ahmedabad became well-known thanks to the Western travels for the craftsmanship of its workmanship (Tavernier 1676; Thévenot, 1687; Campbell 1879; Foster 1905). However, as Gillion reports, its changing fortunes culminated also in neglected conditions: from the 17th century, with the occupation and domination of the Joint Rule (1738 -1753) (Campbell 1879, 255)

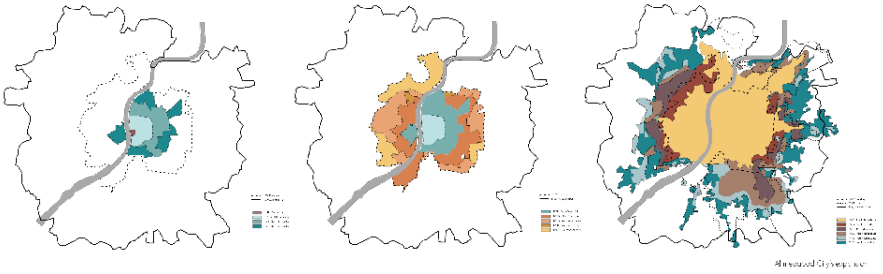

Figure 4. Ahmedabad' City expansion: Between 1411 foundation -1931 British Rule (left); 1931 British Rule - 1959 Post independence (middle); 1972- 2012 (right). © authors 2021

and the Maratha dynasty (1753-1780), when Forbes (1834, 187) reported how the entire territory was in ruins and affected by insecurity and gradual depopulation (Yagnik, Sheth 2016, 77). Also, the wall ramparts had cracked in many spots and there was no life except tigers, hyenas, and jackals in the inner part of the city. Forbes describes the 54-mile-long wall with irregular towers every fifty meters, twelve main gates and several gateways (Forbes 1813, 91; 117). From an area of thirty miles, the city had shrunk to be smaller than six miles and with a population of over 100,000 citizens (Forbes 1813, 150): most of the inland area was covered by ruins and dilapidated public buildings or used as fields and fruit orchards.[18] When Dunlop stepped into the city (December 1817) Ahmedabad was a melancholic relic. To elude the taxes, many of its inhabitants had gone outside the city walls and settled in the suburbs, and houses, mosques and tombs fell into disrepair. In addition, the broken ramparts exacerbated the insecurity of the puras, which were exposed to frequent night robberies, within the city and in the neighboring suburbs (Dunlop 1817).

After the British conquest in 1817, a new phase began for the city. In the central decades of the 19th Century, the British administration played a key role in the revitalization of the overall conditions: restoration of the urban landscape, and economic revival in rehabilitating a favorable environment for traders and entrepreneurs (Bobbio 2015, 27).

The economic recovery led to an overall revival that was reflected in redesigning the urban fabric. Thus emerged one of the most controversial issues concerning the demolition of the wall that had protected the city and played an important role in the history of Ahmedabad's municipal government. Although Geddes wrote the well-known "Note on Ahmedabad," all efforts failed in the end (Stephens 2020). With the beginning of the 20th century, the demolition of the walls led to a large metamorphosis in which the city rapidly expanded in different directions (Michell et al. 1988, 157).

The history of Ahmedabad's walls is intertwined with the history of the city itself and suggests how the relationship with the walls defined its transformation through the ages, from a medieval structure to a modern city (Yagnik, Sheth 2016). It was not the story of two separate cities, nor was it the story of a new western city created alongside a traditional one. In 1960, when Gujarat emerged as a separate state, Ahmedabad regained its capital status after almost 200 years. A few years later, the new capital Gandhinagar was founded, thirty kilometers north on the Sabarmati River, but despite this, it is still Ahmedabad that emerges today.

4. CRAVING FOR MODERNIZATION, IN BETWEEN INFORMALITY AND HERITAGE

In line with central government policies, Gujarat and Ahmedabad have invested in several measures and projects to transform cities into megacities. Most Indian urban settlements face cultural and long-standing problems that impact planning processes. Not only are they confronted with competing uses due to market forces, social needs, and environmental concerns, but also by the lack of updated maps and cadastral records that are not available from municipal officials or in the public domain, creating a big impediment in the planning process (NITI Aayog 2015).

Throughout Ahmedabad's history, different dynamics have played the role of driving the city on the path of expansion and modernization. Multiple levels interacted, changing the city's economy, the network between socio-religious groups, culture, space, and territory. A significant part of the modern metropolis has sprung up on the land which was open fields until a century ago. The most significant territorial expansion consequences are found in the interrelationship between the spatial transformation and population growth, which

led millions of people from different origins, religions, and cultural traditions to settle in or near the city, sharing a narrow space in which coexistence had to be constantly negotiated. Today, the environment is faced with heavily congested traffic, polluted air, broken footpaths, etc. This rapid growth rate is thus likely to perpetuate further damage to the city's public spaces and, by consequence, putting immense pressure on upgrading the infrastructure (Patel 2015, 30-35).

In the process that led Ahmedabad to become a metropolis, the rural-urban dichotomy was a constant factor that affected not only the economic sphere but informed the way urban space was organized and the choices people made in how and where they lived in the city. This factor has consistently emerged in underlining the discourse in the debate between public authority and citizens (Bobbio 2015, 27).

Moreover, the manufacturing, which had been the backbone of the city for about a century, crashed and left ground for financial and real estate speculation, which led to an unorganized city growth. In the meantime, government programs and finances facilitated new economic opportunities (Desai 2012, 31-57), while NGOs have matched funding opportunities and social development programs in an entrepreneurship way. This kaleidoscope of situations dragged Ahmedabad away from its Gandhian heritage and propelled it towards national liberalization and urban globalization (Patel 2000).

In light of this, several projects started in the city with the purpose of beautifying and modernizing the city, aiming to create a new image for Ahmedabad, and to promote it to a large-scale panorama.

4.1. Heritage practices: The City Wall renovation

In 2001, a cooperation project was set up with the French government to revitalize the Walled City. In the Memorandum of Understanding, a provisional list of heritage buildings within the perimeter of the wall was drawn up. The goals were to define the quantity and character of historical buildings, to contribute to mapping and knowledge, and to overview future rehabilitation projects. In recent years, various projects have been done under this agreement. These included the renovation of 75 per cent of the city walls and some Gates (UNESCO 2016). Since 2012, the AMC has undertaken extensive repairs of the fortresses on the western side of the city along the river, seen as an important step towards the preservation of the city's historical heritage (UNESCO 2016). At the beginning of the last decade, the high level of degradation was evident and the wall was crumbling in several spots due to lack of care: vegetation, encroachments, informal settlements, and modern houses anchored to the walls' facades. At the same time, the debate focused on how the informal settlements were considered a disturbance to the archaeological and historical significance of the walls, and therefore should be removed (Siddiqui 2015). About 10,000 inhabitants who lived in the informal settlements close to the wall were forcefully resettled in other areas of the city (Pessina 2019).

To the present day, restoration work has been carried out on the most degraded segments, at risk of collapse. Aiming to complete the restoration of the remaining wall perimeter in the following years, the interventions were carried out with dubious methodologies regarding the historical monument.[19]

Paradoxically, the portions of the wall that still meet the characteristics of integrity and authenticity are the ones not intervened by AMC's work, because of the presence of structures from the informal settlements.

According to a general discourse about the revalorisation of the city, the underlying issue is that the historical wall remains a secondary matter within the policy line, and therefore there is no thought on giving an identity to the remaining fragments of the historical wall as heritage elements (Fig. 5).

Figure 5. Encroachment along the city wall: new constructions along the historical walls (left), scarce consideration of historical pre-existences such as temples (middle), demolition of the walls for new infrastructures (right). It is noticeable how – paradoxically - the sense of authenticity is preserved where the walls have not (yet) been the "victims" of renovation work (left), while the historical patina has been totally lost with the incongruent rebuilding of the wall (middle and right). © authors 2019

4.2. Approach to Intangible and tangible heritage in public space beautification: the Sabarmati riverfront project

Historically, the connection with the river has been characterized by a very active relationship, as evidenced by the accounts of past travelers from Mandelslo to Geddes, to Bresson's images. In 1917, the Sabarmati Riverfront Development Corporation Limited was created by the Ahmedabad Municipal Corporation to manage the redevelopment of the riverfront. A project was envisioned by many civic groups, citizens, political leaders, and professionals (Shah 2013), including the architect Bernard Kohn that in 1964 made a design proposal for the area around the river (Jha 2013), and the Riverfront Development Group that presented an alternative perspective in the 80s. The project was eventually commissioned to HCP, in an unclear process of selection (Shah 2013), and the pilot project started in 2004.

The project changed the existing landscape by narrowing down the riverbank, adding two roads and creating plots for public (mainly a promenade and gardens) and private development (Fig. 6). Since it is a non-perennial river, the water is maintained throughout the year through a connection to the Narmada canal. The narratives behind the legitimacy of the Riverfront project were to create a space for the public and assure that the areas near the river were not flooded. Before the redevelopment, the riverbed was used for farming and cow grazing (in the dry seasons) and a variety of activities had always taken place along the banks: circus, dyeing clothes, markets, religious festivals, etc.

The top-down approach of the project displaced the slum dwellers that used the land near the riverbank over the years creating a substrate of dwellings and establishing an important informal economy with the river. They were resettled in housing in the periphery of the city, in polluted former industrial areas. The livelihoods of these communities were interlaced with the river and, due to the distance of the resettlement sites, became unsustainable. This phenomenon is common in the modus operandi of the Indian government. Renu Desai termed this approach as "infrastructural violence (Desai 2018)

The project of the Sabarmati riverfront was also oblivious to the intangible values connected with the river, as well as the historical structures and urban fabric of the proximity. The new public spaces are at a higher level than the original one and, therefore, block the original secondary entrances to the walled city, forgetting the traditional interconnections between the city and the river. Moreover, no

attention is dedicated to the preservation of the original stone ashlar cladding, at the foot of the wall. In terms of materiality or spatial logics there is no dialogue between the walled city and the riverfront. The auster concrete walls disconnect the two sites, with two distinct identities.
The new design logic, that targets a global citizen, changed the existing relationship of users with the river, turning the river into a riverfront (Dempsey, 2020). The project was inattentive to the daily activities (religious and secular), that constituted an important intangible value related with identity, cultural values and traditions. The river became inaccessible and distanced, contradicting the traditional cultural relation with the water, seen, for example, in the ghats, a traditional form of riverbank that connects the city and the river through a series of steps.

4.3. Mobility planning: the BRTS and metro rail project

In March 2007, the Ahmedabad Municipal Corporation (AMC) endorsed a road widening project for Astodia Road through the Walled City, as part of a larger development plan. The goal was to speed up, thanks to the Bus Rapid Transit System (BRTS), the connection between Kalupur railway station and the west bank of the Sabarmati, which is currently the commercial district of the city.
The enlargement of the road, planned with a fast lane in the middle of the carriageway, had successfully processed, with the demolition of the pols, and planned to the Khajurivali Masjid and the Rani Sipri Ki Masjid. The mosque was built in 1514 and was already listed as ASI heritage monument. Organizations composed by various social groups opposed the destruction of the monument and the dispute

Figure 6. Sabarmati Riverfront Project: Near Ellisbridge (left), Khan Jahan's Masjid (middle), Sabarmati Ashram (right) © authors 2019

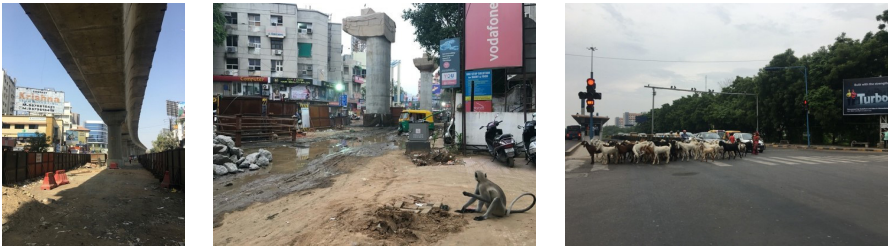

Figure 7. The new underground construction and its relationship to the surroundings (left and middle) and the road section with the BRTS. © authors 2019

was settled in court, saving the mosque and changing the stretch of road.[20] A similar dispute took place between the Gandhinagar - Ahmedabad Metrorail Express (MEGA) and the Archaeological Survey of India (ASI). The Metrorail was planned to pass through the Walled City, demolishing part of the city. This project, due to protests over the listing of the city as a UNESCO heritage site, was revised with a railway about 30 meters underground near Shahpur. The metro will become elevated at Apparel Park, immediately after crossing Kankaria Lake. The three stations in the Old City are located at Shahpur, at Gheekantha and near the Kalupur railway station. The excavation of this tunnel has been authorized by the Archaeological Survey of India (ASI) (Kaushik 2014) (Fig. 7).

4.4. Heritage management: Rani and Raja no Hajiro and Jama Masjid Mosque

In 2016, EMBARQ India and WRI India in association with Ahmedabad Municipal Corporation produced a report to re-imagine Manel Chowk, a square in the historical core of Ahmedabad, near the 15th century structures of Rani and Raja no Hajiro and Jama Masjid. In this report Manek Chowk is identified as a good example of the condition of kinetic city: it is occupied by a daily market of jewelry, with the extensions of shops towards the square, and during the night it is completely changed with many eateries that set their structures (kitchens, chairs, and tables) in the plaza every night.

Near this square is Rani no Hajiro, where we can see a case of heritage management that can be considered informal. The monument is recognized by the Archaeological Survey of India, and it is part of the walled city founded by Ahmed Shah in 1411. The building is part of a complex constituted by the Queens' Tomb (Rani no Hajiro) and the Kings tomb (Raja no Hajiro). The monument is surrounded by dwellings and vending structures, that make it less visible, and the open space absorbs different activities and occupations, as the stored vending structures of the nigh market of Manek Chowk.

The historical structure is managed by a family that lives here for decades and that claims to be the custodian of the space. They take the responsibility of the monument maintenance as well as the management of site visits. The Rani no Hajiro space is organized with a blurred division between visitable areas and more private zones, for resting or cooking. According to Cano and Shah (Cano and Shah 2021) there is no consensus regarding the responsibility of conservation and management of the monument, between the stakeholders on the site and the Municipal Corporation (Fig. 8).

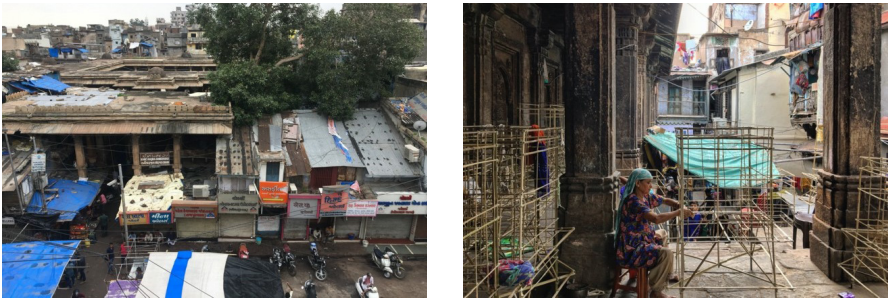

Figure 8. Commercial encroachments and informal activities due to some festivals around Manek Chowk and Rani no Hajiro © authors 2019

5. VISION OF INFORMALITY AND MANAGEMENT OF HERITAGE SITES

Indian cities are sites of contradictions, of complex social and cultural relations that create ever changing spaces with multiple meanings. The vibrant life in India's urban space brings complexity to the definition of projects, moreover related with historical artifacts, because of the malleability and unpredictability use, and the blurred and pliant between public and private space.

Ahmedabad is seen as an opportunity to re-examine and rethink the regeneration rules in a complex context and a chance for a dialogue between innovative approaches and connections to the city's history patterns, which can create new paradigms.

With a constantly thoughtful approach that seeks to go beyond predetermined processes of regeneration and/or conservation. Indeed, it is necessary to be capable of embedding even those layers of significance that are hidden under the simplest outer shell. This is only possible if the city is read in all its complexity and questioning the common binaries of formal/informal, kinetic/static landscapes.

As we see in the cases stated in this paper, Indian cities such as Ahmedabad are simmering with social, political, economical and physical transformations, with different places coexisting in neighboring spaces. A dichotomy persists. On the one hand, there are the rapid changes imposed often by force, from the top down, in pursuit of a globalized modernity, such as those identified by Renu Desai (2018) or Navdeep Mathur (2012). On the other, there is the perpetuation of ancient cultural and religious rituals that echo in everyday life.

As we underline in the paper, we witness a tendency of contemporary government-led planning to not consider the social and physical complexities and apply top-down processes in sites that negotiate informal and formal characteristics as well as heritage considerations, which on the other hand demand a critical and thoughtful evaluation of the city's transformation.

In view of developing future perspectives and intervention strategies it is important to think about frameworks for understanding urban domains. In light of this we identify some key points regarding the formal and informal environment, analyzing their cultural and architectural identities, and the vulnerability within the idea of a smart and globalized Ahmedabad.

A. Preserve the tangible as well the intangible heritage

While the concept of tangible heritage and its conservation is not spread throughout the communities, the intangible behaviors consist as important factors working informally (besides the institutional frameworks) in favor for the preservation of historical structures (Tognon, Paisana 2022).

The cultural and religious rituals of everyday life embody a strong relation to history and tradition. In spite of the fast development of economy and globalization bringing new paradigms of social relations and cultural associations, Indian culture is still very present in everyday actions, perpetuating, not just social and many time class based structures, but also traditional relations with the built environment. The manifestation of traditions in everyday life creates a respect for some heritage structures, if they are attached to a symbolic, religious or historical meaning that was perpetuated through memory and everyday practices.

As an example, the relation with water is historically and religiously a strong paradigm in the creation of peculiar riverbanks. As the architects affirmed, this would be a drive also in the definition of the Sabarmati riverfront project. Although it must be emphasized that the project realization reflects more a vision of using space according to Western models, rather than reflecting a link with the Indian tradition, in this specific case also breaking down the Ahmedabad community's link with the river.

B. Enhance the kinetic as a light answer for preserving the heritage

The understanding of kinetic city brings an important lens to the reading of the urban context, as many of the intangible qualities of malleable spaces and temporary appropriations are being replaced, in the process of urbanization, by spatial qualities that offer less flexibility and allow fewer uses. Urban design and planning must recognize the complexity of the relations between static and kinetic city along with aspects of informality, for a sustainable and inclusive urban development. In the case studies mentioned above (chapter 4.1 and 4.3) we highlight that, while many of the new public infrastructural projects in the city endanger intangible and tangible heritage, on the contrary the informal occupations, mainly because of their light and flexible nature, can preserve the conditions of historical structures. The learnings of the kinetic city and informal occupations are that space, in the Indian context, should be ambiguous and flexible to allow for different uses. The reversible and malleable character of the informal structures allow for a constant negotiation of space and a landscape in flux. In such context it is desirable to apply the same logics when thinking about heritage, with a framework that inserts the notion of temporality in the processes of the design.

Paradoxically where the informal occupation of the heritage precincts is still present, as near Khan Jahan's Masjid, the conservation of the sense of the place is not corrupted by modernity. It is therefore necessary to aim broadly at what Mehrotra calls 'the localization of global programs' where design should not be aligned to Western-derived strategies and processes of action top down, but to a localized model that fits the context. This means to involve organizations and stakeholders that have had a continuous presence on the territory, to be able to incorporate insights and opportunities acquired from different backgrounds.

C. Informal management for attending to identity

In heritage precincts, such as the city of Ahmedabad, the ancient traces are not only imprinted in the architecture and urban fabric, as testimony of the communities' history, but even more visible in the city's cultural and traditional legacy, which is expressed in rituals and festivals, including urban space as an integral part of the communities themselves. The place's bond with the people who still actively live in it, shaping an ever-evolving city form in which new elements are juxtaposed in the older fabric, adding a new phase to the centuries of past histories.

The light and flexible occupations of informality adjacent to heritage structures allows for its reversibility and helps preserve some material qualities of the heritage sites. Despite creating visual disconnections with the built forms, many times the informal structures end up protecting the heritage precincts from weather and natural degradation. Even if the anthropic presence could be considered as a boundary for the touristic contemplation, the informal structures have malleable construction materials and techniques, and they touch the heritage structures lightly and in a reversible way. A clear example of this is the Queen's Tomb, which is preserved and cared for by the community that lives around it and occupies its surrounding arcades with their handcrafts and during the setting up of special festivals.

Moreover, some of the everyday life rituals that are interlaced with tradition are becoming marginalized and perceived as informal. In the case of the Sabarmati riverfront, for example, bathing on the river is no longer allowed and it is seen as a nuisance. Therefore, the everyday practices that have the capacity to create awareness about heritage and preservation are being overturned by the new paradigm of urban planning and design.

D. Social equity as an inclusive participatory approach.

In addition to the need to respond to the preservation of historical values, remaining materials, techniques, historiographical traces of the context, and ineluctable drives towards

modernisation, objectives of social equity must be introduced. Many of the projects built today do not take in consideration the informal appropriations by the most vulnerable communities, such as street vendors or pavement dwellers. In the 2011 census, about 66.2% of the population lived in formally recognised dwellings, the remaining 33.8% in slums or chawls.[21] As of today, there are about 700 slums scattered in various parts of the city. As Ahmedabad is a highly industrialized and developed city, it is a magnet for many seasonal migrants from both rural Gujarat and other states (Shah 1981). Designing for such an environment requires a different way of thinking and working, in which interventions must be flexible, robust, and ambiguous enough to accommodate kinetic qualities. Only by including all in the process of design, with more participatory processes and strategies for social impact, a more nuanced and richer architecture can emerge.

It is important, therefore, to think about urban planning and design frameworks, as well as conservation practices that are truly inclusive and participatory. The complexity of the Indian context can be a challenge to create more participatory processes, but the stake of not engaging with the real, on ground problems is too high. As a base for a more democratic, sustainable, and equitable cities, planning participatory processes can be participatory from the reading of the place to the co-design of solutions, including communities that normally do not have a voice, such as slum dwellers or street vendors.

The equity principle can be pursued through the involvement of various groups of people, which is key to reinforcing heritage values, which are important for the definition of an identity principle for the purpose of sustainable development to create a transcalar and transdisciplinary identity-equity-value relationship.

The value acknowledgement includes first the public involvement by activating participatory decision-making meetings. Participatory processes are fundamental to gain a plural comprehension of the value of heritage or to address contestations for those values.

The acknowledgement of a plural history can create conflicts between groups within the city. The design of these types of participatory processes must be built on the premise that people have equally valid contextual knowledge of the place and a history of conflict solving. These processes must also be examined to understand the relationships and associations that exist between people and the city's heritage.

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NOTES

[1] In 2020, India had a total population of 1,380,004,385, with an average population age of 28.4 years. Approximately 35 per cent (483,098,640) lived in urban environments and the trend is expected to rise in the next few years. (www.worldometers.info) Elaboration of data by United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects. https://population.un.org/wpp/, Accessed on 3rd April 2022.

[2] India's urban population is expected to grow by 814 million by 2050. Forecasts report that, by 2025, 46% of the total population in India will live in cities with more than 1 million people. By 2030, the number of cities with a population over 1 million will increase from 42 to 68. (McKinsey 2010). Four Indian cities (Ahmedabad, Bangalore, Chennai and Hyderabad),

currently with a population of 5 to 10 million, are expected to become megacities in the next few years, with a total of seven megacities expected in the country by 2030 (UN DESA 2012)

[3] For the designation and categorisation of the Indian cities see: https://smartcities.gov.in, Accessed on 12th April 2022

[4] Research on traditional culture in relation to the intangible aspects of heritage is relevant. Sahapedia is a non-profit organization registered in India under the Societies Registration Act of 1860 that carries out studies on the arts, cultures and heritage of India. 'Saha', Sanskrit meaning for 'together with', aims to explore India's various cultural landscapes. See https://www.sahapedia. org. On the city of Ahmedabad in particular, see Ashna Patel's articles on the relationship between craft traditions and intangible culture in Ahmedabad. Select in particular the article 'Uttarayan and the Built Environment: Perspectives from a World Heritage City'. https://www.sahapedia.org/uttarayan-and-built-environment-perspectives-world-heritage-city, Accessed on 1st April 2022.

[5] The 2011 Indian census defines slum as "a compact settlement of at least 20 households with a collection of poorly built tenements, mostly of temporary nature, crowded together usually with inadequate sanitary and drinking water facilities in unhygienic conditions (Government of India 2008).

[6] http: //nasvinet .org/newsite/statistics-the- street-vendors-2/, Accessed on 15th April 2022

[7] This refers to the debate over the construction of the Mumbai skyline and the disputes related to the erection of some of these skyscrapers with globalizing language. https://www.newindianexpress.com/nation/2017/nov/28/mukesh-ambani-built-antilia-on-orphanage-land-illegally-sold-in-2005-maharashtra-state-board-of-wak-1712977.html, Accessed on 11th April 2022

[8] One example is the former "model" Gurgaon city near New Delhi, whose economic growth began in the 1970s, when "Maruti Suzuki India" established a manufacturing factory, and became more prominent after General Electric settled its corporate outsourcing operations in the city, in collaboration with the real estate company DLF. Despite rapid economic and population growth, Gurgaon continues to struggle with socio-economic problems, such as high-income inequality and high air pollution (Rajagopalan, Tabarrok 2014).

[9] According to the "India Urbanization Econometric Model", projections predict that more than 50 per cent of the states would be urbanized, including Tamil Nadu (67%), Gujarat (66%), Maharashtra (58%), Karnataka (57%) and Punjab (52 %). India is expected to have 68 cities with a population of more than 1 million by 2030, up from 42 today. (McKinsey Global Institute 2010)

[10] The smart city mission delineated six guiding principles: community at the core (1); more from less (2); cooperative and competitive federalism (3); integration, innovation, sustainability (4); technology as means, not goal (5); convergence (6). And defined smart-city as "liveable, sustainable and with a thriving economy offering multiple opportunities to its people to pursue their diverse interests" (https://smartcities.gov.in).

[11] The project aims to realize 100 smart cities across the country. The 'Smart Cities Mission' (smartcities.gov.in), launched in 2015, focuses on achieving economic growth, improving the life quality of citizens, local development, and new technology for creating smart solutions for citizens. The mission established $7.5 billion in funding for the first five years (2015-2020) across 100 cities. The government planned to identify 20 smart cities in 2015, 40 in 2016 and another 40 in 2017. The city of Ahmedabad was included in the list on 28 January 2016, along with 32 others. https://ahmedabadcity.gov.in/portal/smartcitymission.jsp#smartCitiesMissionDiv, Accessed on 14th April 2022.

[12] Gujarat's current capital is Gandhinagar, on the banks of the Sabarmati River, about 23 km north of Ahmedabad, on the western side of the industrial corridor, 901 km from Delhi, the political capital of India, and 545 km from Mumbai, the financial capital. Gandhinagar, named as tribute to Gandhi, is a newly built city with the aim of expressing the new, post-independence Indian spirit and thus its planning was commissioned to two Indian urban planners, Prakash M. Apte and H. K. Mewada, pupils of Le Corbusier in Chandigarh. The city construction began in 1966, the government offices moved to Gandhinagar in 1970, and it grew as a commercial and cultural center of

Gujarat. Today, it has a population of 206,167 (Census 2011), 95% Hindus (Apte 2012).

[13] The Indian Zoroastrians, known in India as Parsis, had never been a dominant power, but their influence was considerable in many aspects. The Parsis left Persia in the 8th Century, with the spread of Islam, to go to India, in Gujarat, under the Hindu king Jadav Rana.

[14] https://worldpopulationreview.com/world-cities/ahmedabad-population, Accessed on 14th April 2022.

[15] In June 2015, the Gujarat High Court replied to a Public Interest Litigation (PIL) complaining about the demolition of almost 700 houses under the pretense of renovations and the transformation of over 400 for commercial use, damaging instead the structural integrity. The court imposed a duty on the AMC to take strict action to prevent the deterioration and unlawful loss of the city's rich domestic architecture. In addition, legal clashes between religious groups regarding rights to religious ceremonies are also added to the AMC's rules.

[16] According to a site survey at Mandvi ni pol. Monsoon semester 2019 MCR18, Urban regeneration Studio, Cept University. Tutors: Alisia Tognon, Ashna Patel, Jigna Desai. https://portfolio.cept.ac.in/2019/M/fa/urban-regeneration-cr4001-monsoon-2019, Accessed on 14th April 2022

[17] In 1969, Gujarat was the scene of a riot between Hindus and Muslims between September-October. Unofficial reports count 2,000 dead and more than 48,000 people who lost their belongings. (Gayer, Jaffrelot 2012, 53-60). In 2002, other violent acts called "Gujarat pogroms" escalated in February-March and recorded 2,000 deaths and 2,500 injuries (Jaffrelot 2003).

[18] During those desolate decades, many areas within the walls were converted to agriculture and animal breeding, while the ancient gardens and wells became neglected. This situation continued even during the first decades of British rule, and the land was left vacant for many years despite a partial re-colonisation of the city.

[19] The 'restoration' work involved the complete reconstruction of entire portions of the wall, using incongruent materials with the pre-existing ones. In spite of this, this technique was wrongly identified by the AMC officers as "anastylosis". Furthermore, the AMC did not prepare a unified project that would take into account both the methodology of the intervention and the location of the various phases. There is no graphic documentation and no detailed specifications about the procedures to be followed, according to the specific conditions of the wall and the variable situations of the context.

[20] https://thewire.in/politics/ahmedabad-heritage-city-bjp, Accessed on 15th April 2022.

[21] https://worldpopulationreview.com/world-cities/ahmedabad-population, Accessed on 15th April 2022.

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PAPER #2.04

CITY, UNEXPRESSED SPACES, SPORT. RESILIENCE IN THE DESIGN OF NEW PUBLIC SPACES

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ABSTRACT

The city evolves and overwrites itself and this overwriting creates an overlap of the various plots that bring out unplanned parts of it. The contemporary city is therefore the result of design and incidental actions that have radically transformed it, leaving around it a "kind of space" of difficult interpretation because of the peculiarity that characterizes them. They are ambiguous, undetermined spaces, often resulting from the informal action of man or the result of stratifications within the urban dimension. This type of space is called "interstitial" because it is located between things. They can be elements in urban spaces, entire buildings, or only portions within their sphere. The aim of the present text is on the one hand to construct a definition of what an interstitial space is inside the contemporary city. On the other hand, thanks to the help of case studies, we can understand the most suitable functions for the reactivation and enhancement of these areas in the city. The need to reactivate existing city spaces has increased following the climate crisis and pandemic. It's appropriate to recognize the empty spaces of the city as a "new opportunities" ready to host new functions. Therefore, flexible strategies of action are necessary, which find in the void space of primary importance to realize adaptive devices capable of increasing "urban resilience" and that act as relief valves during extraordinary events. The picture that emerges from studies and research related to the European and Italian panorama of sports infrastructure allows us to identify interesting and innovative trends that show, also in this sector, an increasing attention to issues of urban resilience, architectural and social. Based on this premise, the contribution aims to analyze the recent evolution of public space design modalities in sports practices as a field where resilience policies are applied.

KEYWORDS

Sports infrastructure; urban regeneration; resilient design; public space; society.

1. INTRODUCTION

Resilience is the ability to react to external changes and events, returning to the original conditions.
This word is used in many fields and disciplines, including architecture. The resilience and its innate capacity, which allows a body to adapt to change due to external factors, which have changed its original use, it's a result of the current scenario of the protagonist in the projects of redevelopment and urban construction.
Resilience has also made its entry into the urban and architectural environment following climate change and recent environmental

issues. For this reason, it is also the task of architecture to make itself flexible in responding to changes in the context. Resilience adds a dynamic component to traditional design, allowing people, urban spaces and buildings to live with the changes that are affecting the entire planet.

Urban public spaces, essential components of the contemporary city, contribute to the cultural, social, economic and political functions of the city, moving more and more toward the physical well-being of the community. In fact, in recent decades the attention to health issues, also linked to the increase in leisure, has had significant consequences on the perception and configuration of the infrastructure system for motor activity in the city. Spaces for sport represent the fulcrum of the wider urban reflection on the roles and meanings of public space and how it is frequented.

The phenomenon of the reuse and enhancement of urban spaces is a phenomenon that is active starting from citizens seen as groups of "cultural and social innovators." The forms and types of reactivations take on different dimensions, while the vocation depends on the traditions of the community, the place, the environmental constraints of the context, and the level of innovation needed. To stimulate worldwide these regenerative processes were born many associations such as: the EU Working group sport & health, EU physical activity guidelines, Health in public space of Urbact, designed that identify the sport as a perfect subject promoter of resilience, regeneration and promotion of physical and mental well-being.

Research and experimentation place at the center of the debate the need to address at different scales and in different contexts the theme of the resilient project focused on the ability to give answers in terms of adaptability and flexibility within a vision Aimed at sustainable development (Leone, Tersigni, 2018), to transform the unexpressed places present in cities in new urbanity scenarios.

Climate change (ISPRA, 2021), aggravated by the high rate of urban growth of the last century and the consequent increase in greenhouse gas production, requires "resilient development" capabilities (Adams, Watson, 2010), that is, development based, as well as mitigation actions, adaptation strategies that can respond quickly and flexibly to actions arising from changing environmental, social and economic needs (Ahern, 2011; Madanipour et al, 2014; Ferrari, 2021). Transforming cities into resilient organisms, able to adapt to natural and anthropogenic pressures is a priority now recognized by International Bodies, Public Administrations, Research Bodies (Rockfeller Foundation, 2015) and stakeholders involved in the project process. The involvement of the company broadens the vision of the concept of resilience as it is no longer directed only to the design components but to everything that revolves around them as environment and inhabitants.

"City" recalls "society," for this reason, we cannot think of the city and its parts except as an adaptive society, insofar as it can cope with a changing world. The spaces of the city are not aseptic but, places where communities are born, grow and die, leaving room for new living forms. The picture that emerges from studies and research related to the European and Italian panorama about sports infrastructure allows us to identify interesting and innovative trends that show greater attention to issues of urban resilience, architectural and social. Aware of the importance of sports venues in the city, the contribution aims to analyze the recent evolution of public space design for sports practices, born from unused areas of the city.

2. PUBLIC SPACE: REUSE OF INTERSTITIAL SPACES AND ENHANCEMNET TOOLS

The 2007 Leipzig Charter on Sustainable European Cities broadens the concept of European historical heritage, including not only historic buildings but also public spaces. A well-designed, well-managed and properly used public space is essential for the vitality and liveliness

of urban environments: cities, neighborhoods, densely populated contexts, are characterized by a high quality of streets, squares, gardens, parks and paths, have a very high power of attraction towards different categories of users becoming a privileged destination for investments in residential, commercial, industrial, cultural and tourism. In addition, the Granada Convention recognizes the importance of promoting Europe's cultural heritage and stresses the need to develop new ways in which heritage can be reconciled with contemporary economic, social, and cultural activities.

Similarly, the Convention's guidelines on the Protection of Architectural Heritage recognize that "The preservation of buildings and places does not imply that structures should remain unchanged over time: good conservation practices enable these structures to evolve and adapt to meet the needs for change, maintaining its specific significance."

The recently issued directives and the European programs associated with them show a renewed interest in an integrated approach, capable on the one hand of preserving the historical character of urban contexts, and on the other hand outlining new paths of regeneration and development at different scales.

Traditionally it acted in the process of redevelopment of cities to preserve the built environment, aiming to protect the most significant buildings and monuments from the architectural point of view. The last indications of the approach instead focus on the adoption of measures aimed at enhancing the entire area, considering the historical importance not only of the architectural artifact but also of the places with which it interacts. About urban conservation, it is possible to identify specific measures through which societies have approached the issue of adaptive reuse of public space, conceptualizing the relationship between communities and the environment (Strange, 1996).

Historically, as mentioned, the public space coincided with the urban void, in which there were one or more monumental buildings, which gave the public space the same characteristics of monumentality (Sassi, 2012). In the contemporary city this strong characterization is lost, that is the physical delimitation of the monumental area is no longer so evident, lacking compact and continuous curtains of historical buildings, sometimes losing the idea of identity space (Caputo, 1997).

Some cities have implemented transformations that in the coming decades could be decisive, as shown by the examples of Barcelona, Paris, and Hamburg, as well as those pioneers of Copenhagen, Rotterdam, with the Benthemplein Watersquare (Fig.1) (Fig. 2).

In the study on the effects of climate change, Barcelona is implementing the program "Resilience and adaptation of climate change for the Barcelona metropolitan area 2015-2020" developing climate projections to define the main risks and priority areas for action to increase climate resilience.

After the major interventions of the IBA and Hafen City, the city of Hamburg has activated a plan to drastically reduce the use of cars in 2034 through various measures, including the "Green Network of Hamburg," a system of green axes arranged in a radial model, integrated with two green rings consisting of urban parks and other green areas. The plan envisages a multi-scalar articulation of green areas from the landscape to urban parks and neighborhood parks: in addition to the 8 neighborhood parks, there are 30 neighborhood parks, integrated by micro-quartier parks, urban green areas, and green spaces with linear development. The resilience of the city of Hamburg is identifiable not only in the environmental quality of public spaces, but also in the multimodal permeability of the sustainable mobility network system. A resilient approach to reality must therefore aim to identify ways of managing change not an imbalance but as a manifestation of a "dynamic balance" without forgetting the character of permanence that every design action entails on the built environment.

Figures 1 and 2. Benthemplein Watersquare during the day and night, 2014-2016, De Urbanisten, Rotterdam, Ph. De Urbanisten

3. SPORT PROMOTING WELL-BEING AND ENVIRONMENTAL QUALITY

"The urban space project today should deal more intensely with that set of characteristics of cities that can guarantee social quality, and greater collective well-being, paying attention to the corporal dimension of space, and the concrete possibilities of people to lead a life of safety and comfort" (Welfare space, 2011).
Contemporary territory appears in many cases as a reality with uncertain features, of which it is difficult to perceive the spatial characteristics and to understand the logic of operation. Settlement fragments follow each other with different frequencies, often homogenous and isotropic, without a substantial solution of continuity, the result of discontinuous processes of urbanization, but also the outcome of the phenomena of abandonment of obsolete and no longer functional parts of the compact city of tradition. From the latest strategies of urban regeneration, the places of sports practice are a tool able to fill these parts now in disuse and able to elevate the collective well-being. "The initial idea is that sport is not only a complex of disciplines that develops in the modern era but also a specific form of social relations produced by modernity itself." (Russo, 2004)
Sport seems to be able, in its sense of well-being, to cope with behaviors that are increasingly found in sedentary young people. Several urban-scale regeneration projects in Europe, in terms of social innovation and inclusion of the population in the decision-making and design process, show how the regeneration of many abandoned areas has promoted radical improvement (Fig. 3) (Fig. 4). In particular, careful use should be made to ensure diversified opportunities, moments of exchange and relationships between individuals and groups of users to promote the emergence, consolidation and development of social communities around sports practices. The role of communities in regeneration processes is increasingly central: it is recognized and facilitated by national policies. They encourage empowerment through community businesses that involve local actors to take charge of services and resources.


Figure 3, 4. Watersquare, Tiel, 2014-2016, De Urbanisten, Rotterdam. A project that borns with a society workplan Ph. De Urbanisten.

"Can sports equipment be an instrument of urban planning?" Sport is to be understood as the right of all for a healthy lifestyle and a balanced psycho-physical development. Sport is a significant moment in the formation of everyone, especially for young people who, by practicing, learn civil dialogue and begin to establish the first interpersonal relationships, understanding the principles of commitment, respect and fair play. The European Commission, in February 2013, set out several objectives, including the removal of economic, physical and cultural obstacles to ensure that all children participate in recreational activities, The European Union has a special role to play. In the Italian situation, this directive refers directly to the subject of the renovation of installations. Considering the average age of European sports facilities, Italian stadiums, with those of the United Kingdom, are the most obsolete. The difference that is found with the English stadiums is, however, in the investments dedicated to this field in more recent years. In the United Kingdom, GBP 3 billion has been invested to build new stadiums or improve existing ones, and GBP 150 million a year has been invested to ensure continued upgrading and modernization. In Italy, minor investments have been dedicated to the safety of installations, which, however, remain unattractive due to the backwardness of the management approach.

In Italy prices are on average lower in the low-cost sectors such as curves, although they have fewer services than plants in the rest of Europe; while prices in the higher sectors are on average the highest, while providing a lesser quality of services and comfort. This outlines the shortcomings of plant management in Italy, mainly due to the lack of attention paid by social policies to this issue and therefore to a limited allocation of funds.

It is the mentality that influences everything: the management of the stadium should be interpreted as an opportunity for social, urban, economic regeneration: a positive investment. This would improve safety, reduce the cost of maintaining public housing assets, redevelop degraded areas often located in strategic urban and peri-urban locations, create new economic sectors and new jobs.

Architects who will have the task of carrying out projects in this field are called not only to devise suitable and as safe and functional spaces as possible for physical activity, but also to conceive spaces of social life. The space of sport and public space will no longer have such a clear distinction as in the collective imagination of the last century. Increasingly, the two spaces tend to coincide: the practice of social and collective functions is brought inside the buildings for sport, and at the same time, sport is brought outside, in squares, in streets, in urban interstices.

4. PUBLIC SPACE: A PLACE FOR OUTDOOR SPORTS INFRASTRUCTURE

Within a cultural and scientific debate on the concept of resilience that is affecting different fields of knowledge, the development of resilience thinking on the built environment can find innovative ideas in the design of public space, field of privileged experimentation of planning that place the social and environmental well-being at the center of its work. Numerous studies and researchers are working to define new intervention strategies (Jha et al., 2013; Losasso, 2015; Leone, Tersigni, 2018), as well as for the system of that built, also for the system of the not built, That open connective tissue that structures the city that constitutes its public spaces (Gehl, 1971). Numerous programs, such as the Climate Change Adaptation Plan, planned by some cities (Barcelona, Copenhagen, Zurich, Paris) have chosen public space as a privileged field of intervention for the adoption of specific actions and resilient strategies.

Sports practice is an important tool of resilience and regeneration, able to activate new uses and meanings of places. The main issues that emerge as defining factors of a resilient project or initiative are identifiable in the concepts of flexibility, community and resource management.

The definition of factors flows, first, into the sphere of flexibility, understood as the ability to give adaptable answers to needs in constant evolution. This theme assumes a threefold value: flexibility of objectives in terms of vision and project drivers; flexibility over time through an ability to operate step by step of the design process; flexibility of the solutions in terms of multifunctionality and adaptability of the space in its life cycle.

The speed of implementation and the flexibility of use are the main features of projects aimed at the redevelopment of degraded spaces. Significant in this sense some programs implemented in some Spanish cities such as "Esto no es un solar" in Zaragoza or the "Device de la Cebada", born in Madrid in 2011 on the initiative of the association Todo Por La Praxis, place the synergy between different sporting activities and temporary cultural and social events at the heart of a principle of physical and social urban resilience. Thanks to these programs, which include sport in the design process, one wonders whether sport is an opportunity for urban resilience. The answer to this question must be found in the characteristics that the infrastructures dedicated to sports practice are assuming about the contexts that host them and the increasingly obvious need for healthy lifestyles for communities.

As reported in the CONI 2016 sustainability report, it is important to consider how much sport is a vehicle for inclusion, participation and social aggregation as well as a tool for psychophysical well-being and prevention. Moreover, it plays a fundamental social role as an instrument of education and training that allows the development of skills and abilities essential for the balanced growth of each individual.

Sport educates to be resilient, and resilience mobilizes the resources identified to find positive and flexible responses to adaptation. Sport and the places connected to it have witnessed a profound transformation. The uses, design and purpose of building sports facilities have changed. The trend is to create places that can accommodate not only athletes but the entire community, with services defined by the needs and demands of society. There are more and more examples of public spaces in synergy with other functions, informal sports practices taking inspiration, also from a morphological point of view, from the spatialities necessary for sport: the movement of the ground and the quotas, the alternation of permeable and waterproof materials, the coexistence between different categories of users, lead to a layered use of the spaces (sports, playground, relaxation areas) (Fig. 5).

Today physical activity is understood as a means to achieve conditions of psycho-physical well-being from expanded user groups: these changes are also reflected in the physical configuration of the spaces dedicated to sports in terms of type, features and functionality. Alongside structures aimed at competitive training or structured sports practice, today are emerging new configurations that intend the sport in a more informal and flexible. This trend leads to the creation of systems that integrate with the context, can redevelop degraded environments, rethink existing spaces implement and promote a concept of resilience which is the premise of the goal.
In this scenario, squares, boulevards, urban parks, also small residual spaces, Coverings and places of results assume physical configurations that can not only respond to a renewed concept of public space for sports practices but also configure possible solutions to combat the consequences of climate change and response to environmental issues.
The interventions carried out in Rotterdam within the program Stadvisie Rotterdam 2030 or the case of Promenada Velenje are successful examples given a space public space structured on several levels that adapts to climate change and rain very quickly.
Public space is a cultural reality in transformation, intimately related to the historicity of the culture of the population that hosts it. Despite the awareness of how unstructured sports is a determining factor in new public urban forms, Italy compared to Europe is still lagging in the design of these spaces, In the following chapter we will analyze some case studies related.

5. CITY, RESILIENCE, SPORT. CASE STUDIES

Public spaces today open and flexible places together with a culture of leisure, are based on the concept of a city that sees all its constituent

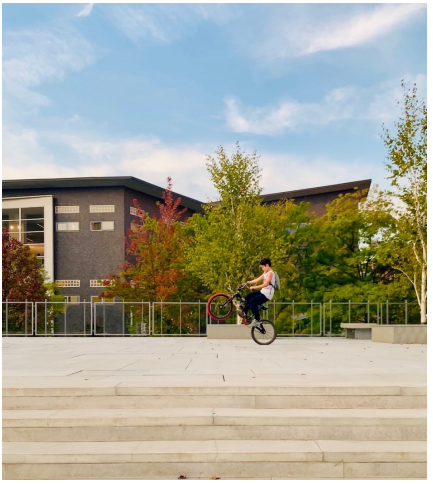

Figure 5. Campus Leonardo, Politecnico di Milano, 2022. Urban sport in the roof of the Renzo Piano's model building Ph. Marta Cognigni

elements oriented to the development of strategies and integrated planning programs that promote sport subject to regeneration. Sports facilities are inclusive and non-exclusive venues where sports and leisure activities are concentrated, as well as public services, support associations and social services that involve the whole of society. In this sense, the spaces for the practice of sport, both competitive and amateur, are increasingly characterized as an open urban place, both in architectural and management, multifunctional and multipurpose with the possibility of hosting sports activities of different types and levels, but also other no sports activities of various kinds, according to the needs of the territory of reference. We analyze some case studies of absolute international relevance that can be taken as a virtuous example.
The Innsbruck InnMotion, located in the Austrian city of Innsbruck, is a track of 185km, developed within the urban fabric and in some

more peripheral areas, which can be covered in different stages and stages each of variable distance. Along the way there are various refreshment points and play areas in which to experience many sports: the entire project develops according to precise environmental sustainability parameters, for the purpose, among others, to encourage a high level of user awareness. In Dorset, England, Outdoor Education has been launched, a project that involves the use of some places where school students can carry out sports activities in productive contexts for their school education. You can practice rowing and other water activities at the coast, practice cross-country at archaeological sites, play orienteering, or do other outdoor disciplines near the Forest of Wareham.

The Municipality of Viborg, Denmark, thanks to the reuse of an abandoned industrial building has realized the StreetMekka. Building dedicated to sports practice. Someone organizes an after-school program, called After School Program, offering children a safe place to practice motor and sports activities, under the guidance of experienced instructors. Every afternoon children from 7-13 years can go to different areas within the building marked on the web, where they can enroll in various courses based on their specific interests. Other examples in Europe and around the world, aimed at sports, find space in dedicated structures and are often integrated into re-functional buildings. In Koprivnika, Croatia, we find the project of Studio UP of the new school center called Gymnasium 46o09'N-16o50E, through which the maximum integration between sports activities and teaching activities is promoted in an area located on the edge of two different districts for functions and urban morphology, between an industrial area and the bourgeois suburbs. The architectural project here takes on a strong political and cultural connotation, in the definition of spaces capable of encouraging integration and dialogue between different social classes thanks to education and, above all, sport. In addition to the public-private partnership for the construction of the high school and the sports complex in Koprivnica, the idea of bringing two complementary urban structures within the same architectural body was applied. Hybrid structures are intended to juxtapose with the concept of public-private partnerships, as the hybrid complex is leased and managed independently of newly formed institutions. Studio UP intentionally used the hybridization of the sports complex, the high school, and other services as a basis for the organization of the entire building.

In Kazan in Russi, in 2020, Legato Sport Architecture created the URAM Extreme PARK, going to reactivate the long river in the section where it passes under one of the largest flyovers in the city. This turns out to be a perfect intervention in which the sport thanks to its relational value has managed to reactivate an area of the city in disuse. The park combines all the sports facilities needed to prepare athletes for high-level competitions, facilities for recreational athletes. It is both a place of professional training but also a new form of public space.

In Italy, as opposed to in Europe or the rest of the world, many so-called "minor" sports struggle to find adequate spaces in which to carry out their activities: this is mainly due to their lower media coverage. This implies, of course, fewer resources to invest in the construction of dedicated centers. So the interventions that are carried out are small cuts and promoted mostly by private individuals. Among those most prominent in Bologna is the redevelopment of the Dozza sports center by the Teco+ studio and the redevelopment of the sports center in Carugate. The Dozza sports center, located in a large park, is one of the main multi-purpose sports facilities in Bologna dedicated mainly to football, with 3 football fields at 11 and a synthetic field for football at seven. To these spaces, have been added areas for new activities for both the unstructured sport, for activities, not sports,

requested by the community resident in the area. The center contains different types of spas equipped for many sports activities: skatepark, archery field (indoor and outdoor), cricket court, playground for basketball, skating rink and/ or rollerblade, Car-model track, gym/ motor room, multipurpose rooms, dining room, children's playground, paintball field, bocciophla. Other examples in Italy that represent the union of these disciplines are: the Giacomini Park in Treviso built in 2020 by the group of architects MADE associates, the Kobe Memorial Park in Naples, Meet & (Gr)eat in Lecce, inaugurated in 2019.

6. CONCLUSIONS

In a perspective of uncertainty and unpredictability due to the qualification and quantification of the consequences of climate change on urban systems and the increase of world population in cities, the difficulty of references to address the urban project emerges. Above all, however, in all the cases mentioned is the open space, "the space between things" (Lanzani, 2003) assumes a particular relevance within the strategy of recompositing of the territory. This happens because the contemporary territories dominate "the open space, no longer dug into the fabric has dilated and largely residual" (Gabellini, 2010). In most cases, open spaces become the element on which to act to improve the habitability of each area and reorganize the relationships between parts of the settlement discontinuous, inhomogeneous, and unused. Multiple research projects has been conducted to define new indicators of urban resilience and technologies in mitigation and adaptation strategies (Doulos et al., 2004; Ahiablame et al., 2012; Santamouris, 2013) to evaluate with instrumental models and analyses the effects of resilient strategies (D'Ambrosio e Leone, 2015). Understanding how to increase resilience, simulate its effects and measure the expected effects, is a commitment that cannot be delegated to the governance of the territory requiring a reflection on the scale of technological design, its methods, and tools able to build a resilient city as a place that does not put extemporaneous remedies to climate change and social issues but that adapts itself by building new opportunities at a social and environmental level. In this logic, the urban spaces of the community become places of change and not an only adaptation, with physical and social characteristics able to respond to transformations. The involvement of the community is the central element of activation of the projects promoting awareness of the need to address social, urban, and climate change, through an onscreen approach to needs, through a redesign of public space, understood as a barometer of the community and its aspirations.

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PAPER #2.05

ARCHITECTURE OF ESSENCES: THE REVEALING ABSTRACTION OF THE TOBACCO LANDSCAPE

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ABSTRACT

The architecture targeted by this study, born to shelter and allow the process of organic transformation of the harvested tobacco leaf, is unequivocally identified with a defined chronology and territory. The tobacco drying sheds of the Vega of Granada have shaped, for more than sixty years and until today, the landscape framework of a region that has historically played a decisive role in this large area that is home to a total of forty-one municipalities. Based on the scientific procedure that guides the systematic organisation of landscape studies, we establish a comparative analysis using the so-called *morphological method of synthesis*; a characteristic empirical practice that allows the enforcement of an inductive analytical procedure for an exact approximation to the landscape, to the time and to the permanence of form as an indispensable requirement of identity. As for the architecture of models and prototypes, we conclude with the architectural characterization of one of the three reference complexes in the province, constituted by one of the most representative models of industrial architecture that is configured on the basis of the essential or invariant in time and space. Geometry acquires prominence, and the material condition of the prototypes loses its relevance in benefit of the relationships that become important as formal configurators of the architectural process.

KEYWORDS

Geometry; tobacco drying sheds; time; essence; prototype.

1. INTRODUCTION

From the encounter of the ideal concept of *abstraction* with the analysis of the industrial and vernacular architecture of tobacco, a new interpretation of architecture is born: architecture as a discipline close to the trinomial defined by form, place and time. One of the greatest aspects of the tobacco drying sheds in Granada is probably how very specific their architecture is, it is necessary to understand the purpose of their construction, different from that of any other building outside this particular industry. The exclusive function that they have to perform in their respective locations in a specific chronological period allows them to acquire properties that approach the constructive essence; they prove the integrity of the exercise of abstraction. The drying sheds do not require installations that are difficult to set up, nor functional programs, nor complex construction processes, nor delicate finishes or costly exterior finishes. They are only space, time, form and skin, built with the exclusive purpose of forming a space cut out of the landscape in which to generate certain environmental conditions.

They are architecture in its maximum degree of purity; and they are so because they were not erected seeking an aesthetic, ideological or sensorial purpose; they have a real, concrete, defined, timelessly admitted and applauded use (Norberg-Schulz 1975).

2. STATE OF THE ART. MIMESIS AND ABSTRACTION

When referring to questions about art, beauty and inspiration as well as the large heterogeneity of activities related to architecture, in the *Critique of Judgement* (Kant 1975) the following statement about the concepts of art and imagination can be found:

> "Imagination is [...] another nature obtained from the matter which the real one provides, and art as the expression or capacity which is in possession of a "cipher language" through which the beautiful forms of nature communicate with humankind in a figurative way. (Kant 1975)."

This leads us to inquire into the relationship between the terms architecture, splendour and mimesis. Immanuel Kant, with absolute logical rigour, introduces an original but sometimes strict concept of beauty. He adopts a position of indisputable classical origin, since he is admitting that the aesthetic beauty is represented by natural beauty, acknowledging the concept of imitation. The beauty and practicality of what is made and constructed by humankind is only feasible through the imitation of nature. In other words: imitation, the artistic, the beautiful or practical and the natural are part of the same thought, of an extrapolated universal integrity, as a natural and inseparable relationship between the terms: architecture and mimesis.

The idea of aesthetic beauty being equivalent to natural beauty is immemorial, perceived by countless civilizations which tried to imitate it. From the origins of humankind and the first artistic and architectural manifestations to the flourishing of the first civilizations, the externalisation of this feeling has been a constant, often inherited and revealed in the form of tangible aesthetic expressions in which the reflection of nature appears identified in cultural events as different as art, architecture and religious beliefs (Cotofleac 2009).

As for the concept of abstraction, we assume that it is not a fixed term of specific meaning. Its use implies conceptual variations according to the discipline, art or science that includes it in its structure, system or knowledge. However, the term has an immovable, enduring and common characteristic to any subject that makes use of it: it appeals to the essential, or rather, to the search for the essential.

The process of abstraction in architecture represents an inquiry into the essence. It is the search for what always remains in any architectural work, a search that is characterised by giving correct answers for what is permanent, invariable, and transcendent in architectural terms. The mental process of conceptualization of thought is present in any architectural process or activity, although with variable strength and intensity (Fig. 1).

When exploring the origins of the existing relationship between self-absorption and art, we have to go back to 1908, the date on which Wilhem Worringer published his doctoral thesis titled *Abstraktion und Einfühlung*. His thoughts and reflections were the starting point of the so-called abstract art in the field of artistic modernity. Worringer explains that through concentration, the object is isolated from the outside world, distancing it from all interdependence, thus approaching its true, immutable and basic value, and avoiding chaos and arbitrariness. The thought that seeks absence brings us closer to the most basic and pure essence of things. That is

Figure 1. Conceptual essence - material essence. The abstraction of a six-year-old boy when drawing the most elementary prototype of a tobacco drying shed, with the Sierra Nevada mountains in the background. Photo: authors 2015

to say, and according to his theory, that any essence tends to universality, a basic condition of aesthetic judgement. Likewise, it does not admit any kind of specific underlying conditions as it only pursues the valid as proof of truth. There is also another important particularity, already announced in the 18th century, but further developed at the end of the 19th century: the empathy or "Ein-fühlung," consisting of the sentimental process of subjective character where the form has the ability to arouse feelings on the observer through the active projection of a meaning of what is observed (Vischer 1873). All the concepts mentioned: mimesis, abstraction and empathy, refer to meanings that are clearly evident in the architecture of the tobacco drying sheds. Mimesis is present in the materiality of the construction, in the use of natural, local materials; the use of components that are in the immediate surroundings of the construction of each building. It is also manifested through the formal and spatial harmony; the similarity with neighbouring buildings, with tradition and the different indigenous architectural manifestations. Lastly, this imitation of nature can be seen in the very architectural foundation of the element under analysis. The rational, logical and simple solution that Nature imposes in its evolution is identical to that which is manifested in the constructive spirit of these tobacco-drying factories. We thus link up with the concept of architectural abstraction, of constructive essence. The drying shed is a manifestation of what is necessary, of the minimum required in architecture to fulfil a specific function. In them there is only what is inexcusable, what is constructively unavoidable, what is indispensable from the material and technical point of view for the existence of architecture.

The empathy of such unique designs is only understandable if one delves deeper into social, cultural and historical questions. The exclusive architectural typology analysed, more than fulfilled its intended purpose, facilitated the development of the population and generated a notable economic improvement in the region; its external appearance was quickly accepted by its inhabitants who willingly accepted it and took it upon themselves to the point of becoming a formal symbol of the local architecture of a long and fruitful period.

3. METODOLOGY

One of the primary characteristics of the 20th century was the triumph of abstraction over mimesis, that is, of the intellectual operation equivalent to isolating being above copying nature. This means that we consider meditated reflection as a renewed method to generate forms, elevating Rationalism to the category of essential discipline used in architecture, art and, of course, general thought.

The conceptualization of reality represents the rational power and the most characteristic, synthetic and renovating intellectual and formal impulse of all the arts that developed throughout the 20th and 21st centuries. Faced with the corset imposed by mimesis, abstraction takes the path of confidence in progress, in the future, in rationality and in the innovative search for a new infinite and free space.

Basically, abstract thinking is understood as any mental operation that is equivalent to mentally separating or isolating a quality or characteristic that is impossible to carry out physically (Montaner, 1993). This means that any analytical procedure that requires the breakdown of a unitary whole into its basic components is equivalent to a search for synthetic reflection; or in other words, any thought that implies the isolation of an aptitude or quality, where we observe it on its own, separated from the subject from which it comes, in order to analyse it and consider it in its pure essence or notion.

Under these principles, an inductive method of investigation is proposed, applying a morphological procedure of synthesis on the chosen prototype, through which it is intended to demonstrate the meaning of essential architecture or zero architecture and its connotations with the topos or place and the different times that are handled in architecture: ontological, material, biological, collective, remembered or evoked.

4. DISCUSSION. INVARIANTS OF THE LANDSCAPE'S IDENTITY

In painting and in any other artistic discipline, all those works that participate in the essentiality and conceptual thinking are considered abstract, leaving behind any gesture that could bring them closer to the specific, the tangible and the contingent. When referring specifically to architecture, the starting point is very clear: architecture is attributed, above all, the capacity to organise, to propose a formal construction with an order that, although it may be complex, must be, in any case, recognizable by its *form* geometry and substantial *skin*.

It seems undeniable that the formal strength represents the most remarkable aspect of all the invariants that characterise the architectural model studied; it is the most evident feature when analysed from the point of view of perception. The clear, gestalt and loaded form of the shed, incites to study it from the power of its appearance, without the implication of other nuances or architectural additions that contaminate a specific and characteristic study (Schmarsow 1897).

A profound analysis on the physiognomy and appearance of a formally defined architectural object that has been infinitely repeated on a specific territory and in a specific time, entails the need to resort to the principles on which its architecture rests and which have been the pillars of its evolution. The formal realisation of the tobacco drying sheds is due to processes of optimization of means in the construction, purification of its figure and adaptation to a specific physical environment, which has determined its expansion without limit and the territorial conquest of a region that is recognised because of its architecture. The interpretation and ultimate understanding of these buildings, leads to the consideration of an elementary manifestation of industrial architecture (INC 1948).

It is an exclusive response and the natural consequence of the combination of

the trinomial: geometric optimization, geographical place and time. In the Vega of Granada there are three municipalities that are clear exponents of a very specific industrial architecture and with an equally defined local level, in which the tobacco drying sheds are the protagonists and they occupy the land in a forceful and explicit way, thanks to the perfect organisation and foresight established in the respective architectural projects. We are talking about El Chaparral, Fuensanta and Peñuelas. The projects of these three spots were drawn up by technicians of the National Institute of Colonisation, an organisation created in Spain in October 1939 which relied on the General Directorate of Colonisation and Rural Planning of the Ministry of Agriculture. They foresee the construction of prototypes of drying sheds in series. The creation of these three *Colonisation Villages* arose from the social and economic deprivation in the post Spanish Civil War period in the province of Granada, and they were conceived with the incorporation of drying sheds built with the most efficient construction techniques and materials of the time, just like the rest of the houses and equipment. When they were built, tobacco exploitation was predominant in the Vega to the extent where it was practically a monocrop, which explains that these new sites were focused on tobacco exploitation (Fig. 2).

5. RESULTS. THE CHAPARRAL PROTOTYPE AS A MODEL IN THE VEGA OF GRANADA

Mimesis or imitation of the natural is considered, in terms of aesthetics, as the essence of perfection and beauty in traditional art. In the restricted sphere of productive architecture, both the enhancement of simple and optimised forms and the consideration of functional efficiency are basic factors in the appreciation of any model of elementary industrial architecture, and in particular they are decisively manifested in the tobacco dryer; a clear example of the exercise of essentiality, abstraction and beauty in a hybrid architecture between industrialisation and landscape contextualisation.

The formal forcefulness, its particular envelope, the interior spatiality of its apparent volume and the geometric and constructive simplicity of the roof constitute the fundamental characteristics for functional efficiency and constructive economy, in other words: the unalterable soul of these buildings. Through the recourse to the architectural repetition of this prototype of proven lucrative efficiency in a balanced and suitably proportioned project environment, the original productive unit for which it was conceived is materialised, constituting the genesis of

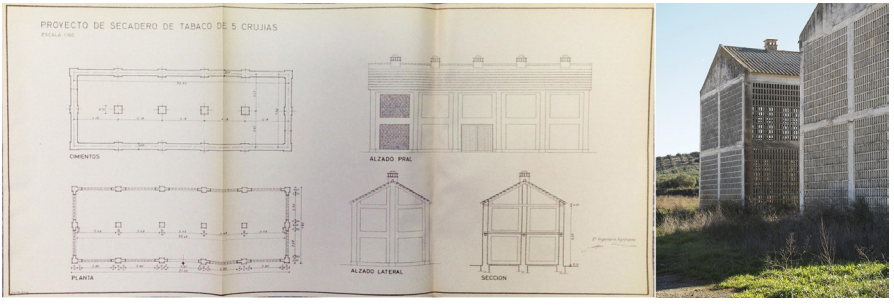

Figure 2. Plan of the prototypes of the "Torres de la Serna" tobacco drying sheds (1962. ACMAPAMA. INC Project. Photograph: Authors 2017

the village of colonization del Chaparral; a harmonious architectural complex that configures a beautiful municipality based among other precepts on formal simplicity, rationality and the permanent presence of the human scale, both in the residential and in the productive sectors.

El Chaparral is located within the Guadalquivir Basin, around 6 km northeast from the city of Granada, at the junction with the Calicasas road, next to the A-44 highway, and its clear metropolitan vocation makes it distinguishable. This town, designed by the architect José García-Nieto Gascón and the engineer Enrique Sánchez Sanz (1957) following the instructions of the General Directorate of Colonization, consists of a residential core for workers with its corresponding agricultural dependencies -barns, corrals and sheds for machinery- and several administration buildings, a church, a school, housing for teachers and commercial premises for artisans. The construction of tobacco drying sheds is also envisaged. Given that the number of drying sheds to be built in this area of *national interest in Granada* was high, their location was planned respecting the recommended dimensions to guarantee air circulation and, therefore, the drying of a large number of plants (Sánchez 1962). As a consequence, standard projects were drawn up for groups of drying sheds that responded to the characteristics of the so-called Torres de la Serna model, promoted by the National Tobacco Cultivation and Fermentation Service, since this model recognised their adequate performance in terms of quality and quantity in the Granada area. The constructive guidelines follow the conditions contained in the manuals of the *Tobacco Handbook* published by the National Institute of Colonisation (1948).

The general features of these models, which occupy an area of 7700 m2, represented by the group of the municipality of Albolote (Granada), are the following:

5.1. Constructive characterization. Type

The main systems and materials used in the construction are:

Foundations: Concrete masonry, with 150 kg concrete.

Structure: Brick masonry pillars with 1:6 cement mortar and double hollow brick partition walls with 1:6 cement mortar, which are finally replaced by reinforced concrete pillars also with concrete strapping at the top with four Ø 6mm rounds.

Envelope: completed with trusses to enclose the latticework, that in this case is made of mass produced precast concrete, although they are originally planned in brick masonry.

Roof: Flat tiles on wooden roof slats supported by a precast concrete reinforcement.

Doors: Metal sliding doors.

Interior blinds: Made of reeds to regulate ventilation and with a rope to roll them up.

Pavement: 150kg concrete in a 15cm layer and 1m wide external sidewalks.

Ventilation: Through the roof placing two chimneys with brick coping.

Plastering and whitewashing: Plastering with cement mortar 1:4 and lime whitewashing, both interior and exterior.

Hanging system: poplar logs supported on commercial reinforced concrete beams, calculated for an overload of 600 kg/m2.

(Fig. 3).

5.2. Architectural typology

The general modulation and the measures of 6.80 metres wide and 6.00 metres high are, based on experience, interesting constants to ensure proper ventilation when taking into account the high number of buildings and their proximity to each other. Other proportions are discarded due to the poor quality of the plant achieved after curing. Five divisory bays are established as the maximum number recommended for an optimal use of the space. The excessive

length of a shed is not advisable for practical purposes, nor is it to exceed the 1000 m3 of capacity estimated by the Service (Fig. 4).

5.3. Functionality and space optimization

The number of tobacco plants per useful m3 is 29 and the planting density per HA is from 12,000 to 15,900 plants, so the m3 that each shed requires will range from 448 to 548 so an average term of 500 m3 is opted for. The total number of drying sheds required when considering an average number of 14,711 plants per hectare - located in the range of 12,000 to 15,900 per hectare - is 20 five-bay drying sheds, each with a capacity for 24,421 plants, a total of 488,420 plants assigned for the farm. The construction of the sheds is based on the economy of production, so it is designed to allow an alternative use as a shed for the long period in which it is not used as a drying facility. For this reason, it has a wide door for the passage of carts and materials in the central opening of the longitudinal façade of the building. The façade walls are built with latticework that allow only the flow of air to pass through and ventilate the structure. This model is replicated in the three farms mentioned above.

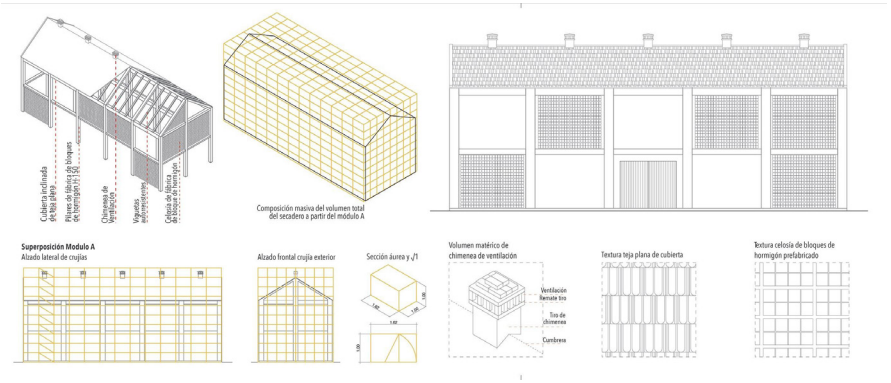

Figure 3. Formal and material analysis. Module type (Authors)

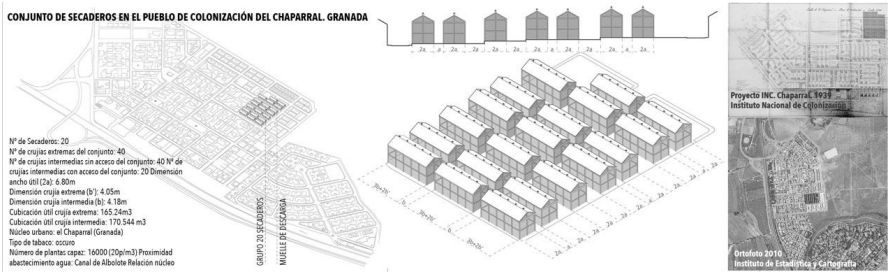

Figure 4. Analysis of implantation in the territory. El Chaparral complex, Granada (Author, 2017)

6. CONCLUSIONS

The revitalisation and implementation of a complete colonisation procedure in large extensions of the national landscape promoted a whole technical, agronomic, social and cultural infrastructure to transform the territory turning it into irrigation areas thanks to large-scale investments which cover from dams to irrigation ditches, from footpaths to railroad lines and from self-built and subsidised housing to colonisation settlements; it was an unprecedented boost that required a complex inter-ministerial coordination. (Junta de Andalucía ed. 2008).

The actions promoted for this purpose by the National Colonisation Institute can be understood today from new heritage horizons so that, together with the inheritance received from the settlements, it is important to consider the large infrastructures and associated public works, acting and conditioning the landscape and territory in an effort to modernise the rural conditions of the province.

Architecture provides a privileged view to fully understand these multidisciplinary actions that changed the physiognomy of many territories. In Granada, the architectural perspective invites reflection and admiration of both the layout and construction of these new towns, and the outstanding infrastructures -tobacco drying sheds- prepared for their exploitation.

The tobacco drying buildings thus constitute the living expression of industrial architecture in a specific historical period in Granada. They are configured not only as a construction linked to the cultivation or natural growth of the tobacco plant; its construction is linked to the transformation process known as curing and its architecture is permanently linked to the absolute concretion of functional and productive efficiency, with the formal purification and timelessness of the invariants of its constructive principles.

The new industrial models associated with this transformation process made us forget about the old industrial models related to other crops -especially hemp and sugar- (Martínez-Ramos 2021), to be replaced in the industrial landscape of the Vega by single, unitary, small, simple and austere buildings. Their formal appearance refers to the essentiality of forms, spaces and materials and the design principles of their design, to abstraction. They are defined by a typology with a modular character and immediate serialisation that leads to a quick and cheap construction; properties that, together with the possibilities of adaptation in their condition of *prototype*, benefit from an enormous capacity for proliferation. They are a response in place and time through an architectural typology of modular character which is defined, characteristic, systematised, typified and designed for repetition, based on a clear, rational and replete form. In addition to its industrial, practical and austere character, the recognisable geometry gives it a timeless and topical sense that is an essential prerequisite for its identity. It also possesses qualities of vernacular architecture and construction, which, in addition to an evident historical empathy with the population, gives it meaning and justifies the identity of the model and its representativeness.

In this context, the contribution of the idea of swarm architecture feasible through the design of a perfect model for its expansion (García Nofuentes 2017, 549-553) and whose development took place between the 1950s and 1960s is an important contribution to the concept and reality characteristic of 20th century Granada, of a controlled dispersion, accompanied by an apparent plurality, which gives prominence to the concept of seriality inherent to the defended prototypes.

In short, the tobacco dryer represents a paradigmatic architectural model that contributes its own identity to the cultural landscape that characterises the Vega of Granada. The tangible experience of its implantation in this territory gives it the iconic value of a timeless architectural invariant that is particular to this province and deserves to be the object of reflection in the heritage context.

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PAPER #2.06

SOCIAL–PSYCHOLOGICAL RESPONSES TO TRENDS OF SUSTAINABLE ARCHITECTURE

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ABSTRACT

Sustainable development became the predominant official paradigm of planning, design, and construction policies. This concept with its environmental, social, economic and cultural dimensions has been applied to the field of architecture since the end of the 20th century. However, numerous researchers still notice one-sided technological and ecological orientation of sustainable architecture and the lack of attention to its cultural, place-based and aesthetics aspects. Nevertheless, sustainability as a design paradigm, undoubtedly encourages a change in the way people consider the notion of aesthetics. The efforts to implement sustainability ideas sometimes lead to very unusual designs – provocative experiments, futuristic solutions or re-using - recycling projects that sometimes may lead to conflicting assessments in the society. This research investigates how aesthetics of sustainable architecture is distinguished and psychologically accepted by people.

KEYWORDS

Sustainable architecture; aesthetics;
architectural trends; sustainability; architecture.

1. INTRODUCTION

Relevance of research. Sustainable architecture can be broadly defined as architectural design and practice based on the paradigm and general principles of sustainability, such as the pursuit of material and intangible well-being, justice for present and future generations, justice within and between societies, protection and promotion of cultural and environmental biodiversity, precautious decision-making, recognition of the interdependence of phenomena (Throsby, 2002), in social, cultural, economic and environmental dimensions. Sustainability must be programmed during the idea generation and development phases and manifest throughout the life cycle of the architectural object. It is maintained that sustainable architecture must not only be durable, flexible, and environmentally friendly, but also contextual, aesthetic and psychologically acceptable (Kamicaityte-Virbasiene and Grazuleviciute-Vileniske, 2011; Berardi, 2013). It is desirable, that the object of sustainable architecture would impact positively, stimulate the sustainable development of environment and society in a broader sense (Kamicaityte-Virbasiene and Grazuleviciute-Vileniske, 2011). For this broader impact to occur, sustainable architecture must be accepted and desired by the society – it must be socially and psychologically acceptable. Social and psychological acceptability of architecture is

closely linked with its aesthetic expression. However, the definitions of sustainable building (Kamicaityte-Virbasiene and Grazuleviciute-Vileniske, 2011; Berardi, 2013) do not identify the particular architectural expression. There have been attempts to categorize sustainable buildings according to their aesthetic expression (Guy and Farmer, 2001; Wines, 2000; Sauerbruch and Hutton, 2011; Di Carlo, 2016); however, the field of sustainable design is constantly evolving and expanding and new trends are emerging. Moreover, the definition of sustainability itself is constantly under debates and new notions of restorative and regenerative sustainability (Istiadji et al., 2018) are taking their grounds more firmly in the recent years. For example, U. Berardi (2013) presents definition of sustainable building related with regenerative sustainability "a building is sustainable if <…> it favors a regenerative resilience of the built environment among all the domains of sustainability". It is possible to presume, that such rapid changes in the design paradigms and constant search for corresponding architectural forms may receive very different reactions in society, which, actually is the end user of buildings and built environments. Consequently, amidst this constant change it is valuable to look at the aesthetic trends of sustainable architecture and to analyze social-psychological reactions to them.

The aim of the research was after the analysis of literature and examples to distinguish currently relevant (both predominant and marginal) aesthetic expression trends of sustainable architecture and to evaluate their social-psychological acceptability.

The methodology of the research encompasses analysis of literature and examples, comparison and systematization of literature analysis results, design and application of online sociological survey, quantitative and qualitative analysis of survey results, formulation of conclusions.

The structure of research is the following: methodological section presents structure and details of research methodology, results section presents distinguished aesthetic expression trends of sustainable architecture with corresponding illustrative material and the quantitative and qualitative analysis of sociological survey results.

2. METHODS

Analysis of literature and examples. Literature analysis was focused on the publications distinguishing trends of sustainable architecture (Guy and Farmer, 2001; Wines, 2000; Sauerbruch and Hutton, 2011; Di Carlo, 2016) and design examples (implemented and projects) available online. The search keywords, such as "sustainable architecture", "sustainable design" were applied in internet search engines. Although the search was not limited to the designs explicitly labeled as sustainable, as numerous high quality nature and advanced technology inspired architectural designs may contain these qualities as well. Additionally, the search in internet resources of architectural content, such as ArchDaily, Divisare, Dezeen etc. was carried out. The collected information included descriptions, photographs, drawings of the objects. After the analysis, comparison, and systematization of collected data 10 contemporary trends of expression of sustainable architecture were distinguished and digital collages were constructed from online available material to illustrate each distinguished trend.

Design of sociological survey. Sociological survey was administered online in the months of April – May 2022. The questionnaire consisted of 27 closed and open questions. The questions were organized in three groups: social-demographical questions, questions aimed at the assessment of 10 trends of sustainable architecture and questions aimed at determining respondents' attitudes towards the distinctive aesthetic features of sustainable buildings. While evaluating each

trend of sustainable architecture, respondents were asked to indicate if the trend is acceptable to him / her, if the trend seems environmentally friendly and to leave a short comment about the trend. 240 respondents, inhabitants of Lithuania, compiled the questionnaire.

Analysis of survey results. In order to analyze emotional responses of survey respondents to the trends of sustainable architecture, qualitative and quantitative approaches were applied. Identifying emotions in written texts requires high level intelligence (Park et al., 2020), thus qualitative approach based on R. Plutchik's (2001) classification of human emotions was applied. According to R. Plutchik (2001), In English language there are few hundred words for defining emotions, thus some kind of categorization and classification is necessary; he provides circumplex model for classification of emotions analogous to a color wheel (Fig. 1), "placing similar emotions close together and opposites 180 degrees apart, like complementary colors". The comments provided by the respondents were analyzed and emotional label was attached to each individual comments using the above-mentioned classification. Quantitative sentiment analysis, judging whether each comment has positive or negative emotion, was carried out further. As a way of recognizing emotions in sentences, the keyword-based sentiment analysis method employs emotional scores of each word (Park et al., 2020). NLTK VADER Sentiment analyzer was applied in this case. The framework of emotional analysis of responses is presented in the Figure 1.

3. RESULTS

3.1 Sustainable architecture directions

Analysis of literature and examples has revealed the wide array of sustainable design manifestations. In order to understand the interconnections of sustainable design trends, the mind map was constructed (Fig. 2) demonstrating five interconnected tendencies – high-tech and low-tech ecological aesthetics, nature-inspired aesthetics, genius loci and participation architecture – that were distinguished based on analysis of literature and examples.

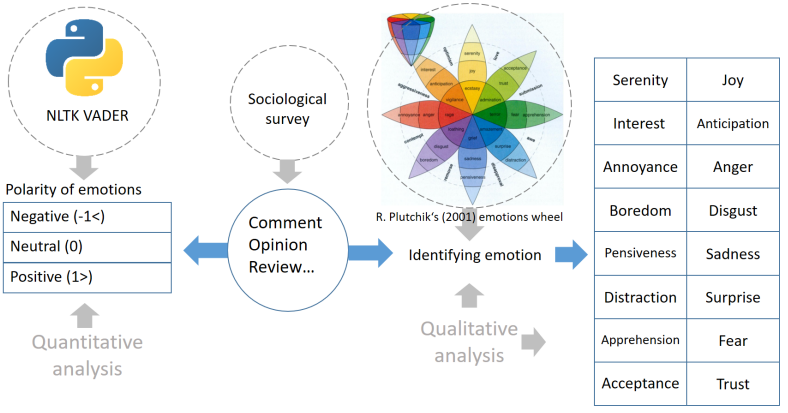

Figure 1. Framework for emotional analysis of survey responses using quantitative (NLTK VADER sentiment analysis tool) and qualitative (R. Plutchik's (2001) classification of emotions) approaches

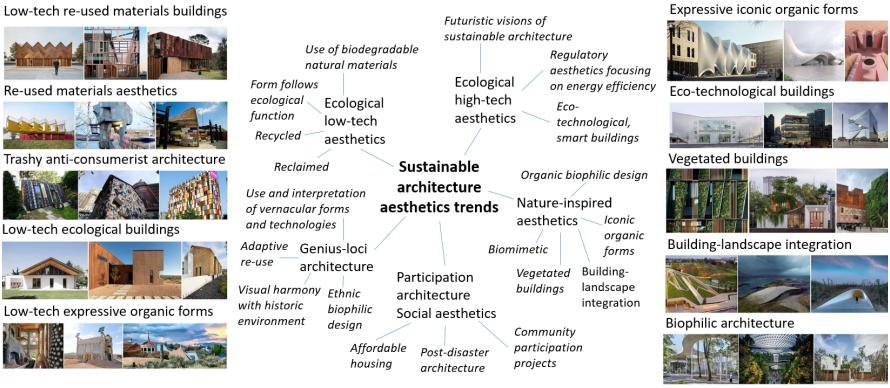

Figure 2. Mind map of contemporary trends of sustainable architecture development and expression and digital collages representing 10 trends selected for the further evaluation of social-psychological acceptability

Researchers still notice one-sided technological and ecological orientation of sustainable architecture (Guy and Farmer, 2001; Wines, 2000), thus distinguishing the expression trends of sustainable architecture for further evaluation, intermediary and marginal trends, that could be beneficial in diversifying the expression of sustainable buildings were given special attention. The following trends were distinguished:

1) *low-tech re-used materials buildings* - the trend towards the use of recycled or re-used materials to create a modern architectural expression;
2) *dictated by re-used materials aesthetics* - the trend, where aesthetics of buildings is dictated by what materials have been obtained for re-use;
3) *trashy anti-consumerist architecture* - the trend where a building can be created from anything that is discarded using secondary raw materials. In this way, the opposition to modern consumerism is demonstrated;
4) l*ow-tech expressive organic forms* - the tendency to create a particularly mannerly architectural expression using natural, recycled or reused materials;
5) l*ow-tech ecological buildings* - the trend dominated by local, natural materials (straw-clay mixture, hemp concrete, etc.), although a modern expression is being developed;
6) *eco-technological buildings* - the trend dominated by glass and metal, integrating the latest eco-technological advances, often using innovative materials;
7) *vegetated buildings* - the trend dominated by greenery (planted facades, roofs or otherwise integrated plants);
8) *building-landscape integration* - the trend where the building blends in with the landscape;
9) *expressive iconic organic forms* - the trend in which the aesthetics of a building is expressed in distinctive organic, plastic forms;
10) *biophilic architecture* - the tendency to deliberately reproduce certain features of natural environments in buildings.

Digital illustrative collages were created for each trend. The collages and the clustering of distinguished trends are presented in the figure 2.

3.2. Results of the survey

The study analyzed 1816 comments related with opinion about the sustainable architecture trends and analyzed them using quantitative (NLTK VADER sentiment analysis tool) and qualitative (R. Plutchik's (2001) classification of emotions) – see fig. 3 and fig. 4 for summarized results. Table 1 represents the summary of the most preferred architectural trends, which are Vegetated, Low-tech ecological, Biophilic, Building-landscape, Low-tech re-used.

The first three architectural trends (*low-tech re-used materials buildings, re-used materials aesthetics and trashy anti-consumerist architecture*) were selected for the survey to test the level of acceptance of the unusual and experimental aesthetics arranged from quite unnoticeable to extreme re-using projects as protest against consumerism form (Fig. 2). The results showed the more extreme expression was, the less it was acceptable (Fig. 3). Although those buildings were created from the recycled or re-used materials, it was not considered as environmentally friendly. Respondents raised awareness of the environmental pollution of re-used materials such as plastics which decays into micro-plastics and creates the further pollution. Also, important question was visual aesthetics. The insights of the survey showed that the most acceptable and encouraged solution of re-using materials would be recycling them to new materials to be used in the construction.

The most moderate recycling trend - *low-tech re-used materials buildings* was accepted quite emotionally positively. Majority of the respondents considered this trend as environmentally friendly. Some respondents showed apprehension towards possible threats of the recycled materials such as environmental friendliness of the used materials, like micro-plastic pollution, decomposing materials and their effect on human health, fire safety, structural issues and material compliance with the legal

Statistical answers (certainly acceptable + acceptable)			Polarity (NLKT Vader) -1 to 1			R. Plutchik's wheel of emotions (The least of negative feelings -disapproval, disgust, contempt)		
No.	Trend	Evaluation	No.	Trend	Evaluation	No.	Trend	Evaluation
1	Vegetated	93.4 %	1	Vegetated	0.3512	1	Biophilic	4.1 %
2	Low-tech ecological	92.5 %	2	Building-landscape	0.3252	2	Low-tech ecological	4.9 %
3	Biophilic	91 %	3	Biophilic	0.3236	3	Vegetated	4.9 %
4	Building-landscape	88.5 %	4	Low-tech ecological	0.3209	4	Building-landscape	4.9 %
5	Low-tech re-used	78.6 %	5	Low-tech expressive organic	0.2605	5	Expressive iconic organic	14.4 %
6	Low-tech expressive organic	64.2 %	6	Low-tech re-used	0.2179	6	Low-tech expressive organic	16 %
7	Expressive iconic organic	52 %	7	Expressive iconic organic	0.2073	7	Low-tech re-used	21 %
8	Eco-technological	49.1 %	8	Eco-technological	0.1602	8	Eco-technological	23.5 %
9	Dictated by re-used	46.1 %	9	Dictated by re-used	0.0920	9	Dictated by re-used	29.6 %
10	Trashy anti-consumerist	27.2 %	10	Trashy anti-consumerist	0.0202	10	Trashy anti-consumerist	42.8 %

Table 1. Evaluation of priorities (the most accepted to the least accepted) of sustainable architecture trends using different methodologies. Source: (Author 2022)

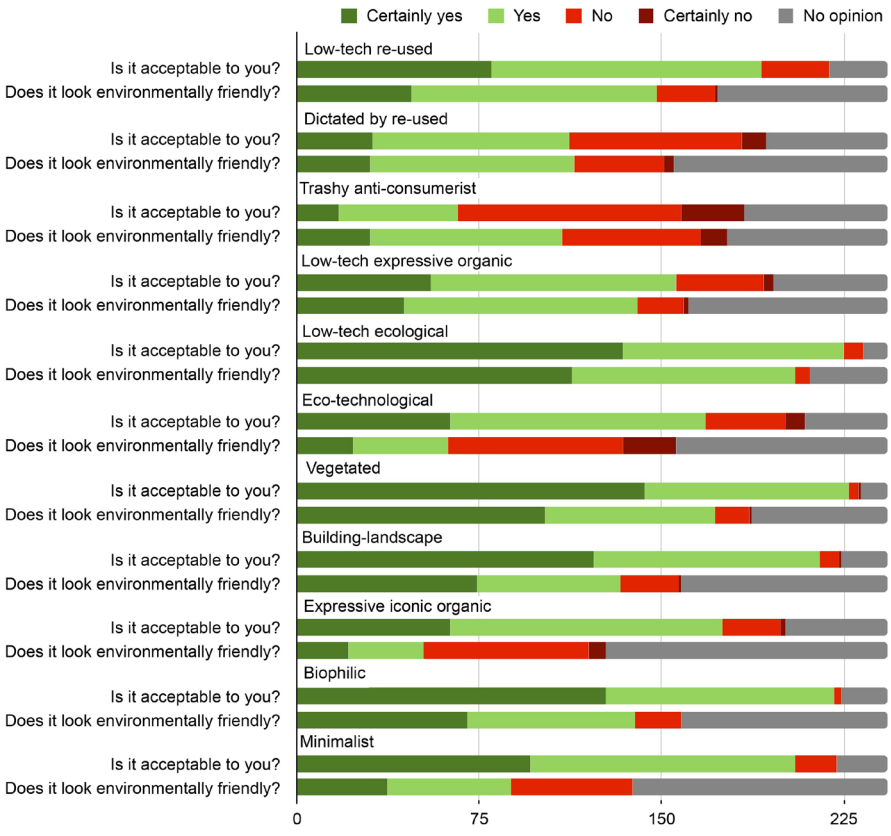

Figure 3. Summarized evaluation of the trends of the acceptance of sustainable architecture. Source: (Author 2022)

requirements for the built environment. The second trend *re-used materials aesthetics* was selected as more intense re-using expression. It was evaluated less positive as the first one, and its acceptance is questionable. Emotional response was hardly positive – disapproval (25.1%) was the dominant answer and was led by the disgust (2.9%) and contempt (1.6%).

The third group in the survey *trashy anti-consumerist architecture* was selected as an extreme re-use example which is actually a form of a protest rather than architectural trend. It was interesting that respondents noticed this difference. The results showed that the greater whole of respondents didn't want to accept this kind of projects. The comments were rich of keywords such as "manifesto", "slum", "trash, "landfill", etc. Two comments greatly illustrates the disagreement towards this trend – „genius" and „shit". Negative emotions, such as dissaproval (32.5%), contempt (9.5%), disgust (0.8%) were obviosly more expressed than possitive feeling such as acceptance (7.0%), interest (2.5%) and surprise (0.8%).

Respondents raised questions towards the quality of aesthethics and architecture itself. Many respondents noticed the colorfulness.

While evaluating *low-tech expressive organic forms* architecture, three groups of answers were noticed: 1 - appreciated as beautiful and sustainable, 2 – disliked because of strongly expressed mannerism, 3 – thought that this style is quite oriental and more appropriate for Eastern part of the world. Integration with the environment was noticed as a frequent remark. This architectural direction was acceptable for the much larger group of respondents and was considered environmentally friendly more often. More positive feelings were noticed such as admiration (15.6%), acceptance (14.8%), interest (9.1%) and surprise (0.4%), rather than negative, such as disapproval (14.8%), contempt (0.8%) and disgust (0.4%). People that expressed pensiveness (9.5%) raised question about the importance of the context, durability, sustainability and appropriateness of this trend to the Lithuanian context.

Low-tech ecological buildings that express contemporary architectural form was accepted really well. Several respondents even expressed the wish to live in this kind of building. The most common keywords in their comments were sustainable, beautiful, ecological, traditional and local. The majority of respondents also noticed that this trends looks environmentally friendly. Some respondents expressed apprehension (0.8%) and pensiveness (5.3%) towards the question if these type of buildings are durable and long-lasting. Acceptance (34.6%), admiration (29.6%) and interest (2.1%) were the dominant positive emotions while negative were only (4.9%) of disapproval.

Evaluation of *eco-technological buildings* was not as good as expected. Although it was evaluated as acceptable, results of emotional analysis showed that positive and negative feelings in the comments balanced quite equally ((acceptance – 26.7% and admiration– 9.5%, while disapproval 20.6%). A lot of respondents noted that the trend is appropriate only for the city center, and only for public and commercial use such as offices. Some comments were that the style looks acceptable, however, it is hardly compatible with the protection of the environment. Expensive and complicated construction, requiring innovative and expensive technology, delivery of the materials extends the supply chain and in this way increases carbon footprint. Apprehension towards the complicated and expensive maintenance of the building such as huge heating and cooling costs, difficult window cleaning, frequent replacement of ventilation filters, and even threats to health such as faster spread of diseases, raising air temperatures in cities. "Lifeless", "deadless" and "disastrous to birds" – was one of the reasons why this type of architecture was disliked. Other features such as non-human scale, aggressive domination, endangering animals and local landscapes, uncozy appearance were the aesthetical reasons of unacceptance. Also, the use of glass in large amounts was one of the unaesthetical features. On the other hand, many respondents agreed that this type of building may be indirectly sustainable, which depends totally on the technology used for saving resources and energy. The larger group of respondents stated that this type of architecture doesn't look sustainable.

Vegetated architecture trend collected the great majority of the positive answers. The results showed its great acceptance to the city environment which lacks nature a lot. Many answers were related to the purified air, beauty and vitality. The apprehension and pensiveness were referred mostly to the maintenance and installation issues as well as concerns regarding to the impact for the building structure. If these questions were solved, this trend would be one of the best accepted.

Building-landscape architecture was also accepted very well but it was related more to natural suburban environments and for places where was important to preserve the view of the landscape. The probable disadvantage of this type of buildings was noted as changes of the natural terrain and possible lack of the sunlight. Respondents noticed that it looks visually

sustainable, however the real sustainability depends on the materials and technological solutions used in the construction.

Although *expressive iconic organic forms* was accepted positively and evaluated as exceptional, interesting and eye-catching, the form itself was not related to environmental sustainability and even in some cases this construction was noted as costly solutions that are complicated to implement and require much more resources. Also, this trend was more acceptable for public buildings rather that individual houses.

Biophilic architecture trend was considered as acceptable and environmentally friendly and was one of the most favorite trends. On one hand, biophilic trend was acceptable through the connection between human and nature, on the other representation of nature and connection to it was criticizes as not sustainable enough without sustainability in construction and materials. (Fig. 4)

Figure 4. Summary of motional evaluation of the trends of the sustainable architecture. Source: (Author 2022)

4. CONCLUSIONS

The concept of sustainability, even though currently acknowledged as the paradigm of development of societies, is not stable and is constantly evolving, currently embracing the notions of restorative, regenerative sustainability and resilience. The expression of sustainable buildings similarly varies between techno-centric, eco-centric solutions and sometimes provocative experiments, futuristic solutions or re-using - recycling projects. For the paradigm of sustainability to succeed social and psychological acceptance is of crucial importance and aesthetic expression of sustainable architecture can play an important role here.

Analysis of literature and examples has revealed the wide array of sustainable design manifestations focusing on high-tech, low-tech solutions, inspired by the characteristics of natural systems and genius loci of the locality, focused on social sustainability. The following trends were distinguished as having potential for diversifying the expression of sustainable buildings: low-tech re-used materials buildings, re-used materials aesthetics, trashy anti-consumerist architecture, low-tech expressive organic forms, low-tech ecological buildings, eco-technological buildings, vegetated buildings, building-landscape integration, expressive iconic organic forms, biophilic architecture.

The study analyzed 1816 comments related with opinion about the sustainable architecture trends and analyzed them using quantitative (NLTK VADER sentiment analysis tool) and qualitative (R. Plutchik's (2001) classification of emotions). The most acceptable and environmentally friendly looking trends were low-tech ecological, vegetated, building-landscape and biophilic buildings. The least acceptable was trashy anti-consumerist, however it was understood as awareness raising project. Many of the respondents welcomed the idea of recycling and reusing, however noticed that the architectural expression is not aesthetically pleasing enough and showed concern to the ecology of the materials used, structural and environmental qualities, impact for the health, material compliance with the legal requirements. Low-tech ecological buildings was one of the most positively evaluated trends, although raised several questions if these type of buildings are durable and long-lasting. Many of the respondents expressed wish to live in this type of house. Although eco-technological trend demonstrates the implementation of environmental friendly technology, it was one of the least related to the environmental protection.

The study showed that sustainability is understood as the wholeness of architectural and engineering solutions, were visual appearance of the building plays and important role. The best appreciated trends were related to naturalness and durability, used environmentally friendly solutions, such as protection of trees and landscape, saving resources, reducing carbon footprint, using sustainable engineering solutions and use patterns.

The study may be concluded by one quote of unknown person of the study:

Style must follow an idea and modern humanity has the ability and means to implement almost any idea in a variety of styles. Style, I think, occurs of what technology is used to extract a particular form of art, and even what material, what function it performs - a pragmatic goal is the essence, it dictates the form as a consequence, not as a goal!

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PAPER #2.07

URBAN STAGES: WHEN CITIES AND ARCHITECTURE BECOME A THEATRE

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ABSTRACT

Throughout history, the theatre has played a decisive part in urban space configuration, not only because of the location of theatre buildings within the city. Outdoor performances in squares, streets and community facilities have also assumed an essential role in the organisation of public space. In this sense, touring theatre must be understood as a resource for transforming and revitalising cities. Festivals such as Avignon, Bilbao and Tàrrega are clear examples of how theatre can appropriate the urban or architectural context and generate new atmospheres. The study of these three cases aims to show how performing practice finds or makes its place in the city, adapting itself to existing urban structures and enhancing their value. In addition, the purpose is also to analyse some buildings and public places that have been designed with an evident scenographic vocation. From Piazza di Sant'Ignazio (Rome) to Can Sau (Olot, Girona), several constructions are conceived as street stages, where everyday life becomes a live performance.

KEYWORDS

Architecture; city; theatre; touring theatre; urban space.

1. INTRODUCTION

The relationship between theatre and urban space can be analysed from different points of view. As far as the historical evolution of Western cities is concerned, the origin of this connection is often traced back to the times of Ancient Greece. From Delphi to Epidaurus, Greek theatres were an extension of the landscape. The location of these buildings defined, to a large extent, the characteristics of their surroundings. Another aspect to be considered is the celebration of events such as the Lenaia and the Dionysia, in which some performances were held all over the polis. The latter was a great festival in ancient Athens in honour of the god Dionysus, based on theatrical performances of dramatic tragedies and comedies. It consisted of two related festivals, the Rural Dionysia and the City Dionysia, taking place at different times of the year.

Similarly, in the period of Ancient Rome, structures for the performing arts were proper symbols of the cities of the empire. Roman theatres, amphitheatres and circuses were decisive elements in the urban fabric and landscape configuration (Morris 2018). The Colosseum and the Circus Maximus insertion around the Roman Forum clearly exemplify that. Nevertheless, there was no exclusive theatre venue during the Middle Ages. Performances took place in buildings initially intended for other uses, such as religious temples and palaces, or in public places such

as squares and streets. It must be said that, in all these spaces, the ecclesiastical authorities used the theatre to spread the Bible's messages and the Christian values among the people. However, later on, minstrels gave touring theatre a ludic and entertaining character, using music and poetry.

With the end of medieval times, Spain began its Golden Age. The beginning of the colonisation of America brought about the Spanish political and military rise, favouring the flourishing of its arts and literature. The corral de comedias established itself as a relevant theatrical space in this context. It was, in fact, a theatrical courtyard delimited by the typical residential buildings of the main cities (Nieva 2000). Regardless, this open space had nothing to do with the model that became popular during the Renaissance and Baroque periods: the Italian-style theatre. In this building, which is still a reference model today, the stage is separated from the auditorium by the proscenium arch, and the audience is distributed in a horseshoe-shaped enclosure. Some of the most famous Italian-style theatres in Europe are the Comédie-Française in Paris (1680), the Teatro Comunale in Bologna (1763) and La Scala in Milan (1778).

It was undoubtedly during the Enlightenment that theatre buildings began to play an essential role in urban regeneration and growth (Ramon Graells 1997). From the 18th century onwards, the performing arts began to have buildings designed exclusively for them. Therefore, performances no longer took place in spaces conceived for other uses. Enlightened intellectuals identified the theatre with cultural development, which is why they gave it a privileged place in the city. The Opéra Garnier in Paris (1875), built as part of Haussmann's renovation plan, is only one example of this new urban planning trend. In other words, a strategic position would be chosen for the great theatres in the urban fabric (Gravagnuolo 1998). The Royal Theatre in Madrid, inaugurated in 1850, and the Vienna State Opera, which opened in 1869, are other cases in point.

Nowadays, most theatre events are not linked to the social elite as they were in the past. Moreover, conventional theatre does not usually receive large audiences either, as spectators have other interests related to new forms of consumption, such as television and digital audiovisual platforms. According to the atlas drawn up by the Observatory of Scenic Spaces, eleven theatres and performance halls have recently disappeared in València. These closures are not isolated, as the same thing is happening in most Spanish cities.[1] Theatres are part of the urban landscape and remain iconic in many municipalities. However, the fact is that the projects for new theatre buildings are rare, and their impact on the urban fabric is not as significant as it used to be. Today, the transformative power of theatre lies not in the construction of large structures but in the appropriation of public space. In this sense, popular theatre and street performances become a powerful tool for promoting culture, making a firm commitment to social and urban regeneration.

This study aims to show how touring theatre can transform and enrich the public space, making art and culture accessible to all. Through street performances, the city's spaces undergo a continuous transformation. The change of priorities in today's society has attracted the population to the ephemeral and spontaneous. For this reason, the relationship between theatre and urban configuration nowadays involves itinerant theatre. Thus, the festivals of Avignon, Bilbao and Tàrrega will be analysed. These are three successful events where the performing arts take over streets, squares and emblematic buildings yearly. In addition, the purpose is also to make known those spaces that constitute an urban scenography due to their architectural characteristics. This will make it possible to approach the relationship between theatre, architecture and urban planning from a more human dimension. After all, theatre is a

human activity, an artistic manifestation that not only occupies a place but often gives it meaning. Spaces conceived with an evident scenographic vocation will be studied, from Piazza di Sant'Ignazio in Rome to the modern structure built in Can Sau (Olot, Girona) by the studio unparelld'arquitectes. The chosen case studies constitute a diverse sample with differences in form but similarities in substance. Although festivals and spaces from European cities are analysed, the study focuses mainly on the current context in Spain, where some cases are not yet sufficiently documented.

2. TOURING THEATRE AS A TOOL FOR URBAN TRANSFORMATION: THREE EXAMPLES

2.1. Festival d'Avignon

Established as one of the leading performing arts events in the world, the Festival d'Avignon has been held every year in July since 1947. This French city is located south-east of the country, on the left bank of the Rhône River, and is the capital of the department of Vaucluse in the Provence-Alpes-Côte d'Azur region. It hosts several urban performances in places as varied as the Church and the Cloister of the Célestins, the Jardin Ceccano, the Maison Jean Vilar and the Boulbon quarry, among many others (Loyer and de Baecque 2016). Specifically, and according to the organisation's data, the festival transforms more than 20 historical and outdoor locations into scenic venues, diverse in terms of architecture and maximum occupancy, from 50 to 2,000 seats. In the last few editions, the number of spectators of shows with paid admission exceeded 100,000 people, including both French and foreigners. In addition, free events attracted around 30,000 visitors. The total number of shows is around 50, translating into 300 performances and more than 400 cultural activities (Le Festival d'Avignon 2022).

Two of these places transformed into urban stages stand out because of their characteristics, history, and disparity. On the one hand, there is a renowned ecclesiastical construction. The Convent of the Célestins in Avignon is a predominantly Gothic monument built between the 14th and 15th centuries. The complex includes the church and the cloister, enclosures for artistic and performing events during the festival. The former is often used for exhibitions, while the latter becomes a veritable open-air theatre every summer. The cloister is one of the most singular spaces due to its architectural value. It has become an ideal setting for theatrical experimentation year after year, with a seating capacity of 500 people. It is, after all, an area enclosed by a gallery of slightly pointed arches from which two giant plane trees emerge. The stage is set up between them, where the live performances occur (Fig. 1).

On the other hand, the stagings carried out in such a particular location as the Boulbon quarry are worth mentioning. Just 15 kilometres southwest of the city lies this now disused quarry. It is a human-made intervention in the landscape that has changed its meaning instead of remaining abandoned. The festival celebration has given an unexpected function to a place initially created for extracting stone (Fig. 1). As the organisation describes, the first time it was used was in 1985 for the staging of Mahabharata by Peter Brook. Moreover, it should be noted that "everything has to be set up in it, from the electricity to the stage" (Carrière de Boulbon 2022, online). Indeed, stage productions outside the city and in a natural context require technical resources to guarantee the performances' correct development and the audience's comfort. Undoubtedly, the transformation of this place into something similar to a natural theatre in the mountains is one of the great successes of the Festival d'Avignon.

Figure 1. Performance in the Cloister of the Célestins (left) and staging in the Boulbon quarry (right). (Christophe Raynaud de Lage 2018)

2.2. Bilboko Kalealdia

The Theatre and Street Arts Festival in Bilbao, known by its Basque name Bilboko Kalealdia, brings together different street performances covering theatre, circus, dance and clowning. It has been taken annually since 1999, making the last edition the 23rd (Kalealdia 2022). The principal sites converted into street theatres are the estuary of Bilbao, the San Francisco urban orchard, Casilda Iturrizar Park, the side of the Arriaga Theatre and other public places such as Arriaga and Convivencia Squares. Perhaps the well-known Doña Casilda Park is one of the locations where most activities take place. It includes many other settings, from the popular Pergola to the Museum of Fine Arts area and the pond. The construction of this municipal garden, which has been the only green lung of the city for a long time, began in 1907. It is an icon of the Biscayan capital. Over the last few years, dozens of productions have been staged in its facilities, which can accommodate a large number of spectators.

The estuary of Bilbao and the San Francisco urban orchard have recently been added to the list of festival venues. As for the former, the aim is to revitalise further the areas linked to the river (López 2022). The fluvial landscape is a relevant element in the urban space configuration. Last interventions around it prove that, such as the insertion of the Guggenheim Museum and its surrounding areas. The latter is an ecological space managed by some city's residents, in which agricultural work is carried out. The Bilboko Kalealdia's incursion into this place encourages other neighbours and outsiders to get to know it. In other words, art and culture are used as sustainability's loudspeakers. Popularising such spaces and initiatives through the performing arts is very beneficial. It is another example of how touring theatre can influence urban regeneration and thus the transformation of cities. The connection between the San Francisco urban orchard and the street theatre festival is an example of culture's commitment to society, in this case in the vindication of more sustainable urban and productive models.[2]

2.3. FiraTàrrega

Elsewhere in the Iberian Peninsula, 500 kilometres southeast of Bilbao, there is the municipality of Tàrrega in the province of Lleida. Its street theatre fair, known as

FiraTàrrega, has been held since 1981. This event was born to turn the town's main festivity into a cultural event that would transform urban spaces through a cultural manifestation, as is theatre (Llacuna, Otal and Ribera 2003). Unlike the cities analysed above, Tàrrega does not have a large population. Its urban configuration has nothing to do with Avignon or Bilbao. However, the fact that it is a small municipality makes it an interesting case study. With just under 18,000 inhabitants, Tàrrega has managed to keep alive and consolidate one of Spain's leading urban theatre festivals. The event intentionally takes on a character more typical of a fair than a festival, just like something similar to a cultural market where performing arts are the matter of interest. This circumstance is motivated by the local context and the way of understanding theatre. Either way, throughout its long history, the fair has evolved to its current state.

Touring theatre makes its way throughout the town, occupying representative spaces such as the Main Square, the church, the schools, the local theatre, etcetera (Què és FiraTàrrega 2022). The former is the most emblematic place in the city's historic centre. A series of buildings of significant heritage value converge here: the Town Hall (17th century), the Church of Santa Maria de l'Alba (17th-18th centuries) and the Chamber of Commerce and Industry (19th century). As for the religious temple, it is a listed building in the category of historical monuments. Its baroque style with some neoclassical features and its façade become one of the backdrops for live performances year after year. Pictures from different editions of the fair show the main stage built in front of the Town Hall. For this reason, its front wall is in the background, while the church remains on the right (Fig. 2). The audience takes up the venue standing together in front of this removable stage.

Figure 2. Comedians in the Main Square of Tàrrega. (Pau Barceló 1981)

When FiraTàrrega is on, the Main Square is transformed into a different place than usual. It goes from a space for social gatherings and commercial relations to an open-air theatre flanked by heritage architecture and traditional dwellings. Moreover, celebrating this event is a defining factor in the town's contemporary history and urban planning. Here, street performances determine the evolution of the public spaces. A clear case is that of this square, whose construction works and modifications must be carried out considering its theatrical function. Ultimately, through the study of this fair, the transformative power of the street performing arts in today's urbanism is confirmed. As has also been seen in the cases of Avignon and Bilbao, such cultural events have several positive consequences on the configuration of urban space. These include the recovery of disused spaces and the revitalisation of those in danger of abandonment. Other results are revaluating public space to the detriment of private facilities and making culture accessible to everyone. Travelling theatre, together with other tools, favours the construction and growth of cities based on social needs and not on speculation and private interests. In this sense, it is part of these changing priorities that are setting the course for a better future.

3. ARCHITECTURE AS URBAN SCENOGRAPHIES GENERATOR

The relationship between theatre and urban configuration can still be analysed from another point of view. This connection, however, goes far beyond the location of theatre buildings within the city or the transformation of public space through street performances. The fact is that urban landscape sometimes contains architecture designed with a clear scenographic vocation. But what exactly does this mean? An illustrative example of this concept is the Piazza di Sant'Ignazio in Rome, designed by Filippo Raguzzini and built between 1727 and 1728. It is one of the most iconic spaces of Baroque Rome, even defined as "the most spectacular scenography of urban rococo" (Blasco 2013, online). This square is in front of the Church of St. Ignatius of Loyola at Campus Martius, becoming a necessary prelude to access the temple. A group of peculiar buildings with curved façades face the monumental church (Fig. 3). They are the result of a design in which geometry regulates every detail. The importance of the geometric layout in this project, based on the outline of ellipses, aims to generate a contrast that highlights the presence of the religious construction.

The truth is that both the shape and the position of the buildings in Piazza di Sant'Ignazio generate a kind of urban scenography, assuming the role of backdrop in a public space that resembles a theatre scene. In places like this, the conjunction between buildings and open space takes on the appearance of a street stage, where everyday life becomes a live performance. In Spain, other more recent architecture cases that also generate urban scenographies can be found. In the northern zone, some of the squares planned by Luis Peña Ganchegui have this character too, as for example the Plaza de la Trinidad (Donostia, 1963), the Plaza del Tenis (Donostia, 1975) and the Plaza de los Fueros (Vitoria-Gasteiz, 1979). They all generate a scenographic atmosphere due to their forms, in which the staggering is a crucial element. In addition, its link with the surroundings is also an important issue (Sangalli Uggeri 2015). This can be seen especially in the latter (Fig. 4), where the relationship with the sea and Chillida's sculptures is highly relevant. In such a context, human activity is theatricalised. The routine is framed in a space that expresses a message of its own.

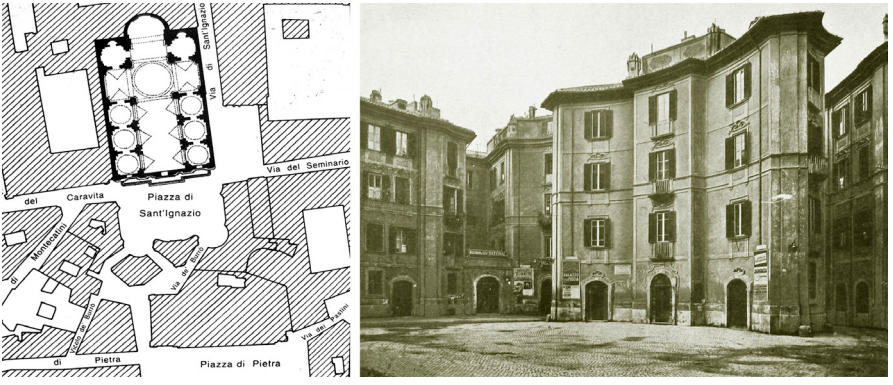

Figure 3. Piazza di Sant'Ignazio. Urban fabric (left) and appearance in the 1930s (right). (Unknown authors 20th century)

Something similar happens with the intervention undertaken by the studio unparelld'aqruitectes in a city in Girona. The team of architects resolved a party wall that had been left exposed in an urban void by designing what they call "an emergency scenography" (Callís and Moliner 2021, 50-51). The project consists of the adaptation of this party wall, located on a vacant lot where there used to be a house called Can Sau. This space overlooks the side of the Verge del Tura Sanctuary, a church dedicated to the patron saint of Olot (the town where the intervention is located). Thus, with the transformation of this vertical element, a deteriorated place has been turned into a meeting point, very attractive for neighbours and visitors. The design of the new façade gives shape to a previously neglected urban space. In the authors' own words:

> "Con ladrillo hueco, se construye una escenografía de urgencia que completa lo que insinúan los contrafuertes, dejando ver en el fondo las huellas de la actividad doméstica marcadas en la medianera. Una construcción de tres bóvedas y cuatro nichos se ofrece al espacio público como una fachada porosa, acompañada de un mínimo graderío. Es una estructura inacabada y apropiable. El artista visual Quim Domene interviene a posteriori en los nichos, con elementos alegóricos a la historia del barrio (Callís and Moliner 2020, online)."[3]

This new structure for the enjoyment of citizens takes on different functions. Firstly, it is an urban and architectural landmark that enhances the space around the church. It also assumes the role of a meeting place where people can sit and socialise. Furthermore, it creates a venue for street performances (Fig. 4). This is another case where architecture has a poetic meaning, transforming a public space into a stage for life. Nevertheless, there is still a much more groundbreaking example in which the urban landscape literally becomes a stage. It is a recording room where artists sing and perform in a showcase. Located in Poblenou, Barcelona, Acid House is an Innovation Centre designed by the studio Arquitectura-G. The project is based on transforming an old factory into a cultural centre where different businesses

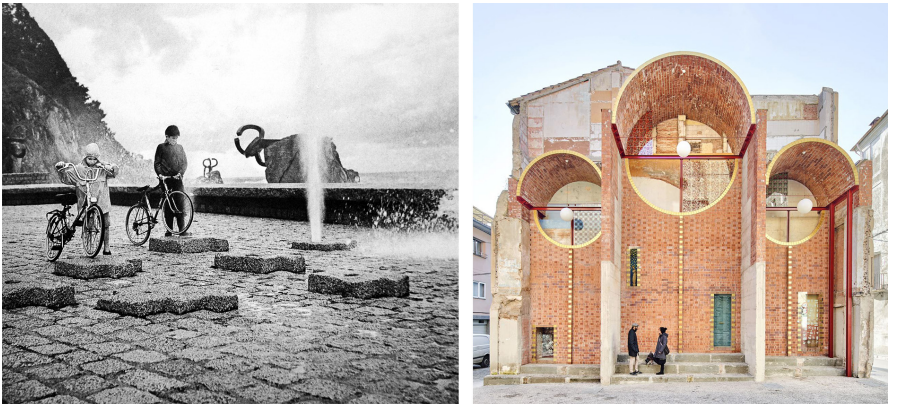

Figure 4. Plaza del Tenis in Donostia (left) and Can Sau in Olot, Girona (right). (Respectively: unknown author and date; José Hevia 2018)

converge (Arnabat, Ayala-Bril, Fuentes and Urdampilleta, 2020). One of them is Window Gallery, where well-known singers and musicians record video clips performing in front of people passing by on the street (Fig. 5). In this case, the architecture takes utmost eagerness to theatricalise the city. Each performance is integrated into the hustle and bustle of the public space. In conclusion, it seems appropriate to quote a reflection by Professor Antoni Ramon on this subject:

> "Els vincles del teatre amb la ciutat no es limiten a qüestions estructurals, urbanístiques. A la ciutat, el teatre no sols és un edifici, més o menys significatiu, monumental. El teatre és una activitat pròpia de la població, que omple de vida alguns espais urbans, els dóna sentit i, a vegades, fins i tot n'és l'origen (Ramon Graells 1997, 14)."[4]

4. CONCLUSIONS

As explained, the theatre has been connected to the urban space configuration throughout history. Although this relationship has traditionally been associated with the construction of buildings and structures for theatrical performance, nowadays, this link has an entirely different meaning. The relationship between the theatre and the city is no longer determined by its imprint on the urban fabric exclusively. The transformative power of theatre today lies in activities such as street performances, and the festivals analysed here are proof of this. Although Avignon, Bilbao and Tàrrega are very different cities, the touring theatre fulfils the same function: to participate in urban regeneration and the evolution of public space. Whether a square, a religious temple, a garden or even a quarry, the performing arts can revitalise and re-signify the space in every place. Art and culture can adapt to every context and

Figure 5. Performance by Rigoberta Bandini at Window Gallery in the Acid House Innovation Centre. (Gallery Session 2021)

increase their value. With tools such as these, the present and future urban planning must be conceived. Future cities must be built according to the real needs of the population and not to individual power or private interests. This is one of the commitments of these cultural events.

Another interesting approach to the relationship between theatre and urban space is the study of architecture projects with a scenographic vocation. These places sometimes go unnoticed by the unobservant eye because of their integration into the cities. However, they are spaces with their own personality and message, which contribute to improving the urban landscape. In them, the city becomes theatre, and everyday life is the play to be performed. The Piazza di Sant'Ignazio in Rome, the projects of Peña Ganchegui, the Can Sau intervention and the experimental space in Acid House are just a few examples that illustrate this concept. Each one is different from the last, but all generate theatrical atmospheres in the city. Whether they are heritage architecture, new projects or refurbishments, they all constitute urban stages. Here, the population is the absolute protagonist, and their needs must be the urban planning priority. In summary, it seems clear that, as some researchers dedicated to the study of the scenic space point out:

> "Theatre is happening all around us while we, the actors, keep playing out our roles in the surrounding existential space (Kołodziejczyk 2019, 19)."

NOTES

[1] Among the work carried out by the Observatory of Scenic Spaces, it is worth highlighting the creation of an atlas of active, abandoned and disappeared theatres in different Spanish cities and the rest of Europe. Available online: https://www.espaciosescenicos.org.

[2] For more information, the activities developed by this neighbourhood platform can be found on their social networks. It is worth noting that similar initiatives exist today in many of Spain's principal cities.

[3] "With hollow bricks, an emergency scenography is bulit for completing what the buttresses insinuate, revealing the traces of domestic activity marked on the party wall in the background. The construction of three vaults and four niches offers a porous façade to the public space, accompanied by a minimal grandstand. It is an unfinished and appropriable structure. The visual artist Quim Domene intervenes a posteriori in the niches, with elements allegorical to the neighbourhood's history." Own translation.

[4] "The theatre's links with the city are not limited to structural, urban issues. In the city, the theatre is not only a significant or monumental building. The theatre is an activity of the population, which fills some urban spaces with life, gives them meaning and, sometimes, is even their origin." Own translation.

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3

INNOVATIVE PRACTICES AND PROJECTS

PAPER #3.01

AGILE ARCHITECTURE: CROSS-CULTURAL CRITICAL CONSIDERATIONS OF MUTABILITY IN DESIGN

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ABSTRACT

Modern architecture is, with limited exceptions, designed and constructed in ways that prove static, staid and resistant to change. Iconic design, crafted by genius architects as sole authors, considered solidity and permanence before responsivity and adaptability. In principle architects knew best what society needed spatially and provided artful designs with expectations that were beyond challenge and not subject to modification. Over the past century there were numerous efforts by designers, such as Gerrit Reitveld, Cedric Price and Kisho Kurokawa, to anticipate change in program, to consider user influence in operations, and to challenge conservative thinking around the monumentality of buildings. In most cases thinking of these innovators outpaced technology's ability to keep pace. However, in recent years and especially in Japan, technology has advanced in ways permitting greater mutability and heighted agility in architecture. Considering pre-fabrication for example, as one means to increase adaptability and customization in architecture, the Japanese market proves a clear leader, a proven innovator and a pronounced success story. North America, on the other hand, has been intensely resistant to agile design, modularized construction and open building. The present research critically considers these two realms, Japan and North America, deploying case studies to illuminate differences in approach. Included in facets considered from an agile architecture vantage point are psychological posturing around change, legal systems around construction, political attitudes around policy and societal expectations around monumentality. Japanese influences of history, spirituality and culture contribute to a willingness to have architecture that's transient, temporary and unfixed. In North America values around ownership, materiality and capital resist architecture that's mutable. This paper analyzes differences in approach and develops a conceptual frame for more appropriate, responsive and responsible architecture for the 21st century.

KEYWORDS

Agile; architecture; open building; systems thinking; innovation.

1. INTRODUCTION

> "Design is a multifaceted subject. It ranges from the smallest manufactured objects to the planning of cities, regions and entire countries. In today's world it is not only local but inevitably global." Cairns, 2014

Smart cities have become a landmark in urban Over much of the long history of architecture the products of design have been rigid, immutable, fixed and permanent. Built out of hard materials and unyielding connections, buildings were and generally still are intended to remain standing for generations, defying gravity and keeping deterioration at bay. While many structures, such as religious centers and government projects, reached for monumentality, even modest houses of the vernacular style aimed to withstand the tests of time. Architecture schools taught the importance of the iconic and celebrated the genius of the designer. This conventional posturing continues in schools across the globe, where the typical design project is a new stoic construction on a clean 'tabula rasa' site. Competition for attention is paramount and obsession with permanence is pervasive.

However, over recent decades we have come to understand the gravity of climate change and the negative impacts of global warming. We have also realized the fundamental role that the construction industry plays in this global crisis, including not only greenhouse gas production but also landfill contributions. Serious efforts have been made by the building industry to try to right the ship. Rating systems promote green building and professional associations subscribe to mitigation measures intended to render the enterprise more sustainable. That said, the push has often been restricted to actions that are low hanging and self-evident, such as reducing fossil fuel consumption, conserving water and lowering embodied energy. All of these steps are vital and commendable, yet they remain insufficient. Glaring in its omission is the ability of architecture to shift and adapt based on changing needs and altered demands. In other words, the potential of Agile Architecture within the greening equation remains largely untouched and untapped.

2. BACKGROUND

> "Considering architecture in the context of the massive changes currently taking place reveals that our profession is more reactionary and conservative than the rest of the world might suspect." M. Shamiyeh, 2007

After the Second War populations around the globe started to swell in dramatic ways and cities began to burgeon in serious fashion, including escalating demands for housing, office buildings, manufacturing plants and the accompanying infrastructure needed to support rapid development. While new technologies and emerging materials were deployed in the construction, the act of building arguably remained traditional in process and outcome. Modern design followed similar practices for production and assembly that its predecessors had advanced and perfected. Even with the initial emergence of information technologies in the 1950s and 1960s, and the promise of novel modes of making, building practices remained mostly conservative and predictable.

There were several brave pioneers who imagined a different future, one informed and inspired by major advancements in art, science and philosophy. Visionaries such as Japan's Kisho Kurokawa and Britain's Cedric Price, pondered the ability of architecture to morph and modify as a building's users and their needs changed over time – whether over a short-term diurnal cycle or across the longer span of a project's lifetime. Kisho and Cedric conceived of architecture that was dynamic and fluid, able to alter its form and function based on activities of its time – whether for innovative housing or for varying public amenity. The courage of these thinkers, who clearly ran counter to the norms of their days, was met with limited success and even less limited uptake. In part the failed vision was a result of their unbridled minds running so far in advance of technology's capacity to keep pace and meet the challenges. Simply put,

the theories underpinning the architectural aspirations were far more advanced than the construction technology available to see them realized.

3. AGILITY AND CULTURE: THE BIGGER PICTURE

> "Details, when they are successful, are not mere decoration. They do not distract or entertain. They lead to an understanding of the whole of which they are an inherent part." Peter Zumthor, 2010

> "Above all, architects should think before they create hardware." Kisho Kurokawa, 2001

Today technology has clearly advanced to levels whereby projects that are agile and adaptable are achievable. However, in many jurisdictions across the plane, the push against agile architecture, prefabricated buildings and modular construction remains profound. Despite such resistance from clients, developers, governments, and the architectural profession itself, to alternative ways of conceiving and creating buildings, there have been some remarkable advances and impressive leaps achieved, considering and constructing agility in design. Without doubt there are pockets of progress in this regard, with places like the Netherlands, Germany and Japan vastly outpacing more staid and difficult regions such as the USA and Canada. The present paper considers a comparison in context, conditions and culture, between North America and Japan, with regard to progress in the realm of Agile Architecture.

There are many demonstrable differences in the ways that Architecture and Construction is approached on either side of the Pacific Ocean. Some of the differences are driven by culture, some by legislation, some by policy and some by posturing. In many respects the success of Japan in advancing the agile and open building agenda, and the failure of North America to follow suit, can be explained in the vast separation that exists in mindset, methods and means between the two disparate worlds. The current paper, while not exhaustive in explorations and explanations endeavors to highlight some key features that act for or against the realization of Agile Architecture. Despite the progress or lack thereof, of any given jurisdiction, the author argues that all architects, clients, builders and authorities-with-jurisdiction must move aggressively towards an embrace of agile architecture, open building, prefabrication, design-for-disassembly, and modular construction if we, as a civilization, aim to tackle the existential threat of climate change. Architecture in our present times can deploy available and emerging tools, techniques and technologies that permit environments to adjust & accommodate to users, to climate, to conditions and to circumstances (Dara & Sinclair, 2018). Artificial intelligence fosters feedback and anticipates change. The author has previously written (Sinclair, Mousazadeh & Safarzadeh, 2012; Sinclair, Mousazadeh & Noori, 2014) about both physical and psychological dimensions of change, considering how environments might mutate and how people might react. The present paper critically considers progress in theory & practice of open building and agile architecture, and develops a viewpoint that can help us better understand the potential of responsive environments to heighten our quality of life. Agile Architecture must undeniably prove a fundamental ingredient of sustainability moving forward. Buildings of tomorrow must be capable of adapting, adjusting, migrating, managing and mutating. Staid design and static dwelling are no longer tenable in an ethos where species' survival is in question.

The following sections of the paper examine and explore dimensions of two cases, Japan and North America, with regard to the structures, systems, attitudes and attributes that characterize the countries. The goal is not to have a fully parallel comparison of

these different cases, but rather to portray and convey aspects of each place that contribute either an embrace or a denial of Agile Architecture. The situation in each country, and culture, is unique and highly complex. The author does not purport these analyses, and resultant characterizations, as definitive. Rather they present some initial musings that might contribute downstream to more focused research aimed at shifting perceptions, removing barriers, and opening minds/paths to more responsive and responsible architecture.

4. NORTH AMERICA

> "Architecture often ignores its role of making a place with purpose." Cedric Price, 2003

Concepts around flexible, agile, adaptable architecture have generally been met with resistance in North America. There are many reasons for a reluctance to adopt building systems that are modular, prefabricated, kit-of-parts and dynamic, some pertaining to legal barriers, some to psychological uneasiness, some to industry organization and some to financial arrangements. Historically the term modular building in North America has conjured up images of stigmatized cheaply built mobile homes. Only in recent years has modular building and prefabrication taken on more innovative design and qualitative character. Even with significant advancements in quality of design and construction, its adoption remains slow, with skepticism running high and market-share minimal. It is worth exploring some of the barriers that have been in place to limit the embrace of Agile Architecture in Canada and the United States (while distinct markets, they do enjoy many commonalities).

4.1. Urban activation scenarios

The design and construction industry in North America is highly fractured and fragmented. Unlike many other markets, including those in the European Union and across Asia, the industry in North America is plagued with intense separation of functions and responsibilities – for example the division of the trades. Each trade has its accepted roles and expected timing within the building production process. The complexities introduced by virtue of a plethora of players and processes proves daunting, and in many ways act against the kinds of streamlining and efficiencies inherent in agile architecture and open building approaches. Prefabrication, for example, pulls together numerous trades, procedures, materials and assemblies in ways that are intensely efficient, in terms of labor, time and money. Open Building, as another example, challenges the sequencing of the trades and makes post-occupancy adjustments easy and quick, in many cases reducing or eliminating the need for downstream engagement by contractors to tackle simple reconfigurations of space.

4.2. Horizontal Structure

In North America the design and construction process is extremely layered with respect to sequencing and production. The organization is horizontal, with each contributor occupying their own disciplinary, legal and administrative silo. Each player in the system is, under conventional arrangements, unique and distinct with arm's-length relationships in place to ensure autonomy. There are an increasing number of non-conventional contractual arrangements appearing in North America in recent times, perhaps acknowledging the need to find more efficient ways of moving building projects from concept to construction. That said, the system in general is arguably broken in serious ways – with unreasonable investments required to bring projects to fruition through mazes of legislation, contractual quagmires and workforce wastefulness.

4.3. Litigation and Adversarial Relationships

From a legal perspective the design and construction industry in North America is notorious for its unfathomable environment of litigation and for its ethos of deeply adversarial relationships. Lawsuits seem inevitable as means to confront differences and the courts prove prevalent as vehicles to resolve disputes. Change orders on many projects are significant in number and prove a financial burden to the system. Pressures to fast-track projects, to reduce delivery times, limit carrying costs and generate revenues sooner, all translate into a milieu where mistakes are made, modifications are required and problem-solving on the fly is normalized. In some respects, it's like jumping from an airplane with yards of fabric and a sewing machine in the hopes of fashioning a parachute before the ground arrives. Certainly, within this indisposed environment many projects do manage to get constructed and often to reasonable levels of care, however not without frustration, friction, anxiety and at times antagonism.

4.4. Quantity

North America is not well known for the quality of its buildings, at least not from a technical perspective. European nations, in general, tend to place far more emphasis on details and a high calibre of production compared to their counterparts across the Atlantic. A study of European architecture journals quickly reveals the differences in approach and outcomes – with EU publications very concerned with details and building as science while Canadian and American trade magazines focus more on images and building as object. In North America there is great attention paid to the commodification dimensions of building production, including maximizing lease-ability and obsession with speculation (i.e., 'flipping' property).

4.5. Value Engineering – Bottom Line Thinking

A hallmark of the North American construction industry is its fixation with numbers and bottom-line thinking. The budget is paramount in the equation of building production, eclipsing aspects of eminence such as detailing, right-to-light, material richness, and psychological dimensions of dwelling. The infamous exercise of 'value-engineering', pervasive in the industry, involves cutting budgets in aggressive ways that seldom consider longer-term human-centric implications. In an economic ambiance where money matters above all else, the art & human sides of the equation commonly suffer. When the exercise of cost cutting is in the hands of accountants and engineers, the architectural value of projects is too often left on the editing room floor.

4.6. To sum up...

While the situation of the design and construction industry In North America is painted as rather bleak, there are signs that things are changing. The preoccupation with fast and cheap is losing momentum in an era of climate change, global warming and an urgent call for sustainability. The demands are rising for responsibility, accountability, durability, adaptability, and quality throughout society, including of course the building industry. Given the negative impacts of the industry on the environment, professionals and governments in North America are critically questioning the viability of business as usual. As this soul searching continues, architects and contractors will need to look for other ways of designing, crafting and occupying spaces and places.

5. JAPAN

> "Those who make channels for water control the water; makers of arrows make the arrows straight; carpenters control their timber; and the wise control their own minds." Wray, 2004

In contrast to the North American case, Japan has been a world leader with regard to innovation in the design and construction industry, including pioneering open building and agile architecture. There are many reasons for such progressive posturing and trail-blazing, including aspects influenced by history, by geography, and by cultural, psychological, sociological and spiritual factors. The embrace of innovation in the industry is pervasive and profound. Prefabrication is normal. Adaptability is commonplace. Mutability is widespread. Buildings are made by many companies, including those known in the West for cars and electronics. Designs are made for disassembly. Building research is well-funded and extensive, having demonstrably positive impacts on the built environment at all scales. Robotics are omnipresent, both in manufacturing processes and on construction sites. Sustainability is an expected, versus an optional, outcome of efforts. It is insightful to consider some aspects of the industry in Japan that set it apart from other nations.

5.1.Integration of Industry

Within the design and construction industry in Japan there is remarkably high integration. As opposed to the troubling fragmentation seen in North American markets, the Japanese system works in a more cohesive and well-oiled manner. Due to radically different approaches to making, including a preponderance of prefabrication, Japan does not struggle with trades colliding and overlapping, with sequencing dilemmas and with a constant barrage of change orders. While projects are delivered in expedited ways, there are efficiencies in the modes and manner of delivery that are quite distinct from North American counterparts. For example, a family can easily order their home in a retail chain store that also provides food, clothing and stationery. Once ordered, the home is manufactured in a factory in prefabricated parts which are then brought to the residential lot and assembled without delay. The production of houses is approached in ways that parallel the assembly of cars, televisions, trains and planes. In North America, to the contrary, the production of buildings is a tedious, piecemeal, slow and arduous endeavor.

5.2. Vertical Structure

The design and construction industry in Japan is vertically organized. Deviating from the North American model which sees a spectrum of individual players, such as developers, architects, engineers, manufacturers and contractors, cobbled together on a building-by-building basis, the Japanese market has many large companies that encompass an array of disciplines under a single roof. In some instances, these mega-companies develop, design and build with professionals fully embedded in the corporation. The unique structure of the architecture profession in Japan, whereby several tiers of status & responsibility co-exist, translates into an ability to have exceptional design talent in-house. While high profile design architects (e.g., Ito-san, Kuma-san, Ando-san, etc.) do play a major role in Japan, so do the wealth of less prominent architects who in many ways do the heavy lifting. The vertical arrangement of the industry in Japan explains, in part, its high efficiency and its remarkable productivity. In an era where waste is problematic, the construction industry globally needs to push hard to develop new modes of making and different ways of working. While many aspects of Japanese society are less than ideal, it is undeniable that the design and construction industry is exemplary.

5.3. Trust + Honor

The long and colorful history of Japan celebrates rich stories of the samurai culture, of the power of Bushido and of the value of honor to a society. While much has happened since the days of the sword, memories and values in many ways remain and continue to inform,

influence and inspire the Japanese people. This impact holds true for the design and construction industry as well, where it manifests in many ways, including great attention to detail, and obsessive concern with workmanship, and a commitment to discharging duties with care. From the development office in the corporate tower to the design department in the studio to the construction worker on the site, no detail is inconsequential, however small or insignificant it may seem to outsiders. The commitment to trust and an unswerving subscription to honor translates into facilitation of relationships in the business and levels of cooperation unheard of in North American settings. In many cases, few if any change orders are issued, even on complex and challenging projects. In many cases major projects are initiated on a handshake between business partners, and problems arising downstream are solved in after-hour meetings in yakitori bars between key players.

5.4. Quality

Unlike North America's concern about the bottom line, and its industry's willingness to value-engineer the art out of buildings, the situation in Japan seems far more balanced. Like its European counterparts, the Japanese building industry is unwilling to separate art from science and poetics from pragmatics. Cost savings are found through innovations and efficiencies, versus going after the low hanging fruit (such as materials, finishes, social space, details, etc.). As a result of this mindset, quality is seldom part of the negotiations around cost control and project budgets. Art is an inseparable part of building, whether in the private or public sector. Even modest projects in Japan are commonly beautiful in design, inspiring in details and ingenious in execution.

5.5. Spiritual Dimensions – Impermanence

A final point to explore regards the spiritual underpinning of Japan, which also exerts significant effect on the culture including the conception and crafting of its spaces and places. Japan follows a complex mixture of Shintoism and Buddhism. The author has written widely on the influences of spirituality on the architecture of Japan. For the purposes of the present paper, what is most meaningful is Buddhism's position on ephemerality and impermanence. In Buddhism there is an acceptance of transience as a fundamental feature of our 'material' existence. Many shrines and temples in Japan are intentionally dismantled and then reconstructed as testament to the impermanent nature of our journey through life and our reality on earth. This sensibility also flows into the design and construction of all project types, not only religious buildings. Such acceptance of impermanence primed Japan for its role as a leader in open building and agile architecture. Structures, like life, should not be overly rigid and too fixed. To the converse they should be subject to shifts, variations and transformations. In examining the traditional Japanese home this fluidity and adaptability is seen in the movement of shoji screens and the complete dissolution of the boundaries between inside and outside.

5.6. To sum up …

Japan is quite unique in many ways, with numerous characteristics positioning the country to assume leadership in advancing an agile architecture agenda. Today our planet faces unprecedented catastrophes driven by global warming, burgeoning waste, escalating pollution, dwindling resources and the arrival of the unknown (such as pandemics, war, political turmoil and the like). The conventional ways many nations have approached the making of cities and buildings is no longer tenable. It is instructive to study, in a comparative sense, the ways in which various countries and various systems design, build and inhabit. In the present paper the author argues that there are timely lessons to be learned by the Japanese ways of seeing, thinking and acting around architecture.

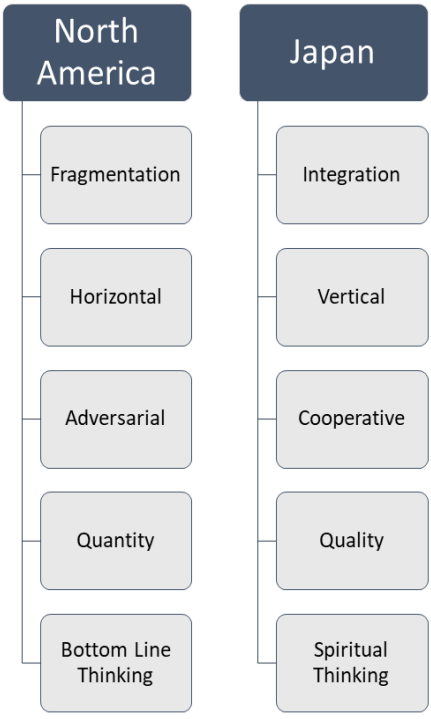

Figure 1. Case Comparison – North American versus Japan Building Industry

6. SUSTAIN: SYNTHESIZING A CONCEPTUAL FRAME

> "Architecture is the will of an epoch translated into space; living, changing, new." Richard Weston, 2011

It is apparent that building industries internationally need to urgently shift gears and change directions. In an ethos of emergency, where we all confront the existential threat of climate change, the design and construction sectors must find more innovative, efficient and effective ways of operating. To this end the pursuit of more agile architecture holds promise. Agile architecture involves adaptability, prefabrication, modularity, design for disassembly, mutability and, more demonstrably, end-user choice, control, management and empowerment. In considering a path forward, as a provocation, the author postulates a more holistic, responsive and responsible approach to design and construction. Without doubt this frame is a starting point for meaningful, and hopefully productive, reconsiderations of the manner in which we conceive and craft the built environment.

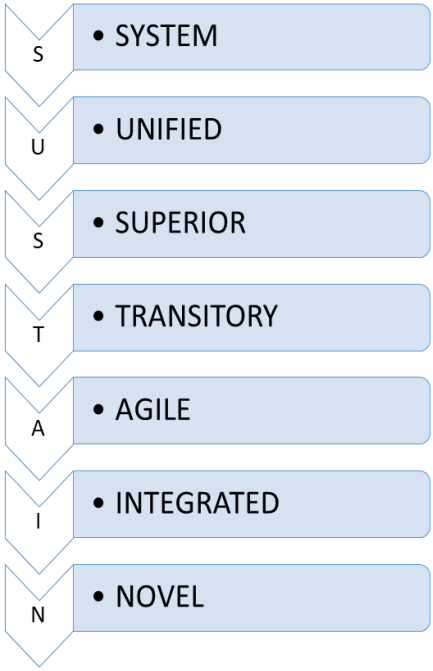

Figure 2. SUSTAIN Frame – Rethinking Design in an Ethos of Emergency

7. EXPLAINING THE FRAME

System: Understanding the process as an intensely interconnected series of activities

Unified: Viewing design and construction processes as far more seamless and far more fluid

Superior: Valuing quality well above quantity
Transitory: Seeing architecture as more impermanent and exceedingly demountable

Agile: Ensuring architecture is adaptable, mutable, responsive and responsible

Integrated: Working to connect the dots and piece together the puzzle

Novel: Seeing, thinking and acting in innovative and unconventional ways

One future scenario for architecture, considering all the current environmental, social and economic issues, would be about designing structures that are fully adaptable from inside out and across scales. Resilience ideally overarches all scales and dimensions. In order to do so, the best designs can be defined as those that spatially, functionally and aesthetically accommodate change. In this kind of architectural practice, collaboration among all the stakeholders is essential. Design, construction and building systems, in this methodology, are not distinct entities that develop independently. Rather, they are all inspired by the latest developments in art, science, technology, theory and practice that should be thought of and integrated from the beginning and throughout the process.

> "People are very open-minded about new things - as long as they're exactly like the old ones." Charles Kettering

Architecture in the 21st Century, a period already understood through its dramatic movement + intense change, must be far more responsive, resonant & resilient than designs for days long past. Rather than requiring users to shift, twist and surrender to fit into static environments, a new Architecture reacts, adjusts & accommodates. The present paper postulates a conceptual frame with which to better consider, create and construct such design. It aims to transition mindsets + methods of Architects + Architecture, in the spirit of the late Kisho Kurokawa, from an age of the machine to the age of life. In the current proposition for reconsidered and more appropriate Architecture, people must reside centrally and the dynamic, responsive & meaningful must eclipse the static, staid & stale. Ingenuity, creativity + open-mindedness proves vital.

8. CONCLUSIONS

> "Through a growing capacity to tolerate uncertainty, vagueness, lack of definition and precisions, momentary illogic and open-endedness, one gradually learns the skill of cooperating with one's work, and allowing the work to make its suggestions and take its own unexpected turns and moves." Juhani Pallasmaa, 2009

Our times are rich in complexity and replete with crises. Architecture, as a discipline and profession, as theory and practice, has proven enduring and impactful. For generations, the design and construction of buildings was about defying gravity, divining dwelling, embodying values and celebrating stability. While many of these aspirations remain significant, they can no longer be accepted as the status quo. In a period of great upheaval and uncertainty, including regrettably the challenge of the survival of our species and the viability of our planet, it is timely to question our values, our methods, our outcomes and our impacts. This critical self-examination includes the

role of architects, the purpose of design, the implications of building and the nature of dwelling. The present paper has examined two arguably different approaches to design and building, namely in North America and in Japan. While each case has its strengths and weaknesses, the author argues that the Japanese approach to construction of the built environment, with its emphasis on integration, modularity and mutability, proves especially relevant as a means to address global upheaval. A comparison of driving forces that shape each case was presented, together with the advancement of a framework for more sustainable, responsive and responsible architecture for the 21st century. It is evident that architecture can no longer advance in a business-as-usual mode – there is far too much at stake to continue on our current path.

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PAPER #3.02

TOWARDS THE REAL ESTATE PROJECT. THE ARCHITECT IN THE NEW PARADIGM OF REAL ESTATE INVESTMENT

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ABSTRACT

After the financial crisis of 2008, which hit the real estate sector particularly hard, there was a paradigm shift in the real estate investment process. Traditional development was drastically reduced, giving rise to the emergence of other agents. The model of analysis, decision-making and development has been redefined. It is assimilated to other types of more abstract investments, while maintaining a clear local component. A tour of the different investment mechanisms that have burst into the sector is made like venture capital funds, crowdfunding platforms, participatory companies and investors with foreign capital. This paper deals with the question of how external circumstances have an impact depending on the objective of the investment. And another point analyzed is the real estate as a product or the real estate as a tool for the sale of another product (tertiary sector). The aim of this paper is to analyze the position of the architect in the new context of identifying opportunities in the real estate sector. In this new context the architect plays a key role in the investment strategy taking into account what both society and the investors need, and thus participates in all phases of the process.

KEYWORDS

Real estate; property markets; investment; behavioral economics; architectural project; real estate project.

1. INTRODUCTION

The financial crisis of 2008, which led to the collapse of the real estate sector in Spain, led to a change in the process of analysis and development of real estate investment. Traditional promotion was drastically reduced, prompting the emergence of other agents. The analysis, decision-making and development model has been redefined. This is assimilated to other investment processes of a more abstract nature. However, the market in question maintains a clear subjective component. Based on this, the behavioral economics perspective is considered to be useful for the analysis of investment decision-making in the property market.

At present, real estate investment is managed by professionals from the financial sector, so the criteria of this sector are applied but they neglect that society has a subjective, personal and even irrational component. Real estate activity cannot ignore the behavior of society as an essential part of the market and the architect must assume a structural role as an expert in the conception of buildings for people.

This paper aims to review the process of analysis and development of a real estate investment, starting from the premise that the concepts of behavioral economics theory should be incorporated as another variable in the analysis and emphasizing the extent to which the architect should be involved in it. To this end, we will draw a parallel between the past social and investment context and the one we are in now. Departing from the current context, we will develop the phases of a real estate investment, from its initial project design to its completion, analyzing the role of the architect in each of them.

2. A CHANGING SOCIETY

Real estate activity has changed. The role of the architect cannot be the same.

Real estate activity prior to the crisis was perceived as a stable process. It was possible to make medium-term profitability projections with a moderate margin of error. The sector was strong and solid, growing in response to high demand. Costs could be determined in a controlled manner, with no major rises or falls during the process. At the time, we were dealing with a property developer who was not very professionalized. Although that person may have had extensive knowledge of the sector, this knowledge was based mainly on their previous experience and was not, in many cases, supported or accompanied by technical, economic, or legal training. The initiatives were based on this previous professional background. Intuition and trust were key to decision-making. On the other hand, the process repeated a pattern with little variation. It consisted of detecting a typical opportunity, with characteristics very similar to those of previous investments made, with a brief period of consultation, often of little depth, to move forward with the initiative. And, after a negotiation process with a wide margin of error, the investment was promoted. The projects were usually a replica of the previous project regarding design, definition and construction. No prior or subsequent reflection was carried out, nor was there any commitment to innovation or adaptation to the socioeconomic situation. In sum, a total disaffection of the investor with respect to society. The developer did not take into account social trends and behaviors, a situation that has now changed. An exhaustive analysis of the profile of buyers, their purchasing power and lifestyle is carried out. On a residential level, the number of children, the percentage of single-family homes and preferences for terraces, among other aspects, are analyzed. Projects adapted to different profiles emerge for future users. For example, at the tertiary level, initiatives arise such as hotels for adults only, or focused on the LGTBI collective. An analysis is made of how society wants to live, and a response is given to this demand.

After the 2008 crisis, the irruption of professionalized agents in real estate investment imposed an investment system similar to that of the financial markets, in which investment decisions are made on the basis of analytical efforts that determine the strategy, with a much more exhaustive control of the entire process. This system based on financial markets is incomplete in the case of real estate investment, which demands something more. It cannot be dissociated from society. It would be a major mistake to leave aside the behavioral variable of society and the individuals that comprise it when evaluating an investment in the real estate sector. Therefore, the application of neoclassical or traditional economics, based on the efficient market, which assumes a logical and rational behavior of the intervening agents, does not provide reliable results in the real estate market. It is proposed that the approaches of behavioral theory will be of great use in making investment decisions in the real estate case. Behavioral economics aims to introduce principles of cognitive psychology when analyzing the economic

decisions of society and its individuals. The combination of the two disciplines, economics and psychology, makes it possible to explain why individuals apparently make irrational or illogical decisions when consuming, investing, saving and lending money (Belsky and Gilovich, 1999). The theories of behavioral economics introduce variables that help to better understand the real estate market and, therefore, offer analyses that improve decision-making "What is important about the behavioral school is that it describes what people tend to do compared to neoclassical economic theory that says what people should do" (Roig, 2015). Similarly, society should be taken into account not only from the point of view of its reaction or behavior to market stimuli, but also from the point of view of its needs and demands. In any case, Roig (2015) does not propose the replacement of the analysis models of neoclassical or traditional economics, but proposes the introduction of hypotheses and models developed by the behavioral school, so as to improve the analysis of real estate investment in order to obtain more efficient results than those obtained only with modern financial theories.

Daniel Kahneman, Nobel Prize honoree in Economics 2002, and Amos Tversky, devoted themselves to the study of psychology in order to apply it to economics. Kahneman exposes the bounded rationality map, where he confronts the systematic biases that distinguish the beliefs people hold and the choices they make from the optimal beliefs and choices assumed in rational agent models. Kahneman and Tversky's work contains three main areas: heuristics in a context of uncertainty, prospect theory as a model of choice in a risky environment, and framing effects that establish a default choice in decision-making. From their study it is concluded that the rational agent model does not provide a complete and efficient analysis of economic markets, since the individuals that compose them have cognitive limitations that lead them to make subjective decisions.

3. FROM THE ARCHITECTURAL PROJECT TO THE REAL ESTATE PROJECT

The professionalization of the process of defining and developing a real estate investment means that the construction project has lost much of its significance. It is just one more step in a much broader project that we call the real estate project. For this purpose, we will detail which are the work areas, in what order they take place and who the protagonists are in each one of them. Furthermore, we will try to define the role of the architect in each of these areas in order to provide a value that we consider essential to the process.

A key notion when it comes to understanding certain investment behaviors in the real estate sector is the concept of product. We abstract the object of the investment and focus on the "product" or "service" that will be the object of a sale and, therefore, will yield income and generate profits and profitability. From this point of view, it is important to understand when the building to be constructed is the product, or when the building is a tool to produce another product or provide another service. The building is the product when the purpose of the investment is to sell or rent the building. However, in most of the building processes, profitability is not aimed for the building itself, as the building is a necessary tool for the development of another activity, whether it is industrial production, hotel services, educational or health services, among others.

The duality between Operating Companies (OPCO) and Property Companies (PROPCO) arises. Specialization in all sectors has led to a model where companies outsource the promotion and ongoing management of the buildings they need to carry out their economic activities. It is common, for instance, for hotel chains not to own the hotels they operate on a rental basis. In this way, the company does not assume the risk of carrying out an activity that it does not know

or for which it is not prepared, and focuses all its efforts on its own activity. In addition, the risk of such activities is diversified not only in the promotion process, but also during the rental and operating activities.

It is important to understand the needs of both in order to bring them to the balance of interests in which an agreement is sealed. On the one hand, the PROPCOs will be keeping a close eye on the building process, costs, deadlines, administrative management, etc. On the other hand, the OPCOs will want to make sure that the building meets the requirements of their activity. In this sense, they will analyze the activity to be developed, assess how the building should respond to their needs and maximize sales.

On another note, time is another important factor in any investment process. It is necessary to control the time from the first capital outlay, or even from the time it is committed to a certain target, as it is blocked, until the complete divestment is achieved. Compared to other types of investment, the real estate sector requires a protracted management and development period. This long process has implications for the profitability, but, above all, for the risk and opportunity cost of the investor. Uncertainty about the market is higher than in other sectors, since real estate has shorter investment and divestment periods. This period, measured in years, causes the Internal Rate of Return (IRR) to offer moderate values. And, since these are high investments, the process must be very well controlled.

Kahneman and Tversky's findings are based on the fact that people in situations of uncertainty tend to look for shortcuts and simplify the process, instead of focusing their actions on rigorous analysis of the data and carrying out rational and objective evaluations. Their studies also show that the fear of loss tends to have more weight in investors' decisions than the expectation of profit. As a result, investors tend to minimize risky situations. This explains why real estate investments, often with long investment and divestment periods, generally yield moderate returns. This usually materializes in two ways: by seeking a guaranteed return, i.e., by closing the sale before starting the process, or by raising the profitability margins so that they can assume the underlying risk.

The opportunity cost is the cost of the alternative that we give up when we make a certain decision, including the benefits that we could have obtained if we had chosen the alternative option. Real estate investment does not offer the agility of divestment offered by other markets, such as the stock market, for example. Therefore, investors assume that their capital will be locked up for a long period of time. And, as a result, they will not be able to use it to carry out other investments that may arise during that time.

And, most importantly with regard to the period of a real estate investment, it is deeply subject to the economic and political ups and downs that society is going through. Let us not forget that, ultimately, the final recipient of a large part of real estate investments is usually the non-professionalized population. In this context, assuming that society adopts rational and timeless behaviors leads to an inaccurate model, whose expectations may differ considerably from the results.

Nowadays, real estate activity can be structured in four phases: Project Development, Project Management, Product Management and Sales Management (see table 1). The first two are part of Business Development and the last two are part of Business Management. The analysis phases have been significantly increased so that Business Development has acquired a very important weight in the whole process. This work area encompasses all the tasks related to the definition of the investment strategy, product definition and administrative management. It is at this point where the analysis of the behavior of society and the individuals that compose it is fundamental to outline the correct strategy. The architect's

BUSINESS DEVELOPMENT AREA				BUSINESS MANAGEMENT AREA			
PROJECT DEVELOPMENT AREA		**PROJECT MANAGEMENT AREA**		**PRODUCT MANAGEMENT AREA**		**SALES MANAGEMENT AREA**	
FEASIBILITY STUDIES	ACQUISITIONS	PLANNING	PROCESSING	RECRUITMENT AND DEVELOPMENT	PROJECT CLOSURE	SALES	AFTER-SALES SERVICE

Table 1. Development of the real estate investment process today. Own elaboration

profession, which has a strong social component, must contribute value when it comes to defining the buildings that must respond to society's demands. Given that the time involved in the process is protracted compared to other types of investments, and that premature divestment is not easy in most cases, Business Development is very important. Determining the strategy and establishing the investment and divestment deadlines is fundamental for determining risk and profitability. The process initiates with Project Development, where feasibility studies are carried out, in which knowledge of the market is fundamental. The relationship with agents and operators helps to understand what they expect from the investment.

The capital may come directly, through professional promoters, or through capital managers. These managers have capital from third parties with whom they have previously agreed the strategy, and are in charge of leading the process, carrying out the promoter activity on their behalf. This type of management is becoming increasingly common, the sources of capital are diversified and are deposited in investment funds, investment vehicles or even microfinance platforms. The capital determines the investment amounts, the target profitability and the return periods. While professional promoters usually have sufficient analytical tools to make progress in the first steps of the investment strategy, capital managers and non-professional promoters require assistance in the development of feasibility studies. At this point, the presence of the architect in the detection and generation of investment opportunities is very important.

Then there are the operators, those agents that require real estate to carry out their activity. They may be hotel, logistics, industrial or administrative operators, among others. It is necessary to know the market trends and the needs of the operators that are active, since it helps to propose attractive investments to the capital. It even opens up the possibility of closing turnkey processes where the entry and exit of capital is previously agreed and subject to a contract specifying the entire process, the milestones to be met and the delivery of the property for its use or operation. The operators focus on the definition of the services to be provided by the property and the delivery period, since it is at that moment that they can begin to carry out their economic activity. The cost of the property, a very important factor, competes with the deadline.

For property developers, cost is fundamental, since their economic activity is the development of real estate. And the period is important from the point of view of risk and opportunity cost. In other words, the longer the period, the greater the probability of unforeseen events that could affect profitability. What is more, the longer they stop having the capital at their disposal, the more investment opportunities they will miss.

Real estate investment in the residential housing sector for sale is the best example of "real estate as a product." There is no purpose other than the sale of the property. And the economic activity of promotion does

not take into account any other economic activity to be developed in it. Developers will seek to minimize costs, even at the expense of the delivery time in many cases. In real estate investment for tertiary sectors, the property is the developer's product, but it is the operator's tool and is subject to their interests and those of their product or service. In this case, the operator will impose the needs of their economic activity and will determine the priorities, where the term usually has a greater weight. The sooner the operator is ready, the sooner the operator will start to develop their economic activity, which is the one that provides them with their profit. Knowing the needs and interests of agents and operators puts the architect in an advantageous position when it comes to participating in the process. And it will be a virtue of the architect to increase their own value proposition, to offer more complete services and, therefore, to be able to obtain a better profitability for their work.

Once the investment opportunities that stem from the knowledge of agents and operators have been identified, the business model is defined and feasibility studies are developed. The architect plays a very important role at this point. The architect must analyze the urban and technical conditions of the land, define the possibilities and determine the yield. This yield can be the maximum possible or the most convenient depending on the needs and costs. There are situations in which it is necessary to find the balance between cost and profitability by assuming the renunciation of part of the yield. We refer at this point to situations in which it is decided to renounce part of the permitted buildable potential. For example, to forgo the construction of a basement car park because the cost of construction, the extension of deadlines and the risk assumed due to unforeseen events are not covered by the sale price that the market can accept. Or, for instance, limiting the number of dwellings in areas where the mass of people raises doubts as to whether they can be taken on by the local market.

Once the feasibility of the investment has been determined, the acquisition phase begins. The negotiation of the terms of the acquisition progresses in parallel with the development of the implementation and the planning of the project. The architect assumes the implementation study and shall take a strong role in the planning of the project. Again, being able to provide a complete estimation of the investment process, establishing deadlines and assessing construction costs, puts the architect in a crucial position to improve the services offered and to gain leverage towards the investor.

Nowadays, the *Due Diligence* of the investment has gained a lot of importance. It is a complete analysis that determines the outlines of the investment. It has three main parts: economic, technical and legal analysis. Although architects are immediately thought to be involved in the technical analysis, it should be emphasized that their presence is equally important in the economic and legal analysis. The economic analysis should include the estimation of construction costs and also of project development and the respective lead times. It is crucial to know the details of project management in order to know which professionals are needed to develop the project: architects, engineers, topographers, archaeologists, geologists, etc. It is of equal importance to know what kind of administrative procedures are required and within what time frame. As for the legal analysis, it is vital to know the urban planning and technical regulations involved, as well as the existing jurisprudence in certain situations that establishes interpretation criteria in case of doubts about these regulations. All this helps to streamline the process of administrative management and licensing. It is also very important to recognize the possible uncertainties that may alter the process. And, in case of unforeseen events, propose alternative plans. The acquisition process ends with the signing of the contracts and the public deed. These contracts usually contemplate the

definition of the process, costs, time frames for established milestones, etc.

The next phase of Business Development is Project Management. Time starts to count and the succession of events are subject to the contract that determines deadlines and payments. And it is vitally important that everything is developed according to what the investor has established. The development of the architectural project itself begins, that is to say, the construction project. This is what we know as the traditional work of the architect. The building is designed, developed and defined in sufficient depth to be able to assess its cost and, subsequently, to build it. Traditionally, it was at this point that the architect participated in the real estate process. Although, the architect was also called upon for occasional consultation in the implementation or in case of technical doubts. But in a short and disorderly process. However, the development of the project has also become much more complex than before and the architect must assume the role of coordinator of a global project in which more technical professionals intervene. Advances in specialization and the ever-increasing demands of the regulations that affect building and the requirements of clients means that multidisciplinary teams have to be formed. The architect must act as the director of these teams where everyone works for and with the architectural project defined by the architect. In the development of the project, it is also important to highlight the importance of the agents' and operators' knowledge referred to above: their participation facilitates the achievement of the goal in the shortest possible time and, above all, the value proposition. The architect must be able to offer a real estate product that satisfies the established needs and, to the extent possible, adds value. In other words, the architect must be able to detect problems and propose creative solutions, in terms of design and cost, that will improve the economic activity of investors. The last step in planning is the support in the tendering procedure. The definition of the best construction systems and materials, as well as the elaboration of the necessary technical documentation to be able to value the work is very important to obtain a quality tender. The success of the tender is to choose the most suitable construction company to carry out the work. It is not always the one that offers the best price. And this will be demonstrated by meeting deadlines and adjusting to the expected costs with the least possible deviation. Architects must lead, together with the developer, the tendering process, which usually involves several rounds of selection. They must prepare an exhaustive and professional comparison of the bids and offer an informed opinion on whether or not the construction company should be hired. To conclude the Project Management phase, the administrative processing of the relevant licenses is carried out. The architect must propose the follow-up of the administrative files and must attend to the requirements that may be requested. Given that the period is usually long, this process usually overlaps with the tendering procedure.

Once the necessary permits have been obtained, the Business Development phase is over and Business Management begins. Its first and main phase is *Product Management*. The first step is to seal the contract with the construction company that wins the tender and the contracting of the supplies for the work. The start date is determined and the work begins. Then comes the follow-up of the site. Traditionally, the architect was in charge of the site management, where the architect guaranteed the correct execution and the adjustment of the executed works to the previous project. But nowadays much more is required. The architect shall offer support in the cost control and even the deadlines of the construction site. In the case of non-professionalized developers, the architect can offer the service of cost controller and carry out an exhaustive follow-up of the construction company's work certifications.

Furthermore, the architect is able to determine new solutions to improve the process or correct unforeseen events that may arise. At this point, it is important to highlight the figure of the architect when it comes to having an overview of the whole process. These are complex processes involving many professionals, both technical and on-site, and also where the architect must coordinate with licenses and administrative files. Architects can position themselves as the director of this whole process. To this end, they must ensure that everything goes according to plan and, above all, that the investment goals are achieved. They must internalize these goals and embrace them in order to assure that the correct progress is made.

Project closure is a time of extreme intensity. It is common to finish right before the deadlines. And, if not, any improvement in them is essential. The architect must, on the one hand, review the site thoroughly and determine the work to be carried out by the construction company. And, on the other hand, carry out the closure of the site on paper. All the documents and certificates required by the administrations for the closing of the dossiers must be provided. It is at this point where the use (or activity) permits for the buildings are obtained and the supplies for the commissioning are registered.

In this last phase, the architect has always played a leading role. But it is important to highlight all the management aspects, which go beyond construction management, and which nowadays require a significant presence on the part of the technical teams. Especially in the case of non-professionalized investors in the sector.

Finally, the real estate development activity ends with the Sales Management phase. One of the major novelties of the new system is the need to deepen the customer experience. Accompanying investors, asset managers and operators until the end helps to better understand them and provides valuable information for future operations. The greatest success of an investment is that it leads to the next one. Furthermore, it is very important to evaluate the investment not only from the perspective of the profitability obtained. It is also important to evaluate whether the strategy initially outlined in the Project Development phase has been developed as intended.

The real estate investment process often requires lengthy periods of time. During this time, the initial premises may have changed. However, a good strategy usually shields the investment from external agents and normally offers alternatives in the event of substantial changes in circumstances.

4. THE ARCHITECT IN THE NEW PARADIGM

People's cognitive limitations mean that their decisions in certain situations do not follow a logical process. Behavioral economics introduces models of people's behavior, especially in situations of uncertainty, as part of the variables to be taken into account when determining the investment strategy. Decision-making, both by the initial investor and the final consumer, is subject to these variables. On the other hand, the investment process in the real estate market involves sufficiently long lead times to take into account important economic, political and social changes. And the response of market players, investors and consumers, to these situations must be taken into account when determining the investment strategy.

Prior to the 2008 crisis, the architect's activity was limited to architectural design and construction management (see table 1). The current model for the development of real estate investment has changed substantially. It is now a more ambitious process in terms of the analysis and definition of the strategy, including different stages that have led to the architectural project being diluted within a much broader project, the real estate project.

The technical part, although essential, is not enough to determine the viability of an investment. Moreover, the professionalization of the sector has led to the emergence of multidisciplinary teams covering every aspect of construction. But this situation, which at first sight seems discouraging for the profession, should once again place the architect at the heart of the entire process.

On the one hand, the architect must be able to integrate all the technical professionals involved as the director and the person most responsible for a common goal. On the other hand, knowledge of architecture and the way it interacts with society should put the architect at an advantage when assessing the appropriateness or unsuitability of a real estate investment.

"Architecture is a service to society and we must understand society by observing and listening to it, so as to be acutely aware of the responsibility that comes with being an architect" (Pinós, 2019). The success of the architect's role in the real estate investment process is to provide value in all its phases. Architects access the market by means of their professional capacity, but they must consolidate themselves in it thanks to the analysis and knowledge of the needs of all the agents involved and of the society that surrounds them.

Architects must play a key role as an analyst of the trends of a constantly changing society. They must position themselves as the specialist in transferring the demands of society into buildings, in an environment in which architectural design, constructive and economic viability and the demands of the social and political context are of vital importance. Understanding global and individual needs leads to a complex but exciting process of defining real estate investment. Buildings, the epicenter of the economic activity that we are dealing with, must respond to the circumstances of the present and the immediate future of society and to the different scenarios that may arise.

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PAPER #3.03

SPACE, FUNCTION AND SYMBOL. ARCHITECTURAL FURNITURE IN DOMESTIC SPACES

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ABSTRACT

The Baldaquin of the Saint Peter's Basilica in Rome represents the spiritual core of the building and holds a distinctive meaning for the complex and the people in it. This piece, defined for this research as architectural furniture, conditions the use of the space it belongs to, affects its scale, gives purpose to its routing, and defines the symbolic reading of the whole.
This monumental object is used as a reference, and its personal, social, spatial, and functional implications are relayed across the field of architecture to the domestic space. An approach to furniture to create a home molded to the needs and desires of the individual and the society he belongs to is detected in the pieces of furniture by Ettore Sottsass and Joe Colombo, presented in the exhibition Italy, the new domestic landscape in 1972. This paper intends to indicate those concepts embodied in a selection of four contemporary housing renovation projects that have used furniture as a complex design element to shape homes.

KEYWORDS

Furniture; living environment; domestic space; design; renovation.

1. SAINT PETER'S BALDACHIN

The Saint Peter´s Basilica would be very close to the top of the long list of must-see buildings when visiting Rome. Besides being at the heart of the Catholic Church, it is also a vibrant building full of history and art. When approaching it, the vast square guides one to the beautiful main façade elevated by stairs and crowned by the statues of the apostles, and behind rises the massive dome—42m wide and 132m tall. Everything is gigantic, and one feels tiny while reaching for the doors with thousands of other visitors. Inside, a sudden feeling of overwhelming amazement and mightiness fills the atmosphere. And immediately, all eyes turn to the center of the space, where precisely under the immense dome, covering the main altar, is the Baldachin of St Peter (Fig. 1).
The precise meaning or importance of this structure may not be known to all, but its hierarchy is evident. Its location, right in the center, its function as the main altar, its size, and the detailed shape of the element make it hard to ignore. The Baldachin is a ten-story-high structure, fixed in its position thanks to a sturdy foundation, consisting of a canopy held by four black Solomonic columns made of bronze. Under the effect of the dome's light, it rises tall, slender, seemingly lightweight, or even fragile, but at the same time so high and impressive it seems to shorten the distance to the dome.

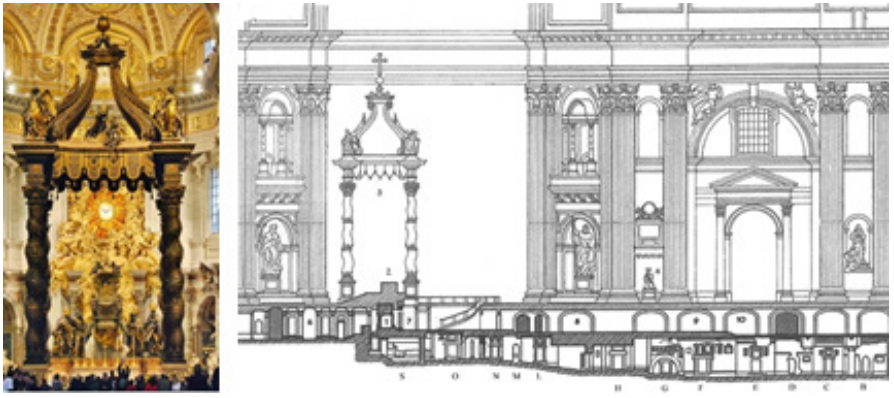

Figure 1. St. Peter´s Baldachin

The real meaning which the Baldachin conceals is, in fact, the connection between God and the Catholic Church through the traditional location of the tomb of St. Peter, Christ's vicar and first Bishop (Kirwin 1981, 143). The tomb location determined the position of the church's crossing and the dome, the highest construction point, with the most outspoken spatial qualities. By placing the Baldachin over the main altar, the most important place in the church, where God is, is spatially accentuated (Frankl 1981, 219). However, this was not always the case. Following the dome's completion in 1590, numerous temporary structures were built, signaling the tomb (baldachin) and defining a main altar in the apse (ciborium) or combining the two structures with their different iconographic and symbolic elements into one.

The Baldachin, which appears so substantial and intrinsic to the space, was only commissioned in 1623 to Bernini. Nevertheless, the Baldachin's presence and influence on the whole space are difficult to deny. It brings the whole building down to a more human scale and organizes the disposition and functioning of the rites happening in the church. It introduces a new reality to a building that had already changed its spatial and even structural design at least eleven times before the definite furniture came in. The spirit of the space is born from its furnishing (Frankl 1981, 213), making it impossible to explain its architecture without considering the Baldachin as an essential piece of architectonic the furniture.

However, can all furniture be equally representative? Can a cupboard or a wardrobe be determining for a space? Can housing benefit from an approach to interior design that takes furniture as its core design element? This paper focuses precisely on the furniture that can shape spaces to determine whether a similar approach to interior design can and has been taken in housing. The paper looks for furniture that, similar to the Baldachin, can be imbued with both functional and symbolic value and therefore dictate the use of the space, direct the user throughout it, or even create spaces of its own.

Two questions arise regarding an alternative way to approach furniture in the home. First, the Baldachin is not domestic but domesticates the space it is in. It possesses the characteristics that allow a function to be held by a person, and its size, location, and overall design determine the space within and around it. *What kind of objects in the home can similarly condense functions that will influence the space around them and provide it with purpose?* And second,

the Baldachin, in broad terms, does not have a complex design. It is a table and a canopy on top. Nevertheless, it serves as the symbolic center of the space. A symbolic meaning is given to it that provides hierarchy past its functional qualities. It is therefore asked, *under which conditions can objects in the domestic sphere be loaded with social or personal meanings that will make them paramount to the space?*

Two primary sources have been used for this paper to answer these two questions: The MoMA catalog for the *exhibition Italy, A new domestic landscape*, in 1972 and the online Architecture platform *ArchDaily*, as they both are very representative of their time and scope. The complementary perspectives of Ettore Sottsass and Joe Colombo, portrayed in their objects and environments on display at the MoMA exhibition, will later enable to approach furniture inside the home in four contemporary projects from a point of view that creates a bridge between the designer and the user. Whereas the environments and objects commissioned for the exhibition have an experimental quality that allows them to express clear intentions while circumventing real-life constraints, the architectural magazines take advantage of the diverse solutions required for real-life application. By studying either approach, the paper intends to cover both the conceptual and the pragmatic.

2. THE NEW DOMESTIC LANDSCAPE

The Museum of Modern Art of New York held the 1972 exhibition *Italy: the new domestic landscape. Achievements and problems of Italian design*, edited by Emilio Ambasz. This exhibition condensed the creative, critical, and subversive proposals of the most representative Italian architects and designers of the time, following the belief that led the museum to open an architecture department in 1932: the inherent meanings in works of architecture and design should be "as consciously investigated and evaluated as are those in works of painting and sculpture" (MoMA, NY 1972, 11). The exhibition organized the pieces into two sections: Objects and Environments; and offered a catalog with additional critical and historical articles that help understand the complexity of the very diverse and often wildly contradictory design approaches.

One Environment by Joe Colombo and a series of objects by Ettore Sottsass stand out concerning the aims of this paper: *The Total Furnishing Unit* and a series of cupboards and wardrobes (also known as Superboxes in other publications) were curated because of their socio-cultural implications. Both Colombo, and Sottsass, had a pro-design attitude and believed in "design as a problem-solving activity" (MoMA, NY 1972, 137) capable of tackling socio-cultural problems and were therefore commissioned with environments in which they could express their particular visions regarding the domestic landscape.

Colombo´s Environment takes a functional view of a furnishing element that goes in line with the first query of this paper. In contrast, the particularly expressive cupboards from Sottsass align with the second query regarding furniture's symbolic meaning. The following chapters will study the conceptual approach stated by these two elements and how they can be linked to recent housing projects.

3. THE TOTAL FURNISHING UNIT: A COMPACT SOLUTION

As hinted by its name, the *Total Furnishing Unit* (Fig. 2) combines into one single module four different units (a kitchen, a bathroom, a cupboard, and a day-and-night unit). The whole module can then be fitted into an apartment to serve all of its occupants' basic needs. The Environment, following a set of guidelines handed by the museum, explores the "domestic landscape with a sense for its places" and designs the "spaces and artifacts that give them form, and the ceremonies and behaviors that assign them meaning." (MoMA, NY 1972, 137)

Figure 2. The Total Furnishing Unit. Source: MoMA NY 1972

The differentiated units can be grouped or displaced to adapt to several kinds of surrounding spaces and opened or closed to display its several functions. While the kitchen and bathroom units serve only this one purpose, the day-and-night unit includes all living functions, from sleeping to eating, reading, receiving friends, and withdrawing privately to the inner closed space, allowing "the user to make his own statement about both privacy and communality" (Ambasz 1972, 21). The space within the units is intended to be "dynamic," and "it should be in a continual state of transformation" (MoMA, NY 1972, 172) thanks to the interaction between the user and the units. This interaction shapes the space around the units and allows it to function by extending or hiding the beds or by displaying the cupboard to obtain a new privacy layer.

The museum guidelines also point attention to the exploration of new materials and techniques of production. Therefore, the units are suitable to be mass-produced, and the functions have been carefully studied to be designed as fitting as possible, taking advantage of the contemporary materials and technologies giving, as a result a white box with rounded corners and with yellow doors and slabs that does not resemble any traditional piece of furniture. Due to their expressive deign, the Units will stand iconic in almost any space they are placed in. Additionally, grouping and solving everything in one element in contrast to several more minor or ephemeral solutions (which would allow the user more freedom in furnishing) will make the Units simultaneously visually, functionally and spatially central to the space.

The Furnishing Units condense not only the spatial qualities necessary for life but also the activities society generally considers to be important. Joe Colombo was mainly focused on the problems related to the human habitat and was motivated to make good design widely available to all social classes. Dwellings, he thought, should be "closer to man's true requirements," and consequently, the house "should be adapted more and more to man, rather than the other way around." (MoMA, NY 1972, 172) However, the *Total Furnishing Unit*, like the other environments of the exhibition, does not produce the container space but is, in turn, thought to be potentially placed in any standard apartment. Specific attention is put to each piece instead of the space surrounding it, meaning that the furnishing units irradiate and fundamentally affect, shape, and give function to the space around (or inside) them but do not depend on it.

3.1. Apartment in Gracia and Principe's Box House

The independency of the *Total Furnishing Unit* and its massive influence on the space around it suggests that some of its concepts can be translated into housing projects nowadays, particularly in the case of renovations of homes and even more if the intervention strategy involves emptying the space. This section will present two recent projects: *Apartment in Gracia* by Kahane Architects & Maria Alarcón (Barcelona, 2018) and *Principe´s Box House* by u+a arquitectura (Vigo, 2012). Both renovation projects take place in Spain in buildings from the early 1900s. The couples living in each apartment were responsible for commissioning the renovations.

The first home renovation, *Apartment in Gracia* (Fig. 3), takes place in a long 70 m^2 apartment with windows only on the short sides. The project reinterprets the spatial conception of a typical last-century apartment full of interior rooms, doors, and halls, "which does not adapt to the current needs of a living space." (Kahane Architects and Alarcón 2018) Therefore, the architects chose to take out partitions, rediscovering the original elements of the apartment. A minimalistic piece of furniture that contrasts with the recovered original elements redistributes the space to the needs and desires of the new users. "The chosen materiality, oak wood, contrasts with the original elements and marks the intervention." (Kahane Architects and Alarcón 2018)

A wooden box containing the kitchen storage, the dressing room, and a bookcase is attached to the long wall, dividing the space into two and "activating the adjacent spaces, providing it with different uses." The two "main rooms of the house" are the social area and the sleeping space. All other functions needed to be optimized and placed strategically in the space; to that end, the bathroom and working space are carefully located out of the way from the main spaces. In contrast to the generic approach of the Total Furnishing Unit, having set users allowed the designers to know their priorities and how they view the world, and personalize their living space accordingly. "Concentrating the intervention in a single volume on the interior of the floor plan" facilitates the spatial consequences significant to the user, creating a "large, open space, flexible and suitable for the current needs of a living space." (Kahane Architects and Alarcón 2018) This furnishing box acts as a background to the spaces around (the living room and bedroom), which are the project's primary concerns. This "singular piece" regulates the connection and privacy between the areas, defining "a new way of seeing, using and living in space." (Kahane Architects and Alarcón 2018)

Figure 3. Apartment in Gracia. Source: José Hevia, Kahane Architects 2018

The second home renovation, *Principe's Box House* (Fig. 4), takes place in a U-shaped 53m2 apartment on the upper floor of a townhouse with openings only on the short sides. After evaluating the existing situation, the architects similarly chose to strip the place and by doing so they uncovered a previously hidden space. "Its conservation becomes the goal and inspiration of the project" (u+a arquitectura 2012), so much it dictates a centralized furnishing box as an intervention that contrasts with the rest of the space. It was "important to maintain a reference to the past, discovering what already existed placing it in a new context of time but keeping its essence and history." (u+a arquitectura 2012)
Following the former logic, the strategy to free the space is condensing elements in a box. In this case, its "wooden box" houses the kitchen front, the toilet, laundry, sinks, shower, and a small closet. The technical uses are concentrated in a simple and light structure, and "around it, the rest of spaces flow while being at the same time visually isolated." (u+a arquitectura 2012) The living room is isolated from the bedroom. Inside the box, the toilet is also closed, but the washing areas and the kitchen are, in contrast, open to the sides, creating tension with the sleeping area and the living room, respectively.
So far, the approaches are very similar: to empty a space that does not accept these two couples´ new requirements, but, in contrast to Gracia's attitude, the Principe's Box House's main element is its titular box, not the spaces around it. To reinforce this idea, it uses visual cues such as a concise geometry, a seamless material, and a zocalo. It is also noticeably lower than the ceiling, allowing the owners to climb it and experience the space from different angles. In this way, the whole box reads as an independent element. Additionally, the box is made of timber, "a symbolic reference that relates beyond the space to the life of the owner" (u+a arquitectura 2012). Building the box with maple wood is a "tribute to the owner's love for Spanish guitars, usually made of this material" (u+a arquitectura 2012).
The project condenses in the central box the functional spaces, giving them more prominence inside the house. They do not only function on the inside but dialogue with the spaces around them, creating tension and putting the act of cleaning and cooking in the center of the apartment life. Placing the

Figure 4. Principe´s Box house. Source: Héctor Santos-Díez, u+a arquitectura 2012

secondary or serving activities in the wooden furniture box transforms the act of washing and cooking into a major event in the space. A body worship becomes an articulating element of the house.
Looking back to the Baldachin, the three objects in this section (the Italian prototype and the two boxes in the houses) are functionally, visually, and spatially paramount to the space. They provide functions and spatial guidelines to the space around them and reflect the society and the time they belong to. The two housing projects, in particular, can successfully bridge that gap between users and designers by understanding their personal and specific needs. At the same time, the prototype has been thought to be used by a general user and therefore carries more social connotations.

4. SUPERBOXES: A SINGULAR OBJECT

Looking back at the MoMA exhibition, the second piece to be discussed in this paper is the Cupboards and Wardrobes, also known as *Superboxes* (Fig. 5), designed by Ettore Sottsass Jr. for the Italian firm Poltronova. They belong to the group of objects selected for the exhibition for their socio-cultural implications because their formal characteristics derive from, or are motivated by, the "ironic manipulation of the socio-cultural meanings attached to existing forms, rather than with changing those" (Ambasz 1972, 20). Sottsass and other designers within this group are redesigning conventional objects with new references, repurposing known forms with altered meanings. Sottsass, in particular, is trying to charge objects with a "ritual weight." "The object is given sculptural form and conceived as an altarpiece for the domestic liturgy." (Ambasz 1972, 20)
The cupboards are highly abstract, oversized objects produced in plywood and plastic laminate. In their making, there are no traces of traditional furniture nor any clues as to how to use them. Sottsass has favored meaning over form and ritual over functionality. About Sottsass and his pieces, Vittorio Gregotti, in his historical article in the MoMA catalog, said,

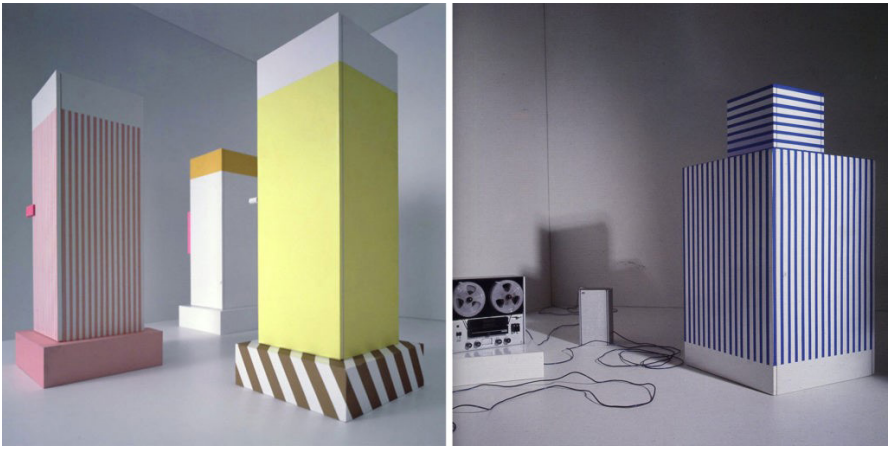

Figure 5. Cupboards and wardrobe, 1966. Source: MoMA, NY 1972

"A feeling of pleasure in colors also comes to the fore in Sottsass' activity in furniture design — but can we still use the word 'furniture' in this connection? They are violently colored presences, centers, and elements with magical references, new altars in which everything depends not only on a symbolic relationship with the object but even more on a ritual approach." (Gregotti 1972, 330)

The Superboxes were designed as industrial objects, but only some of the designs were actually produced and just for exhibitions or installations. The others remained as miniature models, photographed in domestic settings to understand the design intentions regarding the space around them. They are always set far from walls, at times arranged in the middle of the room, thus freeing them from their traditional function, turning them into the absolute protagonist. The *Superboxes* take an ordinary object, transform it in form and scale, and return it to the home as an iconic element that creates tension and structures the space around it by affecting the reading of the space.

4.1. The Magic Box and The LightSlice

The space around the Superboxes relies on the furniture to radiate and influence its surroundings. However, even though the spatial influence of the Superboxes has been considered and specific attention is put to every piece, the space itself is not functionally prepared to be inhabited. In contrast, the following housing projects explore the spatial implications furniture can have when specifically designed for a location. *The Magic Box* by Raul Sanchez (Vindecans, 2020) and *The Lightslice* by Cometa Architects (Barcelona, 2016), much like the projects from the previous section, are also renovation projects found in Spain. They were commissioned by the people who inhabit them, giving the designers a clear input of their needs and values. The following projects are different in size, program, and number of users, but the strategies regarding furniture are comparable.
The first home renovation, *The Magic Box* (Fig. 6), houses a married couple and their two young daughters. It takes place in an oddly shaped 110 m2 apartment on the ground floor of a townhouse with the advantage of having windows on all sides. A load-bearing wall divides the apartment into two long areas. To the west are the kitchen, access, and distribution areas, and to the east four consecutive rooms consisting of three bedrooms and a living room.

Figure 5. Cupboards and wardrobe, 1966. Source: MoMA, NY 1972

This intervention takes place in a bigger house, making it necessary to develop strategies that allow the house to function. The logic consists of stripes and passages one goes through to get to the next bedroom, creating a system of transitions between spaces. Two of these transitions are mainly functional since they host the bathrooms, while the third one is so unique that it lends its name to the project. Each transition is signaled with different materials, and the material chosen for the magic box is brass, which is intended to be a "special material of a precious but mysterious object." (Raúl Sánchez Architects 2020)

"The requirement to design a special space for the girls was present from the first moment", and so, "the project itself takes its name from this element." (Raúl Sánchez Architects 2020) The Magic Box is, in essence, a two-sided wardrobe dividing the two girls' bedrooms, and it would not be anything special if it were not for the meaning it has been given. A personal connection is established with the family and this object, which is given a personal meaning and intention. However, the influence of the magic box is not functionally or spatially crucial for the rest of the house.

The magic box is "an abstract volume, like a jewelry box, a box of surprises" (Raúl Sánchez Architects 2020) which encloses the closets, a secret passage, and a surface for the girls to climb onto, which is a place for them to play, explore, and bond. The architects have intended to highlight this one element throughout the house and, by doing so, the girls and their rooms are portrayed and turned into the raison d'être of the project. The relation with the Superboxes from Sottsass seems clear: a conventional object with a manipulated meaning and presence that affects, directly and indirectly, the users, the space, and the project.

The second project, *The Lightslice* (Fig. 7), has a less evident meaning but more robust spatial, functional, and conceptual connotations. The project takes place in a one-person, mostly triangular 46m2 apartment with windows to the short side towards a balcony and halfway through the longest side to the inner patio. The odd shape of the apartment makes it necessary for the designers to implement some intervention logic to optimize and get light into the space. They position the private spaces to the back, and most of the furniture is fixed in place following one axis parallel to the longer side. The kitchen counter, the washbasin, and the bed have been "perpendicularly placed, freeing the walls and leading to a more contemporary experience of space." (Cometa Architects 2018) The living room is the only room that allows for more flexibility.

Figure 7. The Lightslice. Source: Vicente Ortega, Cometa Architects 2016

A second shorter axis uses a translucent box with the shower, sink, and wardrobe to induce a transition from private to public, both spatially and as a personal experience. The shower and sink are open to the private area of the house and closed with a light-filtering lattice screen to the social area of the house. It creates tension between the washing spaces and the bedroom, insinuating a celebration of the act of washing and grooming. Moreover, when the light is on, silhouettes are visible from the living room. The light-filtering screen that closes the box "allows light from the large balcony windows to reach the wet areas and bedroom" and "at night time, the lightslice amplifies the glowing dimmable light, creating a very relaxing ambiance." (Cometa Architects 2016).

The box, its symbolic meaning embodied in its playful light interactions, reinforces a living experience to see and be seen in contrast with a traditional isolated and closed washing space. The box embodies the concept of light; a light-slice that turns the apartment into a "bright contemporary spatial experience" that "reminds us that the natural light is the supreme of all architectural materials" (Cometa Architects 2016). This furniture translates the concept of the project into a visual, tangible element that the person can use, contemplate, interact with, and relate to.

Light is the thread that binds this whole project together. The symbol of light is present throughout the entire project and is particularly highlighted in the *Lightslice* (the furniture). Light guides the design of the Lightslice, much like the Girls are symbolized by the Magic Box, and the concept of *God* is, in turn, highlighted and represented by the *Baldachin*.

5. FURNITURE TODAY

To conclude, what should be apparent by now is the functional and symbolic role that furniture can serve within a space, which is why furniture can be so relevant in housing renovation, giving existing constructions a new life. While furniture can shape a space, it does not make it, as the space existed before any furniture was placed within it and will remain even after all the furniture has been removed. The space is, in fact, the "jewel" of the architectonic project.

> "The four facades of a house, of a church, of a palace, however beautiful, constitute nothing more than the box in which the architectural jewel is included (..) In every building, what contains is the box of walls, the content is the internal space." (Zevi 1948).

Approaching architecture from its furnishing is functional and spatially representative. The function of a space can be partially, if not wholly, dictated by the furniture placed in it, adapting it to the requirements of the changing society. Therefore, it is logical to consider furniture a crucial part of designing spaces and, as such, a crucial part of architecture itself. The spirit or symbolic weight that links the spaces to the people using them is also embodied in the furniture. In the Baldachin, as well as in the exhibition's interiors and the presented renovation projects, only by understanding the philosophy and application of the architectural furniture can it be understood how these interior spaces are made. As Frankl said about furnishing objects, they alone give the space its emotional and intellectual existence.

A way of doing architecture that tackles the design of the interior space from the perspective of furniture, may allow designers to dialogue with the users and their experiences. Furniture can consequently be the link between architecture and the user; between design and society. Furniture opens up the possibility of personalization at the level of the individual. It can take a space constructed for many and shape it to serve an individual, a family, or an entire community.

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PAPER #3.04

METHODOLOGY FOR QUANTIFICATION OF EXHALED POLLUTANT EMISSIONS IN RESIDENTIAL BUILDINGS

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ABSTRACT

It is known that indoor air is affected by outdoor air, thanks to the various studies that have been conducted in this area, the causes can be varied, from infiltration of buildings, natural or mechanical ventilation. Although it is known that transportation is one of the major contributors to this problem, studies have concluded that there is a proportion of pollutants coming from 'non-specific sources of human origin', all this emphasizes the importance of identifying and quantifying the sources of air pollution.
The intention of this research project, is to characterize and quantify the pollutants that are emitted from residential buildings through their ventilation systems, and how such exhalation affects urban air quality both outdoors and, through recapture, indoors.
The design of a viable methodology for monitoring two residential buildings in Pamplona (Spain) has been proposed, involving aspects such as the extension of the city where the buildings selected for the project are located, their typology, the areas destined for the ventilation systems, the equipment chosen for the quantification of pollutants and the procedure to be followed. All this procedure represents the core of the monitoring process.
Thanks to this methodology, the researchers intend to present results of the quantification of pollutants such as Carbon Dioxide (CO_2), Carbon Monoxide (CO), Methane (CH_4), Particulate Matter (PM), Volatile Organic Compounds (VOC), resulting from the exhalation of residential buildings. These results are the foundation for demonstrating how residential buildings can become another source of pollution for urban environments.

KEYWORDS

Ventilation systems; I/OAQ; atmospheric pollution; emission; building services; monitoring; cities; urban.

1. INTRODUCTION

Outdoor air pollutants are significant factors influencing the levels of the main indoor air pollutants (Hänninen and Goodman 2019) (Karagulian et al. 2015). Research on the relationship between type of residence and health is being carried out, but evidence is still partial and fragmentary, and often subjective or difficult to adscribe to specific causes rather than general factors. For

example, some results indicate that the residents' perceptions of the quality of the urban environment and satisfaction with their residential situation are determined by a large number of different residential aspects, one of these being environmental hygiene where air pollution is a factor (Bonnefoy et al. 2004). In another example, in densely populated cities where residents live in high-rise buildings, pollutants are susceptible to propagate through emissions from building ventilation ducts and facilitate transmission in the community, contributing to a deterioration of both outdoor and indoor air quality through outdoor air reintake. The most affected areas of buildings are those on the upper floors, near the vent pipe (Guo et al. 2022).

Quality monitoring data are necessary to establish the air quality-health interplay, as well as ensuring air quality improvement through prevention and reaction to shifting air conditions. Research is being carried out to improve monitoring. For example, a new method for air monitoring and emergency management at construction where edge computing and Building Information Modelling (BIM) are used has been proposed (Xu, Ran, and Rao 2022) that could be fed data from sensor suites to accomplish real-time analysis.

We have designed an experimental setup trying to accomplish such integrated monitoring using real-life data. Our current research project 'Quantifying pollutants originated by the exhalation of buildings in urban environments'- EXHAL (Ariño et al. 2020), hypothesizes that the air exhaled from the inside through the ventilation systems of residential buildings contains pollutants that can become another source of pollution (Dorregaray-Oyaregui et al. 2022) in Fig. 1. Our setup integrates a suite of sensors in real buildings and measures the exhalation of contaminants from ventilation systems coming out of residential units.

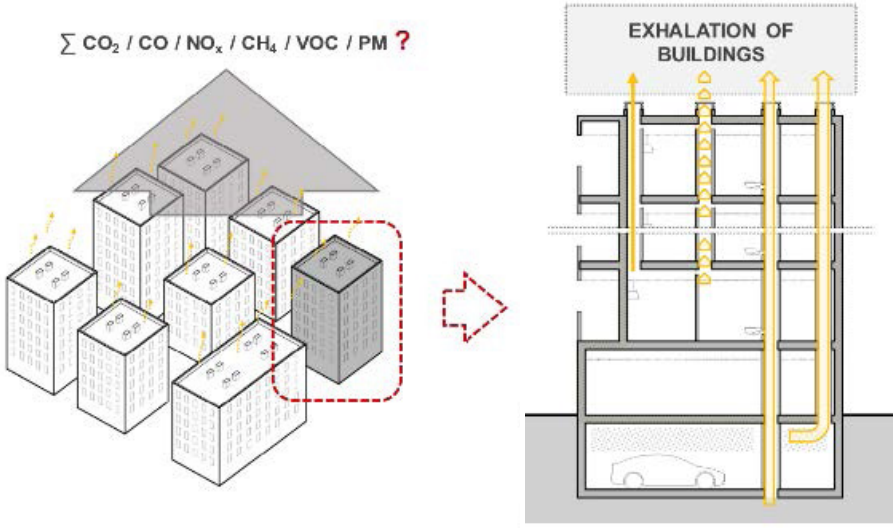

Figure 1. Concept image of research project EXHAL. Source: (Ariño et al. 2020)

2.CONTEXT

2.1. Pollutants

We have selected five main pollutants that can be generated in residential buildings from various common sources or processes and that can be therefore exhaled through ventilation systems: carbon monoxide (CO) from incomplete combustion such as smoking, internal combustion engines (ICE) in garages, or physiological processes; carbon dioxide (CO2) from combustion such as stoves, ICEs or respiration; methane (CH4) from organic matter decomposition such as e.g. in sinks; particulate matter (PM) from multiple processes, combustion, ICEs and outdoor air intake; and volatile organic compounds (VOC) from various household chemical, cleaning agents, woodchip furniture degassing, or toiletries, among other sources. Some of these pollutants are regulated in guidelines and regulations. A summary of the recommendations and/or regulations for concentrations in Spanish, European or international guidelines is shown in Fig.2.

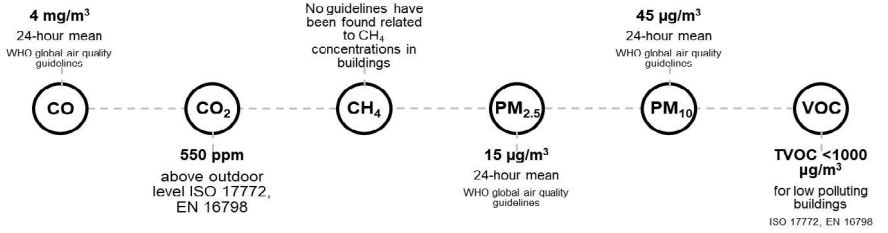

Figure 2. Summary of recommended and/or regulated concentration values of the pollutants considered in this paper. Source: (Robiel Manzueta 2022)

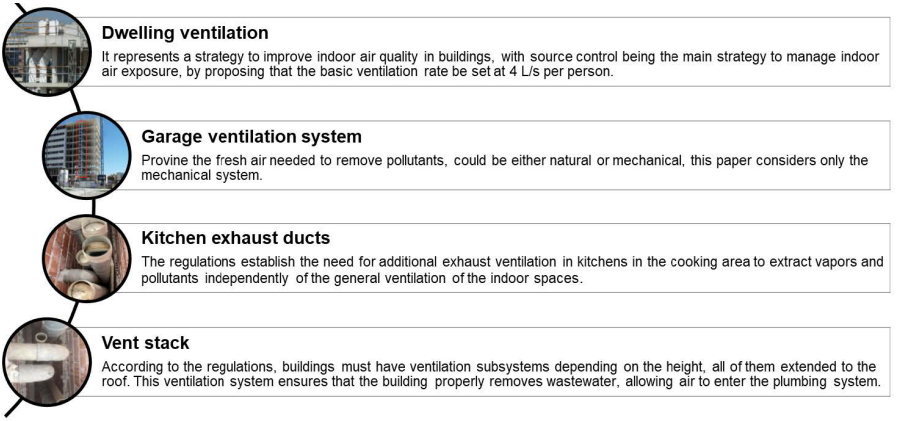

Figure 3. Summary of ventilation system considered in the EXHAL research project. Source: (Robiel Manzueta 2022)

2.2. Ventilation system

We adopted the classification of ventilation systems set out in the Spanish regulations (Gobierno de España 2019) as a reference for the quantification of exhalation in buildings (Fig.3): dwelling ventilation, garage ventilation system, kitchen exhaust ducts, and vent stack.

2.3. Buildings

We selected two tower-typology buildings for this study, named AB and AC in Fig.4, located in one of the new extensions of the city of Pamplona, Navarra, Spain to test our quantification methodology. The buildings have a similar construction methodology and are surrounded by green areas. Their expanse was designed to create a sustainable area that builds a sense of community, leading to a better and more sustainable lifestyle. Both were built following the 2006 Spanish Building Code (Gobierno de España 2019): the buildings were designed with specific areas for installations, where ducts are used for indoor air extraction and kitchen hood (one for each house), garage, vent stack and auxiliary ventilation.

2.4. Equipment

Gas analyzer platform

For the continuous quantification of gaseous pollutants (CO, CO_2, CH_4 and VOC) we used a research-class multi-gas analyzer (GASERA ONE) based on an infrared photoacoustic spectroscopy engine with a patented ultra-sensitive cantilever pressure sensor, designed for use in laboratory, light industry or relatively clean environments and capable of measuring very low concentrations of pollutants (Gasera Ltd. 2017), having detection limits typically in the sub-ppb range, coupled with a 12-probe programmable sampler, fitted with particle filters, and installed such as to avoid potential interference from out-of-range conditions such as condensation or excessive vibration using moisture traps and shock-absorbing surfaces. Insulated metal tubes were run from the building outlets to the multi-sampler. The sampling schedule was programmed to ensure excess flushing of the sample probes between measurements, providing an approximate 15-minute cycle between consecutive samples from the same probe.

Figure 4. Location of AB and AC buildings in Pamplona, Spain. Source: (Sara Dorregaray-Oyaregui 2020)

PM concentration meters

We used two PM meters:

a) The real-time electrometric module of a Dekati® eFilterTM gravimetric assembly. Continuous sample airflow through the whole assembly was ensured by an external mechanical pump providing a 25 l·min-1. The real-time module can measure particles of up to 3 µm, with a minimum particle size of 4 nm at 5 kV. The device's sensitivity is 1 µg/m3 for 70 nm particles and the measurement frequency is 1 s (Dekati Ltd. 2018). A 12-mm low-density polyethylene (LDPE) tube was run to the sampling point. Bypass valves allowed calibration by diverting inflow air through a particle filter for calibration.

b) Low-cost optical particle counters (OPC), Plantower PMS5003, connected to a battery-operated Arduino Mega 2560 platform fitted with real-time clock and SD-card memory reader. Operation was ensured by an ad-hoc application program (Alba et al., unpublished). Each sensor was placed directly inside the ventilation stack. Measuring range was set to 2.5-10 µm. Design resolution was 1 µg/m³, but the consistency error is actually up to 10 µg/m³ for the low end of the concentration range typically found in indoor air (0~100µg/m³).

Flow meters

We calculated ventilation flow by measuring air speed directly in the vent pipes or in constant-section extension tubes. We used hot-wire anemometers (Testo 405i) with a 9-mm probe for smaller pipes and vane anemometers (Testo 410i) for large-section ducts such as garage ventilation systems. All were rigged with DC supply for continuous operation and communicated via Bluetooth to a receiving Android tablet for data recording. Measuring range was 0-30 m/s with a 0.01 m/s resolution.

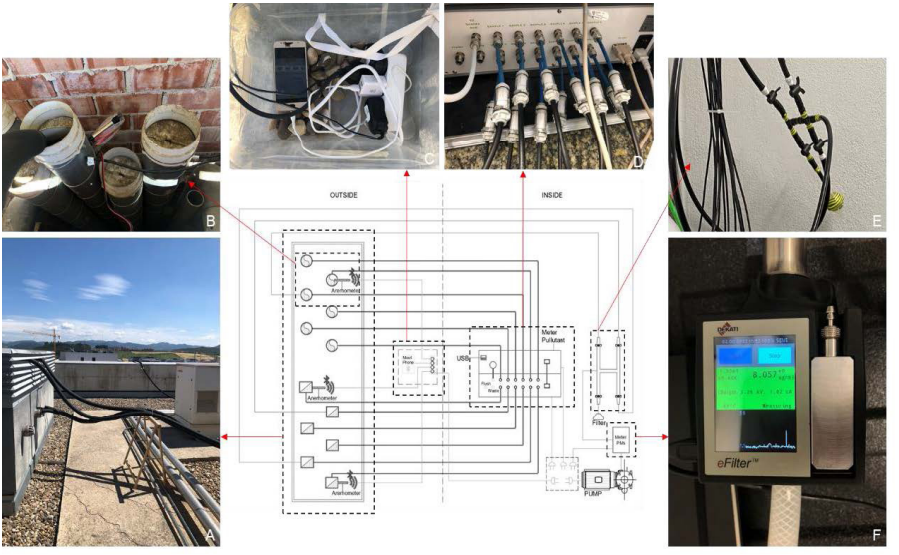

Figure 5. Scheme of quantification methodology. Source: (Robiel Manzueta 2022)

3. METHODOLOGY

We show the measurement methodology schematics in Fig.5 with an example from the AC building. Fig.5A shows the ventilation systems cabin from where the tubes are connected and Fig.5B displays several ducts with gas and airflow probes. Fig.5C is the cabinet containing DC sources and receiving device for airflow meters. Fig.5D shows the particle filters at the multi-probe gas sampler inlets and the probes running to various ducts, while Fig.5E shows the pipes, valves and calibration running to the Dekati particle meter shown in operation in Fig.5F, with the electrometric unit shown at right.

Measurements were taken in 2 to 4 week stretches in each building of continuous operation covering various climatological conditions, alternating buildings by relocating the equipment. During the initial tests and runs, we identified a number of issues that required specific solutions, often leading to re-runs of the experiments. Among these, we can cite:

- Weather sensitivity and extreme temperature fluctuations, leading to condensation and requiring insulation and moisture traps at the lowest probe points;
- Potential turbulent flow in pipes, requiring careful positioning of the airflow probes within the laminar flow regions of the pipes and speed integration and modelling;
- Occasional loss of signal (LOS) from sensors communicating with receiver devices leading to data gaps, requiring longer or repeated measurements for integration and careful placement of probes within range and line-of-sight, as well as frequent data collection;
- Occasional clogging of smaller probes due to insect activity, that could be detected by analyzing the data, leading to periodical pressure-cleaning of the probes;
- Vibration and noise transmitted from the gas analyzer, multi-sampler and pumps to the building, requiring acoustic and vibration insulation;
- Static buildup in PM probes, requiring large-section probes and high airflow to minimize particle adsorption to the probe walls.

4. RESULTS

As the EXHAL project is still underway, the latest research findings are not yet available. We present here
a preliminary summary of results for some of the pollutants quantified in each building, showing the
averages of one month of data in each building, that can give a fair idea of the levels measured overall.

Table 1 lists the specific duct sampled in each building that was sampled.

Sample number/ Building	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12
AB	Environment A	Environment B	Fecal A	Garage A	Bathroom B	Bathroom C	Bathroom D	Bathroom A	Kitchen A	Kitchen B	Kitchen C	Kitchen D
AC	Kitchen A	Kitchen B	Environment A	Bathroom A	Bathroom B	Fecal A	Bathroom C	Bathroom D	Environment B	Kitchen B	Kitchen B	Fecal B

Table 1. Ducts and vents sampled in each building

4.1. AB building

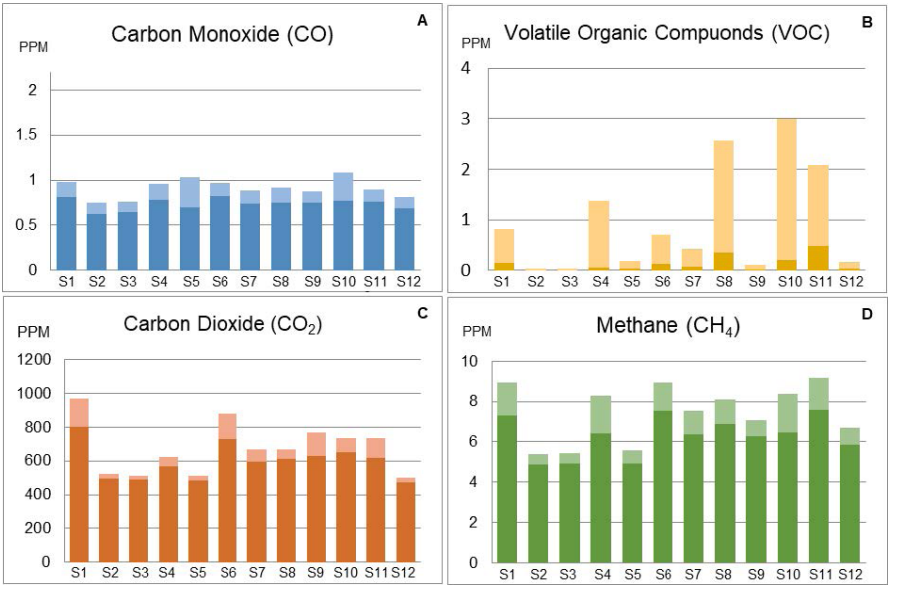

Figure 6. Averages (dark color) and standard deviations (light color) of a) CO, b) VOC, c) CO_2 and d) CH_4 concentrations (ppm) in AB building; measurements for one month of data

The average CO level measured was less than 1 ppm (Fig.6A), well within the range considered normal for urban areas without much traffic.

VOC levels, however, were extremely variable (Fig.6B). We run a series of tests using VOC probes and found no particular calibration problems, so we must assume that such variations can be normal within buildings. This remains an area under active research.

In most of the samples, the mean CO_2 concentrations (Fig. 6C) were consistent with current ambient levels (400 ppm) and generally did not exceed 700 ppm, which is consistent with the levels of natural urban air. However, the ambient air had a concentration generally higher than the indoor air. We cannot discard that, as observed b6 our ambient probe could be biased by boiler exhaust also venting from the top of the building.

Methane levels (Fig.6D) were measured in the range of 4-6 ppm and showed little variation between probes. We had expected a higher level in the vent stack, but it did not materialize in these first samples.

4.2. AC building

The CO levels (Fig.7A) in the AC building were also consistent with a low emission, giving only increased levels for two samples one instance of dwelling ventilation and the vent stack.

We also observed a higher variation in the VOC levels (Fig.7B), but contrary to the AB building some ducts were consistently stable. As the measurement spanned only one month of data

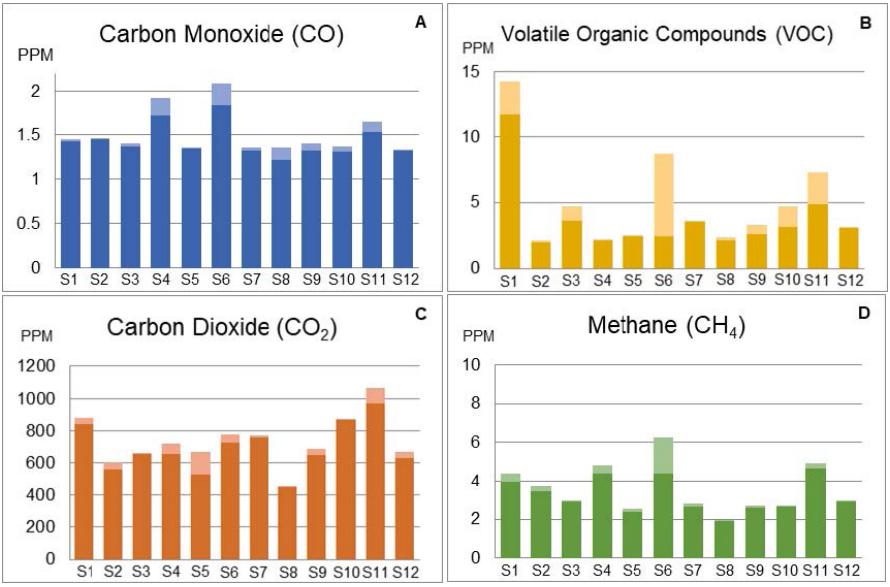

Figure 7. Averages (dark color) and deviations (light color) of a) CO, b) VOC, c) CO_2 and d) CH_4, concentrations (ppm) in AC building; measurements for a month

that did not overlap with that of the AB building, we cannot discard that the activity in the units being measured showed an occupation pattern that was different in both buildings.

CO_2 averages (Fig.7C) were consistent with expected values for indoor air, reaching a maximum in one kitchen. These values may vary depending on the ventilation habits by the unit inhabitants.

Methane levels were generally lower, however, than those observed in the AB building.

5. CONCLUSIONS

In the absence of literature on similar measurement methodologies, we developed and tested a procedure for quantifying the concentrations of pollutants exhaled by ventilation systems into urban air.

The methodology developed is complex and difficult to carry out because of all the factors to be considered (type of pollutants, ventilation systems, type of equipment/sensor, measurement units, measurement range, stations, building typology, transport and calibration of equipment, data collection and data interpretation). Based on these aspects, the following conclusions have been obtained:

- Quantification of pollutants from exhalation from residential buildings can be done using the proposed methodology.
- None of these studies have been conducted before, which makes the methodology complex, considering that the sensors on the market may not correspond to all the requirements of the project.
- Implementing the methodology requires a great deal of effort and requires constant calibration, checking, and data collection.

- Due to inconsistent values and potential technical failures of the equipment, the particle matter measurement has been discarded. The equipment protocol will be reviewed and new measurements will be conducted at other stations.
- According to results, one of the buildings measured had CO in excess of the value considered normal in natural air in urban environments (0.02ppm) and CH4 higher than is, which indicates increased levels of pollutants within the natural environment.
- Consequently, the measurements support the hypothesis of the existence of another source of air pollution due to the exhalation of pollutants from buildings into urban environments.

6. FUTURE STEPS

As the EXHAL research project, with which this paper is associated, is an ongoing project, the following steps must be followed:

- Measurements should be taken at different stations to make comparisons and conclusions that will benefit society.
- Unexpected trends and values have been observed for some pollutants without any reasonable explanation, so further analysis will be carried out by integrating new variables.
- Integration of new, low-cost equipment with a view to expanding accessibility is highly recommended.
- Simplify the methodology of quantification of pollutants exhaled from buildings into urban environments.

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PAPER #3.05

THE USE OF SOCIAL NETWORKS AS A TOOL FOR ARCHITECTURAL AND URBAN DESIGN

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ABSTRACT

The paper focuses on the analysis of new digital media, in particular the sociometric platforms such as Facebook, Twitter..., the writing on these platforms and their impact on architectural or urban projects. In order to deconstruct these new processes of information and data made easily available to the authors of projects, we work from theories allowing to give value (meaning) to writing according to the context in which it is written and materializing in the form of powerful citizen or individual commitments. We look for the keys of analysis allowing to pass from an opinion of influence to an analysis of recurrent commitments to be the object of collective stakes. These different approaches of reading the media/medias crossed with the territory and its collective commitments allow us to develop a method of analysis of the stakes because of the advent of a new project at the scale of a district or a piece of city. Its ambition is to offer to any project author (rarely a data scientist) to appropriate an approach more within his reach while being in phase with the digital reality that transcends the traditional approach of project design.

KEYWORDS

Social networks; semantic analysis; ontology; project; city; citizen; commitment.

1. INTRODUCTION

The digital tools used for urban analysis and architectural projects can only make sense if they are situated in a broader ontology of understanding and nuances of recent theories of smart cities and their critics. An approach that can be part of the digital convergence to increase the capacity to analyze social phenomena related to new urban issues.
The concept of smart city emerges in a rather vague way around the years 1995-2005 (Leccese and Mc Cormick 1999). Several researchers have attempted to define it (Mitchell, 1995; Ergazakis Kostas, 2006) or to situate it in relation to new imperfect urban approaches (Giffinger and Haindl 2009; Jang and Suh 2010), leaving aside the interaction between the territory and its inhabitants to focus on the new technological contributions to the strategic or daily management of cities. The 2010s have seen the emergence of an increasingly critical observation of these approaches, among others by authors such as Nam and Pardo (2011) (Nam and Pardo 2011), Ben Letaïfa (2015) (Ben Letaifa 2015) and more recently Ben Green (Green 2019), who all refocus the issue and the need to take into account citizens in the march of an increasingly digitized city and through issues arising from increasingly complex urban contexts in view of the urban competition raging at all scales of the cities both metropolitan and regional, in the framework

of the theoretical model of creative cities theorized by Richard Florida (2004) and Charles Landry (2012) (Florida 2004; Landry 2012a; 2012b; 2016) to name the most influential. Creative cities that rely heavily on technology to enhance social, cultural, economic and educational development.

Authors agree that the place of the citizen has evolved in the context of the development of smart cities, moving from simple consumers to engaged and more informed actors, defined as a moment of generational and technical rupture by the New Generation Internet Foundation (FING) and described in the report The Time of Ruptures? (D. Kaplan et al. 2012) as a polyform model, based on the observation that the emergence of socionumeric platforms and the social interactions that follow (A. M. Kaplan and Haenlein 2010) redefine the methods for analyzing the impacts of new socio-spatial expressions in the city linked to connected devices such as the smartphone. This new field of research has been particularly investigated in North America through one of the major socio-spatial movements of the last 10 years: Black Live Matters. One of the first significant studies was Beyond the Hastag (Deen, Mcilwain, and Clarck 2016), later complemented by numerous others, all dealing with the relationship between socio-spatial data from the Twitter platform and understanding urban issues (Huang and Wong 2016; Resch et al. 2016; Kovacs-Gyori et al. 2018). These studies confirm a sentiment initiated in the early 2010s, of the paradigm shift in social data at the time of the massification of data (Big data) from socio-digital platforms (Tuhus-Dubrow 2014).

At the same time, actors in urban sociology have commented on the impact of digital technology on individual and collective behavior, such as Bernard Steigler and his work on the Common Plain north of Paris, who has theorized extensively on the relationship between the smart city and its inhabitants, conceptualizing disruption as a misalignment between technical, social and biophysical systems (Steigler 2016). He postulates that there is a collective intelligence well present on the ground, but that it is contained in a societal digital Pharmakon, a pharmacological term specifying that medicine is both healing elixir and poison, applied to the smart and digitized city as a factor of collective individualization destructive of the commons if one is not careful as a city actor.

It should be noted, however, that the analysis of platforms was extremely concentrated on urban and non-local projects (on the scale of architecture) and essentially on semantic platforms (#hastags) of which Twitter is at the forefront but far from being the most used in Latin countries. Our research approach attempts to overcome this lack of analysis at the scale of the architectural project and to reweave the axioms of understanding citizen actions at the very local scale of a building, an architectural object, in a territory of small urban scale: one or several neighborhoods. An analysis that should allow for a new form of simplified analysis that disregards the need for complex algorithms to achieve its objectives, as was the case for the analysis of the millions of hastags of the #BlackLivesMatter movement. An approach that should allow a certain form of reconnection between the project owner-project manager pair and the citizens, new actors and recognized assets of the intelligent city in a context of anxiety-provoking ecological crisis exacerbates the fights of an unknown future as B. Steigler defined it in his Plaine commune approach. At this scale of the project, the question of the place and the role of the architect in the mediation process between the climatic stakes which sometimes require to shake up the habits of a district and the need to better understand the citizens' fears while valuing the daily expertise of the inhabitants who can improve the project process by relying on the free digital tools at our disposal, is also raised.

2. THEORETICAL AND METHODOLOGICAL ASPECTS

Our approach relies on the analysis of texts based on the writings of the Facebook platform in order to discover what citizens think about new urban and architectural projects and then deconstruct the discourses on digital platforms to bring an increased understanding of the frequent phenomenon of rejection of modernity or protection needs (NIMBY: Not In My Backyard) in the Belgian French-speaking territorial framework. This analysis is based on psychogeography, which attempts to describe the uses of the city as well as the defense strategies of individuals vis-à-vis urban pressure (Debord 1958), developed in the early 1960s at the same time as the first citizen movements. It is complemented by the theory of temporal geography of Torsen Hängerstrand (1970) (Hagerstrand 1970), which demonstrated that the actions of a few individuals could have a gregarious effect on the behaviors of a larger number, regardless of their original social framework, as they are rather influenced by the interactions induced on a given territory. Guy Di Méo's approach to social geography deepened these questions through Les territoires du quotidien (Tizon and Di Méo 1996) trying to demonstrate the symbiotic link between a territory and its inhabitants proposing, if necessary, new forms of social cohesion to defend themselves against new aggressions. The choice of our announced research thread is finally based on the resurgence of these approaches applied in the light of the new algorithmic calculation tools and which shows a continuous bridge between the research of the second half of the 20th century and the socionumeric platforms of today where communities make common cause according to the opportunity of the subjects.

The theoretical basis allowed us to develop a method relying on the semantic value of writing (Ferraris 2006) in the context of the Facebook platform as a social science research tool (Kosinski et al. 2015). We voluntarily wanted to reduce the analysis capacity to small local projects so that the analysis could be conducted in an iterative and analogical way, in the sense that no digital tools (API, software, algorithms) were used in the framework of this research applied to 7 projects located in the region of the cities of Mons, La Louvière and Charleroi. The objective being to be able to transmit and diffuse the analysis tool for the whole of the project owners and project managers.

2.1. Ontology of digital writing (Meinong and Ferraris)

The harvesting of behavioral data in public space is now recognized as potentially related to the development of the use in public space of the smartphone and platforms (Fischer 2010; Bingham-Hall 2017). The Italian ethnologist M. Ferraris, strongly influenced by the work of J. Derrida and his grammatology (1967) (Derrida 1967), attempted to define a new relationship to the smartphone in his book T'es où? (2006), complemented by the study of soul and iPad (Ferraris 2014) where he addresses the question of the written word and the trace as a condition of thought by establishing a relationship with the essence of the technique. He concludes that we are spiritual automatons, but free. He considers that the definition of a cell phone is too restrictive as an extension of the wired phone or embedded multimedia support, in front of this machine that can express relationships between humans. He defines a mobile eidos, that is to say that every phone is a writing machine, illustrating the principle of transcription of memory through the machine and in documentary form. In his thesis on digital behaviors and writing, M. Ferraris develops the concept of social object linked to the uses of machines. He develops the idea that social objects need a support in the sense of the capacity to be shared and that we define here as the Facebook platform. From this ontological approach, new notions of

the intimacy of subjects having the possibility to accumulate, save and idealize arise. By analogy with the past, it refers to the papers in the wallet and corresponding to a reconstituted identity based on the role of writing in the social constitution of the contemporary individual. Papers replaced today by posts on FB. They do not exist as such in space, but remain as traces and thus acquire a duration in time to become ideas in their own right making the link between space and writing. The social object is thus a moment of sharing stories (in reference to the act of writing) retranscribed through the digital medium, a tool for expressing our social object (who, what, where?). By this point, we define the intentional value of the writings located on the pages and Facebook groups and more particularly within the framework of the publications which mark out more and more the procedures of authorization of the architectural projects as soon as this one does not fall within the framework of acceptability of the local inhabitants.

2.2. Dissociate the individual from the collective, actors in the writing of the project

The individual is a social object that appeared studied from the 17th century, at the threshold of the modern era of the machine made autonomous to man. Authors like Guy Debord (1958), Zygmunt Bauman (2005), or Guy Di Méo (2009) (Di Méo 2009) speak of the societal impact between the development of the reinforcement of the individual behavior the more the machine puts itself at his service. The complexity of the behaviors of the one can only be compared with the emancipation of the other, pushed to its paroxysm today by the arrival of the smartphone. More recently, the term individuation was developed by Gibert Simondon (Simondon 1964; 1989), today taken up again through the questions related to the socionumeric use (Pinheiro Neves 2011) and finally translated by Bernard Steigler through the concept of Pharmakon. For Simondon, it is necessary to operate a reversal in the research of the principle of individuation, considering as primordial the operation from which the individual comes to exist and reflects the unfolding, the regime, and finally the modalities of its characters. He defines this phenomenon by the transduction. The specificity of this individuation, characterized as a process of concretization, holds that the machine, industrial technical object is an object which functions: the individual technical object is not such or such thing given hic et nunc, but what there is genesis (...) the genesis of the technical object is part of its being (Simondon, 1964). Like the blacksmith's hammer, it is an action tool for doing and acting, thus defining an intentional action integrating much more values than the simple "barroom" discussions often attributed to the actions carried out by collectives on sociometric platforms. This bias of appreciation has been analyzed by B. Steigler through the prism of the concept of Pharmakon defined as the poison of the writing of the project (in the sense of the history of the construction of the building) carried by the project owner and his architect. The philosopher-linguist defends on the contrary that the technological Pharmakon is not an "or" that is inevitably doomed to a death struggle applied to the decried architectural projects, but rather an "and" linking the technophile (represented here by the architectural modernity) and the technophobe (represented by the local residents allergic to the change of their environment)

2.3. Time as a framework for the analysis of the dissociation of the I and the we

In order to dissociate the collective action that can find a certain legitimacy through the socionumeric uses and that of an individual action situated at the same level as the collective through the functioning of the platforms without moderation, the semantic analysis of the Facebook pages and groups of the projects led us to validate the approach of B. Steigler who dissociates the collective we from

the I of individuation through its expression in the temporal flow (Stiegler 2005). An approach facilitated thanks to one of the intrinsic characteristics of these platforms which offer the advantage of being the new safe of the small papers of Z. Bauman's portfolio that the platform keeps automatically. Bauman's portfolio that the platform automatically keeps. Time is an essential and constitutive notion of platforms since everything is recorded, stored and archived there. (Wieviorka 2013) specifies this new paradigm of permanent change by analogy to the book: the reader becomes an author and speaks of the notions of reinscriptive and reticular through a compiling and interrelation approach between the different information that interacts for a given place.

This is the case for the concepts stated in the examples we have analyzed, changing over time to become polyform through the influence of post authors. The concept of re-registration is expressed like an onion that is worked in layers (the re-registration of different readers). The reticularity of re-registrations is even more intertwined thanks to sociometric platforms. The authors conclude that creation becomes protean, co-authored and constantly evolving (Pierrot and Sarazana 2010). However, this reticularity can also be biased by the particular influence of one or more particularly committed and active authors who need to be dissociated from the us. This does not mean that they are excluded from the group, but we need to be able to define the semantic interactions between the different actors and their weight. All of these interactions are symbolized by a timeline of the project, the time flow, which allows us to sort the various interactions of all the citizens according to the themes discussed for or against the project. The longer the time, the more refined the analysis of the evolution of the layers that express intentions, ideas and concepts becomes and the more we can characterize the game of the actors expressing themselves on the platform through the various forms of writing.

2.4. The place of expertise in the joint writing of the project

Today's world has become increasingly complex to analyze, complemented by the ability of the internet to offer knowledge available to all. Through the analysis of projects through the expression of actors on platforms, we have observed the use of elaborate and complex concepts by self-information, themselves made available to actors and citizens by other experts without them necessarily mastering the complexity of the topics addressed. For example, in the context of the project that will be analyzed in this article, the collection of information by certain actors who express themselves regularly does not always make sense. However, you have to be an expert to see this. The example of many posts on the defense of a renovation rather than a complete reconstruction of the site concerned is based on the valuation of the reduction of the carbon impact of a renovation rather than a demolition/reconstruction. Our field experience on these subjects shows that this type of principle is theoretically clear, the reality is always more nuanced depending on the contextual reality of the building concerned. Without a real expertise of the said concepts, the dialogue between the actors of the project becomes loose.

The new context of writing the project through platforms thus raises the relevance of the question of the place of the architect or author of the project who rarely contributes to the citizen dialogue through the digital commons. To this end, we set an analogy from a writing of Kant explaining the link of work that there can be between writing and project:

> a book is the instrument of the dissemination of a discourse to the public, not simply thoughts (...) Herein lies the essential, namely that it is not a thing that is disseminated thereby, but (...) precisely a discourse, and in its very letter (...) the author and the owner of the copy can each say with the same right

> of the same book: this is my book! but in different senses. The first takes the book as writing or discourse; the second simply as a mute instrument of the diffusion of discourse to him or to the public, that is, as a copy (Kant, 1995).

The citizens need to appropriate the book-project, to understand and accept it. If the book is a work written by an author, each one makes what he wants of the book with which he lives. Today, the actors of the sociometric platforms arrogate to themselves the right to write a part of the book without being in dialogue with the author and therefore the work because the complexity of the work is not demonstrated and therefore cannot inspire respect for the dialogue. These actions are therefore not to be taken as a direct attack on the author's talent, but rather as a way of appropriating the book even before it is published, which can obviously create situations of conflict. Our analysis tries to demonstrate hereafter with the selected example that the different writings are not always contradictory to the project and that a new form of dialogue between the actors can be opened thanks to the semantic analysis of the platforms by deconstructing the systematic approach of the conflicts whose outcome is not always in favor of the author and his owner.

3. APPLICATION: BELFUIS MONS PROJECT, BELGIUM

3.1. Setting the context

The Belfius Jean d'Avesnes project is an ambitious demolition and reconstruction project of the regional headquarters of the Belfius bank located in Mons (Belgium), a city with an important heritage character like many Belgian cities. The proposed project is in line with the restructuring logic of banks that are drastically reducing the number of physical branches. The regional head office is to become the main branch for an agglomeration of more than 250,000 inhabitants. The public authorities imposed a broader reflection with the imposition of a mixed project as well as the permeability of public spaces overlooking a military bakery

Figure 1: Proposal for the mixed building (housing, offices and kindergarten) of the regional headquarters of the bank Belfius, Avenue Jean d'Avesnes. Mons, image arch. NOHO, Brussels, 2019

from the Dutch fortified period and located at the rear of the site studied. Initially, the project (arch. NOHO architecture and design, Brussels) foresaw the transformation of the existing building and its extension in alignment with the square and the boulevards located at the historical intramural boundary of the city and then transformed into a brand-new project. The project includes 93 housing units, 1,500 m² of offices, a bank branch for a total of 12,000m² with a public park at the back and a day care center. On paper, this project is virtuous in proposing urban functions, common areas and a strong mix while increasing the density in the city center with very energy efficient housing. The current project was submitted to the city's urban planning department in mid-2020, including an impact study for the construction of the underground parking garage. The public hearing was held in the fall of 2020. As the project was modified during the investigation, a second investigation was conducted in the spring of 2021. At the same time, various negotiations took place between the local parties and the bank, without success. Finally, and after sustained lobbying by the residents, the new project, amended at the margin, was rejected by the municipality. To date, the project has been relaunched with some modifications and should be approved but subject to appeal by the same residents.

3.2. Analysis of citizen actions on digital platforms (analysis in July 2021)

When one invites a search #Belfius, #Mons on FB, one gets in first line the group negative impacts of the Belfius project on the Messines district in Mons (531 members). The second group is the basketball club Belfius Mons-Hainaut (official) (10.453 members on the page). The third page is NO to the Belfius - Avesnes project (232 Likes). The next three groups are fan groups of the basketball club. In 10th place, the position of Muriel Istace, a resident of the project, one of the Community Managers of the pages and strongly impacted by the project (Télé MB 2021). Note that in this case, it is the publications and not the Pages that are listed. The creation process of the page (December 3, 2020) prevails over that of the group (December 26, 2020). However, the group will very quickly supplant the page which will have no more activity from February 25, 2021. The number of posts will be affected by this, respectively (measured until July 27, 2021):

- 21 posts for the page
- 249 posts for the group

The distribution of group posts is fairly constant with a fairly similar average of publications/month from month to month with a continuous growth and a total of 270 publications for only 8 months representing a high activity. In addition, there is a fairly high reader responsiveness with an average of 8.86 responses or interventions for 531 group members (July 27, 2021). The tools can be divided into two categories depending on whether it is the page or the community:

- Page: an "official" advocacy tool
- Group: a tool for building arguments... to enhance the advocacy arguments developed on the Page

It should be noted that our analysis took place just after the pandemic crisis and the containment (between March 17 and May 3, 2020). A paradigm shift that influenced the discussions (cf. Semantic analysis), seeing the emergence of new urban expectations of the residents, going beyond the strict framework of the project.
In terms of influencers, we can highlight two actresses in particular. The first is a local resident of the project who has a view of the bank site, which is currently empty, but whose context would change radically if the project were to be built. Her commitment

is commensurate with her personal stake: one of her children is autistic and has a view of the site concerned from his room. A second actress, who is a resident of the area but not immediately concerned, is more characterized by the NIMBY phenomenon. These two actors demonstrated a rather exemplary strength of argumentation with the search for articles on the internet aiming to support their argument beyond a strictly local issue to make it more global by seeking to educate themselves on the ideas that they then wanted to share with the community and to become a support for the elaboration of the speech against the project.

3.3. Semantic analysis

As the posts progress, we notice the emergence of three recurring themes, we summarize them as follows:

- «Nature in the city to heal us» in a very mineral medieval city. This argument is also used to decry the Belfius project which proposes a park project above a parking lot, limiting the large plantations on the periphery of the parking lot and the felling of the existing 7 trees. This point is the subject of recurrent publications throughout the Timeline of the group and is particularly supported by publications of peripheral articles and positive images of the post-COVID plant life.
- In addition to the sustainable and sanitary issue, the subject of decreasing urban densification is also a recurrent topic for residents and sympathizers in opposition to current urban strategies, especially in a country where demographic growth is continuous with a perspective of 9.2% increase in the number of inhabitants in Belgium by 2050 (Duyck et al. 2022; STATBEL 2022). It allows to argue and justify the reduction of gauges of the Belfius project. The posted articles are always related to the issue of nature in the city, density not being compatible with emptiness and therefore green spaces.
- Recycling is recurrent with the sharing of many external publications. This idea allows to emphasize the argument of maintaining the existing building and renovate it. A subject consolidated in the intentions of local residents by the nomination of architects Lacaton and Vassal for the Pritzker 2021, architects who have particularly developed skills and projects in this area.

Our analysis develops around the semantics structured around objects. The Meinong object diagram used by M. Ferraris to develop his semantic analysis. It must be dissociated according to the characteristics of the media (Page/group). We propose here an analysis of the group:

- Physical object (real): The Belfuis project
- Ideal object (fantasy): to remain as it is (volumes), renovated.

Social object (collective intention): Protect the image of the city, protect against changes, NIMBY phenomenon.

3.4. Qualitative analysis

For the purposes of this article, and for reasons of format, we have discarded the explanation of the elements of semantic analysis through a timeline of the group intersecting the discourses and their evolutions through the publications, we have concentrated on Meinong's taxonomy produced by M. Ferraris, combined with the strength given to the meaning of words over a given time and allowing for the structured analysis of the ideas developed by the actors and the approval of these by their readers.

From this method, developed in the form of diagrams presented in Figure 1, we note that the object and the objective intersect through arguments leading the actors of the page/group to make the urban situation fixed. However, the taxonomic method allows us to

extract broader questions that require a real response from the public authorities. It is on this part that we note that the institutional actors (the services of the Region) as well as the architects or the project owner have been silent in all languages, while in parallel, a real professionalism of communication on social networks has been developed by the opponents. Their discourse has become so unifying for a particular case that it has influenced the municipal decision with a first refusal of a project that is nevertheless strategic for the region (location of jobs, new housing, services, etc.).

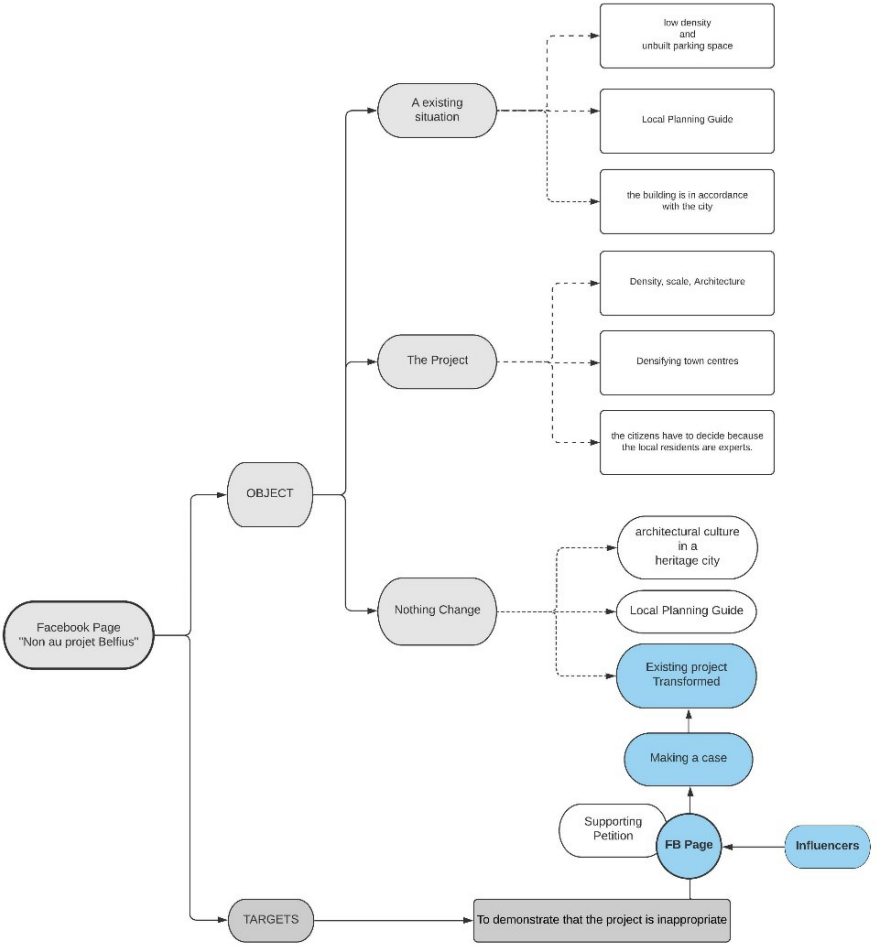

Figure 2: Analysis diagram according to Meinong's taxonomy applied by M. Ferraris in the context of the semantics of Facebook pages and groups, Belfuis Mons Project

The analysis of the objects, but also of the readers' reactions, reveals a significant lack of knowledge of current urban problems that could have been developed by the authors of the projects by clarifying the project process in all its complexity and thus better channeling paradoxical ideas such as reducing density in the city, but also in its periphery in the face of the demographic rise. An idea that confronts the question of housing and the necessary densification of cities in Belgium to allow everyone to enjoy a home. This is what the project is all about. The semantic analysis has shown this contradiction which would have required pedagogy to qualify the remarks of the self-proclaimed experts.

The second semantic analysis is based on the recycling of buildings rather than new construction. While this approach is virtuous, it remains a technically complex subject requiring a case-by-case analysis. The bank's original building was designed in the 1970s, a period when the quality of construction in Belgium had deteriorated considerably during an inflationary period and, from experience, was complex to transform. A complexity that would have deserved information beyond the virtuous concepts stated by the influencers.

We note a concordance of the subjects developed by the detractors of the project and of speeches voluntarily destructive of the Belfius project. We could, once again, demonstrate the will to influence the administrators of the Page/Group using common interests for particular interests. There is probably some of this in the approach, but it would be reductive for a Group that has federated more than 450 people and above all, has allowed the development of a dialogue on current topics of development of architecture and the city of tomorrow, and whose discussions within this group show a certain form of expectations but also of urbanistic candor. There are also many shares (18,6% of shares of the posts, which means a continuous engagement of the readers). This is rare enough to be reported, showing real concerns related to the advocacy axes promoted by the administrators.

3.5. Time for information and expertise

The analysis of this project, succinctly summarized in these few pages, shows that this group, which originated from a local project, but which radiated through the more general questions it posed on the development of the city, should have been accompanied by targeted information that objectively answered the questions posed. However, in this quadrilateral between the institutional authorities, the project owner, the citizens and the project manager, the question arises of a trusted third party capable of assuming this informational status with sufficient credibility? The public authorities and the citizens were in conflict of interest or influence. The project owner did not have the necessary credibility as an applicant. Only the project author has control over the technical topics discussed by the group members and its transcription into the project. However, our research work on other projects has shown that this competence is built over a long period of time, from the beginning of the project until the acceptance of the work (Simoens 2021). A time that justifies even more the role of the project author in this process which must inform to better dialogue and thus respond to the future challenges of the city.

4. CONCLUSIONS

The use of digital platform tools that influencers and self-taught people have managed to use thanks to an original approach of referencing external articles to develop their arguments and supported by their community, is more and more frequent. A finding that supports the fact that the authors of these platforms are no longer innocent and

know how to skillfully develop communication strategies with the tools at their disposal. M. Ferraris shows us the strength of the writing from the digital world and E. Kant before him had already raised the question of the co-production of the book and its work. However, in order to avoid chaos, these parallel writings must be aggregated through a conductor that we designate today as the project author. Of course, his approach is also biased by his position, but it is not a question here of a scientific project, but of an adventure. Other experiments that we have conducted have demonstrated the relevance of the project author taking charge of the platforms' information, as long as the approach is activated at the genesis of the project and with a few rules linked to the functioning of the platforms themselves. On this basis, a new brick in the co-production of the project can be envisaged for the benefit of the parties, but perhaps also to reduce certain risks, such as the unilateral refusal of the project. Our method is in its infancy and invites architects, urban planners or landscape designers to test it to improve it, it is versatile enough to adapt to many contexts.

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4

TECHNOLOGY AND MATERIALS

PAPER #4.01

THE POTENTIAL OF HOOK-AND-LOOP FASTENERS IN THE BUILDING INDUSTRY – TOWARDS A CIRCULAR ECONOMY

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ABSTRACT

Sustainability of the building sector is an urgent matter, as this sector is globally responsible for about 36% of final energy consumption and about 39% of energy-related CO_2 emissions, as well as for about 40% of resource consumption. One approach to reducing these figures is to design buildings that are adaptable to different uses and therefore part of a circular economy. One key aspect of sustainability in buildings is hence the appropriate design of the interfaces, differentiating between durable and non-durable components as well as allowing the separation and reuse of the resources embedded in heterogeneous building components. The requirements for these interfaces are hence separable joints, maintenance friendliness, accessibility and standardization. Hook-and-loop fasteners are currently used in the field of textiles, tools, automotive engineering, aircraft construction, rail vehicles, trade show construction, packaging as well as in fire protection and aerospace. Although still rare in the construction industry, hook-and-loop fasteners can actually meet the requirements named above better than conventional construction joint techniques. In order to encourage a broader application of hook-and loop fasteners, this paper shows the current state of the art and the potentials of their construction-related uses by analysing research projects, patents and the first licensed building products. This includes not only applications for joints components that are easy to dismantle, but also the production of hook-and-loop components made of concrete, as well as the combination with sensor technologies and digitalisation in the context of considering our cities as valuable sources for materials and components.

KEYWORDS

Hook-and-loop; circular economy; disassembly; recyclability; fastening technology.

1. INTRODUCTION

Smart cities have become a landmark in The traditional economic model - the so-called linear economy - is based on a *take-make-consume-dispose* pattern. This model relies on a never-ending supply of cheap resources and energy and a consumer society encouraged by market strategies such as planned obsolescence and is leading to vast, negative environmental and social consequences. In contrast, the circular economy model is "an industrial system that is restorative or regenerative by intention and design" (MacArthur 2013). It proposes a model of production and consumption that involves extending the life cycle of existing materials and products by reusing, repairing, refurbishing and recycling them as long as possible, thus reducing the need for resource inputs and

the creation of waste, pollution and carbon emissions to a minimum. In order to achieve a truly sustainable circular economy, we would need to change our current consumption and production practices in all fields by designing and promoting products that can be reused, repaired, remanufactured and eventually recycled.

The building industry - as one of the world's largest consumers of energy and raw materials, responsible for around 40% of CO2 emissions and nearly a third of all waste in the EU (Adams et al. 2017) - is a key target for European policies aiming to reduce raw materials and energy consumption, the carbon footprint and waste generation (European Commission 2020). As a consequence, rethinking construction supply chains in order to help reduce and reuse waste materials and recover construction materials for further recycling and/or their direct reuse are becoming key aspects towards a successful circular economy implementation.

Material recirculation, encouraged by designing products for disassembly, can potentially prolong the service life of construction components (Eberhardt et al. 2019). While screws, nails and pin fastenings and clipped connections are currently widely used, they do have some limitations concerning their general applicability, the interdependence of building parts (Vandervaeren et al. 2022) and sometimes lead to unavoidable damage through disassembly (e.g. a manufactured board fixed in place with a nailgun). For constructions that have to be loosened and reconnected more than once, hook-and-loop 2022, Universitat Politècnica de València fasteners may constitute an alternative, expanding the scope of disassembly to whose parts of the building where non-destructive dismantling and replacement is rarely if ever implemented, since clean removal means currently considerable additional work and thus higher costs.

2. HOOK-AND-LOOP CONNECTIONS

Hook-and-loop connections are a paradigmatic case of biomimetics, as it was inspired by the burdock's natural mechanism for seed dispersion (Fig.1.). A swiss engineer, George de Mestral, was granted the patent in 1955 after numerous years of development. He gave his invention the name Velcro® (from French velours "velvet" and crochet "hook"), which through metonymy has become a synonym for hook-and-loop fasteners (Velcro® 2016).

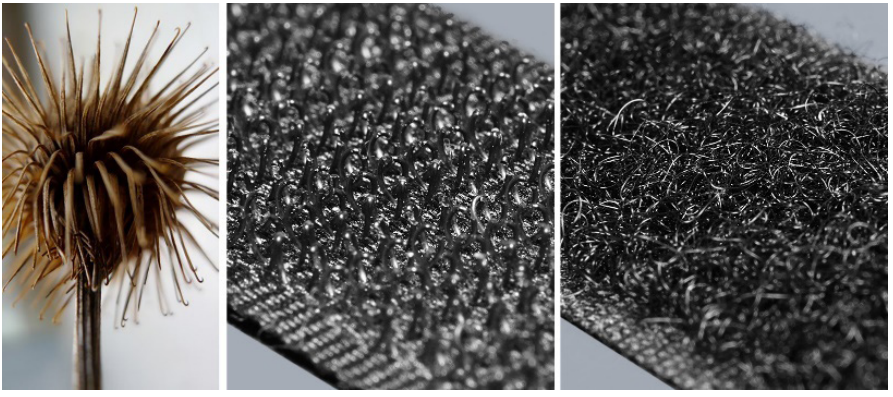


Figure 1. Burdock seeds (KlockarsClauser 2007), Textile hooks-and-loops components (Klink 2010)

A hook-and-loop fastener consists of two connection components, which connect to each other through a large number of complementary connecting elements due to their geometric and material-specific properties. Common geometric shapes of the connecting elements are hooks, mushroom heads, slings or loops. Currently used in the textiles, packaging, medicine, automotive and aerospace industry, hook-and-loop fasteners have evolved from George de Mestral's rather artisanal products to high-performance devices capable of high tensile (Gottlieb Binder 2018) and shear (Krüger 2013) strength, as well as fire (Grinfeld 2010) and acid resistance (Höhe 2009).
A worth mentioning variation is activatable and controllable hook-and-loop connections: releasable fastening systems that provide a shape change and increased bond strength when electrically activated (Momoda et al. 2002). Further patents (e.g. DE112007002135T5 and US20040074069A1) show similar switchable systems. A translation of these principles into a product prototype is the concept Active Velcro System (Brei 2003). This system is used for micro (<100 kg) and nano (<10 kg) satellites for maintenance work in space, as it enables exact positioning of the attached component. Further variations are thermoelectrically activatable hook-and-loop fasteners made of SMA wires (Afrisal 2016) and chemically and electrochemically produced activatable hook-and-loop components on a molecular scale (Ahn 2013). These examples show the high-levels of precision and performance reached in other sectors concerning hook-and-loop technology.

3. AGILITY AND CULTURE: THE BIGGER PICTURE

The building industry has always profited from the technology transfer from other sectors and we can see this happen as well in relation to hook-and-loop fasteners. However, innovation in the construction industry is a rather arduous process, where long-term, straining testing in real conditions often outweigh matters of high-tech and precision. In this sense, and in relation to the structural properties of hook-and-loop fasteners, it is important to note that the connection happens somehow randomly: every hook element can actually be attached to one or more loop elements but not all of them do. The actual number of active or completed connection points can therefore not be fully ascertained, so the possible power transmission lies within a statistical scatter range. Furthermore, many connection cycles lead to loss of strength and damage to the connection elements, so wear out tests are also necessary. The load-bearing behavior of different hook-and-loop products can also differ widely and is determined by their geometric conditions, material-specific properties of their components and the expected number of closing and opening cycles. By optimizing and coordinating these parameters it is possible to produce hook-and-loop products with high adhesive (35 N/cm²) and/or shear strength (41 N/cm²) while keeping a low peel strength (3 N/cm²). The connection itself is made by pressing together the connection partners, with an estimated contact pressure of approx. 20 N/cm² for industrially manufactured hook-and-loop fasteners. (Krüger 2013).
While still a market niche, loop-and-hook fasteners are already present in the building industry. In the following subchapters, we will analyze the most relevant commercial and research-stage hook-and-loop-based products for the building industry, setting the focus on their potential towards a circular economy. The classification of the products is based on their intended and ideal application.

3.1. Mounting systems

Mounting systems like the Metaklett (Metaklett 2010)metallic bands, the Uponor system (Uponor GmbH 2022) for underfloor heating pipes, the Vario XtraSafe (Isovere

GmbH 2022) system for the fixation of vapor-retardant membranes or the Rhepanol hfk (FDT GmbH 2022) system for roof sheeting are already available in the central European market. They all have in common the replacement of glue or metal fasteners with loop-and-hook connections, a principle that opens a wide palette of applications, as they are rather simple to implement and can be used without previous skill training. These systems target the reversible, quickly layable and/or adjustable connection of rather light components (membranes, sheets, pipes) and therefore the facilitation and cost-reduction of the montage process, but a later maintenance or disassembling of the individual components is not envisaged. Consequently, their contribution to a circular economy is almost non-existent. Firstly, because the connection between the mounting-component and the hook-and-loop components represents an obstacle to their recyclability, since it must be difficult or impossible to separate in order to fulfill its purpose. Secondly, because once correctly laid, these components often become bonded in situ through chemical bonds (e.g. screed) or plastic sealants (e.g. roof sealing) thus becoming part of a non-demountable composite layer.

3.2. Building service systems

In a similar way, some research projects are exploring the potential of hook-and-loop connections for fastening building service equipment within a building. The Klett-TGA for example, proposes a continuous loop surface along certain areas of structural elements, allowing the technical equipment to be attached through a built-in hook-mat. The target is here the flexibility for modification, maintenance and replacement of the building service equipment during the lifespan of the building (Riewe et al. 2019).
Concerning the separation and further usage of the components, the disadvantage of the connection between the component and the hook-and-loop components was addressed by using an adhesive which allows manual removal. For this purpose, the hook-and-loop mats are detached from the structural elements at one end and then removed by applying a linear load.

3.3. Interior systems

Interior systems usually target the variability of interior finishes and fixtures. The patent "Velcro system in or on a building" proposed in 2012 "a system that makes it possible to attach tiles, laminate, PVC or carpet whether plastic, stone, concrete, natural stone or any other building material via a Velcro connection to the wall, ceiling or on the floor." (Schaumburg 2012). This patent intends to replace the conventional glue and mortar layers with hook-and-loop connections in order to facilitate the exchangeability of tiles, flooring and other cladding components. To do so, a hook or loop mat is glued to both

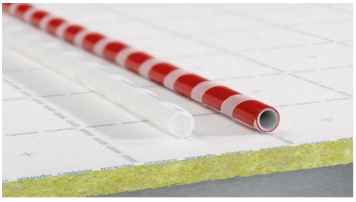
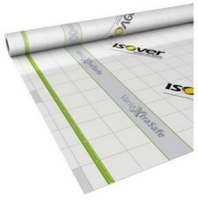
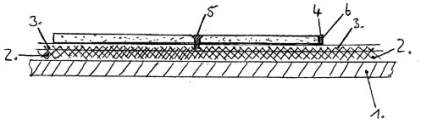



Figure 2. Uponor system (Uponor GmbH 2022), Vario XtraSafe (Isover GmbH 2022), "Klett-TGA" test specimen of making a loop surface on concrete by inserting a loop component into the formwork (Freytag et al. 2018)

the component and the ground element it gets attached to. This means that a) an extra working step is needed and b) instead of originally one layer of glue/mortar we get two. Furthermore, all joints are also supposed to be "formed with Velcro special profiles in all colors and shapes" (Ibid.), which increases dependencies on this commercial system.
Another example of interior system is the "Gecco-Wall" by Jan Werner, consisting of partition walls that can be set up quickly and without major interventions in an existing building. The supporting structure consists of vertical supports that are braced between the ceiling and the floor. Panels can be attached to the support via built-in hook-and-loop elements. (Werner 2018). The applicability is somewhat restricted by fixed panels dimensions, probably leading to clippings at the perimeter. Also, there is no acoustic isolation other than the panels themselves so this system is probably working best for temporary settings such as open exhibitions spaces. Similar systems could be also be convenient as TGA shaft cladding or to cover inspection openings.

3.4. Façade systems

In a patent from the year 2000 (Tachauer et al. 2000), an attempt was made to replace the entire façade substructures with hook-and-loop-capable membranes, thus enabling the façade cladding elements to be easily replaced and source segregated before their disposal. The main idea is to continuously equip roofs, walls, floors and ceilings with fastening membranes consisting of hook elements arranged on both sides and using loop strips for elements such as roofing, wall or facade cladding, insulation panels or floor coverings. The hook-membranes can easily be cut to size and fixed onto the surfaces. However, the loop strips are glued and must be attached at small intervals to prevent the facade from sagging.
One of the few products in development is the façade system *StoSystain R* (Sto Ges.m.b.H 2015), a further development of the external thermal insulation composite system (ETICS/EIFS), a widespread façade system in Central Europe consisting of thermal insulation boards (usually polystyrene) tied through dowels and glued to the exterior wall surface, plus a base coat reinforced with glass fibre mesh and a finish coat giving the appearance of stucco or conventional rendered plaster. The use of a hook-and-loop connection as a means of fastening between the adjustable dowel and the plaster base plate enables adhesive-free assembly, later separation of these components according to type and their reuse or recycling. But while separating the plaster base board from the anchors is



1 ground
2 hook-and-loop bottom side
3 hook-and-loop top side
4 „kletti" profile joint
5 „kletti" gab profile
6 termination profile

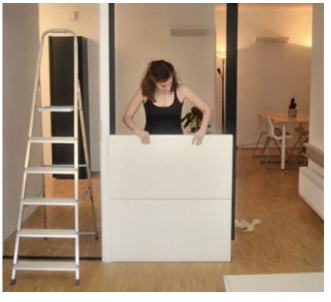


Figure 3. Velcro system in or on a building (Schaumburg 2012), Mounting the "Gecco-Wall" (Werner 2018)

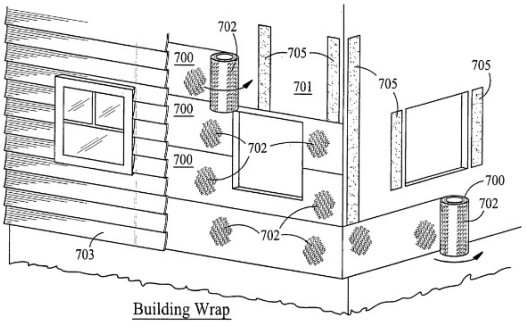
easy to perform, separating the hook and loop component from the board is more difficult. This is nevertheless a significant advance compared to conventional ETICS/EIFS systems. In addition, the dowels and the Velcro® component there could be made of the same material, thus improving their recycling.

A further, much more specific use of hook-and-loop connections in façade systems is the concept developed in the "Piezo-Klett" research project. By combining hook-and-loop fasteners with piezoelectric materials, they become energy harvesters and are able to operate active sensors thanks to the high weight loads, strains, vibrations, changes in temperature or due to air currents and wind loads occurring in buildings, without complex cabling or battery limitations (Raudaschl et al. 2022). In turn, the "Piezo-Klett" elements enable the measuring and storage of data regarding circular economy processes, helping monitoring the entire life cycle of buildings, which could lead back to more efficient recycling processes.

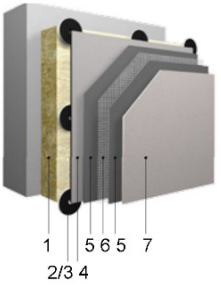
3.5. Concrete systems

A 2016 patent by *Betonwerk Schuster GmbH* describes a procedure in which a plastic or metal loop-equipped anchor is inserted into the formwork. Consequently, a sliding strip, a soundproof strip, a bearing or compression strip or similar can be reversibly attached through a hook-mat to the resulting concrete element (Betonwerk Schuster 2016).

The research project "Klettbeton" (Raudaschl 2020) on the contrary, proposes the implementation of the hook-and-loop principle within the concrete element itself, that is, as a monolithic element. The basic objective is to produce a hook-and-loop component that has the properties of a concrete structural element in the context of material behavior, durability and material purity. Since hook-and-loop components are usually designed to be flexurally soft, it is also necessary to determine whether flexurally rigid hook-and-loop elements could exhibit hook-and-loop capability, but also how concrete might behave when loaded at the surface, as the depth of



700 membrane with loop-engageable hooks
701 building
702 loop-engageable hooks
703 wall defining members
705 loop strips



1 insulation
2 dowel (not shown)
3 hook component
4 support plate
5 flush mount
6 reinforcement
7 final coat

Figure 4. Fastening membrane as a protective exterior structural wrap (Tachauer et al. 2000), Components of the facade system StoSystain R (Sto Ges.m.b.H 2017)

engagement only amounts to a few millimeters (Fig. 5). In the research, a normal concrete was chosen, but optimizations of the concrete mixes (e.g. ultra-high-strength concrete UHPC) seem relevant for future development work. The formwork technique chosen was the 3D wax formwork technology due to their reusability (Kloft 2016), as in contrast to conventional plastic free-form formwork, the wax formwork layer can be melted down and entirely reused. Subsequently, any component equipped with the matching hook-and-loop element can be attached on site without any changes or further additional layers to the concrete element.

This kind of monolithic systems seem to be the most coherent path concerning their potential for a circular economy, as long as flexibility and durability are warranted. A further variation of this system could therefore be the development of controllable, de-activatable connection partners, since a bending-resistant hook-and-loop component runs the risk of being destroyed during dismantling.

4. CONCLUSIONS

Hook-and-loop can offer simple, clean and fast assembly processes while enabling damage-free and detachable connections. Their use could increase the share of building components that can easily be separated from each other, without noise and dust, and fed into the circular economy once a building reaches the end of its life. If properly standardized, it could become a uniform connection system that can basically be applied to any building element, independently of the supplier. However, up to now the use of hook-and-loop fasteners in the building industry has been driven by the demand either for reducing the labour and cost of montage during the construction phase or for increasing the variability (by replacing cladding, building services, etc.) during the life-span of the building. The fact that their use sometimes increases the possibility of disassembly and reuse of single elements is rather exceptional and therefore to be considered a positive side effect rather than a deliberate action. Moreover, adding hook-and-loop mats to conventional elements usually leads to extra layers (glue, bonding agents), thus aggravating the problems of waste segregation.

During the last decade though, new products and lines of research suggest a turning point towards circular economy as main focus. Following the previous analysis, we can identify three main strategies in order to pursue this goal: Firstly, the manufacture of hook-and-loop fasteners in the same material as the building element they will fixate, as that would reduce the number of materials to be segregated from currently three (element, glue, fastener) to two. Secondly, new developments

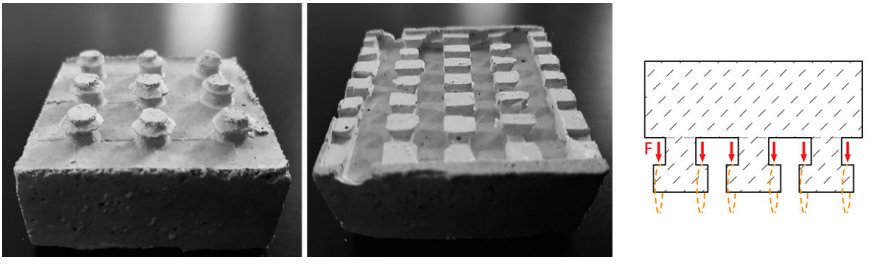


Figure 3. Velcro system in or on a building (Schaumburg 2012), Mounting the "Gecco-Wall" (Werner 2018)

in bonding technology aiming to minimize their negative impact on waste segregation, be it by reducing its share of the total product and/or by reducing its polluting potential in case of recycling. And thirdly, the development of fully monolithic systems, in which the hooks or loops are an intrinsic part of the building elements themselves. Recyclable materials that can be shaped with high precision seem best suited to fulfil this task.

Considering the high levels of performance that they have reached in other sectors and the increasing pressure to reduce raw materials and waste generation in the building industry, the further development of hook-and-loop fasteners construction systems seems definitely a strategy worth pursuing.

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PAPER #4.02

ACTIVE ALUMINUM WINDOW-FRAME INTEGRATED PROTOTYPE WITH A THERMOELECTRIC HEAT RECOVERY SYSTEM FOR VENTILATION AND AIR CONDITIONING

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ABSTRACT

Research interest in the integration of thermoelectric systems in the building envelope have increased during the last years. Studies show that regardless of a low COP compared to vapor compression systems; thermoelectric systems present other remarkable features for heating, cooling and ventilation on buildings. Among those studies, a few prototype experiences incorporate thermoelectric systems on windows.
Alternatively, standard air conditioning systems often require additional equipment installed on façade or wall surfaces that compromise the use of space in the case of building refurbishment. Thus, the integration of thermoelectric systems on window framing is presented here as a decentralized alternative for air conditioning support, whose performance aims at balancing out the heat losses in windows.
The purpose of this communication is to present the development of an active aluminum window-framing prototype with a thermoelectric heat recovery system for heating and cooling. In a typical single-floor house scenario, the active window-frame works in two different modes: pre heating/cooling mode applying forced convection through a mechanical fan and pre heating/cooling mode with natural convection. The impulsion airflow rate meets ventilation requirements according to Spanish Technical Building Code (CTE) for indoor air quality.

KEYWORDS

Active window; peltier; thermoelectric; façade; heating; cooling.

1. INTRODUCTION

Reducing the energy consumption of buildings has been a major concern in recent decades. According to the United Nations Environmental Program, the energy consumption demand around the construction and operation of buildings in 2015 was equivalent to 38% of the global energy demand. Research on the application of thermoelectricity in buildings for heating, cooling and ventilation has emerged as an alternative to conventional systems.
Thermoelectricity encompasses the direct conversion between temperature differences and electrical voltage through two related mechanisms called Seebeck effect and Peltier

effect. Peltier cells are devices that allow for heat transfer when the electric current flows through its circuitry composed by two types of semiconductor materials (n-type and p-type). The heat transfer allows for cooling on one of the sides of the cell while heating on the other. Likewise, the change in the direction of the applied current produces a change in the direction of temperature transfer, giving them the capacity for working as heat pumps (see Figure 1).

Thermoelectricity has been widely applied in the fields of electronics, military, automotive and industry however; their application in energy systems for buildings is a barely developed area. The application of thermoelectric systems in buildings have several advantages over conventional HVAC systems including great versatility of the modules due to their capacity for heating and cooling in a single device. Moreover, the technology's high reliability reduces the need for maintenance. The greatest advantage, however, is the avoidance of refrigerant fluids, present in conventional vapor compression systems, which have a negative impact on the environment and demand large amounts of space.

This paper aims to present an ongoing experimental study carried out in partnership between Hydro Extrusion Spain S.A.U. and Universidad de Navarra, that focuses on the activation of a window frame using thermoelectricity in order to pre-heat and pre-cool the supply air in a residential building. Foremost, a brief background on the integration of thermoelectricity in buildings is presented, including previous experimental studies carried out by the thermoelectricity research group of the University of Navarra. Afterward, design parameters and considerations are described including different operating scenarios and building requirements for TEM integration and window activation and lastly, discussion and conclusions.

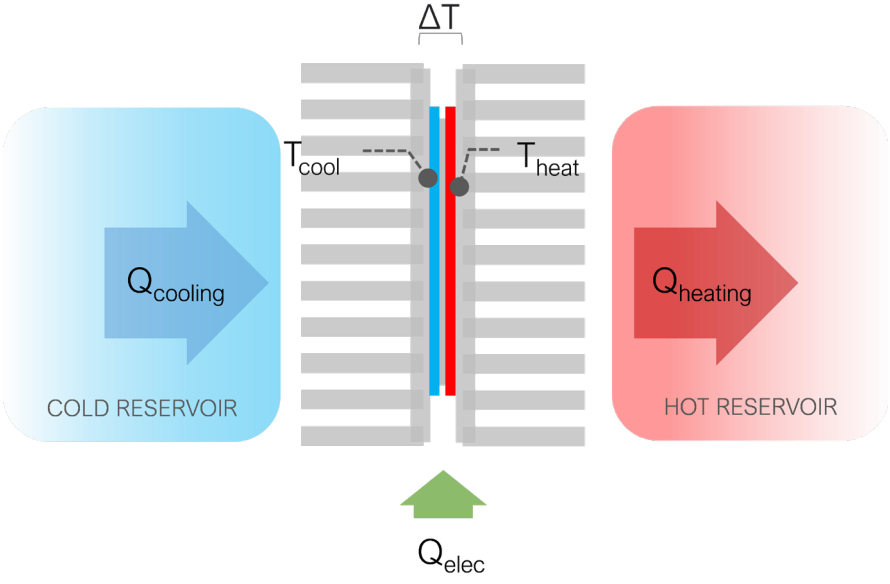

Figure 1. Concept schematic of the operation of a Peltier cell

2. BACKGROUND

Thermoelectricity for air conditioning in buildings has two different applications: through integration of TE modules in different parts of the building or through independent (not integrated) systems. Considering the integrated TE modules, it is possible to find them on the envelope system, mainly façades, in interior suspended ceilings for cooling purposes, in roofs, in heat recovery systems and windows (Figure. 2). Not integrated TE systems are those such as ventilation systems, TE combined with phase-change materials, dehumidifiers, and other devices (Zuazua-Ros et al. 2019).

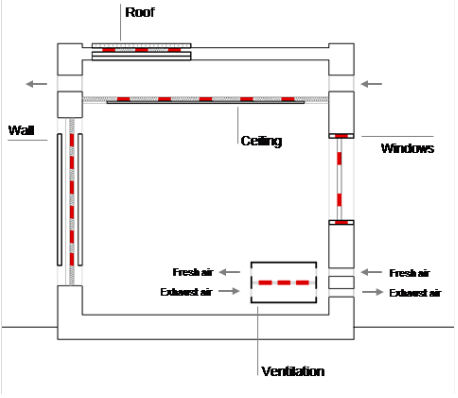

Figure 2. Diagram of the different thermoelectric integration options in buildings. Source: (Zuazua-Ros et al. 2019)

The research group on thermoelectricity at the Department of Construction, Building Services and Structures of the Universidad de Navarra designed and built three experimental prototypes for the integration of thermoelectric systems in the building envelope (Figure 3). A first approach developed by Martín-Gómez et al, consisted of a façade-integrated prototype with 84 Peltier cells (Martín-Gómez et al. 2016). Despite a low COP, the results of the performance analysis served to prove the capacity of the thermoelectric system for heating or cooling of a 6.7m^2 space unit. Additionally, it helped to determine some constructive parameters regarding the integration of thermoelectric systems in the building envelope. Subsequently, Ibañez-Puy et al. presented in 2017 the design of a Thermoelectric Heating and Cooling Unit (TCHU) (Ibáñez-Puy et al. 2017). The prototype was installed in a ventilated façade, using the exterior air cavity to dissipate heat from the TEMs, thus achieving a complete integration of the thermoelectric system. Researchers improved the insulation and aesthetic parameters of the construction. Higher COP values were achieved in comparison to previous experiences. Lastly, Martín-Gómez et al. presented in 2019, a full-scale prototype of a Ventilated Active Thermoelectric Envelope (VATE). The prototype consisted of two modules of 8 Peltier cells each, 2 tangential fans, finned heatsinks and an electrical panel located in between the modules (Martín-Gómez, Zuazua-Ros, del Valle de Lersundi, et al. 2021) The prototype was installed in an actual office space and it was tested under real conditions. It presented some improvements concerning construction parameters, and the optimization of the electrical system allowed for the reduction of volume space of the prototype on the facade. Among other studies that integrate thermoelectric technology in window frame or glass, Xu, et al developed an active window prototype, mounting the thermoelectric modules (TEMs), in two aluminum tubes on both sides of the window, analyzed in laboratory conditions (X. X. Xu, Van Dessel, and Messac 2007). Following up, they built a prototype and tested it under real conditions (X. Xu and Van Dessel 2008a) and subsequently a steady state model of this prototype was validated (X. Xu and Van Dessel 2008b). A similar study was proposed (Birthwright et al. 2008), the TEMs installed on the window compensated for the heat flow through the window obtaining a COP greater than three. Other studies used active thermal insulators (ATI) applying solar energy to compensate for heat losses through the window. The system

Figure 3. Images of façade integrated thermoelectric prototypes developed in the School of Architecture in chronological order from left to right. Left (Martín-Gómez et al. 2016), center (Ibáñez-Puy et al. 2017), right (Martín-Gómez, Zuazua-Ros, Del Valle de Lersundi, et al. 2021). Source: authors

integrates photovoltaic panels (BIPV) that power the TEMs, located between the glazing panes in the façade assembly. In this case, a model was developed to test the performance (Harren-Lewis et al. 2012). The study of an active window concluded that, "The ATI design is a significant improvement over the energy efficient windows. It can reduce heat gain through a window by up to 67% powered only by incident solar radiation. By reducing the heating and cooling load, the economic and environmental cost associated with the building's energy consumption will decrease. Although evaluating only summer cooling option, they deliberated on the option of including a battery to make winter heating a viable option. However, they did not consider the aesthetics of the prototype, concluding that closer examination of the design of the heat sinks would of the heat sink design would lead to a more commercially viable element.

Barreto et al. presented a heat recovery system based on heat-pipes that aims at reducing the heat losses caused by ventilation. On the other hand, to improve indoor air temperature and air quality, as well as thermal comfort. The heat recovery system is coupled to the window frame. The heat exchange between the incoming air and the exhaust air takes place through centrifugal fans (Barreto et al. 2022).

Based on previous experience measuring the capacity of the thermoelectric system to air-condition an entire space, researcher at the Universidad de Navarra found that the integration of thermoelectricity in buildings has several drawbacks, the most important being the difficulties encountered in ensuring the energy demand for heating and cooling.

On the other hand, keeping a constant airflow favors air circulation inside and allows heat transfer. Moreover, heat losses caused by thermal bridges are constant drawbacks despite all the improvements made along the previous experiences.

3. DESIGN APPROACH

Architecture and building need to comply with many mandatory regulations, which can be considered the minimum requirements. However, many other factors must be added to these minimums that are part of the design process such as aesthetics, consideration of ease and simplicity of construction and assembly, low maintenance of all its systems and components (Torres-Ramo et al. 2009)

The component under study in this research is an active window that serves as a decentralized ventilation system with a contribution of heating and cooling to the supply air. Both ventilation systems and windows themselves are sources of energy gains and losses. Thus, the activation of these elements through an integrated TE system aims to balance out those energy gains and losses.

Windows are one of the most industrial and modular elements of buildings. They are technically precise, easy to assemble, easy to customize (i.e. specific glass panes), they offer a variety of solutions depending on the needs and they are dry construction. All these features mean that windows can be considered an affordable system to which another industrialize system can be attached or integrated to.
When conceptualizing the active frame, the initial step is to consider the ventilation operations that the frame can accomplish. Thus, as a starting point, attention has been focused on ventilation requirements established in the Spanish Building Code (exactly CTE HS3). Then, the requirements of the integrated TE system were considered for a final conceptual solution to be developed. The next two subchapters present these steps.

3.1. TEM integration: building requirements and operating scenarios

Given that it is a decentralized system, this equipment must be installed in each room of a house. As a starting point for the initial design, the bedrooms have been considered. In order to meet the requirements for constant flow ventilation in living spaces, the Spanish Technical Code (*Código Técnico de la Edificación)* CTE HS3 "Air Quality" establishes a constant minimum air supply flow of 8 l/s (28.8 m^3/h) for the case of a main bedroom within a house.
According to this, the air inlets can be made in different ways, prioritizing the vents associated with windows due to their ease of execution. Thus, this constant natural ventilation is guaranteed due to aerators installed in windows, which provide a constant micro ventilation air inlet. The natural ventilation is ensured due to exhaust air openings located in kitchen and bathrooms. This will be the first scenario where the active frame prototype will be tested.

The second scenario corresponds to those cases in which there is a controlled mechanical ventilation system with a heat recovery unit. In this case, the minimal renewal air is not only assured, but it is preheated to reduce the energy demands of the indoor space.

3.2. TEM integration: activating the window

The integration of TE systems in buildings supposes the consideration of new factors in the constructive design such as wiring, Peltier modules appearance, ducts, and fans in the first place, and power supplies, sensors and control system in a second place.
As explained before, the Peltier cells will pre-heat or pre-cool the fresh air renewing the indoor air. Therefore, the system will be composed of two chambers, one at each side of the cells, that will drive cooled or heated fresh air indoors.
In heating mode, the fresh air at lower temperature will enter the inner side chamber and will be preheated at desirable 21 ºC to be supplied to the indoor space. At the same time, the indoor exhaust air will be drawn to the outer chamber. The temperature of the exhaust air, being higher that the outdoor temperature, will increase the outer chamber temperature, thus, the temperature difference of the two sides of the Peltier cell will be reduced. This heat recovery system will improve the performance of the Peltier cell, since at lower temperature difference, higher coefficient of performance.
In cooling mode, the operation will be similar, the outdoor air will be pre-cooled when entering the inner chamber, and then supplied to the indoor space. At the same time, the indoor air will be cooler than the outdoor air, thus, it will reduce the temperature difference of the two sides of the Peltier cell.
In cooling mode, the operation will be similar, the outdoor air will be pre-cooled when entering the inner chamber, and then supplied to the indoor space. At the same time, the indoor air will be cooler than the outdoor air, thus, it will reduce the temperature difference of the two sides of the Peltier cell.

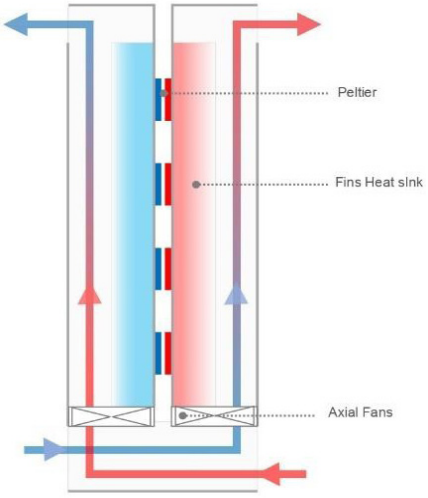

Figure 4. Initial concept schema of the active window frame operation.

Once the concept of the system is defined, the next steps are related to the integration of each element in the frame design. In general, the main items to be addressed are the following:

- Outline of airflows: There is a critical point between the two chambers at each side of the Peltier cell, since at some point both ducts must cross. Figure 5 shows some of the different solutions considered by the research group to solve this issue.
- Heat dissipation: As literature review and previous experiences support, the heat dissipation is a key issue for the optimal performance and efficiency of the Peltier cells. In this case, aluminum fins extruded together with the frame are considered as a heat dissipation system. In order to ensure the best dissipation, axial fans are integrated in the design at both sides of the cells.
- Power capacity: The Peltier cells generally used for building integration experimental research have a maximum power capacity of around 50W. In this case, considering that the system is focused for new building construction or refurbished scenario, in both cases a low energy demand is assumed. Therefore, the integration of 4 Peltier cells (maximum power capacity of 200 W per living space) is considered as starting point.

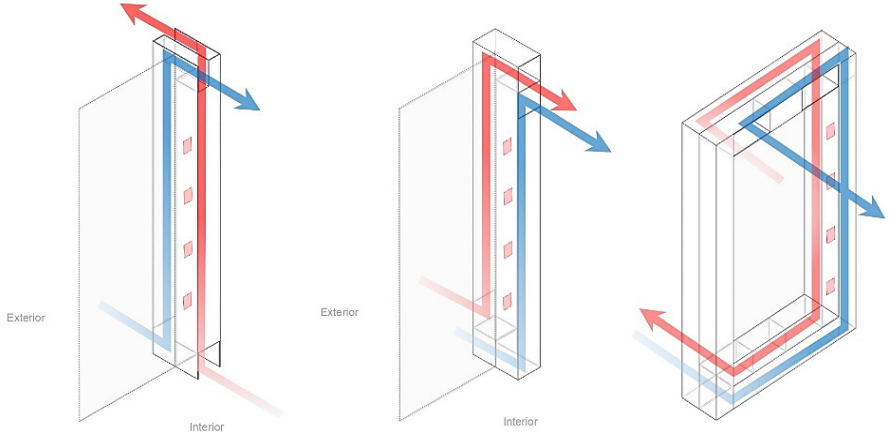

Figure 5. Concept drawings of air flow alternatives

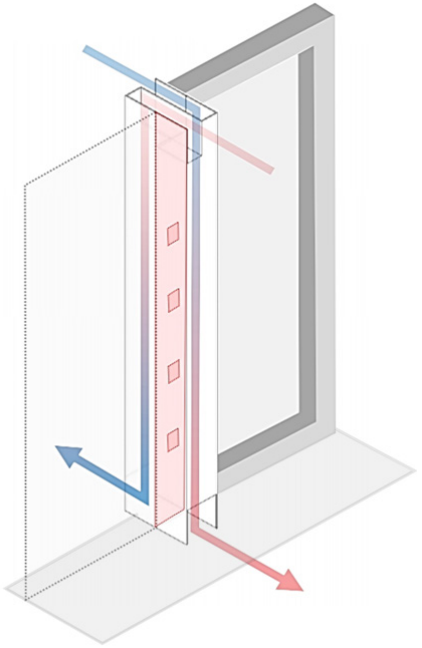

Figure 6. Concept axonometric of the final result.

As a result, the final concept diagram that will be prototyped is shown in Figure 6. The air ducts will be crossed in the lower part of the profile, to ensure the air supply from the upper part of the window frame. This configuration allows the adaptability to any type of window, since it can be extruded and later cut to the desired length.

4. DISCUSSION AND CONCLUSIONS

This paper presents the initial steps towards an active aluminum frame integrated in windows. The active frame under study in an ongoing project will include thermoelectric modules and will operate as a heat recovery system to precool and preheat the supply fresh air to the indoor space.

Since windows are among highly industrialized elements for buildings, the advantages of the integration of thermoelectric systems in window frames ranges from measurement and shape precision to a more simple and specialized installation. Moreover, the experimental prototype presented here, has aluminum-extruded components, which allows for easy integration with windows.

Previous experiences and performance analysis of façade integrated thermoelectric systems demonstrate the feasibility of this technology to pre-heat and pre-cool the airflow, thus helping to improve the indoor thermal comfort and reducing the energy consumption. Among the challenges that will be studied through this experimental prototype are the complete integration of the thermoelectric system with the window frame, which implies meeting the technical requirements of windows in terms of water and air tightness, thermal bridges and condensations. In addition, forced ventilation is required to keep a continuous airflow, and the noise of the fans is another drawback.

Moreover, optimal location of filters on the inlets, would favor an optimal particle filtering which allows for supplying a cleaner fresh air. As for future steps, researchers at the University of Navarra are working on the construction of an adiabatic box where the prototype will be tested under controlled temperature conditions.

ACKNOWLEDGEMENTS

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PAPER #4.03

INDOOR RELATIVE HUMIDITY: RELEVANCE FOR HEALTH, COMFORT, AND CHOICE OF VENTILATION SYSTEM

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ABSTRACT

It is generally recommended to keep the values of relative humidity (RH) indoors between 40 and 60% for comfort and health. However, the environment in our homes and offices is a lot dryer in the winter, going down to 20% or less in cold climates. We can be in such dry environments for short periods, but in the long term we might get physiological impairments such as dry or irritated eyes, nose, throat and skin, and even an increase on headaches and respiratory or skin diseases and allergies. On the other hand, too high values of relative humidity can promote growth of fungi and mites, and create moisture problems in building materials. Those problems could be solved by finding a balance between ventilation rate and indoor humidity production, in combination with moisture absorbing materials. However, these strategies work better with lower air speed and ventilation rate, which may in turn conflict with the need for fresh air to compensate for the production of CO2 and other pollutants. Typically, mechanically ventilated spaces tend to have a lower RH than those with natural ventilation, independently of the season and indoor temperature, since their main focus is providing enough fresh air to keep CO2 levels below 1000ppm. Recently, it has gained acceptance to monitor temperature, humidity and CO2 for indoor air quality and health, which has the potential to show their interactions and help find an optimal balance between them. We carried a building performance simulation (BPS)analysis of an office building with an optimized design for passive strategies and automation in cold climate. Instead of focusing on high air changes, this building uses extra high floors for stratification of temperature and pollutants, to reduce the need for ventilation in winter. Then we compared indoor RH under natural and mechanical ventilation, to reflect on the effect of the ventilation system.

KEYWORDS

Relative humidity; thermal comfort; indoor air quality; building performance simulation.

1. INTRODUCTION

The indoor environment in our homes and offices tends to be too dry in the cold and intermediate seasons. With a relative humidity as low as 20% or even less, we may experience dry or irritated skin, eyes, nose and throat, more frequent headaches or even respiratory or skin diseases and allergies (Wolkoff 2018). That happens because when we warm up the incoming air from a colder environment, it gets dryer. Its water content does not change, but its relative humidity decreases

since the air can contain more humidity as it gets warmer. In cold climates, the warmer indoor air can host up to 10 times more humidity than the colder outdoor air. This means that as we ventilate a room, we are actually removing water vapour from it. So, the room air gets dryer unless we balance the ventilation rate with the production of humidity indoors (occupants, plants, cooking, bathing), use moisture absorbing materials that help buffering the changes in relative humidity, and/or lower the temperature (Woloszyn et al. 2009).

We can be in such dry environments for short periods, but if prolonged in time, we might get certain physiological impairments, especially in our skin, eyes, nose and throat, with dryness and irritation, more frequent headaches or even respiratory or skin diseases and allergies. Therefore, it is generally recommended to keep the values of relative humidity indoors between 40 and 60% for comfort and health. (Arundel et al. 1986)

With a relative humidity of less than 40%, we become more vulnerable to viral respiratory infections, because of the drying of our mucous membranes. In addition, low humidity levels activate the evaporation of water in cough droplets, so that they shrink and get a prolonged suspension in the air and ability to travel faster and longer thanks to their smaller size. (Ahlawat, Wiedensohler, and Mishra 2020)

On the other hand, too high levels of humidity can promote growth of fungi and mites, and create moisture problems in building materials (mould, decay, condensation, corrosion), which in turn can also affect your health. (Baughman and Arens 1996)

Keeping optimal indoor humidity levels in the winter might be challenging because of our competing demands for thermal comfort and air quality. As indoor air gets polluted over time by the users (CO_2, odours) and by the materials inside our buildings (emissions, odours), we need to ventilate the rooms to get more fresh air. On the other hand, new research about comfortable conditions and air quality in commercial aircrafts suggest that the current limits for CO_2 concentration used in buildings may be overestimated (Giaconia, Orioli, and Di Gangi 2013). The current maximum levels of 1000-1200ppm have been calculated as a function of the acceptable outdoor CO2 concentration (350 to 500ppm) and ventilation rates of 7.5 L/s per person. Relatively high values of CO_2 concentration are not toxic "per se", but they are usually correlated to stuffy air and odours from bio-effluents. Following new findings, the limit of carbon dioxide in workplaces may be safely set to 2000ppm for comfort and 5000ppm for safety (EuropeanStandard 2009).

In addition, we have gotten used to warmer indoor temperatures in our buildings, which in turn produce lower air moisture levels.

However, the biggest challenge when attempting to assess the impact of too dry environments on us is that we do not have dedicated moisture sensors in our bodies (Pfluger et al. 2013). As we cannot directly perceive water vapour, the perception of "dry air" can occur as a side effect of increasing temperature, pollution (CO_2, odours) or dust levels, which makes it difficult to isolate and measure.

In addition, we are much more sensitive to the effect of *respiratory cooling*, where the nose acts as a regenerative heat and moisture exchanger (Pfluger et al. 2013). This means that the air we breathe in is effectively helping us to cool down by convection and evaporation inside the nose. Therefore, lower temperature and humidity levels will create a pleasant, cool and "fresh" sensation, despite constant "pollution" of the air. In contrast, higher temperatures and relative humidity can give an impression of "stuffy" air (Fang, Clausen, and Fanger 1998).

Besides, the moisture absorption/desorption by the materials is a *very slow process* that may take up to one year or more, which makes it more complex to simulate and test.

Since relative humidity is inversely related to temperature, a very easy way to improve the environment in a building could be to *lower the indoor temperature*. If you keep it down to 21°C instead of 25°C, you can obtain a 10% increase in the moisture level, which can significantly help improving comfort and health.

However, the combined need to balance out ventilation against moisture production and allow enough time for the building materials to react with ambient humidity, might still make it necessary to lower *air speed* and *ventilation rate* inside the building. That is why mechanically ventilated spaces tend to provide a dryer environment than those with natural ventilation, independently of the season and indoor temperature (Alsmo and Alsmo 2016). Mechanical systems generally focus on higher ventilation rates to give a sensation of "fresh air" and compensate for pollutants production. In the past, they tried to humidify the incoming air to get a moister environment, but this created sometimes problems with bacterial growth (legionella) inside the conditioning equipment.

More recently, it has gained more acceptance to monitor both *temperature, humidity* and CO_2 in office buildings, to improve indoor air quality perception and fight/reduce sick building syndrome (SBS) (Redlich, Sparer, and Cullen 1997). This can allow us to see more clearly their interactions and find a better balance between their competing strategies.

In order to better appreciate the correlation between ventilation rate, relative humidity and CO_2 concentration, we have carried out a building performance simulation (BPS) analysis of an office building with two different ventilation solutions, but with similar temperature curves. In this way, we tried to limit the variables of the systems so that we could appreciate the changes in relative humidity and CO2 concentration, depending mainly on the ventilation rate.

2. METHODS

The *case* analysed in this study is Baumschlager-Eberle 22/26, an *office building* in Lustenau (Austria) with automated natural ventilation, instead of a conventional mechanical ventilation system. It was chosen because of being a rather *extreme example of passive design optimization for cold climate* resulting in very stable indoor conditions throughout the year. The most interesting quality of the indoor environment in this building is actually the near-optimal range for relative humidity, which is within 35-60% even in the cold and intermediate seasons (Hugentobler et al. 2016). These values are in contrast with the much lower humidity levels (down to 10-30%) that are so common in energy efficient buildings, for similar outdoor conditions (Frei, Reichmuth, and Huber 2004; FGK 2015).

Within the building, we focused on the *second floor*, where the local office for the architectural firm Baumschlager-Eberle is located. Being an intermediate floor, it is not affected by border conditions just below the roof or right above the ground, limiting its interaction with the outdoor climate just through the façade. Then, we chose the office on the *north-west corner* because of being the most critical orientation for the cold season, with least amount of solar radiation during working hours.

The energy concept of the building is referred to as *"Concept 22/26"* (Eberle, Aicher, and Hueber 2016). Its objective is to keep the room temperatures throughout the year between 22 and 26°C, to keep a comfortable indoor environment while minimising the use of resources (materials, space, energy). In order to do so, the building envelope must have a very low heat transfer and a high thermal capacity. Moreover, the mechanical HVAC system has been replaced here by a *building automation system* that operates window opening for natural ventilation (fresh air and cooling), and lighting system for backup heating. Indoor temperature, relative humidity and CO_2 concentration are measured by sensors in every office, to ensure user comfort and energy efficiency (Junghans and Widerin 2017).

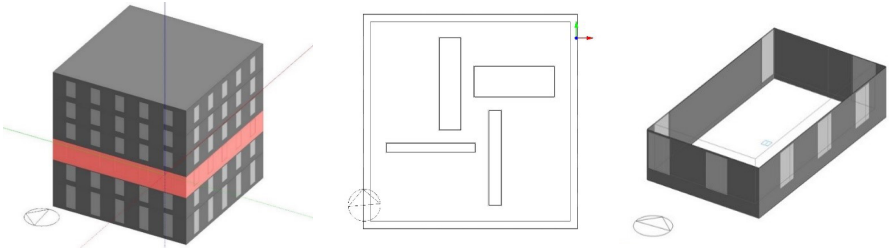

Figure 1. We modelled the whole building in DesignBuilder but focused on the North-west office on the second floor, for the simulations. Images from DesignBuilder

The extensive use of passive strategies include:

- compact shape, as a cube of around 24 x 24 x 24 m^3, to minimize heat loss
- exposed thermal mass indoors, to flatten temperature fluctuations
- high levels of insulation (average wall U-value=0.138)
- very airtight envelope (n50=0.51 on blower door test)
- window-to-wall ratio around 20%
- near-floor-height windows, for good daylight distribution
- triple glazing (U-value=0.7, SHGC-value=0.55)
- narrow vertical vents (VIP) by each window, for natural ventilation (cooling / fresh air)
- window position by inner surface of external walls, for shading
- high ceilings (3.4m) to allow for temperature and CO_2 stratification, thus limiting the need for natural ventilation in the heating season

The high-performance building envelope allows the use of the *internal gains* to cover most of the heating demand in the cold seasons. The automated natural ventilation is then limited to providing fresh air to meet indoor air quality requirements. A downside of having natural ventilation directly from the façade is the reduction in the occupancy density. In order to protect the users from draft, they have to seat at a distance from the windows. In this case, this is resolved by placing the circulation by the façade, instead of by the core.

Then the lighting system functions also as backup heating, which is possible thanks to the high-performance envelope, that minimizes heating needs. Yet, it had to be resolved with low efficiency luminaries (fluorescent tubes), in order to provide enough heat. This use of the lighting system as a backup heating is needed mainly in the heating season, when very low temperatures are expected in the early hours of the working day. Even though this could be considered as some sort of electric heating, it has the

wall	U-value (W/m2 K)	0.138
	Internal heat capacity (KJ/m2 K)	85.76
	Infiltration rate (ac/h)	0.037
window	U-value (W/m2 K)	0.7
	Solar transmittance factor (SHGC)	0.55

Table 1. Main characteristics of the building envelope (Junghans and Widerin 2017)

advantage of using an already existing system for two different functions (lighting and heating), instead of installing two different systems. The equipment considered for the internal gains corresponds to one computer and two screens per user.

We used Meteonorm (Remund 2008) to create the *typical meteorological year* (TMY) weather file for the BPS analysis in Lustenau, by interpolation from the nearest weather stations (latitude 47.25°N, longitude 9.39°E, altitude 405m). This file was obtained as the average from 10 years of temperature measurements (2000-2009) and 20 years of solar radiation (1991-2010).

With a mean temperature of the warmest month 19.6°C and 0.6°C for the coldest, it corresponds to a Köppen climate type *Cfb* (temperate, with warm summer and no dry season). Also, with 2980 HDD18 and 1277 CDD10, it gives an ASHRAE type *4A* (mixed and humid). In this temperate (borderline with cold) climate, only 8.6% of the hours fall inside the comfort zone, prior the application of any passive strategies for climate adaptation.

Next, we performed the *BPS analysis* of the building in EnergyPlus with DesignBuilder as graphical user interface (GUI). These tools were chosen because of their capability for simulating the behaviour of thermal mass and moisture

Occupancy density (people/m2)	0.05
Equipment (W/m2)	11.50
Lighting (W/m2)	5.0

Table 2. Internal gains (Junghans and Widerin 2017)

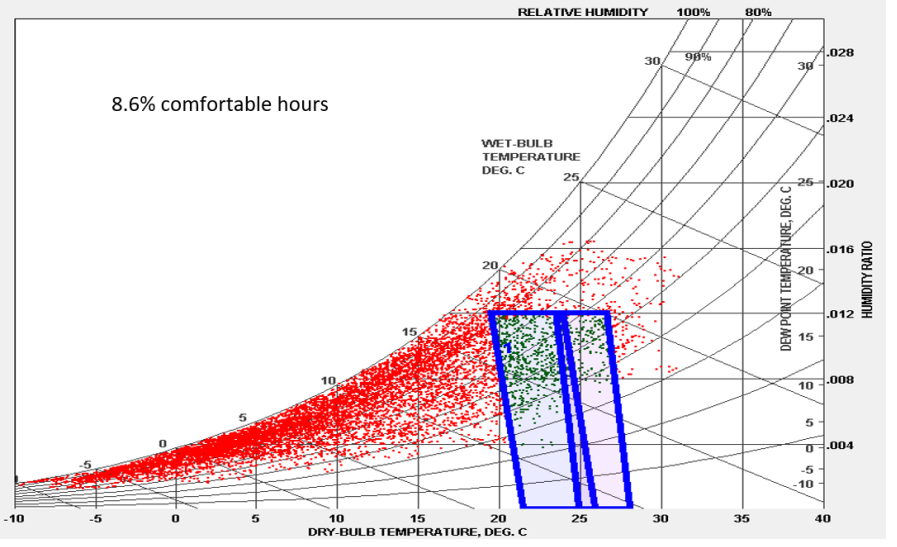

Figure 2. Psychrometric chart for the outdoor climate in Lustenau, Voralberg, Austria

buffering of the materials in use, as well as the possibility for extensive tailoring in the operation of building components and systems with EMS coding (energy management systems). (Crawley et al. 2001; Ellis, Torcellini, and Crawley 2008)
We considered *two cases* in our simulations, one with natural ventilation and one with mechanical ventilation, where we included a whole year warm up period with internal gains, to allow the full thermal and moisture load of the materials. Then, the moisture buffering properties of the different construction elements were introduced, so that we could use the EMPD (effective moisture penetration depth) calculation method for heat and mass transfer. This was necessary in order to produce a more accurate approximation to the indoor relative humidity. We chose the EMPD method over the more detailed HAMT, because it produces very close results to those from HAMT but with much shorter simulation time and fewer errors (Woods, Winkler, and Christensen 2013).
For the case with *natural ventilation*, we designed the vents to resemble the original ones in BE2226 as much as possible (narrow VIP panels on north side of each window, along their whole height, with an opening of 45° to the outside). These vents are controlled by the EMS to maintain optimal values of indoor air temperature and CO_2 concentration. Then, the lighting system responds to the need for adequate light levels (500 lux) in the occupied hours, acting as well as backup heating if needed (but off during the night, in consideration to the neighbours). This system is also controlled by EMS coding.
For the *mechanical ventilation*, we used a heating, ventilation and air conditioning system (HVAC) with heat recovery and without setback schedule (always on). We used the HVAC settings for best practice in Austria (DesignBuilder) with default horizontal vents auto created under the windows, to allow enough air circulation in such an airtight building. In reality, this could have been solved more neatly by having a balanced ventilation system, but this option was not available in the software. Also, it is common practice to introduce a setback schedule for the unoccupied hours, but then we obtained higher indoor temperatures, so we opted for keeping the system always on to obtain a temperature curve as similar as possible to the one from the natural ventilation case, for comparability.

3. RESULTS & DISCUSSION

As mentioned earlier, we wanted to study the results from the natural ventilation and automated controls, in contrast with a comparable HVAC system (similar thermal behaviour but higher ventilation rate).

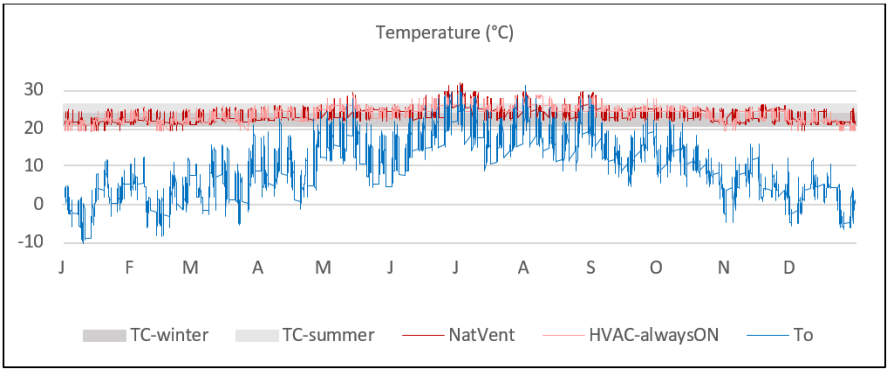

Figure 3. Annual air temperature comparison between automated natural ventilation and HVAC system

We tried to match the temperature curves from the two systems, so that we could see more clearly the effect of the ventilation rate on the relative humidity and CO_2 concentration. The automated natural ventilation allowed for a somewhat higher variability and was not so capable to control the summer peaks. At the same time, this system was also providing slightly higher winter temperatures. Still, they pose a reasonable match, given how different the two systems are, both in principle and operation.

We allowed for a whole year warm up period with internal gains (bi-annual simulation run period). Compared to the conventional annual simulation, only the relative humidity with natural ventilation offered a significant difference, for the first months before the summer. When compared with the relative humidity from the HVAC system, we can appreciate an important increase in the winter months, getting much closer to the recommended 40%. In the summer months, we get slightly more stable values with natural ventilation, though both systems give similar curves. It seems like the lower ventilation rate of the automated natural ventilation allows the moisture buffering properties of the materials to soften the curve and increase the average values for the relative humidity. In contrast, the HVAC system provides a better indoor air quality with respect to CO_2 concentration, keeping it within the optimal range. The natural ventilation system, by prioritising a low ventilation rate that activates the moisture buffering of the materials, allows the CO_2 concentration in the winter to raise to the higher limits of what is acceptable, yet it does not allow it to increase over 1200 ppm. In the summer, on the other hand, the levels of CO_2 are even lower with natural ventilation, though both of them produce values far below the limits.

In the graphical comparison between the two systems, it becomes apparent the difference in ventilation rates, where the HVAC system usually produces more than double the air changes per hour even in the summer.

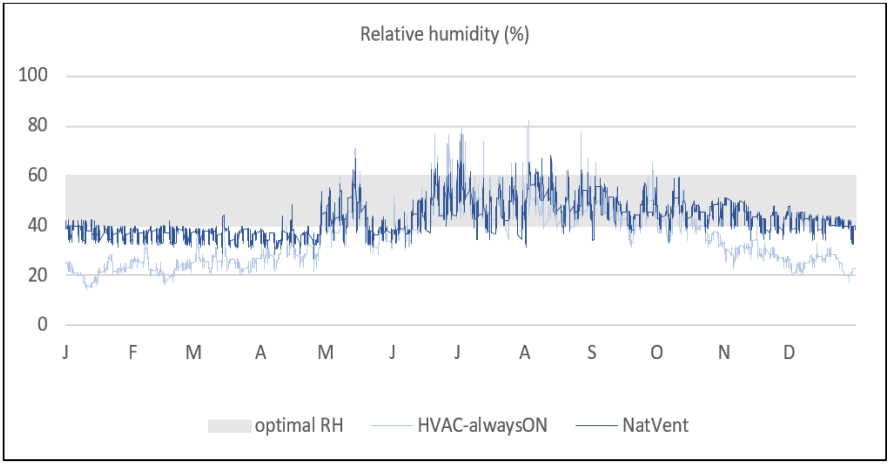

Figure 4. Relative humidity comparison from the two systems under study

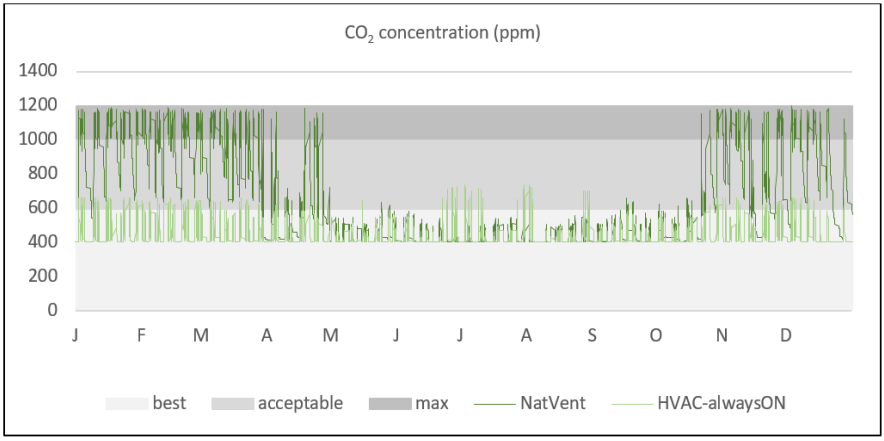

Figure 5. Air CO_2 concentration comparison for the natural and mechanical ventilation systems

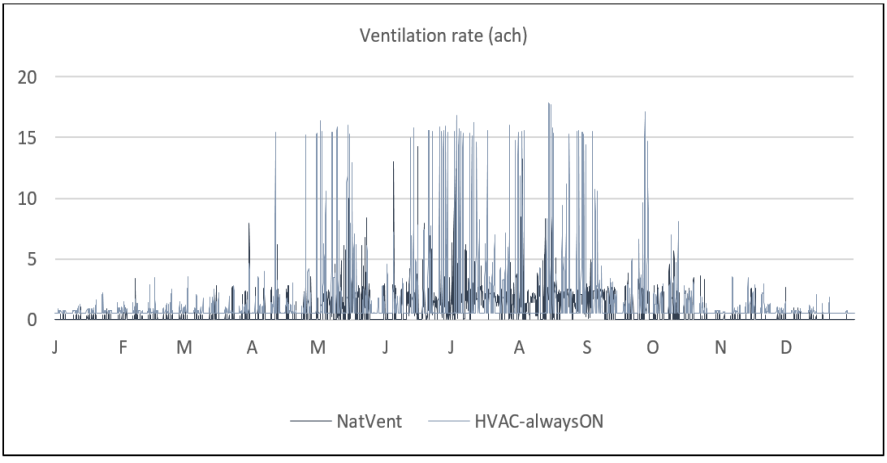

Figure 6. Comparison between ventilation rates for the natural and mechanical ventilation

Even though the annual curves for the air temperature are a reasonably close match, the differences in relative humidity result in a very different indoor climate for the natural ventilation and the HVAC system. While the first is mainly grouped between 30% and 60% relative humidity curves, most of the latter spreads between 15% and 55%. Still, they both have a very high number of hours inside the comfort zones for winter (left) and summer (right), though slightly higher for the natural ventilation (89h vs. 84h).

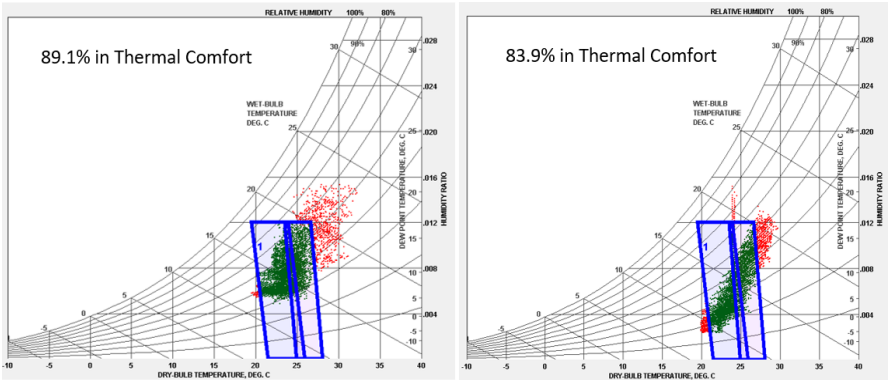

Figure 7. Psychrometric charts with the indoor climates created by the two systems. To the left is the natural ventilation, and the HVAC to the right. (Climate Consultant)

We can observe some overheating in the summer months, occurring for both systems, but more significant for the natural ventilation. This could be greatly reduced by adding solar shading to the windows, not present in the original building.

This paper studies the effect that the choice of ventilation system can have on the indoor relative humidity (RH) and CO_2 concentration. The aim was to provide similar thermal behaviour with different ventilation rates, so that the resulting RH and CO_2 could be compared. Then again, HVAC systems are rather complex and could be fine-tuned to provide a similar environment to that from the automated natural ventilation. The question in this exercise was not whether to use natural or mechanical ventilation, but to become aware of the need to adjust the ventilation rates to achieve a better balance between our competing needs for RH and CO_2. Traditionally, the main objective was to achieve low CO_2 concentrations, even at the expense of creating too dry environments. Nowadays though, we know more about the possible adverse effects of too low RH for our health in the long term (Pfluger et al. 2013), so we ought to consider both parameters when designing the ventilation system of our choice.

4. CONCLUSIONS

As a general recommendation, we should try to keep air humidity levels within the *optimal values of 40-60%* for human health in indoor spaces. This can be best achieved by balancing ventilation rate with moisture production, combined with moisture absorbing materials and lower indoor air temperature. An important step for finding this balance while ensuring a good indoor air quality is to monitor both RH, temperature and CO_2 concentration, so that we can adjust the ventilation rates according to our needs.

A revision of the current limits for CO_2 concentration indoors to include the latest findings from the research community would be of great help for finding a more reasonable balance between the competing interests for CO_2 and RH, for indoor air quality, health and comfort.

Then, further research is needed in order to update the Building Bioclimatic Chart and thermal comfort standards to include more reasonable limits of RH for health and comfort.

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PAPER #4.04

METHODOLOGY FOR THE CHARACTERIZATION OF BUILDING ENVELOPE: VIRGEN DEL CARMEN GROUP AT VALENCIA

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ABSTRACT

This communication is developed within the activities of the project funded by the Valencian Regional Government "The heritage consideration of the social Modern Movement's public housing. The Virgen del Carmen group, revitalization, and energetic updating (MOMOvivso). In this project, a Modern Movement heritage social housing research is proposed to progress in the preservation of this architecture. Accordingly, a methodological model is made and applied to Valencia's 614 housing estate, placed in the suburb zone named "El Cabañal". This residential complex was designed by the architects Fernando M. García-Ordóñez and Juan M. Dexeus Beatty, and it was built between 1958 and 1962. It was developed under the new social housing regulatory framework, which considers different configurations, as well as new constructive techniques, aimed at standardizing the quality of their systems and components and improving the dwelling's indoor comfort.
The present communication is a summary of the analysis process leading to ideation of a comprehensive methodology for the buildings envelope characterization which has been performed under the referred regulatory framework and applied to different types of buildings. For this purpose, three action lines have been proposed: analysis of documentation and contemporary regulations, an inspection report with the visits carried out, and the envelope non-destructive testing.

KEYWORDS

Constructive analysis; characterization; building envelope; social housing; the 1960s.

1. INTRODUCTION

1.1. Context

The Modern Movement for social housing is still considered one of the most important topics for contemporary architecture. The 20th century was the collective housing's intensive construction biggest period in Spain and Europe. Currently, the modern dwelling is consolidated as an important built heritage in the contemporary city. The analysis of each specific case will be crucial for its future valorisation and conservation (García Vazquez, 2016).
The research project from which this work arises aims to enhance the value of the

social housing of the Modern Movement in the Valencian Community, updating its habitability conditions and improving its social functionality. All this needs to be transmitted by raising awareness in society and involving the supervisory institutions responsible for heritage protection in order to guarantee the results of transfer. The "MOMOvivso" project proposes a research work applied to this heritage housing estate. The analysis will delve into the study of the Virgen del Carmen group as a model for systematizing the degradation processes. These will be systematically analysed by defining the constructive elements and identifying their associated pathology to develop an intervention strategies catalogue, always associated with the conservation of their heritage values.

The main aim of this communication is to share a methodological research process on aspects relating to the constructional characterization of the envelopes and their performance. An objective data collection that allows conclusions to be drawn that facilitate decision-making by technicians in conservation, updating and refurbishment actions. The data collection campaigns will be carried out throughout 2022 and 2023 in accordance with the objectives of the aforementioned project.

1.2. Field of study

The Virgen del Carmen's 614 dwellings were one of the first works of the "Obra Sindical del Hogar y la Arquitectura" (OSH) in Valencia, they were built between 1958 and 1962. They are placed next to the "Cabañal" old village's cemetery, and the trainway that connects Valencia and Barcelona. The project designers´ architects were Fernando Martínez García-Ordóñez and Juan Maria Dexeus Beatty (CSIC 1963), and the construction managers were the architect Vicente Valls Abda (OSH) and Mauro Lleó Serret (National Housing Institute, INV by its Spanish acronym). This new housing estate was placed in the "El Cabañal" area, configured by the old fishing settlement. It was the unique intervention made within the Flood Plan after the double Turia river flood, which flooded a large part of the city and left a large part of the population without housing and other facilities (Martínez-Marcos 2010).

The organizational structure used in the group design is unrelated to the near housing environment. Large urban open spaces and open edifications were built. For buildings, two types were designed: linear buildings of 4-5 floors, with a reinforced concrete outdoor seen structure, and two dwellings per stair landing. Furthermore, 2-5 floors towers, with bricks bearing walls, and three dwellings per stair landing (Fig. 1). Thus, housings had cross ventilation and an adequate geographical orientation to guarantee certain passive measures to generate indoor comfort (Jordá-Such 2009). Dwellings have a minimum extension, for 2, 3, or 4 bedrooms. A strong Central European functionalism connection is evidenced within its design, it is expressed in the use of both urbanistic and architectural criteria (Palomares-Figueres and Jordá-Such 2010). Independence between vehicles and pedestrian flow, construction of green and living areas between parallel buildings, façades shaped by large openings or terraces modulation, standardization and prefabrication of constructive systems and installations, flat roofs, and not ornamental finishes (Fig. 2).

The constructive systems applied, were the techniques reported by the OSH with the aim to get standardized and economically controlled constructive processes. These included some small products that were being produced in a huge volume by the national industry, so it allowed an industrial process without important economic investment. The whole group was partially refurbished in the 1980s, and more widely in the 1990s: structural aspects, roof accessibility, and façade lining were included.

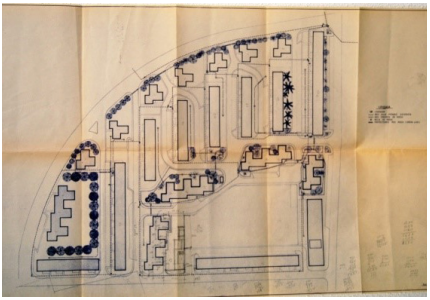

Figure 1. Location plan. Original Project (1958)). Source: (García-Ordoñez and Dexeus-Beatty 1958)

Figure 2. Construction works finish image. Source: (CSIC 1963)

1.3. Historical and regulatory framework

The Spanish National Housing Institute "Instituto Nacional de la Vivienda" (INV) and the OSH were political tools created in 1939, they aimed to promote the construction of social housing in a nationally organized manner (Salgado-Torres 1964).
In a first period (1939-1954) both were influenced by the economic and social aftermath of the recent Spanish Civil War. This beginning was characterized by a severe economic recession as well as important difficulties for the construction industry. The economic resources shortage, the limited industrial capacity and an almost non-existent social-housing legislation did not allow reaching the INV and OSH's main objectives in the first fifteen years. In spite of this, some new technologies alternatives and non-conventional method necessities are raised by the INV and OSH in 1949 (Sambricio 2004). The intensive housing construction takes off in a second and prolific period, between 1954-1964, along which more than 200.000 dwellings were constructed in Spain. Several factors bring about this substantial change. The new economic model change stated in the 1950s came together with a rural exodus to the cities. Two lines of action were developed by the Spanish Government to deal with this situation: on one hand, new social housing was promoted, involving private companies in the development. On the other hand, a new social housing regulatory legislation was created in 1954 (Organización Sindical del Hogar 1964).
A new specific legal framework was created for this new social housing constructive model. It began with the "Ley de Viviendas de Renta Limitada" (Limited Income Housing law) (BOE-A-1954-10883 1954) and its later regulatory implementation. The previous laws ("Ley de Viviendas Protegidas", 1939; y "Ley de Viviendas Bonificables", 1944) were repealed by this new regulation. Two new social housing models appear in this law: "Viviendas de Renta Limitada" (Limited Incoming housing), and "Viviendas subvencionadas" (subsidized housing). Public bodies like OSH, the "Instituto Nacional de Colonización (INC)" (National Colonization Institute) and other specifics agencies, must collaborate with the INV in this issue. Soon after, in July 1955, the "Ordenanzas Técnicas y Normas Constructivas" (Technical Ordinances and Building Regulations) are passed (BOE-A-1955-10121 1955). The basis of the development of buildings and energy standards are set by these ordinances, that were not technologically innovative but which aimed an immediate economy of resources and minimum healthiness (Delgado-Orusco 2003).

2. SOURCE DOCUMENTATION

The bibliographic search developed in this work is based on three main lines of research: General bibliographic on the construction method of the period, papers and others more specific publications about the field of study, and finally, the technic documentation made by the architects for the construction works.

The research documentary team has found the followings project on this housing estate:

- 142-Housing Project. Virgen del Carmen Group. Phase 1. 1958
- 90-Housing Project and 232-housing and urban project. Virgen del Carmen Group. Phase 2. 1958
- Additional Foundations Project for phases 1 and 2. 1962. This modified project introduces a change over the two previous. It modifies the foundation structural system, of both the concrete and the buildings´ bearing walls (Fig. 3).
- Structural Repair Project of the Virgen del Carmen Group of Valencia. 1986. This project focuses on the repair of the external structure of the linear building. After identifying a concrete carbonation process, cleaning and protection were carried out over the affected areas.
- Refurbishment and Structural Repair Project, Virgen del Carmen Group. 1994. The reparation of the internal structure, affected by a concrete aluminous process, is the focus of this project. Water supply installation, sanitation system, a new façade lining, and metal louvres' restoration, are other items included in this project. Important structural reinforces were made by implementing new steel beams under the original slab, which needed a new ceiling, which reduces the clear height. New works to improve the accessibility and the healthiness of housing were included in the subsequent modified project. Thus, new building accesses, new waterproofing and new stairs to the roof were made.
- Urban Project Virgen del Carmen Group. 1994. In parallel with the building refurbishment, a deeply urban transformation is carried out. Renovation of urban infrastructure, new urban layouts, paving and a complete gardener project are included in this actuation.

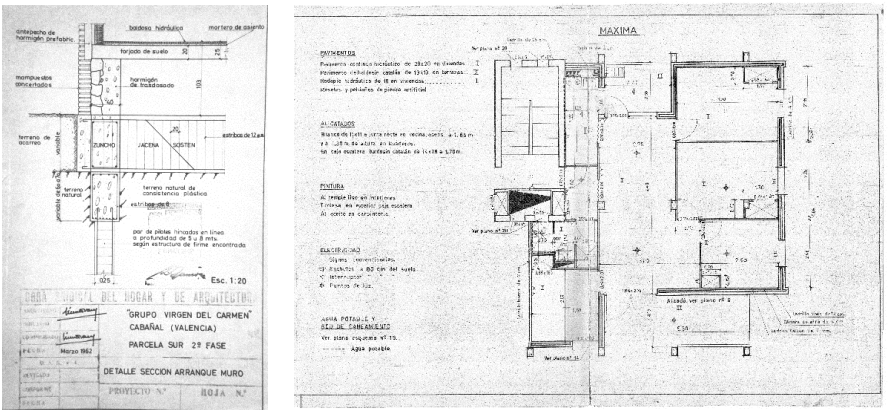

Figure 3. Constructive section and plan with finishing technical specifications, original Project. 1962

3. VISITS AND BUILDINGS PATHOLOGY REPORTS

The technical building ocular inspections and surveys are crucial to reach a correct diagnosis of the analysed items (Galán, 2020). It begins with some elements and field constructive system selection for the inspection. Several visits at different times in the year with different objectives have been scheduled to the housing estate by the research group. General visits, two specific-buildings visits in two different types of them (Fig. 4), or indoor dwelling visits, will be made.

Three inspection checklist models will be made in each stage of the process for the diagnosis work. These inspection checklists will be customized for each selected case of study.

- Information and previous data checklist. These checklists summarize and organize the documental data. This information is only checkable during the inspection stage.
- Data acquisition. Building pathology and damage survey and tests. The data collection aims is to define the building´s current state, the presence or absence of defects and/or injuries and to collect all the necessary data for the correct assessment to be made in the conclusions. In addition, it also pursues to define the real geometric characteristics and to complete the definition voids in previous stages. To this end, criteria of the "ITE" (Technical Buildings Inspection) handbook, and Spanish standards like UNE 41805-9 (Roofs), UNE 41805-10 (Envelopes) UNE 41805-11 (windows), will be followed.
- Diagnosis and conclusions. Within the carried out technical inspection, the most relevant problems and their causes can be concluded, as well as the possible improvement proposals.

4. NON-DESTRUCTIVE TEST

4.1.Thermography

Thermography is a non-destructive test that allows to examination of the infrared radiation of the electromagnetic spectrum. The main infrared radiation source is heat or thermal radiation. It is a useful tool to make an energetic diagnostic, as several constructive defects, thermal bridges, insulation defects, or hidden water leaks can be easily and efficiently detected. It provides useful information to make son- located reparations. The equipment specifications are shown in Figure 5.

Figure 5. Scheme of quantification methodology. Source: (Robiel Manzueta 2022)

Thermographic Camera		
Model	Flir T420bx	
Accuracy	< 0.045ºC	
Display Resolution	320 x 240 px Ultramax ® 640 x 480 px	
Thermohydrometer		
Model	Extech MO297	

Figure 5. Thermographic report equipment

4.2. Windows inspection. Glasses thickness

A glasses' thickness measurement equip model Bohle, Merlin Laser (Fig.6) will be used to assess the houses' windows. This tool includes a laser diode with highly accurate electronic measurement. Simple glass, laminated, bulletproof, fireproof, multi-laminated, or double glazing units can be measured by this device. Also, both glasses and air space between thickness can be measured.

This test provides not only thickness measurements, but also it allows for checking the thermal transmittance as well as the energy efficiency of the envelope, an important input when an energetic simulation is carried out.

4.3. Transmittance assessment

Three phases have been defined for the transmittance assessment:

- Theoretical approach with eCondensa2 software (Fig 8).
- In-situ testing with a portable device, model Testo 435 (Fig. 7). This test provides an indirect measure of the envelope transmittance values. For this purpose, a wireless external temperature probe takes the outdoor temperature values. While another internal probe with four sensors is collecting data, three of them are collecting the wall temperature data, and the last one catches the indoor temperature. All

Figure 6. Glass thickness measure using Bohle, Merlin Laser device

of this is to obtain the wall temperature transmittance.

- Comparison of data obtained with the required parameter by the construction time regulations. This allows us to know the constructive system obsolescence degree, and to consider possible improvement interventions.

Figure 7. Thermal transmittance measure device, model Testo 435

4.4. Public space thermal analysis.

The cities' growth, caused by economic and demographic factors, determines noticeable urban environment transformations. Microclimatic noticeable differences are generated in the cities by these transformations. From the environmental point of view, not only in a landscape sense but climatic, these differences influence the citizens, flora and wildlife environment comfort conditions (Li 2016). Therefore, the urban areas and the external buildings' environment analysis are crucial in the whole study of the housing estate. An aero-thermographic survey is proposed within the urban assessment methodology, and a drone flight over the Valencian studied urban area is envisaged. This flight aims are to determine how the urban morphology, the paving or the vegetation design can influence the Urban Heat Island (UHI) phenome behaviour (Enteria, Santamouris, and Eicker 2021).

Two study areas are analysed, as comparisons between two different urban typologies and their effects on the public spaces of thermal flows can be made. Each area is subdivided into several smaller sectors, so they are easier to be analysed during the flights (Fig.9). The late afternoon is the best time for the data collecting, as it is possible to obtain them after the whole day of sun radiation, avoiding the direct sunny radiation distortions.

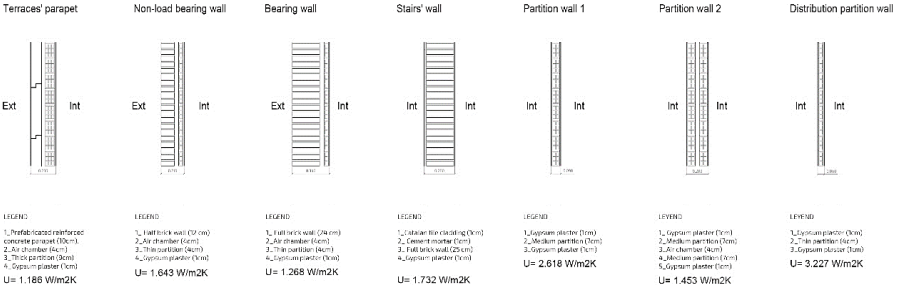

Figure 8. Thermal transmittance values obtained by the simulation software for the existing constructive system

The time flight in every area is 30 minutes approximately. The used drone is a DJI Matrice 210 (S/N: 0G0DE7R0P30017), equipped with an impact energy limiter (parachute), as is required by the urban flight legislation.

Figure 9. The two study areas for the aero-thermographic survey. Source: www.google.es/maps

5. PLANIMETRIC SURVEY AND FINAL DIAGNOSIS

A planimetric survey of plans, elevations and constructive sections will be made based on the previous data collected. The documental analysis, technical inspection and test results will be implemented for this purpose. These plans will represent four stages: initial project status, end-of-built status, current status and improvement modification status. The building pathology and historical modifications observed during the survey will be identified (Fig. 10). This allows to determine a case study graphic constructive evolution, from its beginning to nowadays. Therefore, a new refurbishment and improvement stage could be proposed.

Figure 10. Example of the planimetric survey made of the previous and the current status. Pathologies and modifications are shown. Linear building

6. CONCLUSIONS

In order to ensure social and cultural identity, the built heritage must be properly preserved and transmitted from one generation to the next. Holistic and cross-cutting planning is necessary for the study, treatment and protection of modern built heritage. Precise criteria for historical architecture and social protection are necessary, as well as several repairs and current quality construction and comfort standards updates. Therefore, a coordinated point of view is necessary. In addition, documentation of the analysis of each case study will be crucial to establish databases that will allow future enhancement and conservation approaches.

A planned methodology with technical inspections, surveys and NDT, all compatible with the habitability of the dwelling, is essential for the correct constructive diagnosis of these types. Consequently, the data collections have to be focused on both the constructive characterization and their healthy, thermal comfort and energetic implications.

Hence, a historical evolution timeline is required, and data cross with the originally designed and the final building, as well as to record the transformations suffered by the case study and how they have affected the current status. A progressive study that considers the different stages of the built material and its transformations: project status, construction phase, and current status. In this way, it will be possible to integrate an improvement proposal integrated in this evolutionary line with a continuity character.

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PAPER #4.05

BASALT FRP RODS ASSESSMENT AS AN ALTERNATIVE REINFORCEMENT FOR REINFORCED CONCRETE

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ABSTRACT

The consequences of global warming are becoming increasingly disastrous. Nowadays, our society has the responsibility of reducing the energy consumed in the building sector. In order to reduce this 40% of emissions, applying sustainable development criteria is fundamental throughout the life of materials in construction. More specifically, the use of steel corrugated bars or rods as reinforcement is the most widely used product in concrete reinforcement, and it is therefore important to reduce its climate impact. Basalt Fibre Reinforced Polymers (FRP) is a promising alternative to replace these steel reinforcements due to its high strength, low weight and high durability capabilities.
This work compares different rebars in sustainable terms in an initial phase. Four different materials are studied: steel, stainless steel, glass FRP and basalt FRP. To check and verify the different geometrical and mechanical properties, four rods of each material are tested in the laboratory. Finally, an analysis and comparison of various sustainability aspects is carried out. The aim of this research is to find out which reinforcing bar is the most sustainable and whether the basalt FRP rod is as optimal as it promises to be.

KEYWORDS

Basalt fiber reinforced polymer; BFRP; rods; concrete reinforcement; sustainable structures.

1. INTRODUCTION

The most common structural system in the world is reinforced and prestressed concrete, given its low cost per unit weight and formability (Koch et al. 2003). Corrosion is a natural process of deterioration of a metal due to its tendency to seek electrochemical equilibrium when in contact with its environment. Nowadays, it is one of the most common pathologies in structures, endangering their stability and generating high maintenance costs. Nevertheless, corrosion of the steel reinforcing material such as rods and strands leads to concrete cracking due to internal pressure caused by low-density iron oxide products (Val & Stewart 2003).
Epoxy-coating carbon steel and stainless-steel reinforcing products are common alternatives, but fiber-reinforced polymer (FRP) composites are becoming more frequently adopted as so-called "corrosion-resistant" concrete reinforced materials. The reasons are their excellent mechanical properties, low density and resistance to galvanic corrosion (Meier 2000). Numerous studies on FRP for structural reinforcement are reported every year, covering

topics such as environmental durability (Tanks, Sharp & Harris 2017) and material mechanics (Ricciardi et al. 2021). Considering the time scale of service of life for a concrete structure, long term durability and reliability of the reinforcing materials will be extremely important in this research.

The most commonly used FRPs in construction are carbon (CFRP), aramid (AFRP), glass (GFRP) and basalt (BFRP), although their use as reinforcement in concrete is limited by the lack of data, design guidelines, standards or codes for their use. Basalt fibres have been used as reinforcement in concrete bridge deck slabs because of their improved corrosion resistance (Tharmarajah et al. 2010) and in geopolymer concrete (Li & Xu 2009). Hybrid glass-basalt FRP laminates performed equally as well as GFRP laminates when tested for column confinement (De Luca et al. 2011). Basalt FRP strengthened beams demonstrated better performance in comparison to glass FRP when subjected to elevated temperatures (Tan & Zhou 2011).

The composition of these elements is defined by a matrix as a continuous element, with limited mechanical properties, which acts as a binder providing cohesion to the reinforcements. Two main groups can be distinguished: thermosets and thermoplastics. The most commonly used matrices are polyester resins, vinyl ester resins and epoxy resins. In addition to the matrix, there is also the reinforcement, which is generally the fibres, responsible for providing the composition with optimum mechanical performance. It is essential to establish a synergy between the two components. In addition, there is the interface, the junction zone between the different phases of the material, which can be more important than the nature of the matrix and the mechanical properties of the reinforcement fibre of the material (Poveda 2012).

Basalt is one of the most commonly occurring rock types and basalt fibres possess significantly lower global warming potential than steel and synthetic fibres. Basalt fibres, which are drawn from basalt rocks and come at a relatively low cost, have recently gained more attention as an alternative to glass fibres due to having superior mechanical properties (Ali, Mohamed & Benmokrane 2020).

The literature on the use of basalt fibres in structural engineering applications is limited. FRP rods have excellent mechanical properties, are lightweight and have good chemical and corrosion resistance (Hollaway & Teng 2008). Some of the advantages these materials offer are high tensile strength and stiffness to weight ratio, their ability to resist corrosion and chemical attack, controllable thermal expansion, and higher damping and electromagnetic neutrality than other materials. These characteristics can also provide greater safety and a longer life cycle (Almerich 2010).

Due to FRPs are unidirectional materials having high tensile strength in the longitudinal direction and weak strength in the transverse direction, the existing technology of anchoring steel tendons becomes inapplicable in the case of FRP tendons, and the utilization of such fibre tendons has been linked to successful anchor systems design (Karbhari 1998). The relatively low strength of the BFRP rod in the transverse direction and the absence of an optimal anchor adopted for prestressing such type of FRP tendon make developing the anchor the first step for further investigations. This issue arises in the experimental phase in this research. The understanding of its behaviour is still limited, and the investigation of this material and its performance in different types of structures for testing becomes a necessity.

2. METHODOLOGY

One of the purposes of this work is to study, employing the analysis and comparison of the tests, the mechanical behavior of four types of corrugated bars of different materials for concrete reinforcement: steel, stainless steel, glass fibers and basalt fibers. This study is structured in two parts: firstly, a geometrical and weight study is carried out, and later on, tensile tests.

	Rm (MPa)	Rp 0,2% (MPa)	A (%)	Standard
Steel	>500	>550	>7,5	UNE-EN 10080
Stainless steel	>660	>600	>12	BS 6744
Glass FRP	>420	-	>1,2	UNE 6892
Basalt FRP	>310	-	>2	ACI 440.3R-04

Table 1. Propierties of the assessed materials. (Rm: elastic limit; Rp: tensile strength; A: elongation at maximum load)

The choice of materials is due to the ease of obtaining samples and the relevance in terms of mechanical aspects and sustainability. The reason for choosing 4 samples of each is to avoid dispersion of results, being a diameter of 6mm due to the availability of materials.
The steel rods type B 500 SD were chosen because it is the most traditional and usual. The stainless-steel rods were chosen for their great corrosion advantages. Technically it is expected to result from high strengths because of the cold rolling process. In the case of GFRP and BFRP, they are both competing with each other and they are relatively new, positioning themselves as promising alternatives to common concrete reinforcements. The properties of the assessed materials can be seen in (Table 1).

2.1. Geometrical and weight study

This study is done under the same regulation for all samples. The objective is to know the geometry of each of the samples because this is fundamental to their mechanical and adherence behavior. These data are also very useful for tensile tests. Shall be taken into account: real diameter, real mass, equivalent cross-sectional area, height of transverse corrugations, corrugation spacing and corrugation slope (Table 2).

2.2. Tensile test

Bars are subjected to axial tensile stress to failure, under the considerations laid down by ACI 440.3R-04 B.2 "*Test method for longitudinal tensile properties of FRP rods*" (American Concrete Institute 2004).
As tensile stress is the main stress that rods are subjected to, these tests indicate their structural behavior. The data obtained are the ultimate load (Fr), the maximum load (Fm) and the force-deformation diagram. From the previous data and the data obtained from the geometric and weight study, the conventional elastic limit, the tensile strength and the elongation can be obtained by calculation. These data will be used to carry out the analysis and comparison of the different samples.

3. RESULTS

3.1. Geometrical and weight study

Analyzing the results of these tests, the weight of the samples is the factor that shows the greatest dispersion between the different materials (Table 2). Because FRP elements weigh considerably less, the difficulty of assembly is reduced, facilitating both manual and technological work, with an impact on sustainable practices.
Physical adherence as such, would not occur optimally in the case of FRP materials, since this is mainly due to the corrugations, and these only present a helix shape around the bar, which by a simple blow is detached from it, causing the physical adherence to be less than optimal. This is also accentuated by observing the separation between the corrugations (Fig. 1).

Rods	Nominal diameter (mm)	Real diameter (mm)	Real mass (Kg/m)	Cross sectional area (mm^2)	Corrugation height (mm)	Corrugation separations (mm)	Corrugation inclination (º)
A1	6	5,816	0,218	27,76	0,383	4,35	B_1=70º
A2	6	5,87	0,217	27,74	0,383	4,40	B_1=68º
A3	6	5,93	0,218	27,76	0,316	4,35	B_1=66º
A4	6	5,92	0,218	27,79	0,383	4,40	B_1=64º
I1	6	5,93	0,215	27,39	0,50	5,20	B_1=65º
I2	6	5,93	0,214	27,26	0,55	5,10	B_1=63º
I3	6	5,93	0,215	27,38	0,53	5,10	B_1=62º
I4	6	5,92	0,215	27,39	0,56	5,10	B_1=67º
V1	6	5,88	0,040	27,15	0,16	15,20	B_1=55º
V2	6	5,80	0,050	26,42	0,33	19,80	B_1=47º
V3	6	5,74	0,049	25,88	0,30	17,40	B_1=49º
V4	6	5,77	0,050	26,19	0,13	17,40	B_1=49º
B1	6	7,11	0,083	39,77	0,58	16,00	B_1=61º
B2	6	7,05	0,082	39,03	0,71	15,80	B_1=60º
B3	6	7,15	0,085	40,15	0,51	15,80	B_1=60º
B4	6	6,78	0,080	36,10	0,50	15,60	B_1=58º

Table 2. Geometrical and wight test results. (A: steel; I: stainless steel; V: GFRP; B: BFRP)

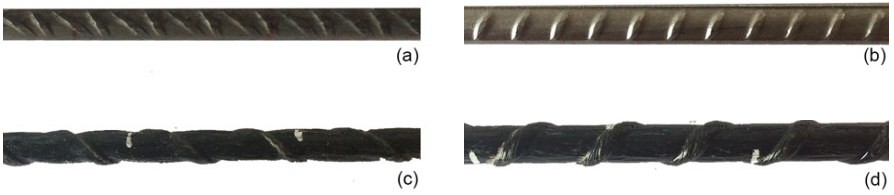

Figure 1. (a): steel rod; (b): stainless steel rod; (c): glass FRP rod; (d): basalt FRP rod

Rod	Distance (mm)	Rm (MPa)	Rp $_{0,2\%}$ (MPa)	A (%)
A1	483	661,38	569,88	25
A2	490	661,13	567,77	23,33
A3	498	668,94	578,89	23,33
A4	453	657,93	563,51	23,33
I1	505	958,01	941,94	30
I2	480	953,77	915,26	26,66
I3	487	961,28	950,32	25
I4	487	951,07	920,04	26,66

Table 3. Mechanical test results. (A: steel; I: stainless steel)

Rods	Rm (MPa)	$Rm_{,ck}$ (MPa)	$Rp_{0,2\%}$ (MPa)	Agt (%)	A (%)
A	662,22	649,68	570,01	11,97	23,74
I	956,03	944,30	931,89	8,36	27,08

Table 4. Average results and characteristic results of the tensile tests on steel and stainless-steel rods. (Rm: tensile strength; $Rm_{,ck}$: maximum characteristic tensile strength; $Rp_{0,2\%}$: conventional elastic limit; Agt: total elongation percentage maximum load; A: total elongation at break)

3.2. Tensile tests

- *Steel and stainless-steel rods*: all four samples had a typical development in each different material as can be seen in Table 3. Average results appear in Table 4.
- *GFRP rods*: One consideration to be taken into account when testing FRP corrugated bars is the protection of the ends with an anchorage system, as when they are gripped by the testing machine, due to their low transversal compression, the ends of the specimens will fail by crushing. For this reason, a precise design of the anchorages is necessary, whereby the anchorage length is crucial and depends on the adhesive behavior of the rebar.

Due to the lack of resources and instruments, the elaboration of the necessary anchorages to carry out the test according to ACI 440.3C-04 was not possible. As expected, in the first test (V4), the failure of the test is caused by the slipping of the rod, due to the crushing of the specimen by compression of the clamp. In order to prevent the ends of the specimens from being completely crushed by the grips and to avoid a loss of cross-section, which would cause the test machine to show a null result, these ends are worked by hammering so that they are as flat as possible, facilitating the gripping of the grips (Fig. 2a). In Table 5 appear the tensile tests results on glass FRP rods.

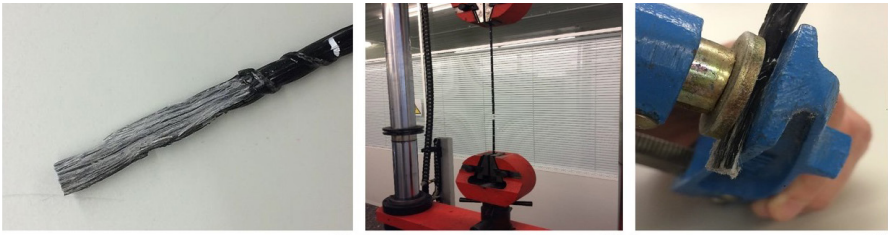

Figure 2. (a) Worked end of a GFRP rod; (b) GFRP rod tensile test; (c) Tightening of the BFRP rod

Rod	V1	V2	V3	V4
Distance (mm)	469,00	483,00	489,00	490,00
Rm (MPa)	336,27	333,83	396,83	395,57
$Rp_{0,2\%}$ (MPa)	-	-	-	-
A (%)	0	0	0	0

Table 5. Tensile tests results on glass FRP rods. (Rm: tensile strength; $Rm_{,ck}$: maximum characteristic tensile strength; $Rp_{0,2\%}$: conventional elastic limit; A: total elongation at break)

Since the tests have not been carried out under the conditions recommended by ACI 440.3R-04, to carry out the analysis and comparison of results in an accurate manner, the values of the mechanical properties, from external tests made under all the precise considerations, shall be added. (Table 6). The force-deformation curves are not added because they do not provide information on the resistant capacity.

- *BFRP rods*: The solution used to be able to carry out the tests without compression breakage at the ends of the rods and their subsequent slippage is similar to that of the GFRP tests, although in this case, in addition to crushing the ends, part of the corrugations is eliminated. To work the ends of these rods, in addition to the use of a mallet, a squeeze is used in order to acquire an optimal grip (Fig. 2c). Table 7 shows the results of tensile tests on basalt FRP rods. The force-deformation curves are not added because they do not provide information on the resistant capacity.
  As before, to ensure better accuracy in the analysis of the results and comparison, in order to follow the standards, a test by an external institution is used. (Table 8)

Analyzing the results, the behavior of steel and stainless-steel rods follows an elastic-plastic behavior with a yield step, obtaining values close to those commonly known. It should be noted that the mechanical strengths obtained in the stainless-steel tests reach higher values due to the cold-rolling manufacturing process. On the other hand, in the FRP corrugated bars tests, not all of them reach breakage due to the slippage they suffer in the jaws. But can be affirmed, thanks to other company tests, that these have a behavior typical of composite materials, generating an elastic-linear force-extension diagram, where an elastic phase

Cross-sectional Area (mm^2)	$Rm_{,ck}$ (MPa)	$Rp_{0,2\%}$ (MPa)	A (%)
31,67	896	-	1,94

Table 6. Average results and characteristics characteristic results of the tensile test on glass FRP rods. Source: (Owens Corning Infrastructure Solutions LLC 2019)

Rod	B1	B2	B3	B4
Distance (mm)	389,00	398,00	411,00	421,00
Rm (MPa)	266,53	268,25	329,26	418,28
$Rp_{0,2\%}$ (MPa)	-	-	-	-
A (%)	0	0	0	0

Table 7. Tensile tests results on basalt FRP rods. (Rm: tensile strength; $Rm_{,ck}$: maximum characteristic tensile strength; $Rp_{0,2\%}$: conventional elastic limit; A: total elongation at break)

Cross-sectional Area (mm^2)	$Rm_{,ck}$ (MPa)	$Rp_{0,2\%}$ (MPa)	A (%)
41,176	907,7	-	2,148

Table 8. Average results and characteristics characteristic results of the tensile test on basalt FRP rods. Source: (Riga Technical University 2019)

is observed without having a plastic phase, determining the fragile behavior of the FRP materials. This behavior is quite the opposite of what is looking for: large deformations that generate warning capacity.
And although the tests themselves cannot be considered valid, the results obtained show high resistances for the little deformation suffered. These strengths are mainly due to its fiber structure, which allows it to absorb high tensile stresses in a direction parallel to the fiber arrangement. What is remarkable about these materials are the high mechanical strengths, values of around 900 MPa, shown by the external tests of these FRP.
The fact that the FRP rods suffer a compressive rupture due to the action of the jaws may seem to affect their compressive strength inside the concrete, but in reality, this does not determine their resistance to these stresses, since inside the concrete the compression will be uniform and distributed along the length of the rod, so it will not be subjected to such high forces.
As it has been already exposed, one of the most remarkable aspects is the high tensile strengths of stainless steel, however, the most optimal proposal in terms of weight-strength ratio is the one composed of FRP, obtaining very similar ratios in both glass fiber and basalt fiber rods.

4. SUSTAINABILITY

Sustainability in architecture addresses the negative environmental and social impacts of buildings by utilizing design methods, materials, energy and development spaces that aren't detrimental to the surrounding ecosystem or communities.
A sustainability study requires a life cycle analysis of each of the different materials. The comparison in terms of sustainability criteria between the different ones is represented in the following lines.
Both traditional steel and stainless steel have on a large-scale favorable aspects to be recycled – unless they are rusted - thanks to their capacity to maintain their properties, but the processes that make this possible entail a high energy consumption, which on the other hand are lower than those produced if recycling were not carried out. On the other hand, FRP materials do not have developed techniques that allow for optimal recycling, which is compounded by the high energy consumption needed to produce the raw materials, but this can be compensated by the great durability of these materials as concrete reinforcement. In addition, the resins used in the matrix are not sustainable materials, at the moment.
Furthermore, one of the phases of the life cycle that most interferes with the sustainable development of these materials is the transport of these materials. The underdevelopment of the FRP reinforcement industry means that the origin of these products is unlikely to be local. In addition to their inability to be recycled optimally leads to an increase in the transport of the materials.
The low weight of FRP corrugated products together with the weight/strength ratios compared to steel and stainless-steel means that the transport of these products is reduced, as equal strength means a significant quantitative difference in weight (Table 9).

	Steel	Stainless Steel	GFRP	BFRP
Weigh/Strength	$3{,}28 \cdot 10^{-4}$	$2{,}24 \cdot 10^{-4}$	$6{,}64 \cdot 10^{-5}$	$8{,}39 \cdot 10^{-5}$

Table 9. Weigh/strength rods relation

Compared with the prices of corrugated FRP, it is shown that these materials have the same strength and durability, but have a lower selling price, which is boosted by their weight/strength ratio, which means that the cost in other phases of the project is lower. Even so, it should be noted that the little technological development to date of this type of materials in structural functions means that other processes such as recycling or production entail other types of costs. However, the sustainable potential of these materials opens up numerous avenues for research and development.

It is fair to mention the durability of non-metallic materials in terms of non-corrosion, that is probably the strongest point. Indeed, this is not the case for stainless steel rods, but the price of these rebars is much higher for the same mechanical resistance. For that reason, for the same price we get more durability in terms of non-corrosion and strength on the basalt fibre reinforced polymer side.

Talking about energy content and gas emissions, it is difficult to compare the tangible amount of environmental impact as all rods exercise unsustainable practices during their manufacture in one way or another. The high energy consumption of this industry and the emissions and gas emissions into the atmosphere are more than evident.

5. CONCLUSIONS

Traditional materials, steel and stainless steel have high energy consumption and high waste production. In contrast, the strength of FRP materials lies in their development potential, which to date is only a small part of what is expected. Their inherent characteristics such as high strength, low weight and high durability capabilities open up a new path towards structures with higher mechanical and environmental resistance using less material than traditional structures, and also at lower economic costs. However, this will require more research and studies to encourage innovation in all processes related to these materials, such as production, recycling and safety. Other improvement key areas that nowadays are not working well are the poor adherence of the corrugations, brittle fracture without deformation described by an elastic-linear diagram without a plastic phase, showing a brittle behavior without deformations at break and lastly, transverse compression fracture due to some anchorages.

It can be concluded that low weights of FRP materials linked to their high strengths offer options for the development of the design and sustainable character of structures, taking into account their difficulty of recycling in favor of improved durability. FRP reinforcement elements are still at a premature stage of development, in the absence of standards, design guidelines and research studies on their behavior in different environments, to obtain sufficient data to establish a fully reliable basis for their use as concrete reinforcement. It can be argued that there is no ideal sustainable rod that meets all the requirements above the rest. In any case, it should be as close as possible to these requirements, balancing all the sustainable factors together and taking into consideration the promising development of non-metallic alternatives.

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PAPER #4.06

DESIGN AND SIMULATION OF AN ACTIVELY CONTROLLED BUILDING UNIT

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ABSTRACT

Conflagrations often lead to catastrophic phenomena in several countries across the globe during the summer period. Such phenomena advocate for multidisciplinary research activities including on- and off-site investigations of data-collection and evaluation as well as event-based virtual scenarios and action solutions respectively. In this framework, a temporary building unit is proposed to host single researchers in remote environments. The unit consists of a lightweight structure that can be easily erected and actively controlled. The unit is supported on four diagonals anchored to the ground and it has a circular horizontal and an elliptical vertical section. The core consists of a glass-fiber polymer (GFRP) cone base at its lower level, vertically positioned GFRP bending-active strips and a GFRP cone at its upper level. The cones are vertically connected through tendons that are activated by linear motion actuators. The structure consists of a double layer gridshell of GFRP bending-active rods and a semitransparent ETFE membrane with embedded thin-film CIGS photovoltaics. Sensors on the membrane transfer continuously the external wind pressure to a control system for the adjustment of the spatial shape of the unit through the tendons. The paper displays the design of the unit in its components, and emphasizes on its adaptivity features with regard to the structural deformability in parametric associative design logic. The methodology followed serves as a basis for further iterative analyses with regard to the form optimization of the structural elements, the system's load-deformation and dynamic behavior.

KEYWORDS

Temporary building unit; bending-active members; gridshell envelope structures; active control; adaptive structures.

1. INTRODUCTION

In remote areas with limited recourses supply and hostile external environmental conditions, living conditions need to be supported by an architecture of temporary, minimum spaces that enable well-being and safety. In this context, examples of effectively implemented research units constitute polar stations in the Antarctic, like the Neumayer III supported on liftable columns in the deep ice surface, the Princess Elisabeth founded on bedrock and considered as zero-emissions building unit, and the Halley VI composed of individual raised semi-autonomous prefabricated modules (British Antarctic Survey, 2005; Hartwig et al., 2006; Sanz Rodrigo et al., 2007). Technology may further support the development of related building units in achieving sustainability of the natural and

built environment through an architecture that features easy transportation, assembly and disassembly, modularity, lightweight, flexibility and adaptiveness to changing functional, external environmental and loading conditions. In particular, adaptiveness describes the process with which an organism gains larger identification to its environment. This may be achieved through modifications in its structure, or its function through behavioral, anatomical, or physiological processes that favor the possibilities of its survival.

In the past decades, features of adaptiveness through a high degree of flexibility played a vital role in a number of architectural experimentations aiming at an improved and sustainable future of the built environment. These aims were meant achievable by respective technological advances, primary enabling industrialization and mass production. The Dymaxion House by Buckminster Fuller in 1945 dealt with a mobile assembled housing unit that could be located in any area. Lightweight industrialized components were used that could be easily assembled on-site (Kronenburg, 2007). The mobile housing unit by Reyner Banham in 1965, named as 'Transportable Standard-of-Living Package', featured adaptiveness based on its capability to be included within different spatial conditions (Spiller, 2006). In addition, the usage of electric panels on the unit's envelope served the provision of energy required for its autonomous operation for independence from other infrastructures. Conceptual explorations by Archigram were interrelated by a number of mechanically, electrically and cybernetically controlled systems (Cook, 1999). The designs consisted of a primary skeleton structure that also carried the mechanical services, and expendable components, i.e., accommodation capsules conceived as industrial design objects, which could be clipped-on, or plugged-in, removed, or replaced from the main structure. In particular, the Living Pods, a concept by David Greene in 1966, dealt with the idea of increased mobility, adaptiveness enabled through flexibility of the interior open spaces and functionality in terms of housing. Although this capsule could be employed within a plug-in urban structure, or could be positioned in the open landscape, it was still envisioned to be a mobile 'house'. The project design could also be related to the Plug-in City project, a concept by Peter Cook in 1964, that dealt with the idea of prefabricated homes assembled into dense fluctuating urban patterns.

Similar concepts have been developed in the frame of a 'micro architecture' vision of buildings that are lightweight, mobile and ecological for the future (Horden, 2008). The structures served issues of mobility and adaptiveness to extreme environments. Through use of lightweight, high strength materials, low self-weight was achieved, as well as easy transportability. Examples like the Ski Haus, Peak Lab 02, PolarLAb, m_Igloo and the Micro Compact Home could be transported by helicopters, or even cars. The envelope structure of aluminum sheets and light-foam insulation could sustain extreme environmental conditions of temperatures, strong winds and snowfalls that prevail in the Alps. Furthermore, the House R-129 prototype by Werner Sobek in 2012, features adaptation to the internal functions and the external environment (Phocas, 2017). In the interior space, a central non-stationary module houses sanitary and kitchen installations. Around this central module various space-cells used for working and sleeping can be arranged. The unit's envelope consists of a plastic material of extreme lightweight and transparency. The structural frame is fabricated from carbon box sections. The skin has an electrochromatic foil, which prevents radiation of heat into the interior in summer and to the exterior in winter. The external surface of the envelope also carries solar cells applied by means of vapor deposition, which reduce light transmission by only 20 %, while supplying a large part of the electrical energy demand of the building.

From an engineering perspective, adaptiveness was initially favored through building mass reduction and high strength materials of relatively low elastic modulus. In this framework, Frei Otto translated natural solutions into architecture (Otto and Rasch, 2001; Finsterwalder, 2011); the coherent effects of bionics were analyzed and applied by technological means. Different physical models were used for the form-finding, such as soap bubbles and spring linkages. Aim was to provide minimum surfaces in tension and optimized shapes in compression. Part of the work applied was the development of pneumatic structures and shapes inspired by the behavior of physical pneumatic systems, such as bubbles and drops. Such physical structures have the particularity that their spherical shape is derived through the tractive forces that act on the wall surface.

An actual turn towards the realization of adaptive structures was achieved through transfer of active structural control concepts, at first place developed in aerospace, mechanical and structural engineering (Yao, 1972). At the same time, architecture was postulated as non-static, of having the ability to adapt in time changes through systems with embedded actively controlled kinetic mechanisms (Zuk and Clark, 1970). Active control concepts proposed were based on the 'Variable Controlled Deformation' method through application of stressing tendons within the structure. Along these lines, the definition of active structures was introduced for systems that involve active and static members, in order to support conventional design loads and extraordinary dynamic loads (Soong and Manolis, 1987). Research activities referred to active control systems of closed, open and closed-open loop, based on theoretical and experimental small-scale models (Yang and Soong, 1988). In all cases, adaptive structures require a feedback control system that includes sensors, as well as actuators for implementing the reconfigurations in response to the external input.

Reflecting on the development of adaptive building units, the current paper displays the design of an actively controlled unit and its components, and emphasizes on its adaptiveness under wind pressures (Ioannidou, 2022). The unit is proposed to temporarily host researchers in remote environments with high conflagration history and future risk. The next section presents the unit's architectural development. The structure and the control components are exemplified in Section 3. Finally, the structural deformability investigated in parametric associative design logic, is presented in Section 4. The conclusions of the paper comprise Section 5.

2. UNIT DESIGN

The building unit that serves temporary accommodation of individual researchers, consists of a lightweight structure that can be easily erected and actively controlled (Fig. 1). The unit is supported on four diagonals anchored to the ground and it has a circular horizontal mid-plane, and an elliptical vertical mid-plane section with maximum diameter of 7.70 m. The pin-joint connections of the diagonals enable the erection of the unit at different topographies.

An open core area in the middle with diameter of 1.50 m hosts the vertical architectural elements and technical supporting systems including convector devices for heating and cooling support of the spaces and a water tank, while all functional spaces are arranged radially on the periphery between the core and the outer envelope (Fig. 2, 3). The entrance to the spaces succeeds through a circumferential corridor zone that acts as intermediate space with 60 cm width, between the core and the individual spaces of the unit. A metal escalator within the core, may be deployed to connect the ground with the main floor level of the unit. The effective storey height amounts to 2.10 m. The functional spaces are compartmentalized with integrated furniture that unfolds out of

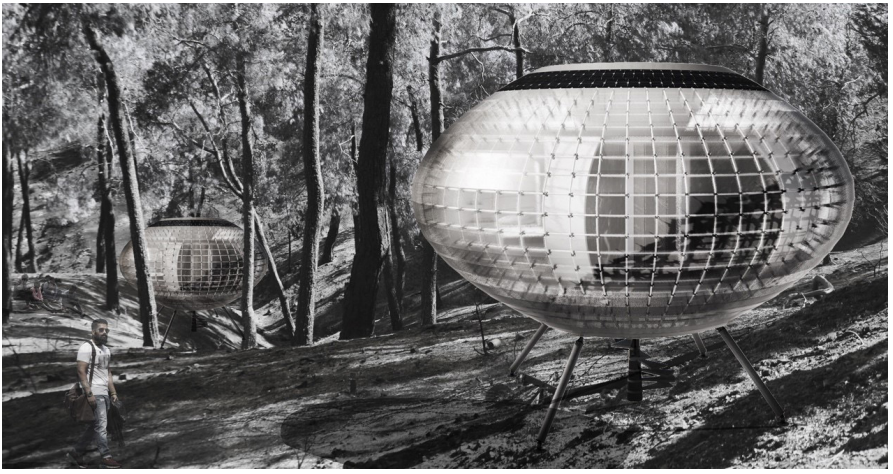

Figure 1. Building unit perspective in forest landscape

the radial inner walls, and covers the basic residential and remotely working needs of the user during the temporary stay on-site. Likewise, the bathroom and the kitchen are conceived as prefabricated elements with integrated appliances. Electricity is provided by thin-film CIGS photovoltaics embedded in the membrane envelope, while natural ventilation of the spaces is possible through horizontal openings in the floor and the roof of the unit.

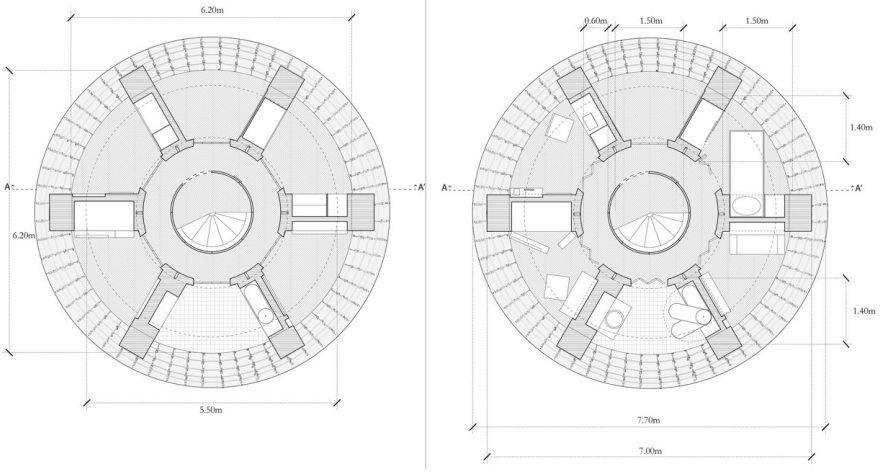

Figure 2. Floor plans in deployed and non-deployed condition of architectural elements

3. STRUCTURE

The primary structure of the building unit consists of the core and a double layer gridshell of bending-active rods arranged on the periphery of the spherical unit (Fig. 3). The gridshell supports an ETFE membrane with embedded thin-film CIGS photovoltaics. The structure is supported on four diagonals of hollow circular section of 150/20 mm dimensions that are pin connected at both ends and anchored to the ground to prevent uplift of the unit under wind pressure. The core consists of interconnected GFRP lamellas at the lower and upper level that form a conus shape, and GFRP strips along the height in between. The GFRP elements have a thickness of 12 mm. The lower and upper edges of the conus shaped lamellas support the gridshell over pin connections and are perimetrically interconnected through tendons, i.e., vertical cables with variable length. The lower tendons' connection succeeds over a pulley that is controlled in its length by a rotating actuator, i.e., stepper motor, arranged in parallel to the pulley.

The bending-active rods of the gridshell consist of GFRP hollow circular sections of 25/2.0 mm dimensions and are pin connected at the crossing points over double steel connection elements. Every third knot of the gridshell is provided with an electromagnetic brake to ensure moment-resisting connectivity of the layers during operation of the unit. The brakes are only released during transformations of the unit under wind pressure.

The horizontal floor and roof grids of IPE140 steel sections cantilever from the core, and are covered on both sides with polymere plates. The inner walls of 16 cm thickness are constructed as sandwich elements, with double heat insulation and outer polymere covering plates. They are provided with linear slots so that the tendons may have respective inclinations during transformations of the unit. The ETFE membrane is point fixed on the knots of the gridshell through strut elements and metal connectors.

Figure 3. Building unit's elements

4. ASSOCIATIVE PARAMETRIC DESIGN

The parametric design simulation aims at investigating the adaptive behavior of the structure under horizontal wind pressures. At the same time, the proposed process suggests the development of an associative parametric design approach that can easily move back-and-forward from the simulation outcomes to the initial parametric design intentions, providing an iterative feedback loop mechanism in the early design phase. The integration of parametric design and physics-based simulation into an iterative design approach is considered as an important element in the form-finding process, since the special nature of the structure, which consists of bending active rods in two directions, does not allow an accurate understanding of its adaptive behavior at the digital parametric design level only. The results obtained combine design intentions and corresponding structural performance verifications, offering first insight in the preliminary design of the structural system. Within the current research framework, the Rhino/Grasshopper parametric design environment and the live physics engine software Kangaroo are used based on a visual programming language (plug-in for Grasshopper parametric environment in Rhino 3D NURBS modelling software).

At first level, data on the direction and intensity of the wind in the specific area of study has been collected. The aim is to find the limits of wind velocity exercised on the surface of the proposed gridshell, in order to adjust its shape accordingly and at the same time, determine the design configuration limits that allow habitation of the interior. For this purpose, maximum and minimum wind velocity values have been collected together with their directions, which feed the parametric design process but also determine the limits of the adjustment envelope of the structure. In a case study of the mountainous Limassol region in Cyprus that suffered severe conflagrations in July 2021, the average maximum wind velocity for each month does not exceed the value of 15 km/h. This information is used as input data in the parametric control phase (Fig. 4), whereas the wind velocity, V [m/s], is related to the wind pressure, P [N/m^2], acting on the building unit as follows:

$$P = 0.613V^2$$

The visual programming process that includes geometric development and parametric control as well as physics-based simulation are formulated into two basic

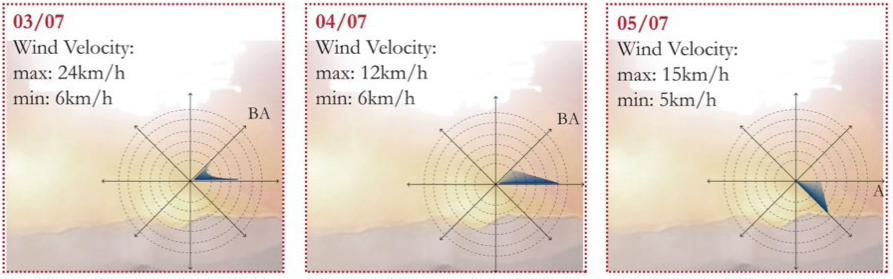

Table 8. Average results and characteristics characteristic results of the tensile test on basalt FRP rods. Source: (Riga Technical University 2019)

distinct steps. The geometrical classification as well as the physical behavior simulation are conducted simultaneously, in order to achieve an optimum adaptive control of the overall shell system. Therefore, the parametric classification of the geometry considers the physical properties of the materials applied. The parametric simulation focuses on the primary gridshell structure, whereas the inner walls and furniture are considered as static elements in the digital environment of Rhino software.

In the first step, that of geometrical development and control, the gridshell is modeled based on three concentric circles with diversifications in Z position. The lower circle, with radius 1.65 m, is fixed and is anchored at the bottom in contact with the four supporting legs of the structure. The middle circle, with radius 3.86 m, is 2.2 m higher that the first one. The third circle is raised 2.05 m above the second one with initial radius of 1.65 m. The parametric development of the latter circle allows control in all directions and angles of rotation (X-Y-Z rotation transformations), in order to response to all scenarios under investigation, but also, to allow transformation reaction of the gridshell in all wind directions. The height and radius of differentiated circles are used to develop a final surface, which is then converted to a mesh and consecutively to a quad remesh system with specific quad remesh settings. In short, the main inputs refer to target quad count with value 360 and include no symmetry in X-Y-Z directions. This allows flexibility with regard to the shape of the quad mesh, producing regular quad faces in all cases of change of the original shape. The final quad mesh includes 351 faces representing respective cells of the gridshell structure. The first step leads to the development of a two-sided conical elliptical shape that is used as the starting point for physics-based simulation and in turn, allows the form-finding of the gridshell under development.

In the second step of the proposed algorithm, the edges of the provided quad mesh are classified as the bending-active rods of GFRP, comprising the overall gridshell in two directions. The bending-active rods are parametrically associated with the rotation deformations that occur in the parametric control step of the algorithmic process. Also, they are physically encoded based on Goals of Kangaroo2 physics-based engine (in previous version of Kangaroo Goals, called Forces). The Goals include Angle (previously Bending), Load, Length (previously Spring), On Curve and Anchor.

The GFRP bending-active rods of the gridshell are firstly classified in two directions by using the WarpWeft component that separates the edges of a mesh into two lists according to the Warp and Weft direction. In each direction and through a parametric procedure that classifies individual continuous edges, this geometrical info is used as input in the Angle component for bending behavior simulation. The Goal 'Angle' involves Line A and Line B but also Rest Angle and Strength inputs. The main goal is to maintain the Rest Length value, regardless of the angle ratio formed between continuous lines, a goal that refers to active bending behavior. In addition, the Goal 'Length' is applied, to maintain the original length of the edges, a behavior which refers to the so-called spring behavior on the basis of Hooke's Law of elastic stress-strain behavior (Ahlquist and Menges, 2011). In this case, the inputs of the initial lengths of the edges as well as the final ones remain the same, which achieves the simulation of the sections as rigid elements without changing their length.

Additionally, the Goal 'Load' is applied as part of the Kangaroo simulation process. Specifically, Force Vectors that have a vertical direction in relation to the surface of the grid and start from each vertex of the quad mesh are inserted as input to the specific component after mesh deconstruction via the Deconstruct Mesh parametric

component. Then, the points of the quad mesh in the lower circle are anchored via the 'Anchor' Goal, keeping the bottom part of the gridshell at a fixed position. Finally, group of points at the periphery of the gridshell, four in each quarter of the structure and one in the upper circle, which is subject to continuous deformation, are formulated. The goal is to use the different group of points as input in combination with corresponding curves in the OnCurve command, in order to keep points on given curves based on each distortion of the overall gridshell. Final step in physics-based behavior encoding is the introduction of all Goals in the Kangaroo Solver component as a list of input data, allowing the calculation and the execution of the overall physical behavior (Fig. 5).

The investigation and control of the physical behavior of the overall gridshell in three dimensions is achieved in the parametric environment of Grasshopper through the parallel and dynamic alternation of the associative parametric geometrical components (i.e., specifically the transformation of the upper circle) and the form-finding process of Kangaroo, representing the kinematically active position of the entire system. For each respective alteration, the upper circle is rotated based on the direction of the wind, allowing bending of the respective edges in two directions but also pulling of the shell, in order to capture the deformation of shape. In order to evaluate the results obtained and to verify the accuracy of the physics-based behavior against the initial gridshell geometry, a comparison between the initial and the final form-found surface is conducted, showing similar value results. This indicates that the structure after its deformation does not change in terms of the length of its elements but only in terms of its bending deformation preserving its initial surface area. Note that a longitudinal deformation of the module induces also a corresponding transverse deformation of the module. Figure 6 shows a series of bending alternations of the initial gridshell according to horizontal wind velocities. As it can be observed, there is a proportional distortion of the gridshell that is triggered by rotational transformation of the upper circle. When the horizontal wind pressure reaches 15 km/h the gridshell is deformed in its maximum state and the expedient indoor living space reaches a minimum height of 1.90 m.

Figure 5. The result of associative parametric design and an instance of physics-based bending behavior simulation of the gridshell

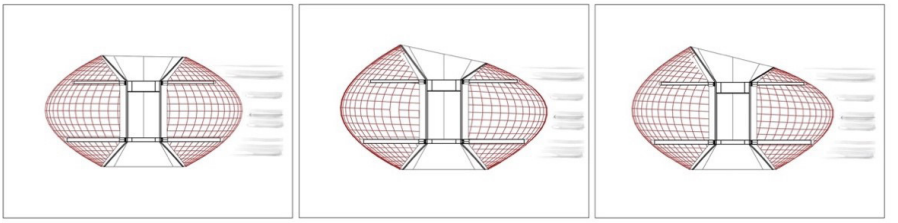

Figure 6. Characteristic bending alternations of the gridshell. Left: Wind velocity value (0.1 km/h) – height of interior space value (2.10 m), Middle: Wind velocity value (10 km/h) – height of interior space value (2.00 m), Right: Wind velocity value (15 km/h) – height of interior space value (1.90 m)

Consequently, the applied physical behavior enables the adaptation of the gridshell in different environments with different wind pressures. Also, the associative parametric design and control of the initial shape allow its modification and adaptation according to various spatial and metric changes of the original geometry, in order to adapt to the respective functional needs. The simultaneous investigation in a single parametric design environment enables the real time control and dynamic correlation of both, the design and the behavioral simulation results. The methodology followed serves as a basis for further iterative analyses with regard to the form optimization of the structural elements and the system's load-deformation behavior under permanent and variable loads combinations, as well as the system's dynamic behavior.

5. CONCLUSIONS

An actively controlled building unit has been presented in the current paper. The unit is based on a modular structure that can be easily transported and erected to host researchers in remote environments with high conflagration history and risk. The structure consists of elastic members that are interconnected through tendons, so that the external gridshell shape adapts to the wind pressures acting upon. The structural principles applied refer to the basic conceptual mechanism of active control initially introduced for providing adaptive structural deformation and stiffness features under varying external loading. The associative parametric design of the unit's behavior has provided insight in the deformation behavior of the system that may further provide an iterative feedback loop mechanism in the early design phase. Further development of the system in achieving autonomous energy efficiency, as well as the Finite-Element Analysis and experimental investigation of its load-deformation behavior are necessary.

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PAPER #4.07

THE ARCHITECTURAL STRUCTURE IN THE FACE OF CLIMATE-RELATE CATASTROPHE: A CLASSIFICATORY APPROACH

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ABSTRACT

Nowadays, given the geopolitical and climatic emergency context in which we find ourselves, various catastrophes of different kinds, including natural ones such as floods, volcanic eruptions or earthquakes, and human ones such as armed conflicts, nuclear accidents or most fires, whose impact often results in human and economic losses, have highlighted the need to rethink architectural structures in order to ensure that they are as resilient as possible.
The key to achieving this and aim of this manuscript, is to firstly identify the intrinsic objective parameters of the most statistically probable catastrophes that we can currently suffer, in order to characterize and classify them from different points of view based on their future consequences on building structures, since only in this way will we be able to conceive and materialize them with the capacity to withstand not only usual loads, but also to present the best possible behaviour in the face of accidental situations caused by potential new adverse episodes.

KEYWORDS

Architecture; resilience; structure; climate; catastrophe.

1. INTRODUCTION

In 2015, the United Nations (UN) approved the 2030 Agenda for Sustainable Development with the aim of building a better world and improving the lives of all its inhabitants. This Agenda contains seventeen Sustainable Development Goals (SDGs), among which we highlight for this paper Goal 11, which calls for making cities more inclusive, safe, resilient and sustainable, and Goal 13, which refers to taking urgent action to fight climate change and its effects.
In relation to this last goal, we see more and more scientific evidence and publications every day that defend and provide objective data on the current process of global warming. Human influence on the climate system is obvious. The warming of the climate system is unequivocal and anthropogenic emissions of greenhouse gases are the highest in history (fig. 1). The atmosphere and ocean have warmed, snow and ice volumes have decreased and sea levels have risen *(IPCC 2014)*.
Since the 1980s, the earth's surface temperatures have been rising, a process that seems to be continuing today, and whose consequences in the form of extreme atmospheric episodes can affect both economic activities and urban life itself (Olcina Cantos J. 2019). This phenomenon and its consequences for our lives and our planet do not go unnoticed by the vast majority of people,

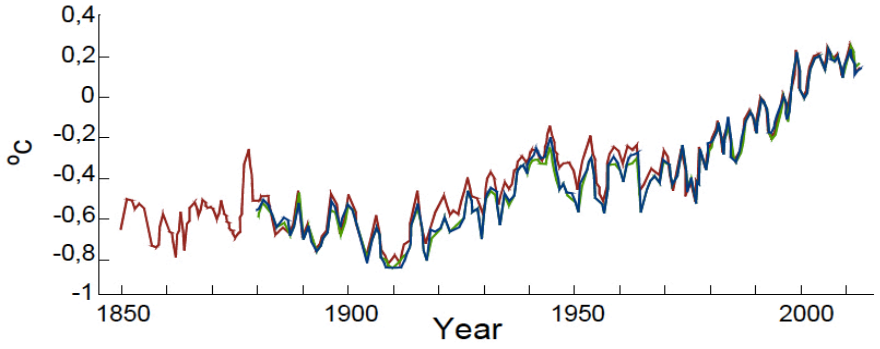

Figure 1. Global average anomaly of surface (red), land (green) and ocean (blue) temperatures combined. Source: (IPCC 2014)

as is shown in some of the risk reports that have been published.

One of these reports is The Global Risk Report (World Economic Forum 2022), for which a survey was conducted in which respondents were shown a list of 37 risks to be ranked, according to their criteria, in order of importance in terms of global damage over the next 10 years. Among the top 10, 50% are related to the environment, as opposed to only 10% for technological or economic risks, for example.

This demonstrates the worrying reality in which we find ourselves and which, at least, is not going unnoticed among the population.

In 2021, as shown in the Emergency Events Database (EM-DAT 2021) created by the Centre for Research on the Epidemiology of Disasters - CRED, 432 disastrous events related to natural hazards were recorded worldwide and 149 others considered to be of a technological nature such as industrial or transport accidents. All of them unfortunately involved more than 10,000 deaths, affected more than 100 million people and caused more than 200 billion euros in economic losses. Globally, while the number of deaths and the number of people affected were below their 20-year averages, 2021 was marked by an increase in the number of disastrous events and large economic losses.

Moreover, due to the effects and consequences of climate change, the observed trend is for the number of events to continue to increase.

Part of these losses, both economic and human, could be avoided or minimised if we ensure that the buildings we design are themselves as resilient as possible. For a building to be resilient to disastrous events, the materials and construction systems that we employ need to be resilient, which is why research into the use of optimal types of structures that ensure the sustainability of buildings in unexpectedly adverse conditions is considered essential (Cortés Cely O. 2015).

It is therefore necessary, in order to research or discuss the consequences of any phenomenon, to have a clear idea of what that phenomenon is, and therefore to identify beforehand the intrinsic objective parameters that characterise different types of catastrophes.

Several authors have already shown interest in the different intrinsic risks of the main phenomena to which population concentrations, and therefore our buildings, are subjected. An example of this is the statement by Jorge Enrique Vargas González (2002) when he talks about the risk of disaster due to landslides, which, according to him, depends on the mass of earth that can occasionally detach,

which, depending on the lack of protection or the relative mobility between the building structure and the soil particles, can lead to different types of thrusts and the sliding of structural elements. This creates an overall framework determined by three key factors: economic, social and environmental. While the economic factor is the one most emphasised today in our immediate environment due to the lack of liquidity resulting from several consecutive crises such as the real estate crisis and the health crisis due to the Covid19 pandemic, it is the social factor that must be addressed in order to save lives.
All of the above should not be understood without taking into account the problem of sustainability in all areas, and of course, in the subject that concerns us: the current world of construction and the design of the structures of our buildings. Linked to the above-mentioned Goal 11, the structures used often do not conform to objective resilient parameters from the point of view of economic, social and environmental sustainability. Furthermore, the overexploitation of resources and the limitation of unlimited access to them makes it essential to analyse and rethink the way we build. In many cases, oversized structures are still being used and in others, they are too fragile to withstand other natural phenomena or subsequent replicas of the initial ones. All of this, given sufficient empirical data and being aware that the climate crisis has accelerated various natural catastrophes and can lead to or accentuate others of human origin, such as, for example, the energy crisis in which Europe is immersed due to the Russian invasion of Ukraine.

2. RESEARCH OBJECTIVES

The aim of this article is to develop a bibliographic search on which catastrophes are considered most relevant from a scientific point of view by specialists in terms of potential damage to architectural structures, to analyse them briefly and to classify them based on different criteria.

3. METHODOLOGY AND LIMITS OF THE RESEARCH

During the course of this research, different scientific internet platforms were consulted, depending on the type of information to be studied and shown. On the basis of the documentation found and the bibliographical consultations made on the different types, each of the selected catastrophes was analysed with a critical eye in order to classify them from different points of view.

4. RISK, VULNERABILITY, DISASTER AND CATASTROPHE

It is important to distinguish between these four closely related concepts, which in many cases are incorrectly used as synonyms, without forgetting that giving a comprehensive definition is difficult, as each discipline or field of research gives its own assessment of the concept.
In the case at hand, we consider the best definitions to be those given by the United Nations Department of Humanitarian Affairs *(UNDHA 1992, 64, 77 & 27)*.
We understand risk as expected losses (of lives, people injured, property damaged and economic activity disrupted) due to a particular hazard for a given area and reference period. Based on mathematical calculations, risk is the product of hazard and vulnerability.
We will define vulnerability as the degree of loss (from 0% to 100%) resulting from a potentially damaging phenomenon.
We will consider a disaster as a serious disruption of the functioning of society, resulting in widespread human, material or environmental losses that exceed the ability of the affected society to cope using only its own resources. Disasters are often classified according to their cause (natural or human/ manmade).
Finally, for the definition of catastrophe, we will use the one given by Karlos Pérez de Armiño

(1999): extreme event, of natural or human origin, which by affecting a place at a given time can cause damage and disturbances such that it triggers a disaster process. This is the relevant concept in the present document.

Caution should be taken with the concepts "catastrophe" (in English usually hazard) and "disaster", which, although often confused in colloquial language, have different meanings. A catastrophe is an event which, in a pre-existing context of vulnerability, can act as a trigger for a disaster, i.e., a process of severe crisis and socio-economic dislocation with serious consequences at various levels (famine, misery, epidemics, exodus, etc.) (Fig.2). The severity and type of impact caused by the disaster depends, of course, on the intensity and characteristics of the catastrophe that caused it, but even more so on the degree of vulnerability to which the affected population was subjected (Pérez de Armiño K. 1999).

It follows that while catastrophes may be natural and unavoidable due to the current climate crisis, disasters are not. Disasters can and should be avoided if a strong commitment is made to help communities prepare for them, reduce their risks and become more resilient. Examples of this are the different territorial action plans on risk prevention that, on a sectoral basis, are being developed in some areas, such as in the Valencian Region in Spain.

5. CATASTROPHY TYPES AND PROBABILITY

Many definitions and classifications of catastrophes have been made over the years (Grisham 1986; IRDR 2014; Lechat 1990; Logue, Melick and Hansen 1981; Weiss and Clarkson 1986) in which we can see that the classification that is a priori most obvious is the one that is most repeated among the different authors and is the one that divides catastrophes into two groups according to their origin, natural or human.

5.1. Natural

We take as a reference the definitions given in the Integrated Research on Disaster Risk (IRDI) report (2014):

a) Biological: Hazard caused by exposure to living organisms and their toxic substances (e.g., poison, mould) or the vector-borne diseases they may transmit (e.g., malaria). Consider: disease/(epidemic), insect infestation and animal incident.
b) Geophysical: Hazard originating from solid earth. We will consider: earthquake, mass movement (dry) and volcanic activity.
c) Climatological: Hazard caused by long-term, meso to macro-scale atmospheric processes, ranging from intra-seasonal to multi-decadal climate variability. These are: drought, glacial lake outburst floods and forest fires.
d) Hydrological: Hazard caused by the occurrence, movement and distribution of fresh and salt surface and groundwater. Consider: flooding, landslides and wave action.
e) Meteorological: Hazard caused by extreme weather and atmospheric conditions of short duration, micro- to mesoscale, lasting minutes to days. We mean: convective storm, extratropical storm, extreme temperature, fog and tropical cyclone.
f) Extraterrestrial: Hazard caused by asteroids, meteoroids and comets passing close to Earth, entering Earth's atmosphere and/or colliding with Earth, and by changes in interplanetary

Figure 2. Relationship between vulnerability, disaster and catastrophe. Source (Prepared by the authors)

conditions affecting Earth's magnetosphere, ionosphere and thermosphere. We refer to impact and space weather.

5.2. Human (man-made)

a) Transportation: Any eventual occurrence which results in damage to property or persons and which is caused by a direct act or occasion of the employment or use of a mechanical, animal or human-powered vehicle.
b) Industrial catastrophes: Hazards originating from industrial conditions, hazardous procedures, infrastructure failures or human activity. They are characterised by the release of potentially harmful substances. They are known as CBRN releases: chemical, biological, radiological and nuclear.
c) Political conflicts and wars. These are those arising from a social relationship whereby two or more collectivities aspire to satisfy incompatible interests or demands, using their inequalities of power to maintain antagonistic or opposing actions, resorting, in the last resort, to violence (Calduch R. 1993). We will consider wars, terrorism, popular uproars, riots, events or actions of the Armed Forces, famine and refugees.
d) Explosion: is the simultaneous, sudden and usually violent release of heat, light and sound energy. We refer to physical and chemical.
e) Fire: uncontrolled fire occurrence that can affect or scorch something that is not intended to burn, at urban, forestry or industrial level.
f) Plastic islands: grouping of non-biodegradable waste that accumulates due to marine currents.

In the light of the above, and with the aim of summarising and classifying in a more synthetic and graphic way the different catastrophes based on the repercussions they can have on the structures of buildings, the following table has been devised (Table 1).

	NATURAL	HUMAN
AFFECT BUILDING STRUCTURES	Earthquake	Impacts (transportation)
	Mass movement (dry)	Explosions (transportation)
	Volcanic activity	Wars
	Glacial lake outburst	Terrorism
	Wildfire	Popular uproar
	Flood	Riots
	Landslide	Events or actions of the Armed Forces
	Wave action	Chemical explosions
	Covective storm	Physical explosion
	Extratropical storm	Urban fire
	Tropical cyclone	Wildfire
	Impact (sidereal bodies)	Industrial fire
DOES NOT AFFECT BUILDING STRUCTURES	Disease/Epidemic	Spills (trasnportation)
	Insect infectation	CBRN releases
	Animal incident	Famines
	Drought	Refugees
	Extreme temperature	Plastic islands
	Fog	
	Space weather	

Table 1. A first classification of catastrophes. Source: (Prepared by the authors)

Amounts updated to 31-12-21

CAUSE	No of Files	%	Indemnities	%	Average Cost	Property Damage	Pecuniary Losses	Personal Injury
Flood	783,323	44.28%	6,897,387,229 €	55.89%	8,805 €	98.00%	1.90%	0.10%
Atypical Cyclonic Storm (TCA, for the Spanish)	728,401	41.18%	1,571,795,561 €	12.74%	2,158 €	97.30%	2.70%	0.00%
Earthquake	54,964	3.11%	622,038,013 €	5.04%	11,317 €	96.50%	3.10%	0.40%
Terrorism	22,375	1.26%	496,122,161 €	4.02%	22,173 €	77.30%	1.20%	21.50%
Popular uproar	7,082	0.40%	91,021,462 €	0.74%	12,853 €	99.70%	0.00%	0.30%
Volcanic activity	6,052	0.34%	223,070,187 €	1.81%	36,859 €	97.00%	3.00%	-
Events or actions of the Armed Forces	2,524	0.14%	5,822,825 €	0.05%	2,307 €	90.90%	2.60%	6.50%
Riot	153	0.01%	1,241,356 €	0.01%	8,113 €	100.00%	-	-
Impact of sidereal bodies	3	0.00%	110,394 €	0.00%	36,798 €	100.00%	-	-
TOTAL	**1,604,877**	**100.00%**	**9,908,609,188 €**	**100.00%**	**6,174 €**	**96.80%**	**2.00%**	**1.20%**

Table 2. Percentage distribution of claims according to cause of claim in the period 1987-2021. Source: (Prepared by the authors based on figures from Consorcio de Compensación de Seguros 2021)

As we can see that the casuistry that can affect buildings, even in a very partial and specific way, is very broad, and we could even subdivide the different types of catastrophes into more subtypes that could end up affecting them, it is necessary to carry out a study of which of the above are those that statistically generate the greatest impact on property, people and pecuniary losses. To illustrate the above, and as an example in the case of Spain, the number of cases or files opened according to the cause of the claim can be taken as a reference. To do so, we will use the database of the Insurance Consortium in Spain (Consorcio de Compensación de Seguros 2021) (Table 2).

The relevance of catastrophes will depend, to a large extent, on the geographical area considered, understood as its location on the planet and its characteristics. We will use the Valencian Region as an example in this document, which will be the focus of our interest in the following sections. To this end, from the same source as above, we can see in the percentage distribution of total compensation, that two of the three provinces in the region appear among the ten Spanish provinces with the highest values, accounting for 16.3% of the entire national territory (Table 3).

In a society like the Valencian society, where the environment has been so intensely transformed over the last few decades, there is no such thing as zero risk, and no matter how many resources are allocated, it is difficult to completely eliminate them. What is more manageable is to try to mitigate their effects until they become acceptable from an economic, social and environmental point of view.

The catastrophic effects of natural disasters considered to be of extraordinary magnitude are related, in most cases, to the improper occupation of vulnerable areas of our territory by human beings.

In addition, future scenarios regarding the evolution of the physical environment in relation to the behaviour of the earth's climate suggest, in areas such as ours, the possibility of more extreme atmospheric dynamics, which means that the territory must adapt to this new reality. On the Spanish Mediterranean coast, for example, changes can already be observed in certain climatic elements such as temperatures and rainfall (Olcina Cantos J. 2019).

Ranking Position	PROVINCE	%	Ranking Position	PROVINCE	%
1	Barcelona	12.4%	7	Málaga	5.0%
2	**València/Valencia**	**10.7%**	8	Sta. Cruz de Tenerife	3.6%
3	Bizkaia	9.9%	9	Madrid	3.6%
4	Murcia	8.2%	10	Tarragona	2.6%
5	Gipuzkoa	5.8%	11	Illes Balears	2.2%
6	**Alacant/Alicante**	**5.6%**	12	Resto	30.4%
				TOTAL	**100.0%**

Table 3. Percentage distribution of total compensation per province in the period 1971-2021. Properties. Source: (Prepared by the authors based on figures from Consorcio de Compensación de Seguros 2021)

However, climate change should be of concern not so much for the variation in the values of the main climatic elements (temperature, rainfall) as for the alteration of atmospheric dynamics and its possible tendency towards a more extreme functioning of its phenomena as a whole. The Valencian territory, due to its physiographic configuration, its climatic conditions and its spatial distribution pattern of the population, is highly susceptible to this type of risk due to extreme atmospheric phenomena.

Furthermore, the European Spatial Planning Observatory (ESPON) has identified the provinces of the Valencian Region as being among those with the greatest risks in Europe as a whole and highlights floods and droughts as the most important risks, as well as seismicity, hail storms, cold and heat waves and windstorms *(Comunitat Valenciana 2011)*.

6. CLASSIFICATION ACCORDING TO STRUCTURAL IMPACT

Before classifying the different catastrophes on the basis of their structural impact, it is necessary to be clear about several concepts that can be confused. These are loads and internal forces.

Loads are defined as the set of external forces that act on a body, or structure in our case, with the intention of displacing and/or deforming it, while internal forces are the forces with which the structure of the body responds to the previous actions in order to maintain its equilibrium.

If, for example, a load P acts on a frame, in order for it to be driven towards the supports, a series of internal forces are produced in the structure itself. A structure is, therefore, a closed set of forces. The external forces are known as loads, and are balanced by means of the internal. For a structural system to be in static equilibrium, the resultant of the sum of internal and external forces must be zero (Alonso Durá A. et al. 2005).

Internal forces in a structure will be the result of the external forces to which it is subjected and depending on its nature and projection over the cross-section local we classify them as axial force, shear force, bending moment and torque (Fig. 3).

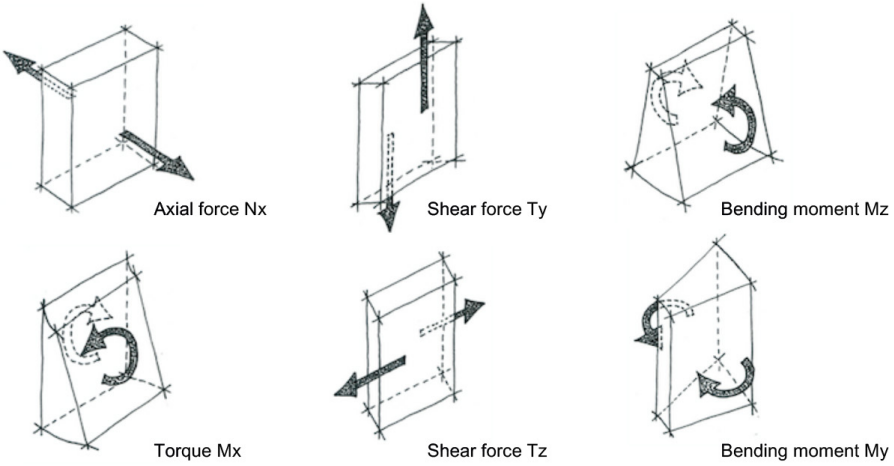

Figure 3. Internal forces. Source: (Prepared by the authors)

Knowing the nature and orientation of the loads that a catastrophe can produce on a structure and knowing the internal forces that they might induce, helps us to be able to identify the damages that our structure might suffer and, therefore, to draw up a strategy to increase its resilience.

With regard to the aforementioned catastrophes, we can establish the following classification:

a) Floods:

- Horizontal thrusts in support bases can involve an increase in bending and shear moments.
- Washing of foundation bases or softening of soil often imply potential differential setting induced and the appearing of bending moments and shear forces in hyperstatic structures, as well as uncontrolled redistribution of axial forces.

b) Earthquakes:

- Horizontal thrusts involve increased bending moments and shear forces.
- Vertical ground motion involves an increase in axial forces, and bending moments and shear moments.

c) Fires:

- Dilatations that, if restrained, might imply an increase in axial forces in elements with a hindered lengthening and frequent increases in bending and shear in the elements that limit this expansion.

d) Strong gusts of wind:

- Horizontal thrusts might imply an increase in bending and shear moments, even alteration of the axial values in the supports located in the façades in the case of slender buildings.
- Suction can lead to the failure of tensile construction elements due to stress reversal.

6. CONCLUSIONS

On the basis of the previous discussion, it can be concluded:

- There are many different types of catastrophes to which we are subject. No matter how much resources are allocated, which would be disproportionate and economically unsustainable and would introduce unaffordable budgetary imbalances, there is no such thing as zero risk.
- It is possible to try to mitigate the effects of catastrophes until they are economically, socially and environmentally acceptable. In the case of architecture, the study of these effects on the structures of our buildings is relevant.
- An appropriate risk assessment is necessary, in which a key factor is the location within the territory of the area in which to act and the identification of the most statistically probable catastrophes in that territory.
- The catastrophic effects of natural catastrophes considered to be of extraordinary magnitude are most often related to the improper occupation of vulnerable areas of our territory by human beings.
- Knowing the nature and orientation of the loads that a catastrophe can produce on a structure and knowing the stresses and their effects helps us to be able to identify the pathologies that can affect it and, therefore, to draw up a strategy to increase its resilience.

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PAPER #4.08

DURABILITY DAMAGE INDICATOR IN BIM ENVIRONMENTS

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ABSTRACT

As Building Information Modelling (BIM) is being increasingly adopted through private businesses in the Architecture, Engineering, Construction, and Operation (AECO) Industries, new tools, procedures, and functionalities appear. In the last years, BIM has proven its advantages by providing benefits to professionals and guiding them towards a new horizon. Currently, the industry is changing in the Spanish market, and refurbishment projects are more demanded than construction projects involving the design of buildings from scratch. As Spanish housing stock grows older, durability and damage in existing structures need to be analyzed during the refurbishment project's early stages. Structural durability is a critical factor in extending the life span of a building and improving the industry's sustainability. This paper presents a tool integrated into BIM environments that can evaluate the durability index in a specific structural element based on data from a visual inspection. This automated analysis shows if any damage is caused by durability factors, such as steel rebar corrosion, and how much time is left until the damage is critical. This tool enables new functionality in BIM environments to control durability and determine when it is critical to rehabilitating the structure.

KEYWORDS

BIM; durability; carbonation; building assessment; building renovation.

1. INTRODUCTION

The architecture, Engineering, and Construction Industry (AEC Industry) has an essential social duty as one of the most contaminating industries in the world. Climate change is a reality, and sustainability demands are increasing. To correspond to this social demand and the 17 Sustainable Development Goals defined by the United Nations, resource consumption needs to be diminished and materials service life enlarged. Considering only the construction, operation, and demolition phases of the buildings, 15% of the world's freshwater resources, 36% of the world's energy; and about 40% of the world's greenhouse gas emission is consumed by the Industry (Crawford, 2011). Buildings have an average life span of fifty years, and most of the time is spent during the operation phase, with its environmental impact directly related to proper operation and maintenance.

Building renovation is key to reducing environmental impact as it has a double effect on service life. On one side, energy consumption during the operation phase is directly reduced, and the building performs at its prime for more time. On the other side, by increasing the life span of buildings with

renovations, fewer new buildings are needed for the population reducing the impact caused by construction.

1.1. Spanish Building Market

In September 2008, Spain entered one of its worst economic crises after the collapse of the building market. The construction of new residential buildings has been reduced drastically since that point, shown by a shift in the revenue from the business. In 2003 the business volume from the construction of new buildings in Spain was 78% (115.841,36 million euros) and 22% (32.615,76 million euros) for restoration and conservation. In 2019 the amounts were 49,1% and 50,9% (43.728,53 and 45.386,53 million euros) respectively ("Observatorio de Vivienda y Suelo. Boletín anual 2020," 2020). The crisis has changed the investment from construction to renovation.

The decrease in construction has caused an older building market in Spain. Due to the reduction in construction from the economic crisis, only 6,5% of the buildings are less than ten years old, while 61,9% are older than thirty years. As the building market grows older, renovation and maintenance are gaining importance, as the buildings present more pathologies. Older buildings require maintenance to extend their service life and meet users' demands. Structural elements directly compromise service life and in the last 12 months, 7.3% of building renovations affected the structure in some way ("Observatorio de Vivienda y Suelo. Boletín especial sobre Rehabilitación 2021," 2021).

The aging buildings in the Spanish market and the necessities to renovate buildings over buildings new ones make building assessment and performance analysis a necessity for the AEC Industry. New social demands for sustainability and an older building market are increasing the necessity to determine the conservation state of a building accurately. Building Conservation Analysis (BCA) is the base for maintenance and management solutions for existing buildings (Matos et al., 2021).

1.2. Building Performance and BIM

Building Information Modeling (BIM) has proven to improve different building performance analyses thanks to its functionalities in recent years. Several Building Simulation Tools (BPS Tools) has been designed in the last years for different building performance analysis related to sustainability assessment (Carvalho et al., 2021; Eleftheriadis et al., 2017; Wu Wei and Issa Raja R. A., 2015), life cycle analysis (Alwan et al., 2021) and multicriteria decision-making (Tan et al., 2021) among others.

BIM advantages for Building Performance Analysis are based on the abilities for interoperability inside these environments. BIM can act as a database storing every parameter of the building and its relations, which can be used to automate analysis processes. These can also be used to create time-related relations among different parameters.

Despite the difficulty of creating a geometrically accurate BIM model of an existing building, these analysis features have been significantly used and have resulted in historical and patrimonial buildings. BIM for Historical buildings (HBIM) utilizes point cloud technologies to overcome this difficulty (Pocobelli et al., 2018) and perform the analysis. Several experiences have been found in the bibliography to perform this kind of analysis on historical buildings, such as Seville's Cathedral (Angulo and Castellano-Román, 2020), the New Theatre of the city of Bologna (Massafra et al., 2020), Four Courts building in Dublin (Dore et al., 2015), Yingxian Wood Pagoda (Jiang et al., 2020) and Flaminio Stadium in Rome (Di Re et al., 2021) among others. The growing interest in BIM by the AEC industry professionals and its capabilities to perform BCA make these environments ideal for building renovation.

1.3.Degradation processes in concrete structures

Maintenances is the main prevention to improve a buildings service life. In concrete structures, it comes from preserving the elements from their degradation processes. Several sources define concrete aging. This degradation can come from pathologies, damage during its life, or simply time passing, and several causes usually interact.

Degradation processes are considered with the Limit State theory in different structural codes. Service states represent different ways to control and prevent these aging processes. Smaller cracking width prevents a quick degradation process by controlling the number of pathogens affecting the reinforced concrete structure and rebars. Cover requirements protect the rebars from early oxidation, lowering their effect and reducing the structure's life span. Among these different degradation procedures, carbonation is constant, affecting the element from the beginning of its life to its end.

Carbonation is a chemical procedure where the carbonic, sodium, and potassium hydroxides in the concrete structure are combined progressively with the carbon dioxide in the atmosphere. The chemical reaction lowers the pH from the 12-11 range to 9-8, reducing its basic environment and allowing oxidation processes to start on the rebars. This reaction's speed is directly related to the porous structure in the concrete and its exposure to the environment. It starts when the element is built and does never finish.

1.4. Research objectives

The paper explores different ways to integrate the durability analysis in the global building assessment analysis performed by private companies and determines some restrictions to adapt. Through developing the tool, the capabilities for BIM to perform building assessments are proven and shown. Two case studies show how the developed tool works inside a BIM environment by analyzing two different structural elements for a residential building.

2. METHODOLOGY

2.1. Integration of the tool in the professional workflow

The tool presented in this article is designed to be for professional use. Several restrictions come from this premise. For this reason, the tool has been designed to work inside the usual workflow followed by private companies when studying a building. Private companies usually have different methodologies and are reluctant to incorporate new procedures. Professionals must understand the workflow and methodologies followed by professionals to develop the tool properly.

After a survey among professionals and personal experience in private business, the authors have divided the workflow into different steps, as shown in Fig 1. First, the building's owners contact the professional and inform them of their needs and problems. From there,

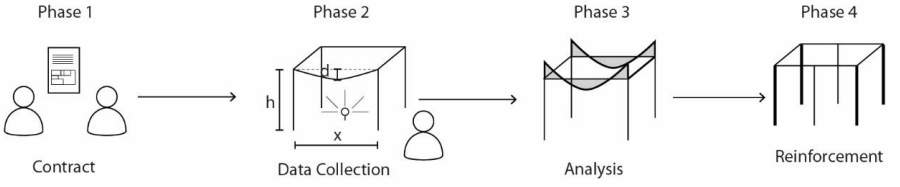


Figure 1. Workflow of building renovation

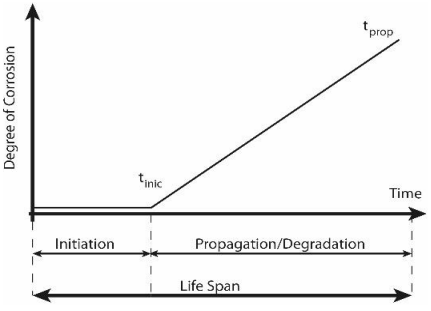
the professional performs an inspection by visiting the building and collecting the correct data. This initiates the analysis phase when technical solutions are proposed to fulfill the owners' demands. Finally, after the changes have been determined, the changes are built, and the refurbishment is done. This workflow describes the general methodology followed by private firms to perform rehabilitation. During the data collection phase and its posterior analysis, new demands may arise depending on the service life of the building.

The data collection proves itself a critical phase. At this point in the process, it is the professional who determines the building's necessities and state of preservation. Despite the owners' demands, pathologies and preservation problems during this inspection may prove more urgent to preserve the building's service life. Despite its importance, most of these inspections are performed visually by professionals, collecting data directly without performing experiments, limiting the data collected. The limitation in the data collected is a barrier to performing service life analysis. This limits the accuracy of the analysis and needs to be directly assessed when designing the tool.

2.2. Determination of the carbonation depth

The new Spanish structural code "*Real Decreto 470/2021: Código Estructural*" (Ministerio de Fomento, 2021) presents a model to determine the carbonation depth of concrete of a certain age. This method is also presented in other European codes similarly, such as the Eurocodes, without any difference. This model defines the "Durability Limit State" as the regulation states it, one of the Service Limit States that a professional must guarantee in the structure.

Carbonation is a slow degradation process that affects concrete elements reducing their service life. Different degradation processes detriment the elements' serviceability faster than carbonation, but they depend on the environment and maintenance. Carbonation is the only process in which it is always present, but it is not always the most prevalent. In general, carbonation is the primary degradation in structural elements (beams, supports, or any kind) which are subject to environments with constant humidity and further away from chloride exposures (from natural or chemical sources). These environments are defined as "XC" in the Spanish building codes, following the European building code nomenclature. The carbonation model is based upon Tutti's model (Tuutti, 1982). It obtains the amount of time a specific concrete element takes to reach a certain carbonation depth. If the carbonation depth is higher than the concrete cover, the element is marked as "carbonated," which means that its rebars are exposed. Oxidation processes start to happen, reducing the element's service life.



$$(a) \qquad t_{inic} = \left(\frac{c}{k_{ap,carb}}\right)^2 \rightarrow\rightarrow k_{ap,carb} = c_{env} \cdot c_{air} \cdot a(f_{ck} + 8)^b$$

$$(b) \qquad t_{prop} = \frac{80 \cdot c}{\emptyset \cdot v_{corr}}$$

Figure 2. Tutti'scorrosion model (a) Time to initiate the process (b) Propagation time

As shown in Figure 2, the model is composed of two phases. First, the carbon dioxide penetrates gradually into the concrete element, carbonating it constantly. The time necessary for the process to reach the rebar is obtained from Equation 1 (a) and depends on the rebar cover, type of cement used for the concrete, air inside the concrete mass, and degree of exposure of the element. After the element is carbonated, the rebar starts to deteriorate, losing tensile strength and increasing in volume, thus breaking the concrete. Later, a crack will appear on the element's surface, indicating the damage.
To study if an element is carbonated or not is crucial to define its remaining life span and so determine if it requires maintenance or rehabilitation. Following the code's requirement, the limit carbonation depth equals the cover. From there on, the element may need maintenance and further study from the professional. Equations 2 (b) show the time for a rebar to loss enough section to be critically damaged.

2.3. BIM Integration

BIM model work as a database for the professionals where they can share and store different parameters and data from several sources and can define new ones up to their needs. There are several BIM software in the commercial market. In this paper, Autodesk Revit has been chosen. It provides an open-source API for programmers and professionals to work on and is one of the widest adopted BIM software in the AEC Industry. The integration is performed using the API, which uses the C# programming language. Through the API, data is extracted from the model and complemented with input from the user.
As presented to perform the evaluation, specific parameters must be defined on the model to store the data in the right way. Autodesk Revit provides several ways to define the parameters needed to perform this task. The tool presented in this article is a complementary tool that helps professionals who need to work on BIM models despite its setup. Revit's *Shared Parameters* are ideal to achieve this task, as they define parameters that can be added to different elements across different files. Using these parameters, the data can be stored without stopping the professional from customizing its structural element to its needs while performing the analysis.

2.4. Workflow of the analysis and user Interaction

The BIM model is used as a database for data parameters and results to perform the durability analysis. Within this consideration, we can divide the analysis into a three-phase step process, as shown in Figure 3. The first phase is modeling. This step introduces the data from the existing building into the BIM environment. The BIM model is developed in this step and covers every aspect necessary for the building's renovation, such as measurement and materials. Once the model is finished, and the desired Level of Development is achieved starts, the second phase. The data is extracted from the BIM model, and the tool is initiated in this step. The user introduces the remaining parameters and performs the analysis obtaining the results. Finally, after confirming the results, they are introduced automatically in the model and stored as values inside the studied elements.
Several factors, such as environmental exposure and cement type, may be challenging to determine and may vary from element to element. Even though the data is extracted from the BIM model, the parameters can be edited by the user. This additional step does not add complexity to the analysis. It deals with the Black Box Effect (Fernández-Mora, 2018) as the professional receives feedback from the input and knows how much the result varies depending on those parameters.
The tool outputs two different results necessary to understand the remaining service life for the element. One of the results is the time until the element is carbonated, and the second is the evaluation of the carbonation itself. With these results, the professionals should decide if the remaining service life is enough for its purpose.

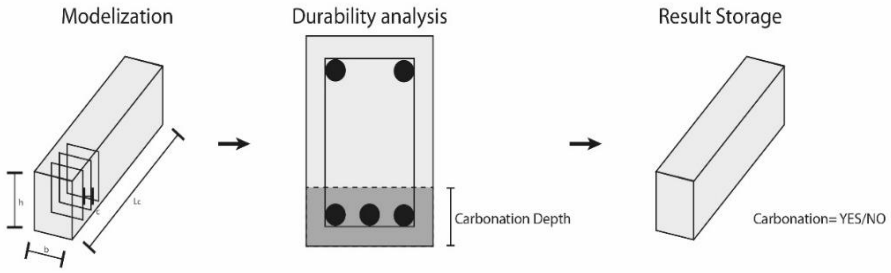


Figure 3. Steps for the durability analysis

3. DISCUSSION AND RESULTS

3.1. Parameter definition and reference values

Several parameters are needed for the durability analysis following the Spanish Structural Code and the posterior evaluation of the carbonation depth. These parameters are stored in the BIM model before the analysis and extracted from there by the developed plug-in. The values for these parameters will be user input and need to reflect the reality accurately to reflect the data. Table 1 summarizes the parameters needed for the analysis.

Visual observation of the element by the professional is not enough to obtain some of the values for the carbonation analysis. While some parameters may be directly measured, some others can only be estimated with indirect measurements or obtained from a laboratory. This section presents an indirect estimation for these parameters, and their

Table of parameters	
Parameter	Unit
Input parameters	
Cover (c)	Millimeters
Concrete tensile strength (f_{ck})	Newton per square millimeter
Environmental exposure (c_{env})	Adimensional
Occluded air (c_{air})	Adimensional
Type of cement	Adimensional
Building's age	Year
Result parameters	
Carbonation depth	Millimeters
Service life left before carbonation	Year
Carbonation	Yes/No

Table 1. Parameters for durability analysis

different values are presented in Table 2. These parameters are: cover, tensile strength, percentage of occluded air in the concrete, and conglomerate composition.

The values provided in the table may be used as a reference by the professional and must be replaced with values obtained through experimentation if available.

Building codes and practices evolve over the years, but they usually are static for some time. Requirements for the materials change and vary depending on and related to industry demands and technology. Considering the building's year of construction, the building code in that year, and the technology available, they can be estimated. The values provided in this section are only valid for the Spanish housing market and may not be accurate for other cases. The natural degradation of material properties during the years has also been considered. These values have been defined after requirements in the different building codes in Spanish history.

3.2. Model visualization and analysis implementation through Autodesk Revit

3.2.1. Revit Family definition

In Autodesk Revit, every building element is an *instance*, and every object is defined by its parameters. A group of *instances* can share properties or describe similar elements, called a *family*. Each parameter value can be exclusive to the instance or can be shared across the same *family*. This categorization describes the relations among any object in the BIM model. The users must define families and their instances corresponding to their necessities.

In a BIM model, there are different *families* to represent a beam, a wall, or a column, and the professional may need to introduce different data onto them. As durability affects every concrete element and the analysis performed is the same, the tool presented can work regardless of the analyzed structural element.

Access to the desired data for the analysis is accomplished using *Shared Parameters*. This type of parameters is defined outside the modeling space and can then be assigned to any element. With this design, the tool is not restricted to a *family* for each element, and the user may implement the data in any structural object in Revit's model. This decision gives flexibility to the analysis as each parameter can be assigned as an *instance* or as a *family* parameter depending on its necessities. They can even be combined with other desired parameters for other purposes outside the analysis.

Reference values					
Parameter	Year of Construction				
	Before 1973	1974-1982	1982-1998	1998-2008	After 2008
Cover (c)	<10 mm.	15 mm.	20 mm.	25-30 mm.	35 mm.
Concrete tensile strength (f_{ck})	10 N/mm^2	15 N/mm^2	15 N/mm^2	20 N/mm^2	25 N/mm^2
Occluded air (c_{air})	>4.5%	>4.5%	>4.5%	<4.5%	<4.5%
Type of cement	Portland cement	Portland cement	Portland cement	Portland cement + additions	Portland cement + additions

Table 2. Reference values

3.2.2. View filters

Once the results are stored in the BIM model, they can be used and managed for different purposes. The results from the analysis are stored on the elements instance so the professional can check them later. Using Autodesk Revit, the data can be represented graphically on the model utilizing View Filters. These graphical filters customize how the data is shown in the 3D model and allow the professional to visualize the elements as desired.

A view filter has been created using the data stored in the Carbonation parameter, which only is applied to analyzed elements. This filter shows non-carbonated parameters as green, carbonated elements as red, and leaves non-analyzed elements unaffected. Using the filter, a choropleth map showing the carbonation in the different elements of the building is created visually representing and summarizing the analysis.

3.3. Case study

Two study cases are developed using the durability analysis tool to determine the carbonation of depth of different structural elements on the same theoretical building. Two case studies are shown, on the same residential building. The sample building is a corridor housing building 32 years old, built in 1990. To simplify the case study, a sole dwelling has been modeled inside BIM. The dwelling is situated on the third floor of the building, which is in the middle of the city and not affected by other degradation processes. The selected elements and the dwelling's distribution are shown in Fig. 4.

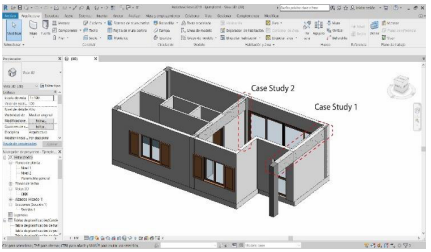


Figure 4. Case studies (1) beam (2) support

3.3.1. Case Study 1: Beam

Element one is a concrete beam partially on the exterior corridor of the housing. The analysis does not differentiate different environments for the same element, so the worst exposure has been selected. The analysis is performed after introducing the data into the BIM model.

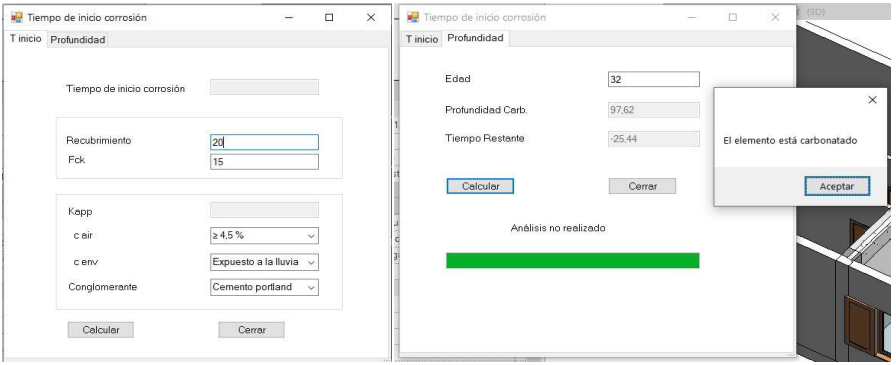


Figure 5. Case study 1 data and analysis

The data is extracted from the instance of the beam in Revit and shown in the plug-in. In the window, the values can be consulted and edited by the user before performing the analysis. When verified, the first phase of the analysis is performed, obtaining the carbonation depth. To perform the second phase, the age of the building is introduced by the user. In this case study, the studied element is carbonated, and the plug-in informs the user with a pop-up.

3.3.2. Case Study 2: Support

Element two is concrete support inside the house. The concrete considered has a higher resistance, as it is more compact, and a test has been performed on other support to measure the cover correctly. To demonstrate the capabilities of the tool the age considered for this element is 5 years old. The element is less exposed to degradation processes than in the previous example inside the house.

The process is analog to the previous one with the data extracted from the model. In this example, the element is not carbonated, and the plug-in informs the professional of the remaining service life for the element.

The degradation process is shown on a progress bar to evaluate the remaining time. After analyzing both elements, the results are stored on the BIM model. The results can be consulted at any given time by the professional. In Fig. 7, the view filter is active, and the professional can track the result for each element based on the color.

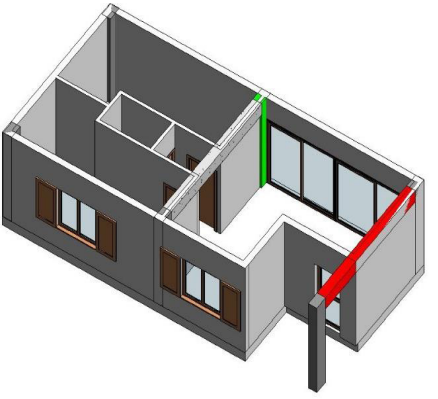


Figure 7. BIM model with view filters after the analysis

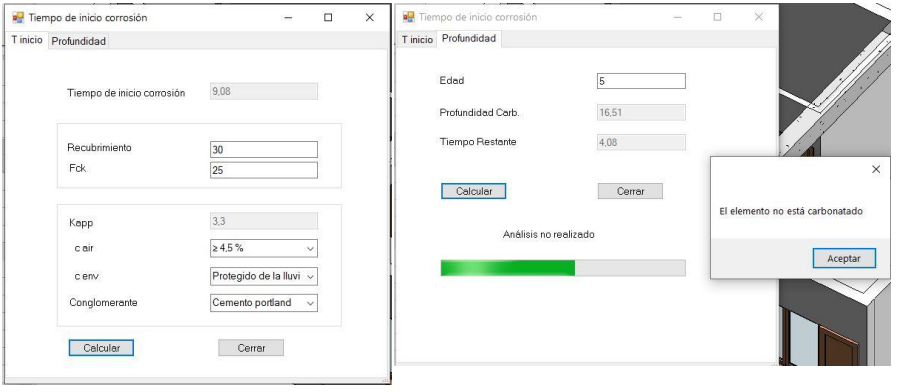


Figure 6. Case study 2 data and analysis

4. CONCLUSIONS

4.1. General Remarks

This paper presents and explores BIM capabilities to manage building degradation analysis for building restoration. This response to a demand in the Spanish housing market and the AEC Industry to restore and rehabilitate buildings and increase their service life. It also is an excellent contribution to sustainability and reduction of CO_2 emissions.

A tool able to evaluate the carbonation in concrete structural elements inside the BIM environment Autodesk Revit has been fully developed and presented. Furthermore, two case studies have been shown to prove its functionality. The analysis result is then stored on the BIM model for future access. The developed plug-in works for any structural element in Autodesk Revit, performing the Durability Limit State analysis by the Spanish structural code.

4.2. Future Research Lines

In the last years, BIM has proven a valuable tool to improve performance in AEC Industry. BIM environments enrich building performance analysis and can determine the preservation state of a building.

The research in this paper lays a foundation for future research lines. Building restoration responds to social demand for sustainability. In order to fulfill the demand, building assessment is imperative and BIM environments have proven themselves able to perform analysis based on stored data.

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5

THEORY, CRITICISM, NARRATIVE AND ETHICS

PAPER #5.01

THE THIRD WAY "AFTER MODERN ARCHITECTURE"

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ABSTRACT

The 22nd issue of the 1978 *Arquitecturas Bis*, entitled "After Modern Architecture", reproduces three articles published in Oppositions magazine No. 5, 6 and 7, where Mario Gandelsonas and Peter Eisenman contributed "Neo and Post-functionalism" respectively and Antony Vidler "A third typology". Together with other texts by R Moneo, Oriol Bohigas and Helio Piñón, they strive to understand what it implies, contains and what the scope of the title is that Kenneth Frampton had designated in 1973. Underlying in them is a "third way," which is neither neo-rationalist, nor neorealist, but rather aims to re-establish the recoverable foundations of modernity as long as it was declared as a public service to transform society. This new architecture would focus on its disciplinary debates, while expanding its cultural base, serving the new social needs and integrating the culture of difference, from overcoming mythological history through situating ourselves "in the meantime" in time. The latest Pritzker, and some architecture awarded by professional associations, or the most debated today is presented dry, crude, informal nevertheless sustainable, efficient, ecological, low-cost, which point both to a stripped simplification and a new *radical realism*. In what follows we will try to verify if any of this new architecture responds to that third way that the theoreticians pointed out as a hypothesis in the initial debates.

KEYWORDS

Radical realism; *Arquitecturas bis*; the third way; postmodernity.

1. THE DEBATE

In February 1977, a gathering of prestigious magazines in architectural diffusion took place in New York. Organized by Oppositions magazine, its purpose was to address the widespread impression of finding "*After modern architecture*" (issue number 22 of *Arquitectura-Bis*), and its reasons.[1] As Kenneth Frampton pointed out in 1976, "the role of the laboratory of the intellectual elite has been exhausted and a strong dichotomy has been established between architecture as a cultural gratification for omnipotent power and architecture as a distraction for an elite" (Frampton, 1976). The magazines *Lotus, Contraspazio, Architecture-Mouvement-Continuité* and *Arquitecturas-bis*, among others, attended the event. In the aforementioned No. 22, texts by Mario Gandelsonas, Peter Eisenman and Antony Vidler are included, which were translated from their contributions in Oppositions, No. 5, 6 and 7, (from 1974), which establish the discursive reasons for this transition, where a deep divide could already be appreciated.[2] In issue number 48 of the same magazine published in 1984, entitled "*Modern architecture and then what?*" -to celebrate

the sixth anniversary of the meeting- the overcoming of representation and its limits was addressed. And with this, the statute of transformation of the architectural discipline was established with the predominance of the other; art, commercial sign, semiotic symbol, ideology or the use of the repertoire of the past as a resolution of types of problems as maintained by Robert Venturi.

The text by A. Vidler, A Third Typology, in issue number 22 correlates with the meaning of those published in issue number 48 below.[3] They all emphasize that Modernity is more than an image, it is a transforming spirit driven by society that promotes its improvement. It is more than the academy, "obsessed with order and orders" and nothing to do with regionalism identities prone to monumentalization, Bruno Zevi will say. For his part, Colin Rowe argues that "modernity began with Brunelleschi and critical detachment." For this reason, they agree that the root of post-modern that was beginning to be seen then constituted a pseudo-anarchic climate converging on a new historicist eclecticism. Because it started from the criticism of Modernity in its banal version -taken as *International Style*- and not in its foundational conceptual bases. The philosopher J. Habermas pointed out that the prefix *post* – "appropriated by neoconservatives and critics of economic growth who have no place in the *Neues Bauen* by calling it destructive"- indicates a rejection of the past without knowing how to put a new name before the non-existent perception of future problems.[4] And he highlights two additional mistakes made by critics; the first, the crisis of modern architecture "cannot simply refer to a crisis of architecture itself, but to the fact that it has allowed it to become overloaded with other people's responsibilities". These are: a) generate "preconceived forms of future life," not habitats; b) make it responsible for not considering a diversity to materialise; c) hold it responsible for not considering that new societies have complex functional interdependencies, beyond the limits of life conditions calculated by utopians. The second error stems from not understanding that capitalist dynamics transgress the architectural process as much as they obviate: a) its contradictions, b) the need for city planning, c) the needs for a structured environment, d) the imperatives of money or power, ending in an *urbanity* of desiring subjects. This, in his opinion, leads to escapist surrealism, because "the nostalgia for undifferentiated forms of existence gives these trends a certain air of anti-modernism, remaining attached to the cult of the vulgar and the reverence of the banal. This *ideology of the simple* denies the immense potential and the precise specificity of cultural modernism.

A. Vidler structures this ideology of the simple that in some cases is linked to the vulgar and banal. He points out that since the middle of the 18th century two typologies had appeared in architectural production. The first linked to the rationalist philosophy of illustration formulated by Abbé Laugier, who proposed that the basis for design should be nature and the primitive hut model (rational order of nature). The second -formulated by Le Corbusier- arises from the need for mass housing at the end of the 19th century, arguing that the model for design should be found in the production process itself. Because "the approach to the nature (of the machine) is as an analogy, not as an ontology." Such an affirmation takes the focus away from the strictly typological debate of that time and therefore does not refer to Aldo Rossi or the Krier brothers (who he refers to as formalists) as a model by settling in the analogous, but rather to *adherence* as the basis of ontology.[5] Vidler's review -third way- identifies such an ontology: 1.- Instead of adhering to nature or technological utopia, *adhering* to the traditional city: "because it provides the material to classify and the forms of its artifacts the basis for its reconciling". 2.- It is based, like the other typologies, on reasoning and classification, not on romantic attachments typical of the townscape or the

strip city. 3.- While architecture used to be compared and legitimized with an external nature, not now. Although the very nature of the elements may be so, their geometries are neither scientific nor technical but only *architectural*. With this, it empties itself of the living social link, referring to a past or social dream, allowing us to speak of its formal condition. 4.- It was born to underline the continuity of form and history against the fragmentation produced by elementary typologies: institutions, social or mechanical of the recent past. 5.- Contradictorily, "this typology is not made up of separate elements, nor is it built with elements classified in order of their use, social ideology, or technical characteristics; it is there, complete and ready to be fragmented". 6.- Such parts do not reinvent the standard forms of the institutions or of the past; they adhere to the following criteria: 6.1-Occurring as an inheritance of these forms in the past. 6.2-Choosing a specific fragment and delimiting its borders, which sometimes intersect with previous types. 6.3- Recomposing these new fragments constitutes a new context. 7.- All this shows an *ontology of the radical city*, denying all the socialist-utopian, progressive-positivist assumptions of the last two hundred years. 8.-Architecture ceases to write history, by disconnecting with society, to become conceived and understood as an autonomous entity, because it particularizes a specific social situation in a specific time and place. Architecture is no longer a social chronicle as Víctor Hugo defined, but through graphic media, it has become a specialization. 9.- For this reason, the city adopts the role of an identifying place of the appropriate typology, breaking the link with the value of "citizen life". 10.- As the city (understood as accumulated life) is the nexus with the lived political experience, the new fragmentation and rearrangement imply a new political revision that will be created spontaneously, in the same transformative process where significant contradictory elements will be introduced, breaking the semiotic logic learned in the direction of a continuity of the city, where only the public is addressed, where professionals at the service of urban life have a place and where work is done from the specialized semiotic micro-understanding. This attitude is subversive because the city ceases to be an "understandable experience." 12.- This third way does not have fixed rules; they are improvised based on the following guidelines: 12.1-There are no historical precedents. 12.2- It is based on instantaneous vitalism. 12.3- Serve urgent needs and does not mythologize the past. 12.4- Reject nostalgia for the past by evoking it unless it is a resource of significant political clarity. 12.5- Avoid eclecticism by filtering quotes through contemporary visual codes. 12.6- Reject the unique transliteration between social order and architectural order, understanding this as limited. 12.7- Its modernity lies in having faith in what is public, its opposition to privatized, individualistic, productivism and consumerist readings, in pursuit of social participation. Being premature in the unfolding of postmodernity, this numbered synopsis contains most of the elements later implemented. To this we must add another factor to the general debate, which is the progressive introduction of the temporal dimension in architecture from the 1980s. The comfortable display of this *critical vitalism of the system*, as Habermas calls it, coincides with a certain socio-economic tranquillity of the decade of the 80s and 90s that allowed innumerable experimentations, mainly those of the author's. This is what another radical part will say that "appeals to the pride of anonymous architecture, without architects, it emerges slowly but willing to assume the implicit risks, such as the emergence of a Volksgeist (spirit of the people)" both in an identity and ideological sense. This debate is parallel in time to the educated experiences that break down Latin American *informalism* from sociology: radical critical modernity (Kulturkritik) took this associative and

experiential model as a body: for G. Deleuze and Félix Guattari as a "body without organs" or space for ecosophy practices (Deleuze, 1994); "space of otherness" for J. Derrida and E. Levinas; "nomadic war machine" in Deleuze; or model of "subjective right" for Henri Lefebvre (Lefebvre, 1968-1969).

2. THE CRISIS IN POSTMODERNITY AND THE ALTERNATIVE STRENGTH

Between 2007 and 2014, the world experienced the great crisis of subprime or junk mortgages, which modified the perception of architecture; going from being understood as a *social lever* to an *accelerator in the construction of a new society*. This period had several consequences; a) the end of the postmodern display of the author, the great works and the star system, b) the drastic reduction of production that ceased to conform new typologies; and c) the demand for a reflection that only vitalists (participatory activists) make, leaving room for alternative positions. All the answers led to the lack of presence of the architect. From the social point of view, it meant difficult access to housing or its unavailability, being this a right and an emancipatory possibility, which contributed to the social exaltations that led to the indignant movements (Stéphane Hessel, *¡Indignaos!*, 2010) that began in the Greek revolts of 2008 and culminated in the 15M of 2011 in Spain, Yellow Vests in 2018 in France, etc. Citizen movements that result from the uprising against indifference and in favour of the peaceful insurrection against the consolidated system, common in Latin America for other emancipatory reasons decades before.[6] Characteristics that coincide with the radical critical bases of the debate, cited by Habermas and Vidler. Such critical movements also focused attention on the "brick", a sector that, having collapsed, created a vacuum. The social group against the consolidated system blamed the architectural profession, for standardising it to the speculators and ignoring their own participation. From this was deduced the co-responsibility of the generations of architects who at that time had the control, experience and career path that allowed them to direct it. Consequently, a *generational assault* took place (Mínguez, García, 2010) The new generations of architects in their thirties went against politics, citizen and social forums, claiming a new time that underestimated merit, hiding behind the loss of authorship (Fernandez, 2021). The first is made clear in the review by Fernandez Galiano, *Ideology and Identity: Piketty vs. Fukuyama*, 2019. The latter is verified in the text, *The Next Generation* in Living Architecture, No. 244, 2022, where it is manifested how four architects in their thirties examine the work processes of a generation of architects under 35, the new elite, to define the *professional ecosystem*, with a sample of 300 studies. They are all part of an anonymous cartography that forms a practical Pangea; pareidolia, with the face of a corsair. (p.19 nº244).

3. THE VITALIST RESPONSE, RAW AND SOMETIMES BANAL

In this context, certain architecture of cultural postmodernism sought as a response the exaltation of raw material, without finishing or alterations, showing its clean face or its insides.[7] These architectural properties fit in with the so-called *third* way announced by Antoni Vidler, as opposed to the anti-functionalist exaltation defended by P. Eisenman or the overcoming of representation by taking conceptual art as a model advocated by Mario Gandelsonas. Among the panorama of their proposals, we can identify four tendencies that we call according to Habermas and Vidler's structure and adjectives:

A) Modern, (Give austerity a glimpse): follows the disciplinary dictates and the

modern arts, where on the one hand the raw links with the revised tradition (emerging environments and cultures) and on the other, entails the search for all the possibilities that the raw material original allows. This line of research seeks continuity with the spirit of modernity, updating its intellectual foundations and incorporating, in addition to the exposed display, the following contemporary values: subjectivity understood within participation, *project culture* understood as cultured critical reflection, and discipline hand in hand with society. Its aesthetic references are Land Art and Arte Povera. Among the finalists of the FAD-2018 we find the Lleialtat Santseca Civic Centre, Barcelona, of the Harquitectes group, where the jury values it because "it links the past with the present, uncovering through a visual document the line of life of this emblematic neighbourhood building. From the entrails of the old, the vivid light of the present resurfaces and coexists." Also, by the same authors and with the same story, *Casa 1413*, in Ullastret, 2015-2017. In this the enclosing wall of the farm (bastard with stone), is regularized and with a ring beam on top to receive the support of various volumes on the inside. These were solved with a short bay in exposed concrete that allows an exploded view of modular folding leaves in all of them. Past-present, old-new, solid-open, interior-exterior, served-servant, are the game of dualities that build its temporal cartography. And this with raw material, surface installations, absence of plaster or cladding, natural wood, etc. The 2019 FAD awards two essentialist houses with few gestures, limited cost and a balance between causes and effects: the Vacation House by Alfredo Paya in Alicante and the House in Galicia by Oscar Fuertes and F. Penedo. The first seems like it wants to disappear, half buried and terraced, hiding between the dry-stone walls. The second, as an extension of a pre-existing house, duplicating it as a symbol, volume and function, but updating it. In both, exposed concrete, load-bearing dry stone wall with different parts or untreated wood, make it up. The recent COACV-2021 award, by Hugo Mompó and Juan Grau for their House in Bétera, is along the same lines: austerity recovered from modernity. In Latin America, this trend is a precedent and derives from its search for postcolonial modernity: like Luis Barragán, Eladio Dieste, Oscar Niemeyer, Frida Escobedo, ARP architects in *Casa Nieto* treated as passive, Lina Bo Bardi, Oscar Tenreiro or the emergency architecture of Alejandro Aravena, etc. While his journey is in search of an autonomous identity of the referents, in the West it results in letting go of self-absorption; the common, the abandonment of self-reference. Recently, the expansion of the Anahuacalli Museum, Mexico City by Mauricio Rocha in 2016 stands out.[8]

B) Neo modern cultural identity; especially developed in international cooperation and with emerging countries by externally trained authors. It has been happening since the peak of cooperation in 1945, structured since the 1970s. It uses raw material with a certain efficiency or instructive rhetoric, while the building reveals both a cultural identity and a certain transferred technical colonialism. The greatest speaker of this line would be the Pritzker Francis Kéré (trained in Germany), who, using local material from Burkina Faso, introduces foreign forms, supplements, layouts or production systems, resulting in an extremely simplified Western architecture, consumable and with indigenist features. The raw and banal is monumentalized. As occurs in the leap between the Burkina Institute of Technology, 2021, from pavilions whose envelope is made of eucalyptus stems, or the Lycée Schorge Secondary School, 2016, to the National Assembly building in Benin, where a new institutional typology is sought.[15] [9] His aesthetic references are reinterpretations

of primitive or tribal art that are intended to conceptualize anthropomorphically, filtering it through informalism (Tippet Rise Art Centre Wooden Pavilion, 2016); in some cases, as a type, in others as makeup, and in others as a production process, such as the cover of vessels in the Gando Library, 2010-2018. In the FAD 2018 the Professional Training Workshop in Burkina Faso by Albertfaus Architecture with Fernando Agustí Domínguez was selected. Also, the Harvest Moon Pavillion by Pablo Saiz Sanchez (Modulab), Cáceres 2017, as a landscape intervention to enhance agricultural activity, with the exterior-interior contrast. Outside, the stack of straw bales and inside, the purity of white. A proposal halfway between Land art, ephemeral architecture or the alternative promoted by informalism, which is reflective rather than semiotic. Here about the awareness of climate change and the preservation of the agricultural environment of Extremadura. Its poetic claim: the proposal integrates agricultural functionality with astronomical phenomena. The old brick warehouse on which it is built faces the sunset on September 6, the day of the full harvest moon that rises at the same time as the sunset on the opposite side. And this in line with the poetics of P. Zumthor in the Bruder Klaus 2001-2007, which links the four moons of execution of the work by its users with the four Swiss cantons and their symbols; earth, fire, metal and water. They share a sustainable language in order to empower user communities, as social reconstruction. In Latin America, emergency and experimental material architecture occupies this space, testing alternative solutions focused on material uniqueness: Shigeru Ban has been testing cardboard tubes since 1994 for refugees (Paper Log House); others with scaffolding, canvas and mesh following the path of Sou Fujimoto in his 2013 Serpentine, such as Avendaño+ Balsa+ Figueroa in the Temporary Pavilion IX BIAU in 2014. Also, the Estudio Chao in its installation Conexidade, 2018. In wood, Josep Ferrando stands out with his "Nido de la Cultura" 2015-17, Buenos Aires, the Construmat-19 Pavilion without waste, or House and Hotel in Ochoquebradas and prototype House 8 +1, Coquimbo, Chile 2017; and in Peru Llona+ Zamora+ Mosquera with its Restaurant Truck in 2009; also, the Bruma winery in the Valle de Guadalupe, by Alejandro D´ Acosta; Naila de BAAQ house, Puerto Escondido, Mexico 2019. In compacted earth, F. Tomboly and S. Carísimo stand out, in Casa Muro, Paraguay, 2020; Takurú House by Jose Cubillas, 2018; the *Pachacamac de Llosa Cortegana* Site Museum; Oscar Gonzalez North Cultural Plaza; or the work in ceramics and earth by Mauricio Rocha and Gabriela Carrillo in the Iturbide studio, Mexico, 2016 or his School of Visual Arts in Oaxaca, 2008. In the Landscape category, the Sport City Oaxaca by Rootstudio + Arquitectos Artesanos stands out, with bamboo lattice or the Morillo Space of 2015, between restoration and recycling. In the West (with a greater formal substratum) this trend leads to tectonic constructionism, while in Latin America (with a material substratum) it is oriented towards the search for identity authenticity.

C) Post-modern sign: (symbolic identity that subtracts the difference). There is also another architecture with similar characteristics that rejoices in the remains that the improper development of the first decades of the century have left. Also, the remains of contemporary industrial production: pipes as planters, painted green areas, etc. In these cases, taking advantage of these skeletons or factory works abandoned due to the bankruptcy of their promoters, activity, economic circles or market availability. *Recycling* is suggested; reuse these objects converted into totems of a time of excesses that are homologated in symbols against unbridled

liberal capitalism. Or from another time and culture as discontinuity. For this reason, they are the substrate for return operations to society, through their public and social destinations. Its aesthetic reference is neorealism that opposed pop art, with an overwhelming semiotics. In 2016, the Spanish pavilion at the XV Venice Biennale, entitled *Unfinished*, proposed by Iñaqui Carnicero and Carlos Quintáns pointed out that despite the economic crisis and the resulting socio-cultural circumstances, quality architecture could continue to be made. The sample of panels on plasterboard frame structures demanded the recycling of that present but unfinished architecture, healing the wounds that speculative maelstrom had led to. He recommended the opposite; creative speculations (also imaginary) that subvert the negative action of those with positive actions of adaptation, erasure or recovery. And all this with 55 selected authors (35 of whom were emerging or almost), photomontages, or proposals for restorations, recycling, transformations, etc., which revealed a new disciplinary order: the empowerment of new vitalist generations. All this topped with eleven interviews with personalities of culture and pedagogy. His reflections taught about the need to build what is indispensable, reduce the carbon footprint, recycle in restoration operations, learn from residential heritage by reusing it, return to the spirit of cooperation, use architecture as a socio-cultural vehicle, as well as a political one, channel the social activism through residential architecture, etc. A set of reflections that built a cohesive and circular discourse; where young people and professors have the responsibility to reverse the order of the world through architecture. Once again, as Habermas pointed out, certain architecture aims to illuminate the world instead of being a tool in its hand. In addition, in this trend, research and typological contributions decline, as much as the architect disappears. This line is nourished in the West by the previous Latin American architectural samples of section B), which had progressed in cooperation operations, emergencies due to catastrophes, the need for relocation, urban migrations, internal reform of informal nuclei, etc (Pino, Carrión, 2021). This lateral look is produced when the West understands that its situation widely shares the reasons that promoted it; the emergency of serving a reality that is judged to be worse than it really is, moved by the desire for change, not a need. Therefore, it is taken as a reference, resembling those inquiries, which establishes a borrowed neorealism, whose iconicity subverts necessity by desire. (Fig. 1)

In 2013, the young Catalan group Lagula Arquitectes built the *Casa Bitxo* in Aviá, Berga, where the most important thing is the west enclosure in massive ceramic latticework and the composition of the

Figure 1. Images collected at the 2016 Biennale, which show the obsolescence and abandonment of unfinished architecture after the decade of shady business. Despite the stark appearance, these intend to promote the initiatives of their social and public uset. Source: montage by the author of others extracted from the Ministry's website

structural concrete surrounds of the fenestrations. This supports a roof with different rods evoking the peripheral topography that covers the ramp, public and private spaces, which reproduce this topology in the form of an interior *raumplan*. This line that makes it difficult to distinguish between restoration and new construction can be seen in the restoration by the Arquitectura G team of Casa Palacio-Safor, Ampurdán, in 2019. The FAD 2021 award at the *Old Can Fabra* Factory, restored as a multipurpose space for young people that includes housing. The work of Fabra y Abrigos combines the restored brick of the industrial warehouse in the interiors with wood finishes on a light structure, articulating all the common spaces of floor circulation through the intermediate terraced space. The COA of Tenerife also rewards in 2021 a restoration and rehabilitation in the *Casa La Toscalera* by Beautell Arquitectos, where mud and brick walls coexist with concrete and steel finishes, defending the archaeological experience. The project awarded with the Mies Van der Rohe 2022 to the *La Borda* housing complex in Barcelona, the work of the local team Cooperativa Lacol. The jury valued the transgressive character of the housing model in a co-ownership regime, co-management of resources and capacities.

D). Anti-modern (ideological identity): there is another architecture that follows the traces of informalism, no longer using raw material, but images of the remains of the demolition, of series, of productions, such as palimpsests of bartering, theft or collection of times. Also, remnants of post-industrial society such as cartons, plastic bottles, pallets, doors, etc., revealing from their consumability a criticism of contemporary waste, the need for recycling, environmental care, or the aggression against the environment that leads to climate change. Its pseudo-ephemeral aesthetic is semiotics of denunciation and participates in radical neorealism. It crudely links the controversial exhibition of dead and sectioned animals by the artist Damien Hirst, known since 1990, with the exhibition A Thousand Years, criticized for being protectionist and sensitive to sadism. This architecture is not precomposed; it arises unexpectedly from the work process. As other professionals and industrialists intervene in this, the result is an amalgamation of multiple criteria with a tendency to accumulation. The Venice 2018 exhibition was entitled Becoming and focused on the teaching environment of the preceding messages: feminism, inclusion, abandonment of predetermined schemes, actions, speeches and student productions that exemplified both other inverse logics and their position on an equal footing with their teachers. The scenography of the space by Joaquín Vaquero Palacios in 1952, proposed by its curators, exposed the brick of the pillars with the stucco half removed, the dirt from the plaster of party walls, the original coarse ceilings together with half-open packaging, panels supported like paintings in those turn-of-the-century *salonnières*, offering a chaotic, but romantic and bucolic image with a carefree and unaffected air, typical of antique dealers and collectors. Titles such as On Ugliness by Umberto Eco, Aesthetics of the ugly, by Karl Rosenkranz, among others, point to *caricature* as a limitation because they highlight the anomalous features so much that it is impossible to conceptualize later, since the highlighted feature is already symbolized. One of the houses recognized at the XV Venice Biennale, the Aragón COA Prize of Aragón and the García Mercadal Prize is the House in three Springs; self-built by the architect David Sebastián in Jarque de la Val, Teruel, 2017 (Turner, 2018). A population of only 62 inhabitants, the proposal symbolizes the reasonable options to solve the emptied

Spain. Built with a very low budget in successive phases, it occupies an old corral or pen, takes advantage of the stone walls and wooden beams, and in addition uses ceramic stock material, thermo-clay, including production surplus and discarded pieces, recycling them. Spatially, it configures a semi-open multipurpose central patio, always sheltered by the roof and arranging private spaces around it. Other common spaces on the first floor fall on this double-height space, articulating everything social. An inclusive, feminist, social scheme that questions the conventional dispositions between public and private domestic spaces as well as their original prevalence, equalizing them. The Latin American examples are more radical when investigating the scarcity of means, without formal limits, from the indigenist plastic framework, referring to naturalistic readings of ephemeral consistency: the SFER IK LAB ecological art gallery by Roth Architecture (Eduardo Neira), Tulum 2018, combines surreal and organic forms, with natural matter of the place. In a bourgeois version, the Nido Boutique in Tulum by BNA Barcelona Architect, 2022. From Roth, the Hotel Azulik Uh May, between utopia and organicism without concept. Or the Tamayo Pavilion by Tatiana Bilbao Studio. Others are the result of cooperation operations that promote multilateralism, transversality, with solutions based on nature. Architecture is expected to provide solutions beyond the discipline, "so that the margins and borders of necessity lead us to seek actions outside of practice", towards a perimeter vision (Vergés, Augé).

4. THE KEYS TO CHANGE; DIFFERENCES BETWEEN ART POVERA AND IMPOVERISHED SOCIAL NEOREALISM

What they all share is their impoverished presence and what is different is the semiotic limitation of the claim. Weakening refers to impoverishing, that is, making something come to the state of poverty through its decay or coming down. Its semiotic limitation derives from its association with the terms neorealism and social, which are integrated in the course of a political will to authentically manifest a reality, however harsh it may be. In some cases, as demonstration and in others as apologetic excess. Because, not being an extended reality, but possible, its use as a plastic or figurative code is sometimes faked, like the search for the exaggerated sensationalism of the very material conditions of the raw. This distinguishes between revealing, shouting or constituting a code; ideological and identity. The ideological code, a consequence of a political position of exhibition of a possible way of doing that, although on the one hand it seeks the intrinsic value of the basic, the naked body and the value of the bulges defined by its bony protrusions, on the other hand, is a symbol of an ideology that puts equality before difference. The identity code results from its repetition as a current solution of an alternative figuration to the high cost of construction, its clean and unpolluted false results, building a symbol of a new world for a new society. Hence its sidelong glance at the previous informalist grassroots proposals in Latin America. And it is in itself the search for basic, skeletal and Biafra solutions of an alternative architecture that finally highlights the poetics of the unfinished or in transit, with an authenticity that is sometimes imposed. What happens is that with this language, not only school buildings are built in Burkina Faso, but contemporary houses are built with non-inclusive distribution schemes and turn-of-the-century typologies. That is to say, it is used only as an impoverished visual code of an architecture, otherwise established as bourgeois. And this shows the tenderness of a romantic attitude as Habermas or Vidler envisaged. Its figurative antecedents, Arte povera, developed in the sixties of the last century, after the impulse of pop art,

the rise of collage, playful art, happening experiences and the imprint of the strength and energy of Fluxus. Povera, stemming from what is impoverished and develops at the same time as Land Art, seeks a return to things in themselves, the natural ones where the residual and humble elements are constituted in the matter of art. Through this, the plastic properties of clean materials are discovered, without imposed treatments or transformations that indeterminate them. Simultaneously, the processing side of matter is emphasised, which is mutant in reaction with the environment and atmospheric conditions. This primer allows us to observe the passage of time in matter, which is one of the main issues in today's architecture in different dimensions: original time of matter and technique; time recorded on the remains used; time of its longevity; time of its reuse, recycling or endowment of artistic capacity, discovered times or serendipity, encrypted times, etc. Ultimately, this attitude takes up those supposed critics of Shocker pop, where the consumer society was questioned and that current situation led by an immediacy devoid of reflection was criticized, where technology sequentially prevails and the citizen is relegated to the background. It is, therefore, also a reaction against the imposition of the technological world. Its works do not crystallize a specific situation, nor does it claim reproduction or representation; On the contrary, they assume the theses of the open work, in process, indefinite, pending completion with the participation of the subject, their implication and interpretation. In that context, the link with ecology was immediate, since the Arte Povera was related to the environment, the medium, the place, the topology, the changing nature, to which it gave value from the implication. With this, sometimes nature itself was part of art, as is the case with Land Art. This artistic development, then, meant a transition towards conceptual art through the transformation of materials, the process, reflective art, thus moving from the object to the concept. These aesthetic considerations come with conceptual ones. Francisco Jarauta's conference in 2000, *Deleuze: contemporary architectures*, provides a framework of the changes and transformations that took place at the end of the 20th century in relation to the arts: end of representation, end of the search for truth, end of identity, time of differences, the rise of empiricism, consolidation of phenomenology and the complex hermeneutics derived from the extension of the open work. In trends (A) and (B) we observe this same conceptual scheme centred on the predominance of subjectivity, whereas (C) and (D) go back to the materialist identity ideology (new objectivity) by putting forward a concept of a non-holistic social subject to the concept of *society of subjects*. To this is added *experimentation and feeling* as a medium of desire, which, on the other hand, the extension of audio-visual media strengthens. Because direct experience (physical or virtual) circumvents adaptability and fuels the distancing with institutional decisions, building its own experience. The experience advances with contact, the body and involvement. Against the end of the identity of the subjects arises the need for something that connects us and keeps us together. Here enters the identification with the forms and matter that provide collective meaning; struggles or collective causes to which one gives oneself to form an idea of community as belonging in the world of the image. The maximum result is sought for the best economy: more effects with fewer causes. This is where experimentation takes hold, which is not only the understanding through the experience of its journey, presence or palpation (A), but also the formation of new social rituals, almost tribal, where the thing is impregnated in our interior, associating thing and cause (B). Its transition to the conceptual seems clear. However, this occurs in a guided manner as a requirement in (C) and (D) when constructing

images of collective identification. This way of changing our consciousness of subjects into consciousness of images is also a way of filling the absence of ideologies, but when it is imposed in the public space as a code, it does not fill absences, it denies potential and specificity. The next step in this architectural dynamic is to deduce the meaning of the experiential memory, *what is felt*. Such meaning is not collective, but personal. And it does not necessarily collide with the meaning intended or inscribed by the author, but rather results from a link between the experience itself, the cause it represents, its experience and the feelings displayed in its learning. The result of this internalized miscellany is a feeling, which allows that Volksgeist.

Thus, David Sebastián refers to the architectural image seeking such a link: he cites the authors who best dealt with poor matter experimentally in search of intensity and emotion, such as Alvar Aalto on Muuratsalo Island, or Sigmund. Lewerentz in the San Pedro church (1963-66), Klippan. In them the sensitivity in the treatment of raw material, the control of light and the volumetry of the building stand out; expressionism in general and in particular. But their approach is non-essential visual. In this sense, they link with a romanticized brutalism and their appeal claims a sensitive return as an alternative to postmodern exuberance, without claiming that in its forcing it entails another emotional sign modality. Where fraternity and complicity stand out, two relevant aspects of a certain contemporary ideology. In Spain, this development has some notable precedents. Enric Miralles built *Casa la Clota* in 1998-99 together with Benedetta Tagliabue. Restoration of the existing one and extension of two adjoining houses to form one with a studio-library space with a walkway and hanging skylight. In it, they use perforated brick severy with visible holes to ventilate the chamber, on structural framing. With filled corners in odd rows for reinforcement that form a simulated padding. Later Benedetta with EMBT builds in 2019, the Kalida complex in the Hospital San Pau Centre Barcelona, with brick and wooden beams but with interior design by Patricia Urquiola. In this case, the exterior proposal is somewhat mannerist by weaving with brick the exploded views of prefabricated concrete and ceramic lattices, which form a floral skin in their tonal change. Such a reference is difficult to separate from the suspended ceramic lattices, some rigged with graffiti typography, in the Mollet del Vallés Public Park, Barcelona, 1995-2001, by E. Miralles. But while Miralles obsessively composes all the linked parts, this anti-modern architecture allows the unexpected to emerge: where the result is provided by the industrialist, the trade, the dysfunctional overlaps resembling an irregular patchwork. Also, Miralles focuses his contributions on the fact that the constructive-structural reason is a whole with the space and the semiotics of the project, while in this they are separate parts that overlap.

5. CONCLUSIONS

The design elements that establish the limit in the discourses of Habermas-Vidler and manifest as anti-modernity in the form of impoverished social neorealism, are: 1.- The substitution of a semiotics that relates architecture to subjects, for another that relates architecture to images. 2.- Radical participatory vitalism leads to giving a relevant presence in the definition of the city and its architecture not to the expert for their educational and cultural merit, but to professionals at the service of urban life and users, thus working from the micro specialized semiotic understanding. 3.- This leads to fragmentation and impossible understandable the experience, which feeds the story of heterogeneity. 4.- The difference or indistinction between new work and restoration or rehabilitation forcing a banal expressionism of nostalgic experience. 5.- The lack of presence of the architect as an absence of trade: highlighting compositions arising from the superposition of layers without prior

Figure 2. Comparative assembly of some of the examples given: 1. Lewerentz in Klippan; 2- Aalto in Muuratsalo; 3-Miralles in La Clota; 4- Benedetta in San Pau; 5 and 6-D. Sebastian in Three Springs; 7- Lleialtat Santseca Civic Center of the Harquitectes group; 8- Modulab at Harvest Moon Pavillion

discretion, empowering all participants to contribute their heritage, which destroys the holistic reading showing the meeting of parts without amalgamation. (Fig. 2)

NOTES

[1] Oppositions, founded in 1973, in the moment of transition of structuralism and poststructuralism, directed by Peter Eisenman, Kenneth Frampton, Mario Gandelsonas, Anthony Vidler and Colin Rowe... The objective: to bring the history and theory of architecture and philosophy closer to architectural criticism, with the intention of establishing new interpretive parameters based on the contrast of the various visions that a fragmented world.

[2] In this, Peter Eisenman wrote *Post-Funcionalismo* and Mario Gandelsonas, *Neo-Funcionalismo*, inciting a debate that is answered by Rafael Moneo, Oriol Boigas and Elio Piñón, where the positions were settled.

[3] Colin Rowe, *Después de qué arquitectura Moderna?*; Jürgen Habermas, *Arquitectura Moderna y Post-moderna*; de Tomas Maldonado, *El movimiento moderno y la cuestión post;* by Alan Colquhoum, *Clasicismo e ideología*; Bruno Zevi, *Contra el Neoacademicismo*.

[4] The text by J. Habermas reviews his opening lecture for the exhibition, "La otra tradición. Arquitectura en Múnich desde 1800 hasta nuestros días," published in Suddeutchezeitung from 5-6 of December 1981. *Later in Der Architekt*, no. 2 de 1982, on the occasion of Godesburg's colloquium "La arquitectura del modernismo ¿un proyecto incompleto? More in-depth in *El viejo Topo*, December 1982, "La modernidad inconclusa."

[5] Although the translated title is the "third typology," the text refers to ways of intervening or approaches, because, coinciding with Habermas, it is an ontological question (about difference). Oblivious to the analogy underlying Michael Hays's debate, in Architecture Theory after 1968, the debates initiated by Alan Colquhoum's Typology and Design Method, 1967, R. Moneo On Typology' 1978, and A. Rossi Architettura Analoga, 1975, whose Intellectual supports are still anchored in referential thinking other than adherence or evocation. Ontology derives subjectivity, not representation, not truth. Alan Colquhoum contributes in *Arq-Bis,* no. 48 a text previously published in *Casabella,* no. 489, March 1983, where he opts for the formal-referential typological model.

[6] Since the 2000s, there have been emancipatory social movements in Venezuela, Argentina, Bolivia, Ecuador, Paraguay and Uruguay. The lastest ones, Chile, Peru and Colombia. They arise against the privatization policies, the monetary policy of the World Bank, holder of its debt, from student, indigenist, feminist and union movements. Their flags; Pluri-nationality, the Rights of Nature, Food Sovereignty, Equal Marriage, Gender Identity, legal, free, safe and free abortion, living well.

[7] We insist on the occasional converging parallel trajectory in Latin America because its problems are different; resources, means, needs, production processes, response to informalism as a metamorphosis, etc. See texts by M Cristina Cravino ""El barrio concebido como comunidad. Reflexiones acerca de algunos supuestos presentes en la focalización territorial de políticas asistenciales". *Urban Notebook,* no. 4. Resistencia: Northeast University, 75-98; and "La metamorfosis de la cuidad informal", Líder Magazine, vol 15, 2009.

[8] On the original by Juan O´ Gorman; initiative of Diego Rivera and Frida Kahlo in 1940, inaugurated in 1964.

[9] All published in *Arquitectura Viva,* no. 245

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PAPER #5.02

AGILE ARCHITECTURE: HOW DO WE DESIGN FOR TIME?

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ABSTRACT

The objective of this paper is to identify and analyze the principles, approaches, and strategies involved in the design of residential buildings that explicitly take into account changing needs over a given building's life. In the view of the researchers, this pursuit is of the utmost significance, particularly in the last few decades—which can be characterized, socially and physically, by rapid shifts. For many industry professionals, flexible design has been branded as costly, difficult to deploy, and demanding state-of-the-art gadgetry. Therefore, after more than a century of attempts to design for flexibility, the issue is arguably still marginalized to the profession at large. Through synthesizing the existing literature, it became clear that design approaches have focused primarily on physical flexibility (i.e., capacity to change the spatial structure). This overly narrow approach leaves the user and the environment out of the equation, leading to the inevitable failure of the built environment's capacity to respond to social or environmental changes.
Admittedly, the attention on low operational and embodied carbon of buildings is greatly supported by near and long-term legislation agendas, particularly in the developed world. However, the present paper is after a measure that is more independent, responsive and holistic; a measure that integrates aspects of durability, flexibility and responsibility; that introduces all layers of physical, social, environmental and economic factors in the form of continuously evolving and dynamic framework; a measure that we refer to as Agile. Yet, a standard theoretical framework for setting such Agile concepts is not yet established. The proposed Agility framework consists of two parts, 1) Design Toolkit and 2) Mechanisms, Plans, and Procedures to inform Policy. The design toolkit is a three-step process, namely, 1) identify strategy clusters, 2) analyze user needs and strategies' objectives, and 3) evaluate the 'value' of the proposed strategies. The goal is to advocate a scientific approach to channel human creativity into its most productive form, eventually improving our judgement by subjecting our theories to repeated testing.

KEYWORDS

Agility; sustainability; flexibility; systems; holism; design.

1. BACKGROUND

Through our pursuit into understanding the notions of flexibility, particularly in residential projects, the most common perception has brought with it an expensive and negative connotation. For many industry professionals, flexible design has been branded as costly,

difficult to deploy, and demanding state-of-the-art gadgetry. Such views have been driven, in part, by technical attempts at future-proofing buildings through the application of specific parameters such as movable partitions or over-engineering; while other buildings, which have stood the test of time have been coined accidental flexibility or simply *good* design (see Imam and Sinclair 2021). The latter argument is that flexibility is not distinctly a result of technical detailing or special componentry which allows multiple configurations to take place. Meaningful flexibility can be applied through an understanding of the fundamentals (i.e., getting the basics right). Understanding the subtle spatial and physical differences between various uses; grappling with the social, economic, political, legal, and environmental forces at play by designing architecture within a holistic context, making it conscious of time and change. Thus, the present paper synthesizes a conceptual framework for heightened Agility and sustainability, thereby realizing more responsible architecture for the 21st Century. Advancing from the established foundation of Gordon's 3L principle (Imam and Sinclair 2020), Open Building (OB) practices (Habraken, 1972; Nascimento, 2012; Imam and Sinclair 2018, 2020) and drawing upon Sinclair's recent Holistic Framework for Design + Planning (Sinclair, 2009; Imam and Sinclair 2020), the integrative model introduces continuously evolving and dynamic solutions that provide buildings with the capacity to shift and morph as circumstances warrant—in essence migrating away from the static architectural practices and staid architectural outcomes that have defined modern architecture.

In this sense, successful Agility may not always need to come from the capacity of the building itself but from the user or owner's capacity to adapt and/or any other numerous variable (e.g., social, environmental, economic, legal, political, technological) which supports the dynamic interplay between building and context. On the notion of expanding, as an industry, we have a proven set of techniques for designing homes, and we know a few best practices for building physical flexibility. However, when it comes to innovation and designing for change, we are arguably still shooting in the dark. We are relying on vision or chasing the 'good designers' who can make magic happen. The present paper attempts to put designing for change on a rigorous footing. In this new reality we live in, where work and living patterns are rapidly changing, we are at the dawn of a revolutionized architecture. It is our challenge to do our part to help create a functioning society that supports people without threatening life on Earth, including our own.

2. AGILE DESIGN FRAMEWORK

The Agile design framework consists of two parts, 1) Design Toolkit, and 2) Mechanisms, Plans, and Procedures to inform Policy. The present paper outlines the Design Toolkit. The design toolkit is a three-step process illustrating the evaluation method, as shown in Figure 1. The first step of the analysis framework is to group the design strategies into clusters by their characteristics. The design strategies were grouped by their holistic means of achieving flexibility, durability, and sustainability; and each cluster includes a set of design approaches identified through three sequential stages: literature meta-analysis (see Imam and Sinclair, 2018, 2020, 2021), survey of experts (see Imam and Sinclair, 2022), and case studies ((see Imam and Sinclair, 2022)). Analysis of each cluster provides information about the effectiveness, feasibility, and value of strategies that meet the present paper objectives (highlighted in chapter one). The two subsequent steps in the Toolkit reflect the expected decision-making process for selecting a design strategy for a particular project. First, a building user's needs are examined and classified, and design alternatives are considered that would fulfill the user's needs. The Agility provided by each design strategy is matched to the user's needs, and strategies that do not meet the user's

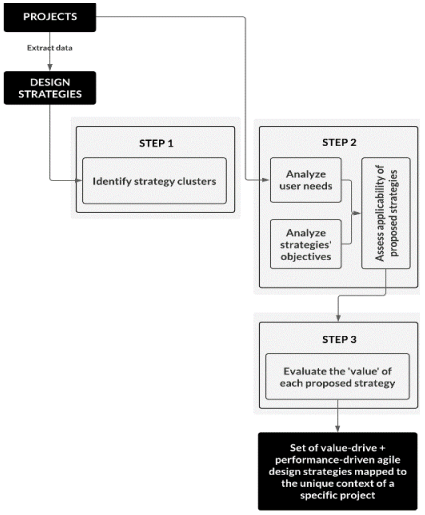

Figure 1. Model of Three-Step Data Analysis. Source: (Imam and Sinclair 2022)

needs are eliminated. Second, the limitations of the most favourable alternatives are examined to determine whether the strategy is technically feasible, and those that are not feasible are eliminated. A given strategy might be eliminated if, for example, it applies only to low-rise buildings and the user's building is a high-rise (e.g., modular panel cladding systems may not be durable enough to withstand wind loads above a certain height). Finally, the costs and benefits of favourable alternatives are examined to determine the value of the Agility gained from each strategy. Before detailing the framework steps, the qualitative units of analysis, design strategies and design approaches must be defined.

- Design Approaches: A design approach is a goal or a set of goals to enable a facility to accommodate future changes. Design approaches are more general than design strategies and do not describe the specific action by which flexibility will be increased. Design approaches often are not generalized across systems or subsystems. For example, an approach may be related to performance flexibility (e.g., to reduce the impacts of interactions between systems.) This approach is applicable to most subsystems within the building and specifies neither the particular action taken to reduce interactions nor the extent to which the interactions should be reduced.
- Design Strategies: A design strategy is an explicit action taken to improve the flexibility, durability, or sustainability (as defined in Imam and Sinclair 2021) of a building or a building's system. An example of a design strategy that increases the capacity of a building system to accommodate change is the use of modular wiring systems; their modularity allows the electrical subsystem to be easily rearranged and rewired through simplified connections. Since the design strategy is the primary unit of analysis, the independence from individual buildings and applicability of the design strategies to a range of projects is crucial.

2.1. Step 1: Identification of agile design clusters

The first step in the Toolkit groups the design strategies into "clusters" that display common characteristics (Agile Principles and Design Approaches). Clusters are identified among design strategies by agile principles (means to achieve Agility), design approaches, and change enabled (visualized in the Agile design framework Interactive). By examining groups of design strategies with one or more similar characteristics, holistic trends in the data can be identified, and conclusions can be drawn about strategies that possess such characteristics, all of which can be explored on a project-by-project basis by the design team. The results of this analysis provide evaluation data about the design approaches and clusters which, for the purposes of this paper, were grouped by the means by which they achieve Agility (see the Agile design framework Interactive).

2.2. Step 2: assess the effectiveness of Agile strategies

Measuring the effectiveness of a design strategy could be judged differently depending on the context of a specific project and the perspective of a given individual. Therefore, the proposed framework suggests implementing a system to categorize the expected and accommodated changes and comparing the Agility achieved to the needs of building occupants.

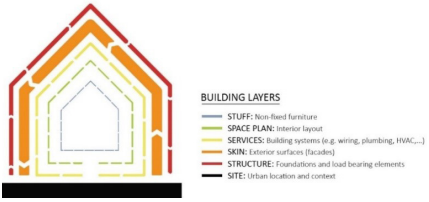

Figure 2. Stewart Brand's building layers of change and longevity. Source: (Brand, 1994)

- Interactions within and among systems: *The relationship is nonlinear*
  A key element in the proposed framework is the definition and analysis of a building as layers of systems and subsystems, which interact with one another. it is important to reiterate Stewart Brand's model (coined in 1994 and discussed in Imam and Sinclair 2021). Brand's model indicates six layers of building systems (Figure 2), each of which changes at a different rate. The present paper suggests analyzing buildings as a set of functional systems, which may or may not be physically distinct. For example, a window is a component within the exterior enclosure and the interior finish systems. The general systems of a building are divided into four general categories, namely, structure, enclosure, services, and interior finish. Each category of systems can be further divided into subsystems (Slaughter, 2001). The systems within a building can interact through various mechanisms. The nature of those interactions (and the systems themselves) influences the building's flexibility, durability, and sustainability to respond to different types of changes.
  Slaughter (2001) concluded group system interactions into three general categories: physical interaction, functional interaction, and spatial interaction. Physical interactions among building systems can be through a connection, intersection, or adjacency. A roof element, for instance, can be mechanically connected to the structure, inserted through the structural elements, or simply rest upon the structure. Systems can interact functionally in ways that enhance, complement, or disintegrate current functions. For example, an exterior wall can provide additional shear capacity to a structural framing system; operable windows can complement a ventilation system, but if poorly incorporated, can sacrifice the performance of heating or cooling systems. Finally, spatial interactions occur when systems operate independently within a particular spatial region or space. For instance, lighting within a room spatially interacts in various ways with different interior surface finishes. While such systems are not physically or functionally interrelating, their spatial interaction may be crucial for the user's perception of the living space or a building.
  It is important to recognize the impacts resulting from interactions between systems when evaluating the construction, operations, and maintenance of a facility, since the impacts may create a series of secondary effects in construction complexity and cost estimates. Each system in a building can be considered an independent entity in evaluation, as long as the impacts resulting from interactions of that system with other subsystems can be clearly identified and analyzed. One specific

impact is the risk of progressive failure, a phenomenon that occurs when the failure of a given subsystem directly results in the failure of another. For example, using site-fixed panel partitions provides simple behind-the-wall access to wiring systems. Suppose the wiring system has characteristics that enhance its flexibility (e.g., modular wiring systems), but the site-fixed panel partitions fail to provide adequate access. In that case, the wiring system also fails to achieve its flexibility. Thus, Agility only occurs when all facets of the framework integrate.

- Change types reimagined: *Allowing designs to co-evolve with their environment*

  A building system can be expected to experience different types of changes throughout its lifetime (Table 1), changes in function, changes in capacity, and changes in flow, each of which can be further partitioned into more specific changes. The present paper expands on Maury's (1999) types of change to capture what the researchers view as necessities of the 21st century. While these change types do not describe in detail the specific changes a building undergoes, most specific changes can be classified into one of these general types.

Changes in Spatial or Function	Relates to the set of activities of components that work together to achieve a specific objective
Upgrade	The upgrade of existing facilities to meet the requirements of the building's current usage class. (e.g., improved and/or repair the HVAC system)
New Functions	The incorporation of new functions within existing facilities to meet the building's current usage class requirements. (e.g., add air conditioning to the current ventilation system)
Modifications	The modification of an existing facility to meet the requirements of and accommodate a new usage class. (e.g., add bathrooms, etc., to change an office building into apartments)
Changes in Capacity	Relates to the ability of a facility to meet certain performance requirements
Loads/Conditions	The ability of a facility to meet certain performance criteria in loads and conditions for particular usage class. (e.g., increase the number of outlet terminals in the electrical subsystem)
Volume	The incorporation of changes in overall building volume, or in system volume within a facility, to meet the requirements of the usage class. (e.g., phased development, or the addition of floors, column over capacity)
Performance-driven	Emphasizes on integrated and comprehensive integration of quantifiable measure throughout the design phases (e.g., optimize TEUI, GHGI in current and future climate conditions), as well as construction (e.g., measuring airtightness).
Changes in Flow	Relates to the interactions between a facility and the surrounding environment and its usage population
Environment	The incorporation of changes in the surrounding or internal environment within a building or facility. (e.g., enhance the ventilation system through operable windows)
People/Things	The incorporation of changes in the passage, movement, or organization of people and objects within or around a building's space. (e.g., create new stairway, or rearrange partitions)

Table 1. Definitions of building and system change types (Maury, 1999, modified by authors to reflect the represent researchers' interpretations of change types necessary in the 21st century)

- Expecting user needs: *Display emergent properties*

  User needs can be defined in a matrix form as the intersections of building subsystems and the change types. As illustrated in Table 2, the horizontal axis of this matrix delineates the building systems and subsystems, and the vertical axis lists the eight general change types. Indeed, the needs that a building user has will change over time. Some changes occur more frequently (e.g., rearrangement of partition layouts), while other changes may not occur until several years after the construction is completed (e.g., adding a new floor on top of the existing structure). The evaluation in the present paper recognizes changes that occur at all stages in the life of the building, including initial construction, operations and maintenance, repairs, renovations, and adaptive reuse. Therefore, the timeframe of each change and strategy should be a part of any framework analysis. The proposed framework classifies user needs according to three timeframe categories: Short-term (1-5 years), medium-term (5-15 years), and long-term (15-30 years). Short-term needs are common, clearly defined, and likely to be forecasted at the time of initial construction. Long-term needs are often large changes (e.g., a change in usage class) and can be more uncertain and difficult to forecast accurately early in the construction process. Medium-term needs have characteristics that fall between the short and long-term needs and often track to predicted technological advancements (e.g., development of wireless technology for the security system).

  The level of Agility achieved by a design strategy is assumed to be constant with time (i.e., strategies have the capacity to accommodate change at an indefinite time change – in the short, medium, or long-term). Because of the interactions between systems, some strategies may require changes to the design and/or construction of another system or subsystems. For example, a building's ventilation system could use the plenum beneath a raised access floor to distribute air, rather than use conventional steel ducts, allowing ventilation patterns to change by simply adding or moving floor panels containing vents. While the strategy provides flexibility to the heating, ventilation, and air conditioning subsystems (within the services system), implementing the design strategy requires changes to the finish system. To capture these factors in the analysis, the design team should use the matrix highlighted in Table 2 multiple times (i.e., repeat matrix table per building system to separate the subsystems undergoing a design change from the subsystems receiving added flexibility). It is important to note that while this matrix method may indicate agile design strategies that may not be as successful as others in achieving the specific user goals, it should provide an indication of all compared strategies that might fulfill the needs. That is, the process will eliminate those strategies that will likely not fulfill the user's needs, leaving a shortlist of effective strategies that could be considered for use once their constraints are identified—obviously, the more specific the ask or user need, the more accurate the matching.

- The Design Toolkit in practice

  Each need for Agility that a building owner or occupant has can be classified as the intersection of the appropriate subsystem and change type. Table 2 provides an example of the User needs Matrix being used to classify the needs of a particular user/owner. Comparison of the intersections provides an indicator of the effectiveness of the strategy with respect to the user's needs. It is important to recognize the feasibility of a strategy's

use. Matching the user needs matrix with the Design Toolkit hierarchy, a building user's needs might theoretically be fulfilled by a strategy that is inapplicable to the particular building type or construction method. For example, the exterior wall knockout panel strategy requires extra reinforcing steel to be provided in load-bearing concrete walls in such a way that a panel can be sawed out and removed without requiring structural rehabilitation in the wall. This strategy does not work in glass curtain walls or conventional masonry structures. Strategy feasibility may also be influenced by interactions between and among building systems. For example, using modular wiring systems may be considered an effective means to accommodate changes to the electrical system, but if the wiring is routed through conduits behind conventional drywall partitions, the accessibility constrains the flexibility. If the modular wiring system is distributed to outlets beneath a raised access floor, the technical characteristics of the floor (i.e., reachable) improve the ease of construction necessary to accommodate potential change.

		Structure		Enclosure			Services									Finish			
		Sub-structure	Super-structure	Walls	Openings	Roof	Heating	Ventilation	Air Conditioning	Lighting	Electrical	Telecom	Security	Plumbing	Fire Protection	Circulation	Floors	Walls	Openings	Ceiling
Function	Upgrade																2	3	3	3
	New Function																			
	Modifi-cation																			
Capacity	Loads & Conditions										4	4	4							
	Volume																			
	Perfor mance -driven					1														
Flow	Environm -ental																			
	People & Things						5	5	5	5	5	5		5	5	5		6	6	

Table 2. User needs matrix in practice, demonstrating the means to classify the needs of a particular user, sampling a list of changes expected in a residential building. Numbers correspond to the following change items: 1) Roof will need to be renovated to improve thermal performance (R-value), 2) Carpeting will wear out and will possibly require a frequent upgrade, 3) Interior designs will alter for aesthetics preferences, 4) accommodate more outlet terminals will be required for electricity, telephones, and computers (accommodating possible apartment split), 5) many services will have to be rearranged to accommodate layout changes, 6) Space is expected to be re-arranged

	COST OR BENEFIT	MEASUREMENT	DESCRIPTION OF MEASUREMENT
Design/Initial Construction	Design difficulty	simple difficult	- design is not overly complex or does not require special skills beyond that of ordinary professional designer. - design is complex enough to require special skills beyond that of ordinary professional designer.
	Ease of construction	- easy - difficult	- construction activities require no extraordinary training. - construction activities require extraordinary training.
	Construction duration	no impact shortened lengthened	- construction duration is approximately the same as with conventional designs. - construction duration is expected to be shorter than conventional designs. - construction duration is expected to be longer than conventional designs.
	Safety concerns	No Yes	- design strategy present no significant safety concerns. - design strategy present significant safety concerns.
	Procurement concerns	no yes	- design strategy no unconventional materials. - design strategy unconventional materials.
	Financial cost	percent change variable	- percent change in cost of building from conventional construction. - complexity of system designs prohibits accurate cost estimation, and system cost varies positively and negatively depending on specific design attributes
Operations and Maintenance	Financial cost	increased not significant decreased not applicable	- O&M activities are more expensive, difficult and/or time consuming. - O&M activities are no more expensive, difficult and/or time consuming than for conventional designs. - O&M activities are less expensive, difficult and/or time consuming design. - requires no maintenance
	Accessibility for operations and maintenance	no change improved access worsened access not applicable	- accessibility for repairs is neither better nor worse than in conventional designs. - accessibility for repairs is much easier than in conventional designs. - accessibility for repairs is much more difficult than in conventional designs. - there are no O&M costs associated with either design strategy or the conventional alternative.
	Irrevocability of commitment	minimum significant failure	- in the event of failure, a new design can be used at minimum cost. - in the event of failure, a new design can be used but at a major cost. - in the event of failure, the design cannot be replaced affordably.
Change Implementation	Financial cost	change in cost variable alternative is cost prohibited	- change in cost of implementing a change in the design strategy as compared to conventional construction techniques. - complexity of system designs prohibits accurate cost estimation, and system cost varies positively and negatively depending on specific design attributes. - design strategy allowing for change is not feasible, either technically or economically, when conventional designs are used
	Downtime	no impact shortened lengthened	- during a change, the interruption of occupied space is the same as for conventional designs. - the interruption of occupied space is shorter than conventional design practices. - the interruption of occupied space is longer than conventional design practices.
	Accessibility for renovation	no change improved access worsened access	- accessibility for change construction is neither better nor worse than in conventional designs. - accessibility for change construction is easier than in conventional designs. - accessibility for change construction is more difficult than in conventional designs

Table 3. Descriptions of the measurements of the costs and benefits of Agility

2.3. Step 3: assess the value of Agility

Benefits of agile design strategies can be in many forms: reduced financial costs, shortened construction schedule and/or downtime, climate resilience, thermal comfort, avoided premature functional or physical obsolescence, as well as less-quantifiable aspects like enhanced aesthetics, ease of construction, safety, and risk of failure. The decisiveness of the commitment to the system layers designs is also an important consideration in the valuation of a strategy since a system design that is easily or cheaply replaced with another reduces the consequences of system failure. Likewise, the 'cost' of Agility (meaning a capital commitment, rather than a negative financial value) can take the same forms. These costs and benefits are intended to be realized by different parties in the construction process, which likely occur at different milestones during the life of the building.

The proposed framework identifies three timeframe categories: initial design and construction, operations and maintenance, and change implementation. These timeframes help describe the distinct types of construction activities that occur in the life of a building. The design strategy is first implemented either during initial construction or renovation when steps are taken to accommodate changes in the future. A change (or a series of changes) is implemented at a later stage. In the time between initial construction/renovation and the first change (and between subsequent changes), the design strategy may directly impact the operations and maintenance activities that occur. The costs and benefits evaluated represent the significant impacts that the design strategy has on the building, user, and owner during these three timeframes. Table 3 lists the costs and benefits evaluated or measured for each design strategy in this analysis, along with each associated measurement. The only clearly quantifiable measure used is an order of magnitude estimate of the cost, as compared to conventional techniques. Since cost estimates performed by contractors may vary widely depending on their capabilities, geographic location, and current construction market, estimates to determine the specific cost should be evaluated on a project-by-project basis.

3. CONCLUSIONS

3.1. How do we design for time?

Significant flexibility can be achieved as a result of reducing interactions between systems, especially reducing the physical and spatial interactions between the finish and service systems. This is a common means of creating flexibility in one system by altering the design of another. These interactions also occasionally impose restrictions on the use of certain design strategies. Most frequently, it is the structural system that imposes these restrictions on a strategy's use, regardless of the system to which the design strategy is applied. The cost of implementing a design strategy during initial construction typically increases the overall building cost, though the literature suggests a relatively controlled increase of less than 2-3 percent. Obviously, some strategies will have higher cost increases, typically resulting from the use of unconventional building materials or specialty products that are expensive or difficult to procure.

The selection of the most suitable strategy depends on several factors, such as the structural typology and technologies of a building, its historical and functional importance, and the socio-economic issues connected with the presence of serious damages and obsolescence. Typically, the ratio between the costs and the performances achieved should be determinant for the

definition of the design or retrofit programs. In other words, synergetic operations should improve the overall characteristics of the buildings, at the same time reducing the ancillary construction expenses. In the view of the researchers, the actual problem arises when the emphasis shifts to the technical and constructional aspects of a project and away from the more socially grounded implications of Agility. When techniques become an obsession, then technology becomes an end instead of a mean to reach an end. The solution is instead to use technology and innovation to create a framework for agile housing, abandoning the idea of strict determinism and strategically allowing a degree of "controlled freedom."

This brings us back to the question posed in title: How do we design for time? From the authors' perspective, technical feasibility alone does not accomplish an agile solution. The concepts and means of Agility discussed in this paper bring an emphasis on process and enabling the building to 'learn' and the users to 'teach' or shape the space themselves. Agility aims for the design to become an ongoing social process between the designer, user, and community within. The designer is responsible for enabling durability, flexibility, and sustainability to take place, as opposed to attempting to control experiences and anticipate the future. In reality, architecture is placed inside a rather unpredictable context where it is forced to respond to and act on exogenous demands or suffer premature obsolescence. It is here where *good* design takes place through the conscious understanding and negotiations of these demands towards synthesized solutions which recognizes the dynamic nature of the context in which the building exists and will continually evolve with time. The present paper views Agility as a design principle that brings time and change to the forefront of thought but requires a reconceptualization of time through shifting mindsets and unifying of values. That said, placing architecture in context may suggest to under design rather than over design, to leave space unfinished as a mechanism for engagement. The unprecedented consequences of COVID-19 and climate change mark what the authors see as the beginning of the end of traditional architecture and urban design as we know it. Incongruously, almost every traditional AEC organization, while trying to figure out its place in this changing world, is stubbornly trying to build a bulwark to protect old models that can't possibly survive the sea of change underway. Thus, from the author's perspective, if change is the new problem; Agility is the new solution.

3.2. Becoming the status quo

Every framework eventually faces an overriding challenge in developing successful products (architecture): deciding when to pivot and when to persevere. The arguments and recommendations discussed in the present paper are prelude to a seemingly simple question: are we making sufficient progress to believe that our original strategic hypothesis is correct, or do we need to make a major change? Because of the scientific methodology that underlies the Agility framework, there might be a misconception that it offers a rigid formula for making design decisions. This is not true. There is no way, nor does the proposed framework intends to, remove the human element—intuition, vision, judgement—from the practice of architecture or designing for the future.

Fast-forward several years to when Agility concepts are well-practiced, this last transition can be especially difficult for innovators and architects to accept: their transformation from radical researchers and practitioners to the embodiment of the status quo. Most researchers and practitioners are likely to get caught between applying comfortable means and methods (those ideas that became part of the status quo)

and constantly entertaining suggestions for ways they could be improved. Above all, how do we know that "your way" of designing for the future will work? How can we mitigate costs and risks? How can we educate the next generation of architects about Agility concepts? It is these questions that require the use of theory to answer. The goal is to advocate a scientific approach to channel human creativity into its most productive form, eventually improving our judgement by subjecting our theories to repeated testing.

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PAPER #5.03

ARCHITECTURE AS A HETERONOMOUS DISCIPLINE. DEBATE, THEORIES, PERSPECTIVES

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ABSTRACT

The debate surrounding the universal criteria of education is the starting point for an exploration of the specific nature of teaching architectural disciplines, based on a balanced alchemy between scientific, humanistic and technical knowledge, and characterised by an essential experimental approach. In this scenario, are there codified formulae for arriving at a definition of education in architecture that is capable of responding to the needs of a renewed approach to knowledge and the discipline's evolution? We are living in a historic phase where the dynamics of training are being constantly revised, which should see teachers once again play a central role as the cornerstone of an educational and formative journey, consistent with the current reconfiguration of professions. It is a maieutic method of learning which interprets the conceptual, design-oriented and constructive dimensions as substantial and integrated elements of architectural practice; methods and tools are the means and not the ends of a teaching environment that is open and increasingly connected to each individual student. As an intellectual figure, the architect requires holistic – as well as scientific – training, able to strengthen a cross-cutting search for the foundation of an architect who should have mastered the art of constructing real buildings and living spaces, and have an evident sensitivity towards measurement, space and harmony. Today it is essential to formulate a reflection on the role of the architect, in relation to contemporary urban and social dynamics which place the environment – and its protection – at the centre of the debate. Design is learnt by designing. This means that the transmission of the values of design culture should be understood as critical competence, capable of synthesising cross-cutting contributions and addressing the complex problems of contemporaneity, by means of a conscious creative process. This contribution examines this phenomenon in order to outline methods and tools capable of training architects of the future.

KEYWORDS

Architecture; heteronomy; education; teaching; design.

Architecture is one of the many disciplines which, based on its heteronomous nature, aspire to represent a community's future, present and past.
The synthesis deriving from artistic-humanistic factors, together with the technical-scientific component, constitute the root of the process that shapes the architect as an intellectual figure capable of presiding over material processes connected to the ability to masterfully select schedules, phases and actors – elements which are all flanked by that magical and

essential sensitivity to composition which has fed this craft since its origin.
Over time, the cultural debate has broadly examined the issue of art having to surrender to heteronomy while preserving the needs for aesthetic autonomy.The act of examining architecture's role through the filter of its *autonomy or heteronomy*, in times of knowledge hybridisation and disciplinary interpermeation, fosters an understanding of the current trends, and encourages the updating of fragments of a debate that have been chiselled out in our culture and tradition.
The risk of forgetting its own ontological status, of losing its own identity in the fragmentation and entropy of contemporaneity, finds a response in the concept of design as the synthesis between artistic ideation and environmental and social conditions, configured as an element capable of marrying the antithetic drivers towards an autonomous vision of the work, on the one hand, and a heteronomy linked to geographical, cultural, sociological and psychological characteristics, on the other.
Thus, heteronomy, as a condition in which an agent party receives the rules governing its own actions from an external source. The etymology of the word, which comes from ancient Greek and sees the merging of two terms – ετερος *éteros* "different, other" and νόμος *nómos* "law, government" – suggests that, at its core, is a dual sentiment which today pervades architecture: the sin of self-referentiality and the strength of dependence on other knowledge.
Just as constructing buildings does not entail one single response to a need, but rather incorporates the concrete translation of desires and aspirations, other disciplines pertaining the world of design also reflect, in their evolution, the issues of contemporary life. In fact, the fragmentation of skills, the specialisation of knowledge, the rapid modification of work tools, digitalisation and the hyper-development of communication constitute phenomena which substantially impact the evolution of such disciplines in a reciprocal interaction with the intangible values – economic, social and cultural – of a community, and the material structures represented by the places in which said interaction is expressed.
The challenge of complexity is based on social, technological and environmental changes, and it is a challenge which involves space, as a tangible resource, on its global scale and in its human measure; and *time*, as an intangible resource, currently assessed in terms of speed and flexibility, but also duration and permanence. These elements impact design viewed as a whole, as the synthesis of multiple areas of knowledge which, given their constant evolution, are subject to continuous debate.
In an acceptance of heteronomy as a condition in which actions are not guided by an autonomous principle, intrinsic to the discipline, but are rather determined by interaction with external factors, this theoretical reflection on the evolution of the tools of knowledge and practice, is intended to define possible scenarios capable of dealing with the risk of losing the ability to synthesise the relationships between the conditions that define the identity of architecture itself.
Difference chosen on the basis of value and the ability to establish relationships between several points of observation become key moments in a practice of assessing the process and the method of affirming architecture as a discipline. The term *heteronomy*, used in contrast to *autonomy*, by Kant and then others after him, has taken on a positive value connected to mutual respect between reason and creativity, between exact science and the empirical approach, between contamination and isolation, introducing the social value of its existence every step of the way.
At the 1949 Lima Conference, Ernesto Nathan Rogers claimed that there was also a social dimension running alongside the principle of "architecture as an art": "Alberti, in the extreme precision of his thinking, warns us that the

idea must be translated into works and that these works must have a practical and moral purpose to harmoniously adapt "to use by men", and I would like to point out that he uses "men" in the plural, namely society. The architect is not a passive product nor a creator completely independent from his own epoque; society is the raw material that he transfers by giving it an appearance, an expression, and the awareness of these ideals which, without him, would remain implicit. Our prophecy, like that of the farmer, already contains the seeds of future growth, since our work also stands between the sky and the earth.

Poetry, painting, sculpture, dance and music, even when they express contemporaneity, are not necessarily limited in practical terms. But we architects, whose task it is to create synthesis between utility and beauty, must at all creative times feel the fundamental drama of existence because life continuously contradicts practical needs and spiritual aspirations. We cannot reject either of these needs because a merely practical or moralistic position denies the full value of architecture, just as much as a purely aesthetic position would do; we must mediate one position into the other" (Rogers, 1948).

Rogers discusses the relationship between instinctive forces and knowledge acquired through culture, together with thinking about the role that study plays in an artist's training. In fact, it was during some of the debates that arose at the *International Congress of Modern Architecture (CIAM)* that the issue topic of architecture, as a discipline placed between self-sufficiency and dependence, acquired centrality within the architectural context. In that scenario, the issue of the autonomy and heteronomy of pre-existing environments took on a role of strategic importance.

The reasoning inherent to the significance of form in architecture and the need to be liberated from heteronomous influences did not manage to weaken the idea of an architecture capable of influencing the governance of an entire society, thanks to an attitude that was very consistent with the writings of Rogers himself. Participants in the 1959 CIAM meeting in Otterlo included Ignazio Gardella, Ernesto Nathan Rogers, Vico Magistretti and Giancarlo De Carlo as members of the Italian delegation; every architect brought a project to share and comment on as a manifesto. Ernesto Nathan Rogers, who exhibited the Torre Velasca, and Giancarlo De Carlo, who displayed a house in the Spine Bianche quarter of Matera, were openly criticised because none of the principles approved by the CIAM could be recognised in their works.

De Carlo's design identified a break with the consolidated design and construction method used in Matera. Under these cultural circumstances, in order to justify the decisions made, Giancarlo De Carlo affirmed the following: "my position was not in fact to break away from architecture, into sociology, for example. I cannot stand those who, to paraphrase what I said, dress up as politicians or sociologists because they are incapable of doing architecture. Architecture is – and can only be – the organisation and formation of physical space. It is not autonomous, it is heteronomous" (De Carlo, 2001). Even more than in the past, today it is not possible to conceive of an architecture cooped up within its own enclosure, adverse to contamination and relationships with other disciplinary worlds; architecture is the world and the world is the combination of our knowledge.

Architecture triggers reactions and phenomena: it is not only and exclusively the passive and active outcome of a person's material work. "We believed in the heteronomy of architecture, in its necessary dependence on the circumstances that produce it, in its intrinsic need to be in harmony with history, with the experiences and expectations of individuals and social groups, with the arcane rhythms of nature. We rejected the notion that the purpose of architecture was to produce objects and we maintained that its fundamental objective was to ignite processes

to transform the physical environment, capable of contributing to the improvement of the human condition" (De Carlo, 2001).
Productive and cultural reinterpretations place the discipline of architecture at the epicentre of critical reconsideration regarding living spaces and workplaces. Consequently, new interpretative models emerge, which often highlight the fickleness of architecture constructed in the absence of a robust theoretical apparatus, demanding that *technical rationality* capable of restoring the centrality of the constructive act, through the contribution of actions which in fact have their origins in other areas.
The transformation of building practice has in fact entailed direct changes to the structure of the nature of knowledge, to the role of skill, to the definition of new professions based on the needs emerging from the productive and socio-cultural system.
The architect can no longer ignore the fact that architectural practice is not completed by means of an implosive dynamic, but rather he is called to dialogue with the many iterations that the cognitive act of design itself entails, calling into question a theory of disciplines which, to a different extent and using different logics, offer their significant contribution to the creation of the design and the work.
As Alvaro Siza affirms, "The architect is not a specialist. The depth and variety of the knowledge that the practice of design entails, its rapid evolution and its progressive complexity mean that an architect can never have enough knowledge or expertise. Bringing things together – pro-gettando ['designing' in Italian] – is his domain, a place of compromise that does not mean conformism, of navigating the intricacies of contradictions, the weight of the past and the weight of the doubts, and future alternatives, aspects which explain the non-existence of any contemporary established agreement on architecture. The architect works with specialists. The ability to connect, use bridges between areas of knowledge, create beyond the respective borders, beyond the precarities of inventions, requires specific learning and stimulating conditions. [...] Architecture is therefore risk, and risk requires an impersonal and anonymised desire, based on the fusion of subjectivity and objectivity. In short, a progressive distancing from the self. Architecture means compromise transformed into radical expression, that is, the ability to absorb the opposite and surpass contradictions. Learning this requires an education in searching for the 'other' within oneself" (Siza, 2008).
We witness the co-existence of contrasting – often extreme – design trends, aimed at reaffirming the historical and traditional framework of constructing by means of the constant re-proposition of the characteristics of *persistence* that consolidated architecture, by its very nature, promotes, and at interpreting the evolutionary – and markedly intangible – guidelines that contemporary society promotes as phenomena of daily life. Speed, temporariness, resilience and flexibility are just some fragments of this. In other words, the suggested direction points towards the immediate creation and prefiguration of innovation as the element that characterises stylistic features, materials, languages, technologies, and only later do we tend to delineate the space they generate; from this, there emerges an anomalous pathway which leads from *technique* to *function*, through *form*, denying the circularity of the three factors at play. Hence the need to reiterate the "humanistic and human" dimension of the practice, which also guides the training processes, in line with the words of the historian-philosopher Youval Noah Harari, when he says: "Many pedagogical experts argue that schools should switch to teaching 'the four Cs' – critical thinking, communication, collaboration and creativity. More broadly, they believe, schools should downplay technical skills and emphasize general-purpose life skills. Most important of all will be the ability to deal with change, learn

new things, and preserve your mental balance in unfamiliar situations" (Harari, 2018). This needs, which reopens the issue of the dualism between "art" and "discipline", superseding it in favour of a terminological coexistence since it is the quality of the design and the work that define its belonging.

Reflecting on the fundamentals of disciplinary pathways and tools, in light of the innovations which involve the theoretical foundation of design in not only conceptual but also instrumental terms, means reasoning with regard to the concept of "design culture", understood as the ability to operate by means of the synthesis of various contributions, tackling complex problems through a conscious creative process.

The threat of a short-circuit deriving from a discourse that supersedes practice, together with a standardisation aimed at establishing construction's dominion over architecture, again taking up *Rogers'* discourse, create the possibility of finding a lifeline in an attempt to find a balanced mix between figurative research and technology in the wake of the ever-current example of the Bauhaus or consolidating the thinking of some masters of modern Italian architecture operating in that post-war era that is synonymous with both physical and moral reconstruction. The attitude of the latter towards formal and technical transformation and adaptation is an paradigmatic example of conforming methodological choices in reference to the supremacy of design and the articulation of the phases thereof. In exalting the outcome, the strength of the process is often imperceptible; in the acritical celebration of architectural work, the method seems to dissolve into the finished product. Technical innovation and disciplinary self-referentiality tend to deny the concepts of continuity and transversality, through a constant act of isolation; on the contrary, the act of design, as a selective operation carried out from within a vast wealth of knowledge, cannot fail to deal with variables of a functional, formal, material and linguistic nature in a common unity of purpose, while said variables have, over time, constituted the source of energy for both theoretical formulation and the works being created.

For years, the debate in architecture has focused on the synergic or contraposed dualism between cultural approaches linked to the *venustas* and the *firmitas*. With regard to the interpretative coupling of *tectonics and form*, Kenneth Frampton notes the existence of a dual tendency that is both identifiable and conflicting: the willingness to favour the formal sphere as the predominant one, rejecting all constructive implications, on the one hand; and the tendency to celebrate the constructive framework as the generator of morphological style, emphasised by the ostentation of architectural detail, including that of a technological nature, on the other.

The design of contemporary architecture is enriched with sprawling values that are often fundamental, yet at times even damaging to the successful completion of the work: it should identify the moment of synthesis within which the designer pursues balance between all the interpretative categories that comprise it, espousing the Vitruvian meaning, according to which practice is «the continuous reflection on utility» and theory «consists of being able to demonstrate and explain the things that are made with technical ability according to the principle of proportion» (Vitruvius Pollio, 15 a.C.).

Architecture will have to increasingly demonstrate how it represents an applied and intellectual activity of targeted synthesis, of a complex system within which it is not only desirable, but indeed critical, for the cultural, social, environmental, climatic, energy-related, geographical and many other components inherent to it to interact proactively, together with the more spatial, functional and material components that materialise in the final construction itself through factors borrowed from neighbouring fields, and not just factors endogenous to the discipline of architecture alone.

As Thomas Kuhn demonstrated with his writings addressing scientific revolutions, if the sciences cannot be understood in the absence of their historical dimension, then disciplines such as music, the arts as a whole, philosophy, and indeed architecture, are cultural phenomena that are only fully comprehensible when viewed in relation to the culture of the time and with the multiple factors that fed them. However, precisely as demonstrated by Kuhn's theories (Kuhn, 1987), their evolution is also fed by "scientific revolutions" – moments of rupture capable of changing the community's attitude towards the discipline itself and especially the inherent paradigms.

Such disciplines, when divided and enclosed within their own disciplinary fields, are not capable of expressing the poetic quality of life and therefore "making one feel and making one conscious of the aesthetic sentiment" (Morin, 2019). Within a unitary vision that exists parallel to the transcalarity that said vision presupposes, the technology of architecture – as a discipline often called upon to play the role of a glue that binds various areas of expertise together – acts as an tool of domination within which science and technology interpret man's intellectual needs, expressing the most up-to-date principles of contemporary culture. The ability to prefigure the new, as is implicit in the very etymology of design, and, at the same time, to interpret continuity understood as coherence of method and of values, is common to the majority of the disciplines that interact with it. Dealing with culture, society, cities, landscape and environment requires a multifaceted vision and the ability to interpret problems, but also mental openness towards opportunities, mastery of complexity, in the face of a concept of quality determined by principles of efficiency and the consequent standardisation of languages.

The importance of relationships, the search for those which Eiffel called the "secret laws of harmony", the disciplinary specificity of design as the ability to connect "in order to understand, critique, transform" (Gregotti, 1981), and the ability to identify the difference by involving it in the transformation process inherent to design, constitute the foundations for the evolution of heteronomous disciplines through the surpassing of notions of technique and context as passive reference points, but rather aspects which generate possibilities and conditions for references to be adopted critically.

Hence the validity of a "polytechnic" cultural approach capable of employing tools and skills that can address the operating conditions of a heteronomous context, but also stimulate critical approaches oriented towards innovation and manage change from the perspective of design as an opportunity, to cite Franco Albini, for "experimentation and verification in relation to the advancement of construction techniques, survey instruments, knowledge in various fields and in relation to the ever-changing contemporary culture" (Albini, 1968). Within the concept of tradition – as inferred from its evolutionary character – form, technique and production, in their historical *continuity* and not placed in opposition to one other, make up the fields of application through which, in parallel, research proceeds in order to ensure a coherent synthesis of design. The *technology of architecture and technological design* have the task of reinstating architecture's personal hallmark: a sort of DNA to be handed down to future generations, in part as a discipline dedicated to amalgamating the skills originating from other areas of knowledge. In the exercise of design, the categories of urban planning, composition, technology, structure and systems engineering all converge, with the result being increasingly accentuated by multidisciplinary nuances, in pursuit of a sense of balance between the parts; a structure founded upon simultaneity and heteronomous logic in the study of variables, by means of translations, approaches and skills as expressions of variegated identities. "Architects can influence society with their

theories and works, but they are not capable of completing any such transformation on their own, and end up being the interpreters of an overbearing historical reality in which, if the strongest and most honest do not succumb, they alone therefore represent the value of a component that is algebraically added to the others, all acting in the common field" (Rogers, 1951). Construction, in this context, identifies architecture as the main element in the transmission of continuity, placing the *how* at the point of transition between past and future, rather than making it independent of any historical evolution. Equally, architecture determines its path within a heteronomous practice of construction through an effective distinction between the strength of the principles and codes inherent to the discipline – consolidated thanks to long in-built innovation – and the energy of experimentation in its own right

Sometimes, faced with the difficulty of establishing the identity of disciplines, one seeks to trace a border that makes it possible to understand their sense and contents. However, it seems even more important "to work on the limits of each area of knowledge", to cite a concept expressed by Salvatore Veca (Veca, 1979), placing communication between the fields at the centre, interpreting relationships and connections, and identifying the relational perspective as the foundational aspect of the practice.

Architecture's position as an "art on the borderline of the arts"1, as reiterated on several occasions by Renzo Piano, allows for reflection on its identity, placing it in a position not so much of marginality as of centrality.A concept of "border" inspired by the sociological perspective which distinguishes the "finite limit" (boundary) from the "area of interaction" (border) (Sennet, 2011; Sennet, 2018), in which variable but constructive contact takes place with the necessary entities in order for it to stay up-to-date. The heteronomy of architecture coincides with its "universality", a concept which for Alberto Campo Baeza (Campo Baeza. 2018) constitutes the identity of architecture. Dependency on the life of man and on the development of society and its cultural growth derives from a single and unavoidable factor: its heteronomy, a necessary condition for a process – both artistic and technical – that must express the values of a community over time and represent not only the "new" but also the "beautiful".

To cite some concepts previously expressed by Edgar Morin, a design practice based on "necessary as well as possible contaminations", on the contribution of "knowledge as an open system", but above all aimed at working "against continuities that are unable to encapsulate the dynamics of change" (Morin, 1974) therefore becomes an opportunity for theoretical elaboration on the identity of the discipline itself, placing it in balance between the technical and the poetic spheres, but necessarily being brought up-to-date in the completed work, thus giving substance to the "webs of intricate relationships that seek form" (Italo Calvino). Architecture will have to seek out and affirm its own identity, its essence as a discipline that is at once scientific and poetic, its essence represented by the harmonies, codes and measures that history has handed down to us, along with the pressing duty to update them as required.

The complexity of the architectural field occasionally expresses restricted forms of treatment that are bound within narrow disciplinary areas or, in contrast, tend towards an eclecticism so vast that it prevents the identification of any discernible cultural perimeter. In spite of the complex phenomenon that characterises the transformations that involve the theoretical foundation of design and the figure of the architect, it is a matter of urgency to attempt to reinterpret the act of design and architecture as a coherent system rather than a patchwork of components.

"Contemporary architecture tends to produce objects, even though its most concrete

purpose is to generate processes. This is a falsehood that is full of consequences because it confines architecture to a very limited band of its entire spectrum; in doing so, it isolates it, exposing it to the risks of subordination and delusions of grandeur, pushing it towards social and political irresponsibility. The transformation of the physical environment passes through a series of events: the decision to create a new organised space, surveying, obtaining the necessary resources, defining the organisational system, and defining the formal system, technological choices, use, management, technical obsolescence, reuse and – finally – physical obsolescence. This concatenation is the entire spectrum of architecture, and each link in the chain is affected by what happens in all the others.

It is also the case that the cadence, scope and intensity of the various bands can differ according to the circumstances and in relation to the balances or imbalances within the contexts to which the spectrum corresponds. Moreover, each spectrum does not conclude at the end of the chain of events, because the signs of its existence – ruins and memory – are projected onto subsequent events. Architecture is involved with the entirety of this complex development; the design that it expresses is merely the starting point for a far-reaching process with significant consequences" (De Carlo, 1978).

The contemporary era proposes the dialectic between specialisation, the coordination of ideas and actions, the relationship between actors, phases and disciplines: the practice of the organisational culture of design circumscribes its own code in the coexistence and reciprocal exploitation of specialised fields of knowledge and the discipline of synthesis that is architecture.

With the revival of the global economy on the horizon, the dematerialisation of working practice has entailed significant changes in the productive actions and social relationships that coordinate the process Hence the need for a humanism closely tied to the reintroduction of the concept of "beauty", in terms of its modern meaning that has shifted from a subjective sense of value towards a universal one. This in turn leads to the importance of dialogue with disciplines that combine within a polytechnic matrix that forever pays close attention to the relationship between theory and practice, to architectural design as an act that is simultaneously intellectual and technical. Therefore, starting with the assumption that "no theory can be brought forward without hitting a wall that only practice can penetrate" (Deleuze and Foucault 1972; Deleuze, 2002; Foucault, 1977; Deleuze, 2007), today it is essential to promote the humanist figures of artists, musicians, philosophers and architects capable of mastering design as the synthesis of external factors but also as an internal dialectic, as well as skills that can create culture understood as technical knowledge.

Despite a growing need to implement skills and means of coordination between professional actors, disciplinary fields and sectors of activity, architectural design has become the emblem of the act of synthesis. This is a representation of society which, having developed over the last three centuries, from the field of social sciences that once defined it as a *machine*, an *organism* and a *system*, is now defined by the concept of the *network* or, more accurately, by the notion of a s*ystem of networks*, in which a person's desire to establish relationships places them within a multitude of social spheres.

The *heteronomy* of architecture, between *hybridisation* and the *contamination of knowledge*, represents not only an objective fact, but also a concept aimed at providing the discipline with new and broader horizons, capable of putting it in a position from which it can energetically and courageously tackle the challenges that the cultural, social and economic landscape is increasingly throwing at the heart of our contemporary world.

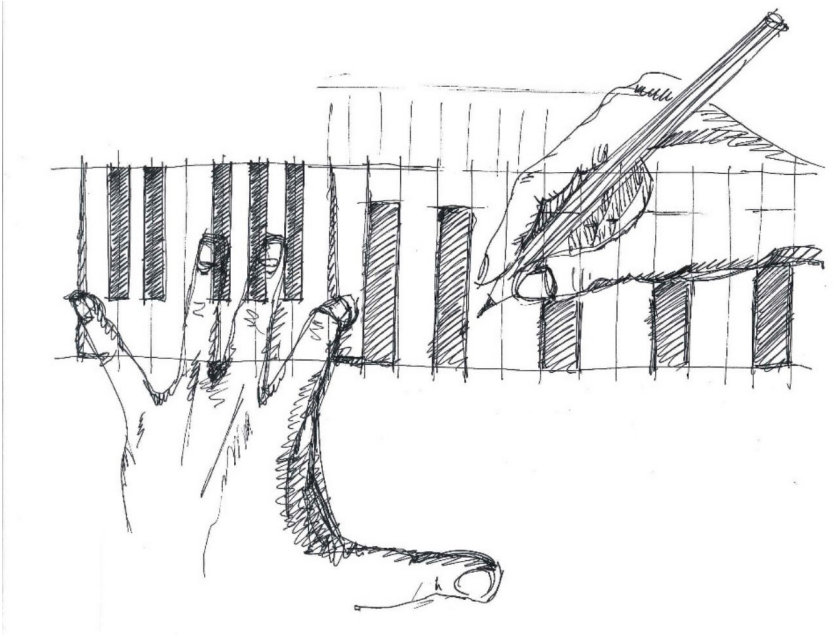

Figure 1. Music becomes Architecture

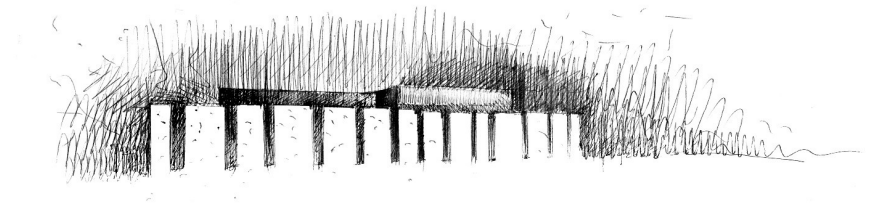

Figure 2. Architecture becomes Music

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PAPER #5.04

CRITIC GOES HOME. THOUGHT AS A TOOL IN ARCHITECTURAL EDUCATION

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ABSTRACT

"Architectural Critique" is a subject of the Master's Degree in Architecture (MUA) at the School of Architecture of the University of A Coruña (ETSAC). Fernando Agrasar and Luz Paz Agras, the professors responsible for the course, orient its contents towards the development of critical judgment skills, with a clearly practical approach. The course has been taught since the academic year 2018-2019.
In the 2020-21 academic year, the topics of the Final Year Project (TFM of the MUA) were various residential programmes in Santiago de Compostela. The main practice of the course focused on the elaboration of a critical essay on a contemporary housing programme built in Galicia.
The different critical analyses were summarised and recorded to create a video in which a wide range of issues were condensed, including environmental, compositional, functional, social, economic, and technical aspects.
This video was used as the basis for the debate, organised in a public session held at NORMAL (the University's cultural space and exhibition hall). The event was entitled: " Living today in Galicia: Critical Considerations". Fernanda Canales (CDMX) and Ricardo Carvalho (Lisbon) together with the professors of the subject composed the table in which questions about contemporary inhabiting were discussed, following the critical considerations included in the video of our students. After the round of interventions, a debate was opened among the participants.). This session, broadcast by streaming, condensed the contents of the course and fulfilled its academic objectives of offering students a reflective and critical position from which to develop their architectural project.

KEYWORDS

Architectural critique; critical thinking; architectural composition; contemporary housing.

1. INTRODUCTION

The 2020-21 academic year took place in a pandemic situation in which classes were face-to-face, but security protocols were applied and travel was restricted. The syllabus of the subject 'Architectural Critique' of the Master's Degree in Architecture, which had begun to be taught in the 2018-19 academic year, proposes content referring to the analysis of texts and the theoretical proposals of various authors, from the mid-20th century to the present day. These topics are presented throughout the course, while three practical tasks are developed, sequenced in terms of their difficulty, which consist of writing a critical essay on a specific work that students must document and visit.

The subject covers the following topics:

1 Conceptos básicos: A crítica como mecanismo de aprendizaxe; o ensaio crítico; os obxectivos da crítica; as orixes da crítica; o papel contemporáneo da crítica; as ferramentas da crítica de arquitectura. 2 As aportacións de Alöis Riegl: a crítica formalista. 3 As aportacións de Benedetto Croce: a artisticidade e a espiritualidade da arquitectura. 4 As aportacións de Bruno Zevi: a caracterización do espazo e a defensa da heterodoxia. 5 As aportacións de Reyner Banham: os valores tecnolóxicos. 6 As aportacións de Erwin Panofsky: a xénese das formas artísticas. 7 As aportacións de Rudolf Wittkower: a relación entre as formas artísticas e a cultura. 8 As aportacións de Ernesto Nathan Rogers: tradición, historia e monumento. 9 As aportacións de Christian Norberg-Schulz: o carácter existencial do espazo. 10 As aportacións de Walter Benjamín: a crítica marxista á modernidade. 11 As aportacións de Gaston Bachelard: a crítica fenomenolóxica. 12 As aportacións de Manfredo Tafuri: crítica e ideoloxía. 13 As aportacións de Collin Rowe: a análise da forma. 14 As aportacións de Rem Koolhaas: a reflexión dende a creación. 15 Conclusións: a aprendizaxe arquitectónica a través da crítica.

The choice of the buildings and environments in which the internships are carried out is linked to the theme of the Final Degree Project, which is prepared during the Master's degree. In the course to which we refer, the project themes were focused on various residential programmes in Santiago de Compostela. Consequently, the architectures on which it is proposed to write a critical essay develop residential programmes of different characteristics, all of which are in Galicia and are contemporary works. The case studies selected include interventions in rural and urban settings and new builds and refurbishments, encouraging a variety of circumstances for the analysis.
This work is carried out as a third practical project, to be delivered at the end of the term and for which the following statement is provided:

1.1. Architectural critique 2020-21. Practical Project 3

After the two previous practices, we will tackle a series of critical essays on sixteen residential architectural projects, with different design programmes. The common link between all of them is their contemporary nature and the fact that they were built in Galicia.
Each group is assigned one of these works with the task of writing a critical essay on it. The steps to be followed for the practical work and its timetable will be as follows:

1. Architectural DOCUMENTATION of the work (surroundings, plans, photographs, details, ...)
2. Evaluative documentation on the piece (awards, news, specialised reviews, testimonials, ...).
3. Preparation of a SCRIPT with the fundamental ideas that structure the critical essay, supervised by the lecturers of the subject.
4. Preparation of a CRITICAL ESSAY on the building studied.
5. Preparation of a short EXHIBITION with graphic material and the main ideas developed.
6. The delivery of the work (in Moodle) will be done on the day set for the exam of the subject (January 19) before 10 am. With the summary of each paper a video will be prepared, which will be the fundamental element on which a round table on CONTEMPORARY RESIDENTIAL ARCHITECTURE IN GALICIA will be organised. This round table will be held in February-March 2021.

1.2. List of works (Fig. 1):

1 Housing for gypsies in Campañó, Poio, Pontevedra, César Portela and Pascuala Campos, 1970.
2 Housing and facilities in Montecelo, Paderne, Paderne, Manolo Gallego, 1984-1989
3 Cabins in Broña, Outes, Salgado e Liñares, 2015
4 Residence for students on the Vigo Campus. Alfonso Penela, 2000-2002.
5 Bela Fisterra Hotel. Creus and Carrasco, 2019
6 Housing cooperative in Galeras-Entrerríos, Santiago, Carbajo Barrios, 2016.
7 Housing, facilities and car park in Ourense, Vier Arquitectos 2002-2007
8 Pilgrims' hostel in Vilalba, C. E Meijide and J. V. Meijide, 1999
9 Housing in Caramoniña, Santiago, Víctor López Cotelo 2001-2009
10 Residential day centre in Redondela Santos-Martínez 2008-2012.
11 9 Public social housing in Mugardos, Jorge Salgado 2007-2011.
12 43 Homes for young and old people and day centre in Ferrol, Ábalo Alonso arquitectos, 2007-2010.
13 Refurbishment of building in Galera street in A Coruña, Creus e Carrasco.
14 Rural tourism house and flats in Aldán. Alfonso Penela, 2008
15 Refurbishment of 7 buildings for 9 homes and a commercial premises in Vigo. Cendón-Vázquez architects, 2014.
16 Prototypes of housing-containers in Santiago, R. Novio and C. Taboada 2006

Assignments are made for groups of a maximum of three students, groups of two or even individuals.

1.3. Schedule

30/11/2020: Presentation of Practical Project 3
21/12/2020: First review of proposals for exercises for Practical Project 3
28/12/2020: Tutorials for Practical Project
19/01/2021: Handing in of papers at the scheduled time for the ARCHITECTURAL CRITICISM exam and preparation of the video recording of the round table on CONTEMPORARY RESIDENTIAL ARCHITECTURE IN GALICIA..
02-03/2021: Celebration of the round table LIVING IN GALICIA TODAY: CRITICAL CONSIDERATIONS.
The following organisational chart is proposed:
Work (To be delivered 19 January before 10:00h):
- Title page: Title of the case study + name of the group members
- Referenced images
- Length of text, minimum 2,000 words
- Text structure with headings
- Notes and bibliographical references in footnotes

Presentation for recording of the video (To be delivered 19 January before 10:00h)
- Maximum of 10 images in PowerPoint format
- First standardised screen with template uploaded in Moodle

Figure 1. Assembly of the case studies

Recording of the video (during the week froml 25 to 29 January, 2021)
- The maximum duration will be a maximum of 10 images timed at 20 sec/each.
- It is recommended to rehearse and coordinate the exhibition before the recording session.
- The recording will take place in the auditorium of the University School of Architecture.

This work, the results of which can be jointly evaluated in the public session " Living today in Galicia. Critical considerations", is the central didactic tool that organises the course, the methodology and results of which are presented in this text.

2.CRITIQUE AS A TOOL FOR LEARNING

Critical appraisal is frankly diminished in contemporary architectural culture. Powerful images and unjustified judgements have brought reasoned, authoritative and complex reflection to the brink of extinction. With honourable exceptions, quality critical essays are no longer abundant in the most prestigious periodicals, nor in specialised publications, nor in the complex panorama of digital publications dedicated to contemporary architecture. Descriptive reviews and the always self-interested opinion of the authors themselves have replaced the critical exercise as it was understood until a few decades ago.

This panorama has contributed to the fact that architecture students all over the world base their references and interests on the architectures included in the syllabus, on those referred to tangentially in classes and on those published without the necessary deliberation.

The effort involved in visiting a building, documenting it, researching it and writing a critical essay on it, in a guided and didactic way, has an undeniable educational potential. The progress of this critical exercise is presented in class, during the course of its elaboration, to be debated among all the students and guided by the teaching staff. By sequencing the critical reflections throughout the months of the course, it is possible to see remarkable progress.

In the first approaches, the difficulties encountered by students in this task are evident. The considerations on the case studies analysed begin by being fundamentally descriptive, based on the documentation obtained in physical or online publications. In most cases, the students contact the studios that are the authors of the projects and, in the first stages of the work, they reproduce what they are told about the circumstances of the project, their approaches, etc., without any trace of a critical perspective.

The visit to the building is a decisive step in the work, as it provides the students with their own experience in the perception of architecture, which entails the first approach from their own perspective, although in this case, the visit was not possible in all cases due to the pandemic. As the work progresses, the students incorporate critical reflections that the teachers intentionally introduce in the lectures or in the specific corrections of the practical classes. In some cases, they produce analytical graphic material on the case studies, which allows, on the one hand, a more in-depth knowledge of the architectures analysed and, on the other, to have explanatory images to accompany the critical reflections.

Through the pooling sessions of the examples studied, concepts such as the role of collective housing in community building emerged in the Paderne project by Manuel Gallego; housing as a social asset in the gypsy settlement in Poio by César Portela and Pascuala Campos (Fig. 2); or the questioning of the accepted idea of "sustainability" in the Cabañas de Broña by Salgado Liñares (Fig. 3), recent winner of the National Architecture Prize.

Figure 2. Housing for gypsies in Campañó, Poio, Pontevedra, César Portela and Pascuala Campos, 1970.

Figure 3. Cabins in Broña, Outes, Salgado e Liñares, 2015

Residential projects in historical contexts provide reflections on the relevance of common and public spaces, due to their position in compromised fabrics, the prominence of the residential building in a historical fabric, etc. Examples such as the Galeras-Entrerrios Cooperative by Carbajo Barrios or the Caramoniña apartments by López Cotelo, which are part of the historic fabric of Santiago, the work of Vier Arquitectos in Ourense, or the work of Calle Galera by Creus y Carrasco, in A Coruña. The refurbishment of existing pieces is also present in the case studies, such as the intervention by Cendón-Vázquez, in Vigo, or the Rural Tourism House in Aldán, by Alfonso Penela (Fig. 4).

The variety of examples for which a critical interpretation is proposed allows for a broad consideration of residential typologies, which requires the consideration of the perspective of the diversity of users, with the singularities of each of these groups. From the temporary tourist accommodation of the Hotel Bela Fisterra by Creus and Carrasco, or the Pilgrims' Hostel in Vilalba, by Carlos and Jorge Meijie, to the specificity of the housing for elderly people of the Residential Day Centre in Redondela, by Santos-Martínez (Fig. 5).

Figure 4. Rural tourism house and flats in Aldán, Alfonso Penela, 2008

Figure 5. Residential day centre in Redondela, Santos-Martínez, 2008-12

3. CRITIQUE AS A DESIGN TOOL

When preparing a critical analysis, the students have to choose the aspects on which their analysis should focus, such as functional, social, economic, contextual, technical or formal aspects.
It should be remembered that, at the same time, a housing project is being developed in the workshop. The connection between the classes and the work in Criticism and in the Master's Thesis Workshop (TFM) is sought, but not in a directed way. We believe that this "discovery" must be personal and spontaneous in order to obtain optimum results. For this purpose, a brief exercise is carried out in the middle of the course, in which the advances of the basic projects that are being developed are intertwined, so that each one of them carries out a critical exercise on the architectural proposal of a colleague.
The project is no longer the search for a solution to a series of pragmatic problems, such as slopes, connections with the road, or the orientation and views of the rooms. Critical reflection places the essential intentions and values before other questions, for which the project's own theoretical approach, if it is solid and well-founded, will offer a solution.
The critical evaluations of these studied interventions provide a series of reflections that the students cannot see as recipes, as they are diverse cases, but which they discuss in parallel to the Master's Thesis. The proposals they develop are located on the edge of the historic centre of Santiago, in a consolidated area with cobbled streets and a large park, making decisions on the rehabilitation of the existing structures. These critical interpretations of examples built on consolidated plots or rehabilitation interventions, raise questions about intervention criteria and approaches that are essential as tools in the design process. In the same sense, the diversity of typologies that form part of the case studies encourages specific approaches in the process of designing for a community and determining the ways of living that this architecture implies.
Kindling a critical perspective in the students has allowed us to observe how these reflections were passed on to their design approaches. Aspects such as the links with the place, the generation of public space and common spaces, the determination of residential typologies according to the users, etc., began to emerge in the accounts of their projects. These questions allow them to move away from the uncritical resolution of domestic spaces according to normative rigidity or strict technical resolution, enriching the project and providing more coherent solutions.

3.1. Reflecting, confronting, organising, presenting and convincing

1. The process in which students have to develop their critical work goes through the following stages:
2. Reflecting on a real project, visiting it, studying its design and the existing publications on it. Sometimes also by meeting and interviewing the authors. This involves understanding the key issues that underpin the theoretical framework that supports the building to be studied.
3. Confronting, with other study processes on contemporary buildings, the variety of interests and theoretical orientations. In the first presentations in class, decisions are made about which basic questions are dominant in each of the architectures: context, social problems, new forms of inhabiting, ... The coincidences and divergences are of interest at the moment when the first decisions are being made about their own project.
4. Organising a critical text involves choosing the issues to be addressed and prioritising them, as well as understanding

that positive and negative evaluations are intertwined.

5. Presenting the work in progress and, eventually completed, requires a rare task for our students, who have not been trained in debate and public presentation in primary and secondary education and, of course, the university has not solved this deficiency. The effort has a notable educational value, since, in the practice of architecture, presenting an idea so that it can be carried out always involves these processes.
6. Convincing is undoubtedly a consequence of a good critical analysis. The presentation of considerations and perspectives on an architectural work must be based on a well-founded reflection, which can only be refuted with arguments of the same level of rigour and solidity. This final objective is necessary for writing a critical essay and essential for justifying architectural decisions whose results will require important resources and will condition the lives of their users.

3.2 Evaluation of an experience

The presentations of the practices carried out by the students were recorded () and used as base material for the organisation of a critical session that took place at the NORMAL, in the exhibition space of the University of A Coruña, on 25 May 2021, both in person and online. The students were invited to this event, as well as the authors of the works studied, and it was open to a wide audience, in order to visualize the educational experience.

During the event "Living in Galicia Toda: Critical Considerations", the Mexican architect Fernanda Canales (Fig. 6) and the Portuguese architect Ricardo Carvalho (Fig. 7) participated from New York and Lisbon, respectively, discussing the singularities of their contexts in relation to contemporary habitation and, considering the Galician case from the viewing of the students' presentations and in conversation with the course lecturers.

The discussion was open to the public, both in the NORMAL and online, and a series of conclusions about contemporary living emerged that highlighted a number of universal themes and some contextual singularities.

In terms of the most relevant aspects that were repeated in all the contexts, the most outstanding one was the relevance of common spaces, where relationships of coexistence and collaboration are forged, complemented by the relationship between domestic space and public space. Another of the ideas that took centre stage in the debate was the need to make domestic spaces more flexible. The diversity of family and cohabitation units implies the need to adapt spaces to different ways of life, an idea that the recent pandemic has helped to consolidate. In addition to this, sustainable planning is a contemporary condition in all areas: social and political, construction, energy saving, etc.

This international event added value to the work carried out by the students, disseminating it and allowing new critical interpretations to be built on it from external perspectives.

In the successive courses of the subject, this approach of linking critical analysis and project tool is continued, selecting, in each case, the case studies in relation to the proposals for the Master's Thesis project to be completed by these students. The selection criteria are also maintained, being examples of contemporary architecture in Galicia, visitable, and through which a critical reading allows reflection on the Master's thesis project

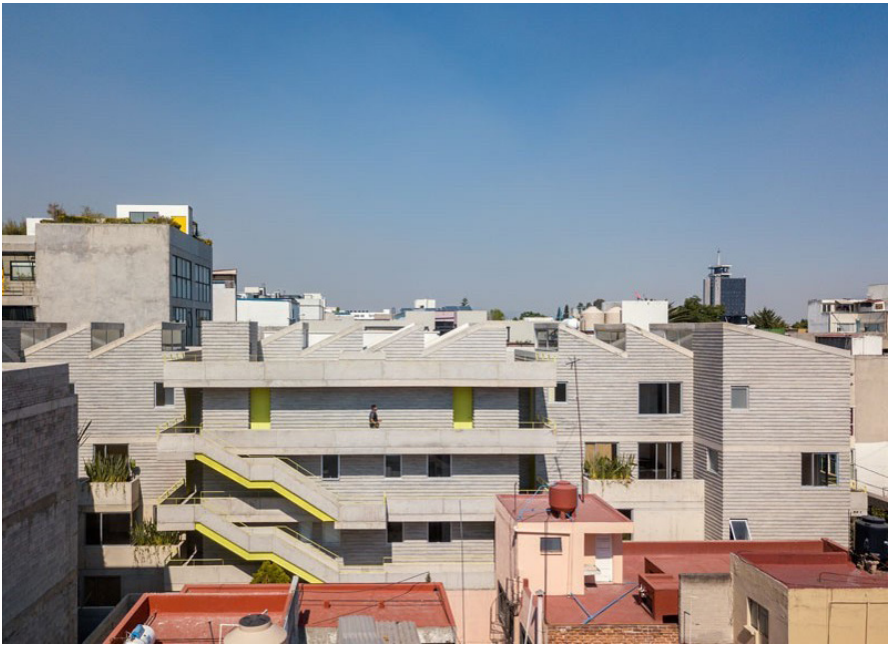

Figure 6. Vecindad Monte Albán, Ciudad de México, Fernada Canales, 2020

Figure 7. OR12: 2 Housing Blocks, Lisbon, Ricardo Carvalho, 2020-25

PAPER #5.05

DESIGN, BUILD, OCCUPY, ADAPT: CRITICAL CONSIDERATIONS OF ARCHITECTURAL EDUCATION IN AN ETHOS OF UPHEAVAL

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ABSTRACT

Over the past century, as mobility increased and communication heightened, architectural education saw a shared vision gain uptake and adoption in many corners of the globe. Informed by an embrace of architecture as a regulated profession, schools pursued similar standards, structure, accreditation & assessment, albeit with local overlays and national policies dictating details and nuancing content. While numerous models developed in concert, all pursued the notion of education providing base competencies for the subsequent pursuit of professional registration/ certification and associated modes of practice. In many ways curricula has been increasingly comparable between many international regions, which has resulted in benefits around legibility, reputation and value of architecture as both discipline and profession. Centered on the studio as a signature pedagogy, architectural education has tended, to date, to translate well across borders and boundaries. However, recent challenges such as climate change, health calamities, financial crises, and global conflict, to name but a few, have given cause to critically review architectural education, writ-large, in terms of content, delivery, value, efficacy and impact. The present project, driven by researchers in North America and the Middle East, examines and interrogates aspects of architectural education considering this ethos of upheaval. The work, which is exploratory in extent and preliminary in character, is intended as a provocation concerning the status quo. Included in the probe are factors that prove fundamental to our productively advancing the profession and practices of Architecture: namely technology, psychology, sociology, business, research, sustainability and ethics. Developing from an environmental scan, and drawing from extensive administrative experience (in numerous nations) of the two lead authors, the research then examines selected details for each of these factors - proposing new means and methods that promise to better prepare architecture students for a dramatically different world. Ancillary yet vital qualities, such as interdisciplinary engagement, leadership, intersectoral understanding, and holism, are investigated with respect to a curricular reset. The authors shape a novel model for higher education in architecture that resonates with emerging demands and equips students to survive and thrive given the changing global context and the transcendental 'new normal.'

KEYWORDS

Architecture; curricula; pedagogy; systems thinking; innovation; culture; resilience.

1. INTRODUCTION – SURVEYING THE LANDSCAPE

> "Design is a multifaceted subject. It ranges from the smallest manufactured objects to the planning of cities, regions and entire countries. In today's world it is not only local but inevitably global." (Cairns, 2014)

For the past several decades, since the millennium, our world has been subjected to extraordinary changes, challenges and, with more frequency, catastrophes (see, for example, UN Environment & International Energy Agency, 2018, Irfan, 2019, Pak, 2019 & Imam, 2020). Following on the heels of an unprecedented period of international order, stability and peace, we have seen in recent times growing uncertainty, indeterminacy and chaos. Today many systems are under strain, many organizations are in upheaval, and many individuals are encountering stress (Sinclair, 2021). The pressures on long established means and ways prove intense and undue, with erosion and collapse more common and more tragic. From human-made structures, such as financial and political bodies, to natural systems, such as ecological and environmental spheres, we are witnessing incomprehensible upheaval. Impacts of broad and endemic instability, mutation and failure are grave (Sinclair, 2020). Implications, costs and effects of dramatic shifts, including societal disorder, pain and suffering prove exceptional. Clearly the consequences of inaction are frightening. That said and given the shear magnitude of many of shifts in context and circumstances, we struggle to find appropriate paths forward.

Historically the university has had fundamental, meaningful and critical roles to play in furthering civilization, in guiding development, and in improving quality of life. From educating citizens and discovering knowledge, to questioning directions and proffering moral guidance, higher education has played vital roles in our communities – advancing society while instilling confidence, building awareness, and injecting optimism into an often-uncertain milieu. Such key roles of the post-secondary sector have been under escalating attack, sometimes with dramatic outcomes, in part related to the broader and deeper assault of many of the systems that have defined modern life over the past century. While it is easy to slide into pessimistic posturing, and modes of helplessness, especially considering the scale and scope of the challenges in our contemporary lives, it is essential for us to confront the unknown and to endeavor to find routes to a brighter tomorrow. The present paper acknowledges this troubling ethos, yet contends that higher education, and in particular architectural education, have vital opportunities to contribute, individually and collaboratively, to solving some big problems and bringing order, balance and harmony into our communities, countries and civilization writ large.

2. BACKGROUND

> "Education is about healing and wholeness. It is about empowerment, liberation, transcendence, about renewing the vitality of life. It is about finding and claiming ourselves and our place in the world." (Palmer, 1999)

While architectural education has a relatively brief history in universities (transitioning from craft & guild models to more formal schooling rather late in the game), the authors argue that the potential to make a demonstrably positive impact on current crises is both significant and urgent. Many of the hard and heavy problems at play in modern life, including

health, economies, climate and conflict, to note but a few, have strong connections to and relationships with the built environment. While the magnitude of any one crisis is daunting, the interplay and intersections of 'distinct' problems creates even greater crises that demand tremendous creativity and innovation to comprehend and solve. Architects are only now beginning to more fully grasp the agency and ability that they have to tackle some of the challenges on our doorstep, to operate across disciplinary borders, and to help reverse the downward slide on many fronts (Couzens, Sinclair & Klumper, 2022). Design education (especially considering the studio as signature pedagogy) stands as somewhat unique within the academy and is, arguably, well positioned to potently contribute to solving wicked, complicated and multi-faceted problems (Sinclair, 2015).

3. ACCREDITATION, STANDARDIZATION AND LOWEST COMMON DEMONIMATORS

> "Appropriate solutions to some of our most daunting problems will arise through the concerted efforts, open dialogue, and collective wisdom of the wide array of stakeholders, professionals, politicians, decision makers, and citizens (both engaged and disenfranchised) who have the will and wherewithal to make a difference and to make the world safer, healthier, and better. It seems vital for us to critically examine, and question, our belief systems and their connections to the ways we define, refine, and realize progress." (Sinclair, 2015)

As architectural education developed within universities, and societies advanced in terms of principles, policies and protections, the need increased for more uniform standards in curricula, inputs and outputs. The self-regulated professions, most notably, offered assurances of competency for the right to protect title and scope. To meet such claims around awareness, knowledge, skills and abilities, schools with architecture programs looked to the vehicle of accreditation as a means to ensure quality and foster consistency. In many countries rigorous accreditation regimes were developed and enacted to 'raise the bar.' For example, the Canadian Architectural Certification Board (CACB) and, in the United States, the National Architectural Accrediting Board (NAAB), were established to promote, delineate and enforce standards in the education of architects. In general, such moves and mechanisms have been incredibly positive, providing assurances to their respective societies that students graduating from 'accredited' programs are duly educated and properly prepared to enter the profession. In earlier manifestations the regimes and criteria were arguably more rigid and common – with one size fitting all – however, over time more flexibility and customization, in essence celebrating the uniqueness of schools, was enacted. Such higher levels of mutability and 'give & take' were aimed at acknowledging the character, culture and climate inherent to a given school in a distinct setting (e.g., geographically, demographically, philosophically, politically, financially, etc.). To meet the distinctiveness of a particular school, some balance was sought between disciplinary and general (e.g., liberal arts) content, between scientific and artistic dimensions, between theory and practice aspects, etc. While such approaches, attempting to meet societal needs while also seeking some equilibrium between the general and the specific, worked well in the education of many generations of architects, the authors of the present paper argue that today parts of the strategy may no longer prove appropriate nor viable. In particular, as is presented in the current research, we argue the basic skills and core knowledge must be reformed to meet, head on, the plethora of new forces, factors, crises and catastrophes in our orbit.

The present paper argues against subscribing to lowest common denominators to shape and set accreditation criteria. While core knowledge can and should be determined and addressed

in architectural education, each school needs to ask tough questions, grounded locally, regionally and globally, concerning how they can best build and deliver a curriculum that prepares their students for practice in a rapidly shifting and taxing ethos. Spelling out some base demands, which tackle key problems, will afford insights into new directions for accreditation. The first and second authors of this paper, both seasoned scholars and experienced senior administrators, have worked with, written about and interrogated architectural accreditation systems in various jurisdictions. Assessment of current regimes for accreditation underscores many especially important criteria that should be retained and even strengthened, for example addressing life safety, comprehensive design, collaboration, and accessibility, and others. The paper endeavors to address and fill in some key deficiencies, or gaps, given society's rapid transformation of and emergent challenges at this point in time. The present research attempts to identify some central challenges facing us, and by extension residing within the domains of education, while also exploring potential means and methods with which to confront these ongoing and very troubling problems.

4. MOUNTING + GROWING CHALLENGES

> "Architecture often ignores its role of making a place with purpose." (Cedric Price, 2003)

As previously underscored, the problems facing society today, and indeed civilization writ large, are countless, complex and concerning (Imam & Sinclair, 2018). In many ways the massive escalation of said issues, both in number and scale, prove incomprehensible. A century ago, problems were typically localized, simple to grasp, and manageable to tackle. However, today, for many reasons including, most notably, the explosion of information technologies, problems jump jurisdictions, are evasive to understand, and often impossible to deal with (at least through the deployment of conventional means, available tools and accessible knowledge). Crises are now inseparably intertwined, blurred & unbounded, difficult to categorize, and even harder to consider. Single disciplines can no longer understand, on their own, contemporary dilemmas. Rather, diverse disciplines must closely cooperate in analyzing circumstances, navigating through the quagmire of complications, seeking reasonable remedies, and charting paths forward. Conventional modes of operation can neither fully see nor fully solve unconventional crises (Sinclair, 2019).

To begin the process of questioning architectural education, pedagogy, curricula, and accreditation, the researchers identified, defined and delineated some more pressing facets of modern society that demand our attention. By considering the problems in play today, logically we are better able to reform and reset teaching and learning to better prepare students for practice in ever-changing and turbulent times (Sinclair, 2020). The following are some more perplexing, tricky and 'grand' challenges that warrant our focus as educators, practitioners and professionals. Unquestionably the boundaries among these challenges are blurry with overlaps manifold – while the researchers separate these for descriptive and manageability purposes, when addressed within the curriculum attention should be given to dynamic interactions and systems-thinking. While this call flies in the face of the Western mantra that highlights for "A place for everything and everything in its place.," it is nonetheless essential in fragmented times and too often dysfunctional realms.

- Climate: The implications of climate change, and global warming, are now well grasped by countries around the planet. The devastation and disasters once predicted are now playing out in real time before our eyes and in our communities. From wildfires

and droughts to hurricanes and floods (to barely scratch the surface), climate chaos is wrecking havoc on our lives and costing us greatly (financially, socially, psychologically, etc.), as citizens and societies. As we know, the design and building sectors are major contributors to such crises. As we also know, design and building sectors must be major players in remediation, resolution and regeneration. Students need to be intensely knowledgeable and skilled to contribute post-graduation. Sustainability, green, living and well buildings are no longer marginal or optional – they are mandatory and mainstream.

- Health: In the northern hemisphere we commonly spend upwards of 90% of our time indoors – in buildings. For many years, the architectural profession was not overtly aware of connections between the way we design and the implications to users of these designs. However, in recent years, for many reasons, acute awareness, and deep knowledge, has arrived that connect design to health, both individual health and community health. Tightly sealed buildings brought sick building syndrome into common parlance. Central air systems raised understanding of risks of airborne illness, such as Legionnaire's Disease. Automobile focused planning has engineered exercise from our lives, ushering in escalating obesity and other conditions. On a positive note, research has also contributed to heightening our understanding of the vital roles and positive impacts of daylight, greenery and views in our lives, and especially within buildings. Society is now more aware of the intense relationship of design and health, and as a result increasingly demands architects, and their designs, to foster wellness.
- Economy: The financial impacts of the building and real estate sectors, within our societies, are massive and even immeasurable. Buildings, and the large spectrum of companies (development, design, construction, manufacturing, management, etc.) that feed into the building industry, play primary roles within local, national and international economies. Related to other facets, including climate and health, growing attention is focused on our responsibilities to manage resources in diverse ways, including recycling, adaptation, and obligations within circular economic systems. By training, architects have historically had limited exposure to theories and practices concerning macro and micro-economics. However, architects inevitably, through their design work, have major influences on finances and economics. Students need to understand how money flows, how resources are deployed, the ways in which materials move, and the roles and responsibilities of architects within these extraordinarily complex relationships, dynamics and structures.
- Inequity: Architecture and development, as pertains the building sectors of society, have arguably been connected to power and privilege. Architects meaningfully participate in a relatively small fraction of the built environment, for example in North America it is widely accepted that Architects design less that 10% of constructed buildings. Many critics have expressed frustration that greed and preservation of the status quo have fueled much of the enterprise. Recent moves and movements to address other than the so-called 'one-percent' have seen the spotlight, in essence underscoring the need for environments to be fairer and more inclusive, versus catering to narrow segments of society. Over recent decades attention has been directed to the widening wealth gap between the global north and south. While this gap continues to grow, recently focus has been on income and wealth inequities within developed nations and even within cities & communities. Architects, historically and conventionally, have exercised limited voice in such discussions and debates. However, there

are signs of a shift, whereby the profession and practitioners are talking about such imbalances and seeking ways to positively contribute to a more just society. Students absolutely need to be informed and engaged in conversations, research and projects aimed at bringing more equity to the built environments. Architects have remarkable opportunities to exert influence – dialogue needs to transpire around means and methods to reach good ends.

- Conflict: Locally, regionally, nationally and internationally conflict brings disruption, despair and in many cases death, to good men, women and children. Much of the West has been relatively isolated from such turmoil -- however in recent years, and especially with the rise of domestic disarray and disagreement, even areas accustomed to calm have been confronted by chaos. Within the architecture profession there has been scant attention paid to such concerns around conflict, simply because out-of-sight translated into out-of-mind. That said, it is no longer an option to be ignorant, apathetic or uncaring. Today the situation is morphing with many societal problems, and especially pertaining to conflict (regardless of root causes – whether political, legal, religious, ethnic, etc.,), looming large in our lives. Whether next door or around the world, architects and the profession need to be informed and need to develop stances, especially on humanitarian grounds. This does not imply that regulatory or advocacy organizations, and even individual firms & corporations, should be intrinsically political, but rather that they need to be aware, sensitive and open to action. To such ends, the education and preparation of students should include curricular content that builds knowledge of such affairs, and equips students to become informed, inspired and responsible practitioners.

To sum up …

The challenges facing modern society, and impacting our everyday lives, are many, complex, and, largely, unavoidable. While traditionally the limits of the architecture profession were clear and bounded, we no longer have the luxury of avoiding engagement, claiming ignorance or limiting our view. In fact, the opposite scenarios are urgent, whereby architects, and architecture students, are willing to get involved, are informed of the facts (and able to separate wheat from chaff) and are operating with eyes wide open. Specialization does not release professions from bigger societal obligations, limit their ability to positively effect change, or excuse them from rising to meet moral imperatives.

5. PEDAGOGY'S COLLISION WITH CHANGE

> "A connected curriculum would encourage the integration, application and discovery of knowledge within and outside the architecture discipline, while effectively making the connections between architectural knowledge and the changing needs of the profession, clients, communities and society as a whole." (Boyer, 1996)

Philosophies concerning education, and the structure and delivery of teaching (i.e., pedagogy) need to be tightly and meaningful connected to the spirit of the times. To execute education that is out of touch with contemporary issues, which proffers obsolete knowledge, or that focuses on outdated skills, places the architecture profession on the losing side of equations for progress (Sinclair + Furlan, 2022). Architecture, as a discipline and a profession, is well positioned to embrace, advocate for and introduce real, positive and demonstrable change. However, for such transformative impact to materialize it is necessary to reform the ways we prepare students to practice in an arguably volatile and, at times, desperate world. For sure the authors in no way propose a far-reaching denial of the past, or a broad discounting of previous means. To the contrary, many aspects of past

and present architectural education are both relevant and potent – for example, the studio's emphasis on iteration, open-mindedness and tacit knowing – and deserve our attention and incorporation (i.e., into reformed modes of operating). That said, there are aspects of the ways in which we have taught that need scrutinizing, reforming or abandoning. In this way the authors encourage an extremely critical assessment of needs and a subsequent determination of theories, tools and techniques that could be developed and deployed moving forward. We need to ensure our curricula, and our students, are future-fit, resilience and adaptable. We need to teach students to be cognizant that there are many things they do not (and perhaps cannot) know, but also how to cope with unavoidable uncertainty and unpredictability.

Just as there is a plethora of challenges facing society, and higher education, so to is there a wealth of possible means to respond. The present research underscores numerous aspects of higher education that may prove especially germane at the present juncture. These aspects are not isolated and distinct, but rather are highly interconnected. A key aspect of our suggested reset of architecture education is to approach curricula, and teaching & learning, in a manner that embraces systems-thinking and that instills in students a profound awareness of the inter-relationships of forces and factors, means and methods, theories and practices at play and to our avail as problem-solvers in and creators of the built environment. Numerous of the points rendered below have been illuminated by the first author in previous papers (see, for example, Sinclair, 2019), underscoring glaring deficiencies (e.g., business, psychology, research) in the present diet of courses + studios offered in many schools of architecture. The following are a selected array of issues to consider as pedagogical reform is envisioned and enacted.

- Technology: Technology has developed in extraordinary ways, including the arrival of advanced computer, information and communication systems that have irreversibly altered our lives, our cities and our civilization. For architects, such technology has remarkably transformed the nature of practice. Beyond the physical and conceptual confines of the design office, emergent technologies are shaping construction systems, prefabrication + making, robotics + manufacturing, and even monitoring/modifying of building environments and performance. Educating students to master, optimize, criticize and contextualize such technology is paramount.
- Psychology: Architecture is not a fine art but a social art. In constructing a building there needs to be attention paid not only to the container, but vitally to the contained. Users need to be defined, understood and accommodated in our design processes and products. To this end it is vital for designers to understand how built environments shape who we are and how we feel as users of spaces and places. Environmental psychology needs to be a required part of the curriculum in all schools of architecture. There is ample research explaining the relationships (both positive and negative) of people and place – it is fundamental to cover this territory in the education of architects.
- Sociology: While architects, as noted under the category 'psychology,' need to understand how design effects people, they also need to be knowledgeable around how groups of people, including communities, behave and react, and what they expect and deserve. There are many fields that address such complexities, including cultural anthropology and urban sociology. As have been noted elsewhere in the paper, there is a pressing need to understand design and construction in a broader fashion than attention to site and building may suggest. In fact, many aspects of group behavior, such as NIMBYism (Not In My Back Yard), directly impact the paths and outcomes of discrete projects. Architects are increasingly called upon to respond to community needs,

fears, aspirations and the like. The education of architects should, in sensible ways, incorporate such learning within accredited programs, including opportunities to observe/participate in political exercises (e.g., development approvals, land-use approvals, court cases, etc.).

- Business: An examination of most schools' curricula will quickly highlight an absence of formal business training. However, the primary aspiration of most students in such programs is the pursuit professional practice and the establishment of a private firm. Given that business acumen is fundamental to opening and running a company, and to sustaining it to get projects in and out the door, this deficiency in the education of architects is somewhat unfathomable. In many schools the exposure to business comes only through limited professional practice courses (often single 3-credit hour) within a student's program of study. In many studios projects are not assessed regarding construction cost or financial viability. Pro Forma are largely avoided as key to understanding projects from a development vantage point. And yet, if attending to money and business practices are viewed as optional or even in bad taste, there are inevitable and negative consequences downstream. Students need to be versed in business principles and comfortable manoeuvring in business milieu – their success, efficacy and impact as practitioners is directly hinged on such intelligence.
- Research: Today clients and governments, and even the public, are increasingly expecting evidence to inform decision making. Evidenced based design is a concept that has seen strong uptake, whereby processes are influenced meaningfully by knowledge. Previous examples of links between design and health outcomes serve to illuminate the value of research to architectural production. In many architecture schools formal research training holds limited cache. Students commonly see the extent of 'research' defined by internet search engines, and the most evident manifestation of 'research' as precedent studies. Few students are exposed, yet alone educated, concerning research methods, or distinguishing qualitative versus quantitative, or grasping principles of validation, generalization or dissemination. Rare are cases of students mining through research journals, in architecture and critically beyond, to build arguments supporting their project design directions. In light of the previously noted 'grand' challenges facing our globe and ourselves, the education of architects needs to develop research skills, knowledge and acumen.
- Sustainability: Fortunately, many schools have embarked on paths that meaningfully introduce principles and practices for environmental sustainability, green buildings, and the like. However, this content is commonly packaged into a discrete and bounded (often 3-credit hour) stand-alone course. The authors argue this is both insufficient and inappropriate. The locus of sustainability knowledge, and skills development, needs to be in the studio with projects as case studies. While students may gain awareness of rating systems and performance metrics around green building, they need to be facile with the fundamentals and principles underpinning such assessment programs. Understanding the core drivers of systems that celebrate and manifest concepts of living or well buildings is essential in the education of architects. Students should move beyond the goal of 'doing no harm' to embrace objectives around restoration, regeneration and demonstrable respect of environments.
- Ethics: Finally, we all need to work diligently and tirelessly to instill in our students, and by extension to architects, a vibrant and consequential moral compass. The first author has researched and widely written

(see, for example, Sinclair, 2019 "The Devil's Crop") on the need for students to interrogate and determine concepts of right, wrong and appropriate. Manifold aspects of society, and its systems, are under assault – with many questioning the facts and truths that guide our steps and inform our decisions. Rather than simply accepting popular opinion, or progressing with less than adequate evidence, architects and students of architecture, need to be well versed and well equipped to determine the facts and to render ethical decisions based on solid grounding and strong foundations. While this is hard sledding, it is perhaps the most critical of all suggestions brought forward in the present paper.

To summarise …

The previously mentioned list of issues to insert and intertwine in architecture curricula is neither complete nor defining. Rather, it is an attempt by the authors, based on research & experience, to identify potential subjects and to illuminate acupuncture points that can, if exercised, stimulate the broader system into more potency, higher efficacy, greater relevance and deeper impact. As noted, each school needs to find a curriculum that works in context, that celebrates personality, and that respects accreditation demands. The authors believe this can and must happen, but that our current global circumstances warrant a major reset – to our minds following the guidance and provocations laid out in the present paper. Again, we underscore many of the objectives and criteria in present accreditation regimes are sound, but argue they are insufficient as presently cast.

6. SO WHAT? IDEATIONS AROUND A CONCEPTUAL FRAME

> "While we endeavor to provide spaces and places that are functional, durable and dependable, the real magic of design and planning lies in those aspects that move us well beyond. Strong design and planning accept the pragmatic as a given while aggressively pursuing the inclusion of the poetic. It is in this intricate balance of pragmatic and poetic that the spiritual is most likely to manifest. With basic needs realized, users of our spaces and places can then have the opportunity to experience beauty, encounter solitude, attain flow and achieve meaning in ways that enhance emotions, accentuate perception and heighten pleasure." (Sinclair, 2019)

In consideration of the challenges facing society, that architectural education must respond to and is embedded within, and the tools and techniques at our avail to cope therein, the authors explored the overarching parameters that are necessary to achieve traction toward progress. Historically, while architecture itself is a far-reaching discipline, incorporating by necessity dimensions of art and science, it has tended to operate within a rather limited bubble. Conventionally conducting & coordinating the sub-fields of engineering, and with oversight on construction matters, the architect has resided in the relative separation and security of the building industry. However, the drastic changes in society, including the call for greater equity diversity, and inclusion, have ushered in more sensitivities concerning user needs, community expectations, environmental responsibilities, and so forth. Further, recent calamities such as the global pandemic, sick building syndrome, endemic obesity, and other physiologically + psychologically impactful conditions have brought to light the roles of architecture & design in either improving or degrading our wellness. Research abounds pointing to the built environment as a fundamental determinant of public health. Additionally, architecture has more often than not been a display of power and an instrument of privilege, serving intentionally or inadvertently to separate and segregate various sectors of the population. Such prominent factors, introducing striking change into the market, give architects cause to pause.

It also calls on educators and researchers to reconsider approaches, and aspirations, around the teaching of students and the pursuit of new knowledge. To such ends, the authors have developed a model, or conceptual frame, comprising the key tactics needed as novel curricula is developed, teaching is adjusted, and research is conducted. The model was developed to provoke thinking that departs from the status quo – in essence a challenge to a business as normal approach to current education. The following four elements comprise our model for a pedagogical reboot.

- Interdisciplinary: Novel problems demand innovative approaches, and central to this pursuit is to expand the view and widen the catchment beyond the arguably narrow confines of Architecture. As this paper has underscored, the built environment is shaped by and in turn shapes many forces (including people). Buildings influence health, the economy, the environment, our feelings, and so forth. Architectural education, however encompassing it may claim to be from a 'subject' or topic perspective, needs the input of other disciplines. Our students need to be taught by, and interact with, others beyond our discipline – for example, medical doctors, social workers, cultural anthropologists, etc. Interfacing with those outside our field and learning to see through the eyes of the other, is essential in an increasingly complex society.
- Leadership: It is necessary to develop awareness and knowledge in underserved and unserved areas of the curriculum, as the paper clearly delineates. However, understanding alone proves insufficient. Students need to have the skills to mobilize knowledge to effective ends. In this regard we identify the critical need to develop strong leadership qualities within a student's time in an accredited school of architecture. Leadership equips students to move an idea from concept through construction or mobilizing a principle into an action. In many ways to achieve traction, pedagogically, schools need to transcend book learning to immerse students in experiences which test their ability to lead. One way to meet this objective is to have students actually solve problems in the 'real world' (in-situ) versus addressing them hypothetically in the classroom (in-vitro). Experiential Learning presents a powerful vehicle to have students move theory to practice, ideas into reality, and words into deeds.
- Intersectoral: Today it is insufficient to attempt to operate, as an architect, in isolation from the messiness of the market. Likewise, as we educate students to become architects, we need to ensure that integration replaces isolation. While specialization remains important to building discipline-specific knowledge and skills, this specialization must be grasped and operationalized within a great sphere of other specializations, other disciplines, other professions, other fields, other players, and the industry writ-large. As students work through an accredited program there needs to be opportunities to discover, firsthand, how others contribute to imagining, conceiving, constructing, occupying and managing the built environment. Of course, included in any equations for the crafting of build environments are the broader array of environmental design professionals, the many authorities holding jurisdiction, the building contractors, the product manufacturers, and many citizen groups. Students need to learn not only about the existence and responsibilities of these sectors, but critically how to engage with them, to work together, and to solve problems as a team. From awareness of life cycle assessment to knowing how to maneuver within supply chains, today's students need new ways of working that were simply irrelevant or unknown in earlier times.
- Holism: Last, but by no means least, is the critical need to teach students to think about systems, connectivity, relations, and inter-

dependencies, in rich, potent and effective ways. Rather than delving only into details and specifics of design processes and products, equal if not greater focus must be on systems-thinking and holism. Many of our modern problems are the result of reductive thinking – of obsessing on the minutia of a given circumstance as opposed to grasping context, understanding history/genesis, and seeing how puzzle pieces fit together. The adage that one 'cannot see the forest for the trees' is entirely relevant to our argument. Students need to see the bigger picture and to grasp correlation and cause-and-effect well beyond the confines of a narrow design decision or building project. This includes environmental dimensions of projects (e.g., watershed impacts) but also implicates social, financial, political, cultural and spiritual realms as well. Students must be able to holistically appreciate novel problems if they aim to arrive at appropriate, innovative and impactful solutions.

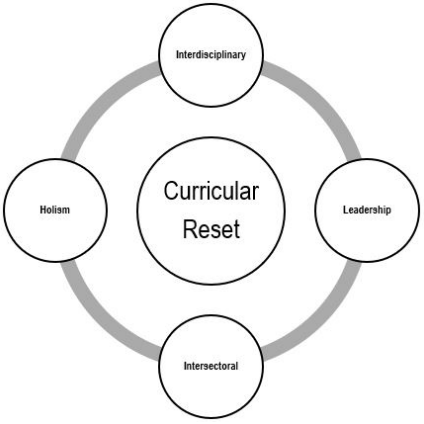

Figure 1. Rethinking Design Pedagogy in a Milieu of Dramatic Change

Enacting the Frame

Architectural education moving forward, regardless of the different curricular directions per 'accredited' school, should critically consider these four aspects of pedagogy: namely, interdisciplinary, leadership, intersectoral, and holism. The authors contend that embracing & enacting these overarching tactics will better equip the teachers and the curriculum to prepare graduates for maneuvering in environments of professional practice (both process and product-wise) that are remarkably complicated, often volatile, and undoubtedly in flux. Taking an integrative strategy whereby 'seeing, thinking & acting' are expanded and intensified seems vital in our current times. This frame also contributes to the urgent need to develop clear and cogent worldviews' and 'self-views' in our students – that is, having them confidently grasp their world and understand their place and potential therein.

6. CONCLUSIONS

> "Through a growing capacity to tolerate uncertainty, vagueness, lack of definition and precisions, momentary illogic and open-endedness, one gradually learns the skill of cooperating with one's work, and allowing the work to make its suggestions and take its own unexpected turns and moves." (Pallasmaa, 2009)

So much of our world seems confusing and discouraging – perhaps depressingly understood as plunged into darkness, chaos and uncertainty. That said, the authors believe there is outstanding opportunities for architects, for the profession, for the schools and their students, to contribute to strategies, systems and solutions for a brighter future. In large part we contend that to meet such ends the education of architects needs a drastic reboot. Often systems are difficult to reform or transform, and especially when the associated

bureaucracies are heavy and cumbersome. Inertia is difficult to deal with in many cases. We argue that a curricular reset is perhaps the most viable place to begin the shift – from product oriented to process driven, from single buildings to systemic attention, from a concern with the container to an obsession with the contained, from priorities of aesthetics + form to equity, social value + sustainability, from operating in isolation to being an essential contributor in a dynamic web of agents and actors, etc. The present paper should be understood as intended – as speculation, observation, provocation and proposition, versus as definitive stances on indeterminate, fluid and unprecedented circumstances. We are all struggling, as architects, educators and students, to make sense of an increasingly senseless milieu and to find ways to inject reason, creativity, strategies and solutions to right some ships and proffer some hope.

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PAPER #5.06

WISDOM OF PERSIAN ARCHITECTURE: EXPLORING THE DESIGN OF THE M.T.O. SUFI CENTRES IN SEARCH FOR THE 'SPIRIT OF PLACE'

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ABSTRACT

The field of architecture and design has changed and been impacted by advanced technology over the past few decades. Our world, which was already experiencing drastic change, has recently encountered accelerated upheaval due to the global pandemic. Enamored by virtual reality (VR), 3D printing, global positioning, and the proliferation of robots, we are arguably too often surrounded by resultant superficial, meaningless, and soulless spaces to which we can neither relate nor connect. The sense of delight, serenity, poetry, and beauty that we inherently desire and yearn for, is becoming increasingly rare -- and at times even lost -- in today's architecture. It can be argued that contemporary architecture risks becoming more a tool and product than a work of art that mirrors society and self. As architects, we are responsible to humanity through our quest to design spaces that reunite us with our inner selves and foster a sense of being. Considering recent challenges, crises, and catastrophes, designers are continuously researching the well-known traditional and aged architecture of the past for novel approaches that can enlighten future works. Architects are beginning to more assertively seek factors that propel transcendental experience in space. The present paper considers the case of Persian architecture - one of the richest and most eminent architectural styles in the world. Most buildings of this genre were designed by individuals who were most notably spiritual masters, mystics, astronomers, mathematicians, philosophers, and then architects. This paper interrogates architecture to critically delineate Persian architecture's role in enhancing contemplation and provoking reflection while highlighting spaces that poetically respond to and nurture our soul. Deploying a literature review and analysis of recently built Sufi Centers in the United States, the research then builds an argument for linking the wisdom of Persian architecture with the spirit of place focusing on the encounter of transcendental moments in space. All these Sufi centers are affiliated with the *Maktab Tarighat Oveysi* (M.T.O.) Shahamaghsoudi School of Islamic Sufism. Analysis of case studies culls out qualities of space that give rise to sacred (non-religious) experiences including connection with self, balance/ harmony, and most important of all, unity, and oneness internally and externally. Persian architecture, as one of history's most celebrated building traditions, considers the intense relationship between the sacred and profane, between mortal and immortal, and between the physical and the non-physical. The analysis of these exceptional case studies serves as the foundation for an anticipated and thought-provoking guide to 'transcendental design,' introducing a novel

approach for designers that encourages advancing beyond the physical form to pursue and optimize the vital intersection of wisdom, space, place, and self.

KEYWORDS

Persian architecture; theory; transcendental space; unity; sacred space; spirituality; holistic design; systems-thinking.

1. INTRODUCTION

> "The purpose of construction is making things hold together, of architecture to move us. Architectural emotions exist when the work rings within us in tune with a universe whose laws we obey, recognize, and respect. When certain harmonies have been attained the work captures us. Architecture is a matter of 'harmonies,' it is a pure creation of spirit." (Le Corbousier)

Faced with an inhumane and alienated society where one is constantly relying on technology for day-to-day needs, humans are in search of connections with their origins by creating sacred spaces that are uplifting and positively charged. Architecture has become more of a product that is being produced rapidly. This result in creating spaces that are: shallow, lack quality, and continue to exist without character and meaning. Given the advancements in science and technology at the moment where there is a constant need for quantifiable proof and reasoning, humankind is distanced and disarmed to genuinely experience the poetics and phenomena of art and architecture through a more qualitative approach (Failer 2014). It seems that we are in need to have more spaces that activate our "relationship to nature, a sense of spirit, connection to place, and the assurances of community" (Sinclair 2000). Exceptional architecture is a special realm between imagination, reality, creativity, and a search within where everything reunites - a space that can "transcend time and climb toward the infinite" (Ardalan and Bakhtiar 1973). In transcendental architecture, there is no distinction made between space and the person present in space which fosters a sense of cohesion. Traditional methods of designing spaces are renowned for their unique and distinctive qualities in creating moments where people connect with themselves and their surroundings and one of these traditions is how Persian designed buildings through a lens of sacred. As Sinclair states "When one considers great cities, or great Architecture, or great spaces, there are inevitably aspects of 'awe', 'breath-taking' and the 'magical' at play" (2011, 4). Buildings and places that not only exhibit beauty, balance, and harmony with the physical world but also evoke a sense of curiosity and awareness beyond the brick and mortar- metaphysical qualities that foster connection with the Divine. Therefore, the embodied meaning of the visible world can be grasped once we look beyond matter and form to reach the invisible. This is the only way to truly experience architecture as a whole and to understand its relationship to ourselves and the environment.

With its distinctive style and design elements, Persian architecture echoes profound spiritual and cosmological meanings and concepts as well as, an in-depth connection with principles of nature and the metaphysical dimension. As one of the well-known architectural styles, Persian Architecture contains elements that are all interwoven together, and "nothing is ever divorced from meaning" (Ardalan and Bakhtiar 1973). In this paper, the authors aim to focus on the depth and layers of meanings that are hidden in this type of architecture with reference to mysticism. Meaning in Persian translates to Ma'na - genuine meaning or the spiritual. In the teachings of Islam, space has meaning as well and it is "one of

the most direct symbols of being" from the cosmology point of view, it is "the locus of the universal soul" (Ardalan and Bakhtiar 1973). Even though this style of architecture has a long history and deep roots in history, very few researchers have investigated an in-depth study and analysis of it in connection to sacrality and self. For this reason, this study aims to first investigate the depth of sacrality in Persian architecture through the lens of Sufism, the mystical dimension of Islam, and secondly to ascertain the link between key design principles and sacred by exploring the concept of hermeneutics (Ta'wil) and symbolism (Corbin 1969) by looking at specific examples of buildings called *Khaneghah* 'House of Present'. It is important to note the additional layers of information provided in this paper are through Nooshin Esmaeili's (one of the author's) lifelong personal experience, understanding, and education as a student of the School of Sufism. In this paper, the authors are interested in the connection and relationship of the individual with their surrounding environments, through the lens of sacred, and its impact on creating unique ineffable moments that are beyond the ordinary. As Rudolf otto states this experience can be a mystery or a non-rational and non-sensory feeling where the primary and immediate object is outside the self - a numinous experience (Otto 1970). This study, therefore, set out to explore and uncover the wisdom of Persian architecture and the significance of the self within it. The findings show a holistic approach to designing space where one is present and connected not only with the environment and atmosphere, they are experiencing but also with an inward experience and reflection resulting in oneness and unity with the internal and external world. The findings also highlight the importance of orchestrating the physical with the metaphysical realm in architecture for a coherent design that is timeless and mystical.

2. SUFISM: THE PATH TO SELF KNOWLEDGE

Sufism, the mystical dimension of Islam, is an inner spiritual quest to realize one's true self and to become one with the beloved-the Divine. There are various Sufi orders in the world, however for the purpose of this study and based on the authors' personal experience and knowledge of the school (as a Sufi student of the M.T.O. Shahmaghsoudi), the focus will be primarily on the M.T.O. Shahmaghsoudi School of Sufism. Professor Nader Angha, the current master of the M.T.O. Shahmaghsoudi, defines Sufism as the "Reality of Religion" (N. Angha 2011). He clarifies that the only way for the seeker to reach the truth, regardless of their ethnicity, race, or culture, is to gain knowledge of the 'Self' rather than following a formalized religion blindly. Even though the organization is recognized as the M.T.O. Shahmaghsoudi School of Islamic Sufism, members of all other religions, including Christianity and Judaism, attend Khanegah and join the weekly sessions. According to professor Angha "The most fundamental purpose of religion is to transform human beings from their base level to their Divine level of existence" (N. Angha 2011, 36). Schimmel also explains that 'Mysticism has been called "the great spiritual current which goes through all religions. In its widest sense it may be defined as the consciousness of the One Reality – be it called wisdom, light, love or nothing" (1975, 4). A central concept of Sufism is the principle and fundamental doctrine of Unity (Tawhid) or the action of uniting both within oneself and the world (Nasr 1964). In our today's culture, we are accustomed to seeing "ourselves and other matter as individuals, separated and isolated" from one another by relying solely on our senses (N. Angha 2011, 42). In so doing, we are kept distanced from knowing our inherent essence and the unity of all existence remains hidden from us.

The traditional Sufi culture was mainly centered in Persia over the past few

centuries and it has inspired the culture, people, traditions, art, and architecture of this region (Grisell 1983). The Persian word for Sufism is Irfan derived from the word mari'fa, which means to know, to cognize" (N. Angha 2011, 38). In Sufism the seeker of knowledge and truth is called Sufi, '*salik*' or '*aref*' who embarks on a journey through three main stages, to reach truth and enlightenment. Salik becomes the lover in search of the Divine - the beloved. These stages are *Shari'at* - traditions (exoteric/external), *Tarighat* - the path of the heart (esoteric/internal), and *Haghighat* - state of the heart (Truth) (S. Angha 1986, 5). In Sufism, this truth, known as the source of life or the Divine, is within the physical body in the center of the heart (N. Angha 2002). The external world is the manifestation of the Divine that encompasses the cosmos. It is the reflection of the macrocosm whereas the Batin is the hidden dimension within man and is regarded as the symbol of the microcosm. Figure 1. A seeker is united with this source through self-cognition once all attachments to the world of material objects and the physical body have been removed. The seeker must transcend from the external, physical world (*Zahir*) to the hidden metaphysical realm (*Batin*) to reach the truth and thereby become unified with the Divine.

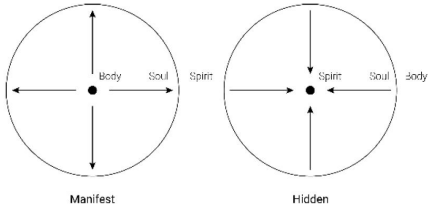

Figure 1. The manifest (Zahir) & the hidden (Batin). Source: (Ardalan and Bakhtiar 1973)

2.1 Principles of Sufism

To acquire self-knowledge the seeker is required to move from the external to the internal by following a specific set of principles to become pure and worthy to meet with the beloved. For obtaining truth and reaching self-cognition, a student first learns to manage and control his/her desires, habits, inclination, and dependencies on all physical, mental, and emotional levels. Consequently, transformation becomes apparent and gradually an inward sense of balance and peace will become dominant over all the constant "external attractions that pulled him in different directions" (M.T.O. 2022b). The Salik will discover the horizons of awareness without interruption and hesitation by following these eight principles (N. Angha 1986):

Zikr	to remember	Remembering God (the beloved) at all times
Fikr	to think, meditate	Being in a state of awareness and wondering
Sahar	to awaken	Awakening of soul and body
Jui'	to hunger	Having exterior hunger (mind) & interior hunger (heart) to obtain the truth & to persist in the search
Somt	to observe silence	Ceasing to think and talk about worthless things
Saom	to fast	Fasting of the body from food, mind from attachments, and soul from desires
Khalvat	to observe solitude	Praying in solitude, externally and internally
Khidmat	to serve	Dissolving in the truth of the master and dissolving in the Truth of existence, God.

Table 1. Principles of Sufism. Source: (N. Angha 1986)

2.2 Khanegah – M.T.O. Shahmaghsoudi Centers

To gain any kind of knowledge, one needs to go to school and start learning under the guidance of a teacher or a master. In Sufism, the school where the *salik* would go for spiritual direction is known as the *Khanegah* which translates to 'House of Present'. The word *'Khaneh'* means house and 'Gah' is that real or true moment in which a person is present. Gah is that full awareness and presence that one needs to continuously reach and prolong, both inwardly and outwardly (M.T.O. 2015b). From prayer, contemplation, and group chanting (*Zikr*) to serving and practicing stillness and solitude, the seeker practices each of the above Sufi principles under the guidance of the master or '*Pir*' towards the journey to enlightenment. Figure 2 below features images for two of the M.T.O. centers in Virginia and Houston, Texas. The Sufi ritual and practices are only the initial steps for entering the realm of the hidden within one's heart. As a symbol of external purity and oneness, towards an ultimate manifestation of truth, every student wears a white garment. This practice serves as a reminder to the seeker that "one's outward and inward calmness saves oneself from distractions and leads the seeker to tranquility and peace within" (Sepehri 2019, 58). When students enter Khanegah, as a practice of liberating from all physical belonging and attachments, they will leave their social ranks, belongings, attachments, worries and thoughts, and even their shoes behind before entering this sacred space (Grisell 1983). The challenge is to move through the external world as well as the human physical body to reach the internal source of life within the heart where peace and unity reside.

3. UNITY AND SACRALITY IN PERSIAN ARCHITECTURE

> "What lies behind us and what lies before us are tiny matters, compared to what lies within us." (Ralph Waldo Emerson)

Sufism has immensely influenced the traditional architecture of Persia. Persian architecture creates sacred spaces as a medium for delivering transcendental experiences. These are not necessarily religious settings, but rather spiritual and mystical ones. Sacredness goes beyond the physical to evoke unmeasurable feelings. It elevates a regular state of thought to a more meditative and transcendental state, creating indirect yet sensitive communication at the individual level (Esmaeili and Sinclair 2021). To reflect and manifest sacrality in a physical form, unity has been one of the key components of this architectural style. The message of sacred places, such as Khanegah, is to "connect with ourselves and the world within and experience the transcendent" (Goldberger 2010). From the perspective of Persian architecture and Islam, man is not separate from the cosmos. As Hossein Nasr states "The body of the man

Figure 2. M.T.O. Shahmaghsoudi Sufi Centers. a) Houston, Texas. b) Herndon, Virginia. c) Herndon, Virginia. Source: (M.T.O Website 2015a)

is the temple wherein resides the spirit (ruh) similar to cosmos that is animated by the same *ruh*". (Ardalan and Bakhtiar 1973). As previously mentioned from the Sufi perspective, the source of "life" (spirit or ruh) is in the man's heart, and it is called *'Jaan'*. The teaching of Sufism defines this source as the "stable reality" and calls it the "true self" or "I." Sufi teachings offer a more tangible explanation of this eternal source using the analogy of a seed. Once the seed is planted, it becomes apparent that the knowledge and life are embedded within the seed, and all " the necessary structure for it evolutionally process to move from seed to fruit was foreseen in the seed itself" (N. Angha 2011, 45). A pure and eternal source that resides within each being and similar to all cosmos are "equated with the Divine" (N. Angha 2011, 39). It is for this reason that the key doctrine of Islam is the oneness of existence - The One source, one beloved, and one truth. "Search for truth in your heavenly double, at a third point in the heart, the point of union of the two worlds, one delicate and one harsh, between sleep and wakefulness. The source of life in the heart is the light of knowledge and certainty, and the very knowledge itself.... It is the essence and the body of all things. Everything is brought to perfection by it" (Sadegh Angha 1986, 63).

Similarly, Christopher Alexander also explains this concept as the sense of self and refers to it as "I" or "Self, a pure unity that exists within all matter that he calls the "Blazing One." He states "This actual unity cannot be described as a structure. Yet it is this actual unity which is the source of life in the things we admire, and the goal of all our efforts when we make a building or work of art." He refers to it as parallel to the material world, but " that it is inherently incapable of having the structure" (2002, 150). Like Christopher Alexander, the Sufi teachings also describe this stable unity as formless but eternal. Sufism makes clear that even though the matter has different manifestations, its genuine reality is never lost, and nothing is either increased or decreased (N. Angha 2011, 42). Professor Nader Angha states "If we observe the structures of the smallest particles to the largest celestial bodies, we will see that the existence of each entity is founded upon a structure, and yet these structures are hidden to the naked eye" (N. Angha 2011). In Persian architecture, the physical form symbolizes and materializes this eternal source, while the spatial experiences are how it is represented and accessed (Esmaeili and Sinclair 2021). Humans have awareness of their body, their mind, and self. Humans are aware of their bodies and of themselves, thus it is reasonable to claim that our sense of self is entwined with the life and spirit of the building or place we are in.

3.1 Spirit of Place

The well-known concept of the Genius Loci (Spirit of Place), presented by Christian Norberg-Schulz, explains a similar concept in architecture. When all components of architecture work together in harmony and are unified, the outcome is a collection of spaces that have meaning and character (1980). Norberg-Schulz focuses on the existential dimension of architecture and emphasizes the qualitative and phenomenological aspects of space. His approach is to define and exhibit the relationship of man with his environment. It is common in western culture to refer to the individual in the space as the 'user' whereas, in Persian architecture, the individual is not the user who enters and passes through the space, he/she is in presence of architecture. The focus is on the full existence of the individual in space (mentally, emotionally, physically, and spiritually). The idea is to completely immerse the person in the experience, allowing them to feel the vitality and personality of the place from the first instant they enter it until the very end. Persian architecture has a distinctive approach that signifies a constant dialogue between the self and the place, creating an atmosphere that encourages introspection

while reuniting the individual with their origins. This dialogue then becomes a pathway in the experience of transcendence, which is "not beyond us but within us" (Walton 2015). This is also similar to the concept of "dwelling" that Norberg-Schulz introduced. He states "where dwelling happens is where life occurs" (1980). Persia has a complex and rich architectural history. Each element of the design has a spiritual connection to the overall theme of unity and oneness. Thus, the mystical and ontological depth of Persian architecture can only be appreciated once we transcend beyond the form and materiality of these elements. It is only then that we will be able to establish a clear relationship between the physical and the metaphysical, which will aid our understanding of sacrality and the transformational capabilities of Persian architecture (Esmaeili and Sinclair 2021).

3.2 Symbolism

Traditional architectures have been known to include a unified system of signs and symbols. Due to its rich content and manifestation of mystical and spiritual values, Persian architecture is one of the significant sources of symbolism. As a mediating vehicle, Persian architecture has applied this approach to represent the Divine, and the metaphysical concepts - a bridge between abstract, subjective principles with the tangible human experiences (Akkach 2005). This style of architecture serves as a gateway for transcendental exploration and meaning. As previously mentioned, the concept of *Zahir* and *Batin* (outward and inward) and their relationships are particularly important in understanding symbolism. According to Sufi's teaching, the external world is seen and "readily accessible to everyone" whereas the internal world is hidden and referred to as unseen. The outward world is " the world of natural realities that can be known directly through sense perception, whereas the unseen is the world of spiritual realities that can only be grasped by imagination" (Akkach 2005, 29). Thus, it is through symbolism and imagery in architecture, that one can access the unseen. In Persian architecture, each external appearance and manifestation (*Zahir*) is the emergence of an internal truth (*Batin*) and a pathway to reach the final stage of ultimate truth (*Haghighat*). Samer Akkach explains that symbolism can be one of the best methods for "comprehending the inner meanings of traditional art and architecture and for penetrating deep into their worlds of spirituality and metaphysics." (2005, 10). It is the inherent quality of sacred spaces to bring us into a state of peace and contemplation and to provoke and symbolize remembrance of the Divine (*Zikr*) (Nasr 1987, 4).

In addition to being a method, symbolism is also a language to convey thoughts and concepts in architecture. As Martin Lings put it is "the most important thing in existence" and "the sole explanation of existence" (Lings 1991, viii). In Persian architecture, spiritual connotations are prevalent in the choreography of space as well as architectural and design elements. Several of the principal places where symbolism may be seen include the usage of sacred geometry/shapes, and mathematical representations, as well as a relationship to nature and the cosmos. As Foster states "Centuries before computer-instigated geometry, through its knowledge of abstract mathematical symbols and their unifying relation to the various orders of reality, Islam aimed to relate the material world to its basic principle" (Foster 2005, 8).

4. CASE STUDIES

To better grasp the concept of symbolism and sacrality, this research conducted a preliminary examination of several key Persian architectural components via the prism of Sufism as well as their connection with cosmology and spirituality. The four case studies selected for this paper are the

Sufi Centers (*Khanegah*) affiliated with the M.T.O. Shahmaghsoudi School of Sufism, built recently in the USA. It is important to note that the current study was based on a limited number of data collected mostly on the center's existing photographs, from the M.T.O. Shahmaghsoudi website (http://suficenters.org/) as well as the photographs that are shown during weekly online lectures. Therefore, a more comprehensive and in-depth analysis of each of the centers is necessary for the next phase of this research through an in-person site visit.

As mentioned earlier Khanegah means the "House of Present." The symbolic meaning of the house is the heart and *gah* is the present moment in time – not past or future - where the seeker is fully present, aware, and focus on his heart. It is though one's full presence in the heart that the ultimate state of self-cognition or *Haghighat* can be achieved in the journey from the self, through the self, and to the self. Since *Khanegah* is the primary place where the seeker turns to pursue knowledge on the path of Sufism, it is a rich source for understanding the wisdom of Persian architecture in connection with spirituality. Sufi students gather and unite in *Khanegah* for prayers, zikr, lectures by the master, or other related activities. It is important to note that these centers were all designed by the current Sufi master, known as *Pir*, and built under his guidance and supervision in Virginia, Los Angeles, Dallas, and Houston, and by attending Khanegah students practice peace, balance, and harmony both externally and internally. This is accomplished through practicing self-discipline, being mindful of the present moment, and regulating and controlling all aspects of being - physically, mentally, and emotionally. Architecture becomes an external manifestation of the journey to self in the path of the heart. The seeker shows his adherence to the eight Sufi precepts followed by other traditional rituals - *Shari'at* - (exoteric/external) - to develop a consciousness that will allow him to contemplate the Divine. All the design elements are a means to "provide coherent modes of articulation for the awakened soul that seeks external expression" (Ardalan and Bakhtiar 1973).

4.1 Geometry and Form

Geometry and form are the main elements of design in creating spaces and moments in architecture. Shapes can influence how space is expressed architecturally. Nature is the source of all geometric forms and orders, and it is through nature and the cosmos that we understand the mathematical and complete manifestation of geometry and form. Foster reinforces this by stating that "the very structure of creation lies within geometry and numbers" (2005). Space is the most explicit representation of existence in Islamic doctrine, and "the 'locus' of the Universal Soul" in Islamic cosmology (Furze 2010). Geometry is directly connected with numbers and numbers are units of spatial classifications – three dimensions of space (x, y, z). Geometrical forms as defined by Furze, is "still moments, revealing continuous, timeless universal action which in general terms is hidden from sense perception" (Furze 2010, 81).

In Sufism, the circle is the most complete geometric shape, has great significance, and serves as the ultimate reflection of unity. The use of the circle and dome is one of the key elements known in Persian architecture which is also seen in the design of all the four M.T.O. Centers. The circle is entirely symmetrical relative to the center in all directions, making it the emblem of perfection. A circle is an endless form with no beginning or end. The circle symbolizes infinity and eternity, and it is the main underlying principle of composition in Islamic art and architecture, from the smallest detail patterns to large forms and buildings. Circles and spheres are said to be the symbol of creation as they can be found in the smallest particles such as atoms and cells and the movement of electrons (microcosm)

to the movement of stars and galaxies (macrocosms). The use of the dome in the design of the *Khanegah* and the orientation of the building towards the Qibla, are notable examples of this concept. In *Khanegah*, similar to all other sacred Islamic places, the students face the one singular point in the direction of *Ka'ba* (known to Muslims as the house of God and center of the Islamic world) for prayers, *zikr,* and mediation (Akkach 2005). This allows everyone to pray in one direction – towards the center- as a whole and practice oneness and unity as a large group as well as internally.

Breath of the Compassionate

In the teaching of Sufism and Islam, it is stated that man is the masterpiece of all creation and that go manifested himself and placed his essence into the man – *"Nafas - Al Rahman*" or the Breath of the compassionate. "The Breath of the Compassionate is the substance in which flowers all forms of material and spiritual being. It is the symbol of the creation of the entire cosmos. Physical bodies are manifested in the material cosmos when the Breath penetrates the material substance which is the receptacle of the corporeal form" (Corbin 1969, 298). The breath of the compassionate is also visible in the geometry and form of the *Khanegah* in the shape of the 8-pointed star.

In Persian architecture, all polygons originate from the intersection of circles including squares, rectangles, and triangles. Square represents the four directions, four quarters of the universe, four seasons, as well as four elements of nature – earth, wind, fire, and water. It is a symbol of stability and it "represents the most externalized and fixed aspect of creation" (Ardalan and Bakhtiar 1973). The 8-pointed star is also created by intersecting several circles because of interlocking two squares. The 8-pointed star, symbolizing the eight principles of Sufism, is connoted with the expansion and contraction of the form signifying the inhalation and exhalation of the universe. Once the two forms are placed adjacently, they alternately expand and contract into one another, giving a visual sense of inhalation & exhalation. Figure 3 illustrates how the final form evolved through intersecting circles and the portrayal of the directional forces that shaped it. The symmetry and balance of the form also symbolize harmony and unity.

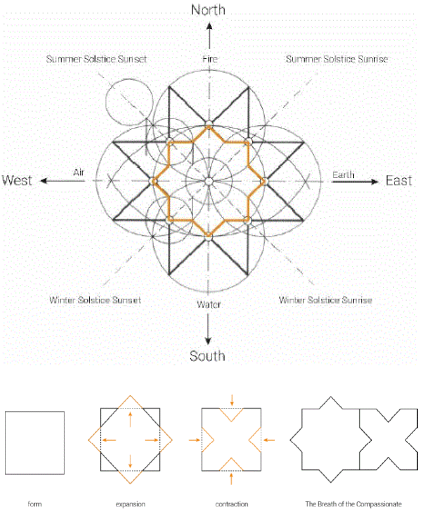

Figure 3. Development of the 8- pointed star - "The Breath of the Compassionate"- Source: (Author 2022, Bakhtiar 1976)

It is worth mentioning that the name of the Maktab Tarighat Oveysi (M.T.O.) Shahmaghsoudi is named after the first recipient of the holy prophet Mohammad's Cloak who was Oveys al-Garani from Yemen. Oveys knew the prophet inwardly from the heart without ever meeting him in his lifetime. Prophet Muhammad (PBUH) mentioned in one of his sayings: "I feel the breath of the Compassionate coming from the direction of Yemen" (Corbin 1969, 32).

4.2 Water and Purity

As one of the four elements of nature, water is a symbol of life, purity, reflection, and contemplation in various cultures and religions. Robert Birch describes the importance of water as the "...essence of life and the connection to water through place signifies a connection to an elemental place in Ourselves" (Birch 2014, 87). In both nature and our physical bodies, water is a metaphor for life (Barrie, Bermudez, and Tabb 2016) Persian architecture emphasizes the use of water as an essential element of design for sacred places both its physical and non-physical qualities. As a symbol of purity, water is present in Persian architecture for cleansing rituals before prayer whereas, in Persian gardens, it symbolizes life, beauty, and reflections of heaven on earth. In the design of the Khanegah, as well as the Memorial Building (built for the previous master of the M.T.O. school in Novato - California) a water fountain or a water feature is placed in front of the building in the courtyard. Most of these water fountains have an 8-pointed star pattern or decorations that resemble this design. By paying close attention one can see the fountain is composed of several components that join together to form a single entity that sits on a single point, and does so in perfect balance in line with the laws of physics and mathematics (Ayazi 2013). Figure 4 shows images of the water fountains located in front of the Sufi centers in Los Angeles and Dallas as well as the Memorial building (built for the previous master of the school- Professor Sadegh Angha) located in Novato, California.
One of the significances of Persian architecture is that it is both quantitative and qualitative, measurable, and immeasurable, tangible and intangible all simultaneously. The poetic, rhythmic, flow and movement of water along with its overall presence, not only activate the aural senses and provide a peaceful experience but also resembles the passing of time in creating an active architecture (Barrie, Bermudez, and Tabb 2016; Esmaeili and Sinclair 2021). The fountain symbolizes the pure life embedded within each individual and the internal balance and harmony that the seeker requires to achieve by practicing concentration and stability on the source of life in the heart. It can be said that the water symbolizes the external purification of the body and mind (Zahir) in the journey of internal self-cognition (Batin).

4.3 Persian Garden and Paradise

As part of its traditional culture, Persian architecture utilizes religious and philosophical ideas to construct a spiritual framework and has strived for unity and harmony within it. In Persian architecture, connection with nature, placement of the structure on the landscape, building's relationship to its surroundings and context, and the structure's orientation (toward the

Figure 4. M.T.O. Shahmaghsoudi Sufi Centers & Memorial Building. a) Los Angeles, California. b) Dallas, Texas. c) Memorial Building, Novato, California. Source: (M.T.O Website 2015a)

Qibla) all have meaning and significance. On the other side,the use of the gardens and courtyards symbolizes the ultimate paradise and image of heaven on earth where humans can thrive and be in their ultimate state of being. Gardens are an expression of the soul where the body reunites with the spirit or '*Jaan*'. It is a place where man is in full presence and experiences space with all his senses, the sound of the water and birds, the fragrance of the flowers, the colors of the trees, the warmness of the sunlight, and the overall beauty of the natural environment (Shirvani 1985). Man, according to Islamic teachings, is not distinct from nature. The garden from an architectural perspective "reflects the sense of place, the garden being viewed as a defined space encompassing within itself a total reflection of the Cosmos"(Ardalan and Bakhtiar 1973). The garden not only symbolizes growth and constant change in nature but its structures forms from a state of "progressive unfolding" (Alexander 2004). The Garden is a symbol of natural beauty that is hidden within it like a gem. The beauty is reminiscent of the Divine or the beloved. It is beauty that "bring (s) about remembrance of that celestial Beauty. If understood spiritually, beauty becomes itself the means of recollection and the rediscovery of our true nature as God had created us, the nature we still bear deeply within ourselves although it has been forgotten as a result of our falling into the state of ignorance and no longer knowing who we are" (Nasr 2007, 76).

To enter the garden and reach the main entrance of the building, one is required to pass through a Gate. The gate symbolizes the entrance to heaven, and it also denotes a passageway via which a seeker passes to begin the spiritual journey. As explained by Nasr, mysticism contains two main gates "knowledge and love" (Nasr 2007, 82). The journey is long and challenging; however, the seeker accepts to step on the path (Journey to self) and proceed toward the gate so he can eventually reach the truth and enter the garden - the paradise. The gate can also be symbolized as the entrance to the heart. Salik, through concentration and patience by practicing all the Sufi principles, will finally complete his journey and enter the realm of transcendental.

5.CONTEXTUALISING CASES | CONTRIBUTIONS TO A BROADER RESEARCH AGENDA

Through examining Persian architecture and its connection with sacrality and Sufism, one can understand different layers of knowledge and wisdom hidden within this architectural style. More research is needed to not only comprehend Persian architecture from a transcendental perspective but also to reveal design ideas and concepts that have been used traditionally for connecting man with their inner essence (Jaan) through architecture. There is still so much to learn and investigate that will further our search

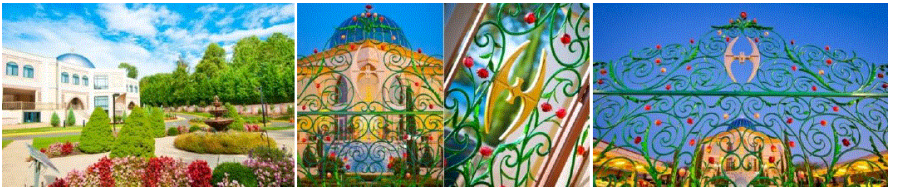

Figure 5. Garden and gates of the M.T.O. Shahmaghsoudi Sufi Centers, Source: (M.T.O. 2015a)

for creative ideas and methods to design environments with quality and meaning beyond form and matter. This preliminary study is part of a larger pursuit, and puzzle, to connect design to transcendence, stirring of the soul, and discovery of the self. This is a step toward a more thorough examination that is required to understand the relationships between the interior and external characteristics of the built environment and our everyday interactions with space. It is essential to not only explore the architectural characteristics of space but to observe and understand individuals' experiences and sense of space. This will be completed in the next phase of this research by implementing surveys, interviews, and conceptual mapping as well as first-person interpretation and analysis of space. The aim of this research and the purpose of this study have been reviewed with the M.T.O. Shahmaghsoudi representatives. A personal visit to the centers, collaboration with M.T.O. Shahmaghsoudi, personnel, and possibly a meeting with the architect of these facilities are planned to obtain further information for this project.

It is important to mention that all the M.T.O. Shahmaghsoudi Centers are designed by Professor Nader Angha, the current Sufi master of the school. Professor Angha's expertise encompasses a wide range of subjects, including physics, mathematics, astronomy, astrophysics, quantum mechanics, biophysics, philosophy, poetry, and architecture, in addition to the esoteric disciplines and sacred sciences (the science of letters and numbers, alchemy, etc). (M.T.O. 2022a). As a result, our project is seeking approval from the M.T.O. School to examine these centers under the direct supervision and direction of Professor Angha. This is to ensure all the information is aligned correctly with the teachings of the school, as well as to make sure nothing is overlooked or interpreted misleadingly.

6.CONCLUSIONS

> "Where is the Life we have lost in living? Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?" (T.S. Eliot)

It is through the connection with the physical world that one can reach the realm of the unseen. The purpose of this preliminary study was to discover Persian architecture's wisdom and its link with the cosmological and metaphysical dimensions to reflect meanings that are beyond form and substance. Architecture goes beyond deploying bricks & mortar and building walls and roofs. The rich embedded meaning for each of the elements makes one curious to appreciate space as a whole entity. By becoming fully present in the moment and experiencing the space in deep ways, this style of architecture not only connects with the individual on a tangible level but also brings one closer to the self, providing a sense of peace, harmony, and tranquility. Since ancient times, sacred architecture has served as a conduit for the invisible to become visible and as a means of establishing a connection with the Divine. This study has identified that Persian architecture, seen from the Sufi perspective, strives to express the idea of harmony and oneness within one's heart, from the outer world of Zahir to the inner world of Batin. One of the more significant findings to emerge from this study is that the spirit of place in Persian architecture is not just in the space or the choreography of the space but that it is embedded within every element of design – unity in diversity. All design aspects have special meanings that represent the journey to the truth along the road of self-cognition, from the orientation, form, and geometry of the structure to the usage of the garden and even the gates. In the path of Sufism, students seek their inherent and inner beauty concealed within the heart via external forms in the physical world. The present study

contributes to our understanding of spirit in architecture not as something religious, but elegant and universal that can be experienced by everyone beyond the confinement of their race, culture, religion, or background. This research has proffered a deeper insight into understanding the connection of physical with metaphysical, visible, and invisible forms one of the well-known styles of architecture. As such the research will play a part in extending the wisdom ingrained in Persian architecture concerning the self by looking at the newly built case studies through the rich and perceptive lens of Sufism. This study will prove useful in expanding our understanding of designing buildings and spaces that are not simply a passageway for individuals to move through, but places that have qualities and create moments - spaces that require stillness and the full presence of an individual to connect with all aspects of their being. It is important to mention that the scope of this study was limited in terms of the number of design elements explored for the mentioned case studies. A further examination could assess and explore other key design elements, such as materially, color, light/shadow, etc, to grasp a more comprehensive understanding of sacrality in Persian architecture. The next stage of this research will concentrate on an in-depth analysis of all the four centers. To gain a deeper understanding of the quality of the spaces and the experiences people have while visiting, each of the centers will be investigated from both an architectural and phenomenological aspect.

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PAPER #5.07

ARCHITECTURE AND MUSIC AROUND THE ALHAMBRA. REMINISCENCES OF A DREAMLIKE WORLD: LA PUERTA DEL VINO (DEBUSSY)

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ABSTRACT

Orientalism, as a variant of exoticism in the Romantic period, adopted a series of topics linked to distant countries and oriental cultures, including Spanish lands, especially Andalusian. This phenomenon was especially prolific in the world of the arts around the Alhambra, «doubly romantic for its medieval and oriental origin» (Raquejo, 1989).
Alhambrism was developed by traveling writers in the early 19th century, eager for suggestive scenarios in which to recreate their poems and stories. Later it spread to the plastic arts, with painters such as François Antoine Bossuet, John Frederick Lewis, David Roberts, Gustave Doré or Jenaro Pérez Villaamil. In the case of architecture, Alhambrism was nourished by parallel sources. On the one hand, the awakening to the conservation of the Alhambra as a monument witness to a dreamy period in the history of Spain, and the first interventions by Rafael Contreras, still under babbling and unscientific criteria. On the other hand, the impulse to decorativism through the seminal studies of Owen Jones and Jules Goury, convinced that «in the Alhambra the exemplary paradigm of the most perfect ornamental and chromatic system of all historical styles had existed was hidden» (Villafranca).
Music also found fertile ground for creativity in the Alhambra between the mid-19th and early 20th centuries, within the nationalist romantic movement. However, it was mainly the Spanish composers who chose the Alhambra to reflect the national identity: Tárrega, Turina, Albéniz, Bretón, De Monasterio, to which we should add a Debussy influenced by Falla.
The communication aims ultimately to investigate through analysis the musical resources used by the last-mentioned composer, Claude Debussy, to evoke with sounds the architecture and the sensual atmosphere of the Alhambra in one of the most representative works of Alhambrism in music: *La Puerta del Vino* (The Wine Gate).

KEYWORDS

Romanticism; nationalism; exoticism; orientalism; Granada (Spain).

1. ORIENTALISM, EXOTICISM AND ALHAMBRISM

During the 19th century and the first decades of the 20th century, a cultural movement against Classicism and the Enlightenment emerged in Europe and America: Romanticism, a new current that exalts the individuality of each work and the personal expression and interpretation of art and reality.
On the other hand, the 19th century represents for Europe a series of accelerated changes in the artistic sphere, and a scientific, philosophical and historical progress that

aroused, among other aspects, an interest in the Orient and Eastern culture. Studies of the European Islamic past proliferated and opened the doors to a new orientalist discourse through literature. This latter contributed to the proliferation of the new trend thanks to authors such as Victor Hugo, Gustave Flaubert, Georges Borrow, Prosper Mérimée or Théophile Gautier. Under an orientalist gaze, these romantic travellers laboriously sought sources of inspiration and knowledge to inspire their works, which they found in the Iberian Peninsula by equating it with the Orient and with this exotic reality they imagined.

Al-Andalus and Muslim culture made Spain one of the richest European countries in terms of oriental art. That is why romantic artists will turn their gaze to the architecture, landscapes and culture of the Arab society that had left a beautiful legacy after eight centuries of coexistence. In particular, the romantic gaze focuses on the Andalusian region, from which a new ideal, unreal and mythologised vision of an orientalised Spain was generated, which became an obligatory destination for every romantic artist in search of inspiration. The Spanish exiles themselves played a fundamental role in this romantic and orientalist exaltation, establishing contact with foreign artists and spreading the image of Spain there. In turn, there are countless Europeans who visited the peninsula attracted by these ideas, and spread their work in their origin countries. In particular, they focused their admiration on the city of Granada. Not only it was the greatest exponent of the contrast of cultures between West and East in Spain, but also represented a unique and incomparable example of wealth, brilliance, exoticism and colour, where the Alhambra and the Generalife played a fundamental role.

From this breeding ground arised the Alhambrism, a new artistic current that gave rise to an infinite number of works throughout Europe inspired by the Granada monument. This tendency had its beginnings mainly in the literary field. However, few artists resisted drawing the gardens, palaces or fragments of Granada and its Alhambra, of which a large number of engravings and sketches are preserved. Noteworthy among them was the architect Owen Jones, who found valuable knowledge about ornament and color in the Nasrid complex from a purely scientific approach, which he incorporated into his influential book *The grammar of ornament*. He produced an endless number of meticulous drawings, surveys, tracings and details that became a key reference point for the development of architectural Alhambrism.

Figure 1. The architectural complex of the Alhambra, seen from the city of Granada (Spain)

The Alhambra was in the cross hairs of the architectural debate of the century, and its spaces and ornamental elements were replicated and taken as inspiration by architects such as Agustín Ortiz de Villajos, Rafael Contreras, Narciso Pascual and Colomer, Émile Boeswillwald or Owen Jones himself. This architectural trend became a symbol of luxury, wealth, identity and spectacle. It was applied in exhibition pavilions as a symbol of national identity, as well as in Arab cabinets in aristocratic and high bourgeois residences and interior design in entertainment and show business establishments.

Parallel to architectural Alhambrism and within the field of 19th century music, Romantic composers –both Spanish and European– took as reference the spaces that these palaces offered as a source of extramusical inspiration to evoke the sensations and experiences that they themselves lived or imagined. This source of inspiration is what romantic artists called *programmatic music*, a music based on ideas, images, external stories that support it. In the case of Alhambrism, the source of romantic inspiration is the architecture of the Granada monument, its landscapes, its legends and its atmospheres.

Some of the Spanish musicians who composed following the Alhambrist line were Isaac Albéniz, Manuel de Falla, Ángel Barrios, Tomás Bretón, Ruperto Chapí, Jesús de Monasterio, Joaquín Turina, Francisco Tárrega. However, it should be highlighted the role played by the French composer Claude Debussy (1862-1918), the leading exponent of this genre outside Spain. Considered a reference of musical impressionism, Debussy is characterized by his complete detachment from musical rules in order to give free rein to his freedom as an artist, filling all his works with colour and sonority. He proposed completely new harmonic structures, giving greater importance to rhythm and tries to express, through music, every nuance of colour, reflection or freedom of movement, as it could be found in a painting by Monet.

The characteristics listed allow us to understand the growing interest of this author for the orientalism and exoticism that surrounded the image of Spain and the Alhambra, whose colours, atmospheres and itineraries allowed Debussy to develop his creative talents in pieces like *Lindaraja*, *La soirée dans Grenade* or *La Puerta del Vino*. We will discuss the latter in more detail.

Figure 2. Architectural Alhambrism: a) Owen Jones: The Alhambra Court, in the Crystal Palace (1851), London; b) Rafael Contreras: Neo-Nasrid courtyard of the Anglada Palace (1874-1878), Madrid

Figure 3. Romantic views of the Wine Gate: a) David Roberts: Charles V's Palace with the Wine Gate (1833); b) Frederich Lewis: Sketches and drawings of the Alhambra (1835)

2. LA PUERTA DEL VINO, CLAUDE DEBUSSY (1913)

2.1 Context of the work

In late 1909, Manuel de Falla (1976-1946) sent a congratulatory postcard to his friend Claude Debussy (1862-1918) featuring the image of the Wine Gate of the Alhambra in Granada. The image shows the inner and eastern face of the gate, taken from the square of the Palace of Charles V, which is opposite the scene. The exact date on which the image was taken and when it was sent is unknown, but the fact is that it was the trigger that prompted the French composer to write a new prelude for piano, which was included third on the second album of *Préludes*, published in 1913.

The Wine Gate is the main access to the Medina of the Alhambra, inside the fortified complex. Its erection dates from the early 14th century, although the decoration of the interior doorway was carried out half a century later (Patronato de la Alhambra, s/f). It consists of two levels: the lower one, made of masonry, where the passage opens through a tubule arch (or pointed horseshoe), while the upper one, made of brick[1], contains an open-plan room. Of the eastern side stand out the exquisite decoration of the spandrels of the arch, developed using square tiles with ornaments of leaves and branches with shades of green, blue and yellow on a white background, plasterboard framing the window of the upper floor, some remains of paintings on plaster, and brick rigging seen in reddish tones arranged obliquely over the arch.

However, the architectural features shown on the postcard acquire an impressionistic nuance due to the play of light and shadow in the image (Fig. 4c). To the sharp contrast between the dark interior of the arch and the illuminated background plane is added the shifting projection of the shadow of a nearby but absent tree, and the oblique shadow line of the adjacent eaves. The exotic medieval forms, the fictitious colouring of the photograph or the deterioration of old constructions[2] are reminiscent of romantic picturesqueness. The composer's complicity with the postcard received is shown in his letter of reply to Falla, dated January 3, 1910, in which he stated: «You have flattered my taste for beautiful images on one of the sides I am most passionate about, for you know how much I love, unfortunately without knowing it, your country» (Debussy 2005: 1237; Otaola, 2007).

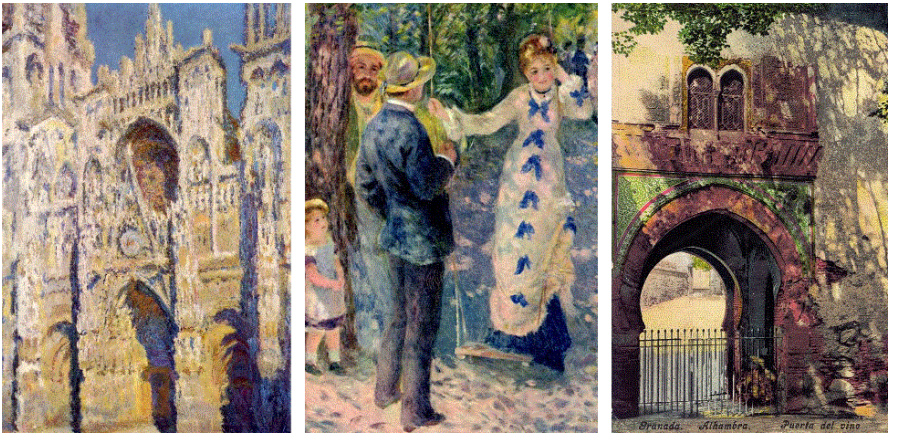

Figure 4. (a y b): Pictorial Impressionism a) Claude Monet: La Cathédrale de Rouen, Le portail et la Sant de gira-Romain, plein soleil; harmonie bleue, 1892-1893. Musée d'Orsay, Paris ; b) La Balançoire (1876), Auguste Renoir. Musée d'Orsay. C) Purger y Co. version 2, s. f. München: Postcard sent by Falla to Debussy at the end of 1909

2.2 Evocation of architecture in Debussy's La Puerta del Vino

One might wonder whether Debussy, when composing the suggestive atmosphere of *La Puerta del Vino*, was directly inspired by the architectural features of the building and the impressions and feelings aroused by the image, or whether, on the contrary, creation occurred indirectly through topical resources associated with Andalusian exoticism, including music. It is difficult to give a concrete answer, but possibly it is a mixture of all the above.

It is worth remembering first of all that Debussy never visited the Alhambra and that the most he ever spent in Spain was a few hours to attend a bullfight in San Sebastián.[3] The approach to the Wine Gate is therefore produced through the image. «If you cannot afford to travel, do it through imagination»,[4] Debussy himself once said. No less important in this scenario is Debussy's contact with Spanish composers and their music in Paris.[5]

The formal structure

In general, the structure of Debussy's music resembles a mosaic, in which subtle variations of repeating musical units and contrasting units that continue to maintain common elements manage to give unity to the work through a network of melodic, rhythmic and harmonic associations (Morgan 1994: 66). On the other hand, while in Classicism the musical form of prelude used to anticipate a major work of greater length, in Romanticism preludes become autonomous pieces susceptible of being performed independently through the hand of Chopin (Llácer 1980: 127).

In particular, the prelude *La Puerta del Vino* responds to a ternary structure A-B-A' (Table 1), that is, «a contrasting central section followed by a thematic/tonal repetition of the first part» (Pomeroy 2004: 47), to which a final Coda is added. This formal scheme, recurrent in the Debussynian repertoire, is here of a closed type according to Pomeroy (2004: 47), since the first part ends in the tonic (c 41) followed by a central section B in a contrasting tonal area (cc 42-65).[6]

Section A (cc 1-41) consists of a brief and «rough» introduction (cc 1-4) that anticipates the character of the piece. It is followed by the theme (cc 5-16) and its reworkings progressing through joint degrees (cc 17-30), ending with a passage of chord progressions (cc 31-41) that concludes on the tonic chord. As for section B (cc 42-65), it starts with the same introductory beats as the beginning of the piece, but suddenly tonality changes (c 44). The discourse takes up previous motif material in passages of different character (*âpre, passionnément, ironique, gracieux*) or *tempo* (*en retenant*). The last section, A' (cc 66-84), deals with the variation of the first to complete the specular scheme. It begins with the theme (cc 66-74) and continues with its shortened reworkings, the last of which (cc 84-85) marks a progressive departure distancing that prepares the definitive extinction in the last bars (Coda, cc 85-90).

Section A (D♭ or Re♭)	cc. 1-41
Section B (B♭ or Si♭)	cc. 42-65
Section C (D♭ or Re♭)	cc. 66-84
Coda	cc. 85-90

Table 1. Structure of La Puerta del Vino, according to Bruhn (1997)

Is it possible to relate this A-B-A' scheme to the axial layout of the Nasrid building? Hardly. Although it is true that both have a false symmetry, this formal structure is quite frequent in Debussy's repertoire, not only in his preludes (Pomeroy, 2004: 47). Moreover, the emphasis on the musical work occurs at the ends A and A', whereas in the architectural work the entire ornamental apparatus is concentrated in the central part ("B"). In addition, in the postcard sent by Falla, the framing does not even cover the entire façade, but rather focuses on the gateway.

About rhythm

Debussy uses the «Mouvement de Habanera», a recurring rhythm among French composers when evoking the image of Spain,[7] despite its Cuban origin. Debussy himself had already used it in his above-mentioned alhambrist works *Lindaraja* (1901) and *Soirée dans Grenade* (1903). It consists of a slow binary rhythm formed by a first beat with dotted quaver and semiquaver, and a second beat with double quaver. (Fig. 5a).

This rhythm permeates the whole piece, as an *ostinato* on the bass, except for sporadic passages. To this substrate, foreign rhythmic units are superimposed by groups of figures that show a desire to escape from constraint. In this sense, Debussy's piece seems to be in tune with the uninhibited, fresh, decorative and apparent character of Nasrid architecture, in contrast to the rigor and forcefulness of the neighbouring Palace of Charles V, which would get on with Wagnerian grandiloquence.

Figure 5. a) Habanera ostinato rhythm in the bass of La Puerta del Vino; b) beginning of the melodic theme by diatonic ascending tritone (cc 5-8)

Melodic discourse

Unlike the traditional melody, the thematic concept in Debussy's music consists of «a series of collections of short motivic particles that are variations on other interconnected mutually [as if they were objects observed from different perspectives (Burkholder 1984: 928)], rather than derivations of a single primary melodic resource established as a starting point at the beginning» (Morgan 1994: 60).

Figure 6. Detail of ornamentation on the Eastern facade of the Wine Gate (Alhambra, Granada): arabesque in spandrels (albanegas), plasterwork and remains of paint on plaster (Source: https://andaltura.com/la-alhambra-y-el-generalife/puertas-de-la-alhambra-y-el-generalife/puerta-del-vino/).

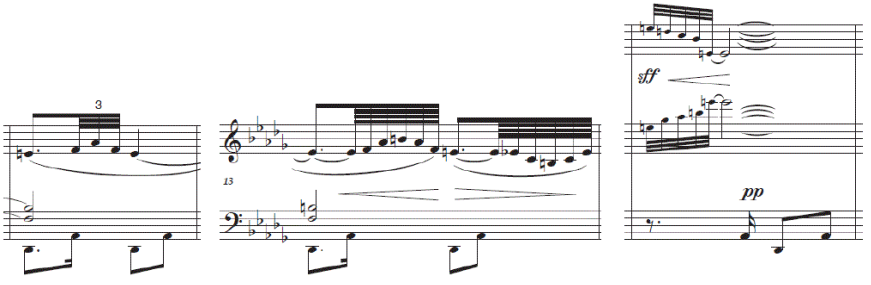

Figure 7. Detail of melodic ornaments in the prelude La Puerta del Vino (Debussy) (from left to right): flourishe (c 11), melismas (cc 13 and 14) and converging arpeggios (c 21).

In the most expressive passages, the discourse unfolds into three different levels: while in the foreground the melody advances by joint degrees, alternating rhythmic patterns of three and two notes, in an intermediate level pedal notes appear and in the distance the Habanera rhythm resounds. The architectural analogy is served by estimating the different approaches of visualization: overview, background vision and detail.

The theme begins with a melancholic tritone ascending by diatonic ensemble degrees with decreasing figuration (cc 5-9) (Fig. 5b). Upon reaching the first resting place, the melody is adorned with a flourish that emphasizes the listening of the augmented second interval (c 11), characteristic of the minor Hispano-Arabic mode.[8] This ornamentation would be identified with the *jipío* or *lamento* of flamenco singing. Shortly afterwards, the ornament takes on greater prominence, being applied in a series of melismas that emulate other melodic formulas of the *cante jondo* (Otaola 2007: 8). One of the most effective moments is the converging arpeggios of ornamentation that recall the plucking and strumming of the guitar.

The mentioned motives resources are impressions that evoke the gypsy, the Andalusian, the Nasrid, through the turns of *flamenco* singing and the melancholy sound of the guitar. «Debussy identified Spain with the guitar, which for him was not an instrument of joy and joy but melancholy and intimate» (Otaola 2007: 4). Exotic scales help to recreate an orientalist atmosphere. All these arguments are nonetheless musical.

As for the evocation of architecture, several interpretations appear. If we resort to the idea of *arabesque* –the ornamentation formed by tracery, foliage...– present both in the arabesque work of the spandrels and in the plasterwork that escort the geminated recess on the upper floor, the musical ornaments of the piece (flourishes, runs, *arpeggios*...) would only be alluding to the rich architectural ornamentation of the Gate built (leaves, branches, palmettes...).[9]

Another aspect that can be put in parallel is light and colour. Both the tiling and the overall appearance of the façade provide a chromatic play rich in contrasts. In music, the concept of chromatism refers to the use of alterations outside the basic tonality. Debussy is given to dissonant passages –especially in section B– from which emanate flashes, vibrations, mystery. Thus, from the chromatic richness of the piece a link can be inferred with the contrasts of colour and the ephemeral play of lights and shadows on the ancient walls of the Gate.

The Spanish character

Debussy prescribes an interpretation a*vec de brusques oppositions d'extrême violence et de passionnée douceur.* And already in the first bars a strong contrast is heard between the violent *acciacature* of the first bars and the placid *très expressif* of the melodic theme. This abrupt confrontation would represent the contradictions and nuances of the Spanish character, but also the contrasts of textures –stone, brick, tile, plaster– and of lights and shadows –the illuminated background in contrast with the dark interior of the arch–.

The rich variety of indications for the control of dynamics, articulation, *tempo* and expression reflect Debussy's interest in sonority itself (Hinson s/f). Other notations –metronomic indication, fingering, pedal notation–, however, are entrusted to the performer's discretion and have consequently been omitted.

Debussynian harmony

The tonic D (=Re) (sections A and A') and B (=Si) (section B) are at the base of the entire prelude, although they cannot be considered tonalities in the traditional sense of the term, due to the high level of dissonance, the frequent tonal ambiguities and the modal character that surrounds the whole work. Hinson (s/f) speaks of polytonal harmony. Debussy's free way of understanding harmony leads him, for example, not to resolve dissonances and to accept with pleasure the progression in parallel movement.

Both D and B appear as pedal notes, being one of the most extensive examples of these ostinato-shaped designs (Gironés 2018: 80). Each of them actually works as a double pedal: D-A in the first case and B -F in the second, inseparably linked to the rhythmic pattern.

When establishing architectural-musical affinities, the same concept of harmony is transversely comparable in its broad meaning of «proportion and correspondence of some things with others in the whole that compose» (DLE 2021). It is clear that one is the order of the building and another the order of the piece, but the same absence of fixed rules that is observed in the gate is openly evident in the piano prelude.

3. CONCLUSIONS

Both musical and architectural Alhambrism draw from the picturesque and orientalism. However, the architectural one is much more literal, it could be said that it is a revival, but not so in the case of music. Arabic music is not used as such to replicate, but rather the musical topics associated with Spanish.

Debussy's prelude represents a late manifestation of the musical Alhambrism, which maintains the aura of mystery and exoticism of the romantic texts of Chateaubriand or Irving, and the paintings which Lewis or Roberts had anticipated throughout the 19th century, through a personal synthesis of exquisite mastery.

Starting from the creative substrate of the composer, the references that he uses to elaborate the prelude come from resources extracted from Andalusian folklore and the sound of the guitar, as well as from the impressions raised when observing the picture of the Nasrid monument, surely stimulated without being aware of it by the figure of the sender. Consequently, it is not possible to understand the piece without the existence of the *flamenco* singing, just as it would not be understood without the intermediation of the precise photograph, an image that gathered in itself all the impressionist-painterly potential that the French composer was able to develop. It is difficult to find a reliable musical description of the architectural fact, but rather a series of affinities that reflect a particular mood, atmosphere and feelings derived indirectly from this Alhambra's Gate. These impressions would mainly revolve around the freedom and uninhibited character of Nasrid architecture, the contrasts of light and shadow, the backlighting effect of the arch, the play of material and chromatic textures, the ornamental richness, the different planes of vision and listening, the harmonic order not subject to strict rules, the instantaneity of the moment, and less probably, the symmetrical tripartite structure.

NOTES

[1] The photograph predates the restoration undertaken by Leopoldo Torres Balbás between 1923 and 1927. This is why the brickwork is still hidden by an added plaster.

[2] According to Aloïs Riegl, the antique value of a monument "manifests itself rather in an imperfection, in lack of closed character, in a tendency to erosion of form and colour" (The Modern Cult of Monuments: Character and Origin, 1903).

[3] According to Lesure (1982: 101), this visit would have taken place during the summer of 1880.

[4] Letter to André Messager (Debussy, 2005: 778).

[5] It is the case of Ricardo Viñes, Isaac Albéniz or Manuel de Falla.

[6] The absence of repetitions means that this formal interpretation is not categorical. In fact, other authors propose slightly different schemes. The one proposed here is based on Bruhn (1997).

[7] Other French composers who adopted the Habanera rhythm to evoke the Spanish character were Georges Bizet: Carmen (1875); Jules Massenet: Le Cid (1885); Camille Saint-Saëns: Havanaise (1887); Maurice Ravel: Habanera for two pianos (1898).

[8] In reality, it is a minor third interval that is perceived as an augmented second.

[9] Curiously, Debussy composed Deux Arabesques for piano around 1890.

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PAPER #5.08

VEGETATION AND THE CONSTRUCTION OF SPACE

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ABSTRACT

In the last century, the architectural renewal proposed by the functionalist ideal of the *living machine* placed the architectural object in a context, establishing perceptive relations with it but remaining substantially distinct. Although in some cases the vegetation was incorporated into the architecture for the definition of some internal open spaces, it is necessary to wait for a revision of these principles to find new research for a deep interaction between natural and artificial space (an ecosystem architecture-nature).
After these experiences, the focus on vegetation has decreased, returning to be a central theme of contemporary research, especially in response to the complex crisis and pandemic underway that has defined new qualitative and quantitative priorities for domestic space and cities.
The contemporary debate about the relationship between built space and vegetation has often been devoted to the urban scale and the external and public dimensions of buildings. At the scale of architecture, the presence of vegetation is often evaluated from the point of view of environmental comfort and for its use in energy strategies.
In response to the new needs of living and building (for a truly integrated and sustainable environment), the contribution aims to offer a reflection on vegetation as an architectural and spatial component (mainly in areas with medium-high population density) whose presence acts as an element of structuring and sorting the project. In the desirable change of priorities, the contribution aims to offer a reflection on the theme through a framework of the role of vegetation as a material of the project, making use of different experiences, reporting case studies, and analyzing the use of vegetation concerning the multiple issues of space. The contribution, therefore, elaborates good practices, in order to define ideas and rules for the role of vegetation in contemporary architectural space.

KEYWORDS

Architecture; design; nature; innovation; green.

1. INTRODUCTION

The question of *green* architecture and the presence of greenery in public and private spaces is today of such socio-cultural evidence that it seems necessary to return to reflect on the relationship between man and nature, the symbolic value as well as the spatial relationships that may exist between architecture and vegetation. The sanitary emergency and the conditions of isolation have led to reflections on the new needs of green for the domestic and for the collective space (De Marco and Margagliotta 2020), although the current resumption of interest in these issues, however, is often vitiated by some preconceptions (many times the

question is declined only to a technical-technological perspective) or inaccurate terminology. Therefore, there is a need to deepen some concepts from the point of view of the principles of architectural design and, moreover, to elaborate and update some of the notions underlying the relationship between architecture and nature, and more specifically the relationship between built space and vegetation.
In the required change of priorities, the contribution identifies and describes ancient ideas and principles useful to define a theoretical background to the contemporary architectural debate, as well as a reflection on the theme through a framing of the role of vegetation as a material of the project; moreover, different experiences are collected, reporting case studies and analyzing the use of vegetation in relation to different contexts and the multiple issues of space. The contribution therefore elaborates good practices, in order to define ideas and rules (environmental and aesthetic) for the role and presence of vegetation in contemporary architectural space.

2. NATURE AND ARCHITECTURE

In the contemporary condition, the *green* – present and persistent in different quantities and qualities – is the memory of a natural world to which man, in various ages and ways, has always been related. In primordial terms, in fact, depending on the cultures, nature has represented an unknown and indecipherable world (the fear of going into the woods), but also, at the same time, a harmonious system to which man himself aspired through behavior and forms. The history of civilization tells of numerous and different parks and gardens, real or ideal, both for their physical characteristics and for the symbolic values: the Garden of Eden, for example, it is the sacred and symbolic place that directly represents the Creation in which the human being lives and must take care of; inside, then, the trees offer fruits that can provide *knowledge* and *life*. And it is precisely the tree that is often used as a powerful archetype at the origin of the building (Kräftner 1981): the tree that unites heaven and earth, that brings together air, water and fire, becomes symbol – according to Jung (2012) – of many concepts such as the source of life, growth and development, the unfolding of form, rooting, shelter, but also death and rebirth. In the search for a relationship between nature and man – and consequently the relationship with architecture as a human activity of modification of places – essentially resides the sense of being on earth, or the central theme of philosophical thought that, according to different reflections and interpretations, each epoch has faced. In this regard, it is possible to macroscopically recognize two interpretative and operative positions – that of homological art and the one of analog art (Portoghesi 1999) – which are described below.
First of all, we must necessarily consider that, in an epistemological sense, architecture is a part of nature: it is as a whole of things and signs that man leaves during his passage, a testimony of our living on the planet. It is therefore a reflection *from the inside*, an analysis of a part in relation to the whole. The artifice, from this point of view, is a component of nature of which man himself is part: "The artist is man – writes Paul Klee –, he himself is nature, part of nature in the area of nature" (Klee, quoted by Hadot 2002, 185).
Architecture, therefore, as homology of nature and *second artificial nature* that modifies the primordial condition of *natura naturans* referring to the archetypes of dwelling, to the myth of the hut, to the construction as a combination of natural elements (Margagliotta 2020). Nature, then, as a model for every creator process and as ubiquitous physical reality, as well as a system of order (of the entire universe) that, in certain cases, feeds the project with figurative suggestions.

Thus, the column derives from the tree that, according to Vitruvius, with its foliage can inspire Callimaco to the creation of the Corinthian order; in the same way - writes Rykwert (1977) - from the '500 and for several centuries the architects

> […] managed to produce an Order of Architecture both elegant and rich […] but most limited their efforts to vary the Corinthian capital... and finally they forgot that, in order to compete with the Greeks, it was necessary, not already to follow them step by step, but to go back to the primitive theory, that is to say to the Nature itself (Ribart de Chamoust, quoted by Rykwert 1977, 6).

The relationship between nature and architecture can be interpreted, then, from a second position, diametrically opposed to the first for the results. Primitive nature is, in this case too, the precondition for any action, while architecture (and art in the general sense) – as the creation of the human spirit – arises by analogy from contemplation of nature, as an instrument of dialogue, of relationship, of comparison.
Architecture, therefore, not as a figurative imitation of nature but, rather, as a means and specific language of man (the only being on the planet that builds with aesthetic intentionality), albeit with an abstract and procedural aspiration to nature. It's the thought of man, inspired by nature, to create an artifact through the transformation of materials, to establish a system of order, controllable and persistent, with uses and functions, unlike the natural order as a field of changing relationships, 'rude' and 'negligent' – says Laugier (1987, 40) – to be remedied, in fact, with human ingenuity. The architectural principles are however studied and extracted from nature: think of the labyrinth, vegetal architecture probably derived from the geometrization of the forest and built exclusively with trees or hedges, made for playful purposes and delight but, at the same time, daedalic space of imprisonment; or even to the mountains, natural monuments from which to grasp generative rules since 'even the geological formations generate standards' and, to build well, 'man raises walls in the image of the rocky faces' (Le Corbusier 1941, 47).
In the same way, from the analysis of the laws that structure the natural elements we can get to build the rules that support the architectural composition; as Le Corbusier states:

> Nature is mathematical, the masterpieces of art are in harmony with nature; they express the laws of nature and make use of them (Le Corbusier 1955, 29).

In the wake of this research, in the last century the architectural renewal proposed by the functionalist ideal of the *living machine* placed the architectural object in a context (urban or natural) establishing perceptive relations with it but remaining substantially distinct from it. Although some parallel experiences have investigated the hypothesis of an organic architecture, arising from a processual and generative inspiration of nature (St. John Wilson 2007), the *mechanistic* position undoubtedly had greater diffusion; to exemplify this approach, we can remember some of the architecture-manifesto of the International Style, the Villa Savoye by Le Corbusier and the Farnsworth house by Mies van der Rohe, extremely different in formal and spatial research but united by a similar relationship with the surrounding nature – to which architecture looks while remaining at a reasonable distance – and with the soil:

> The grass is a beautiful thing, the forest too. The house will land on the grass like an object, without disturbing anything (Le Corbusier 1964, 24).

Although in some cases the vegetation was accepted in the architecture for the definition of some internal open spaces (roof-gardens,

patios), it is necessary to wait for a new phase of research, with the revision of these principles and subsequent experiments to find the attempt of a deep interaction between natural and artificial space. Particularly significant is the experience of Atelier 5, also because it develops deliberately starting from the lecorbuserian legacy, but reversing the results: the Halen residential unit (1960) rises from the study of the Unitè d'Habitation but extends horizontally grafting on a hill, in a refined interpenetration between architecture and nature with numerous private vegetated spaces (gardens, patios, grassy terraces) that replace the idea of collective greenery (Atelier 5 1995). The utopian and ecological researches of Paolo Soleri, instead, move from a critique to the indefinite expansion of the Wright's Broadacre city. The concept of arcology, defined by the same architect as a portmanteau between architecture and ecology, is substantiated in the unfinished experimental city of Arcosanti (Arizona, 1970), which proposes alternative models of housing, design and construction: limit the expansion of the city by designing the population density (miniaturization), build a community, use prefabrication to reduce consumption and costs:

> Nature shows that for all organisms or society of organisms with any increment of complexity, there corresponds a spatiodurational contraction of its functions (Soleri 2019, 128).

The concept of an architecture-nature ecosystem is common in the architectural research of the 60s and 70s of the last century. It dates back to the last CIAM, celebrated in 1959 in Otterlo, the dissemination of some theoretical ideas on megastructures (architectural and urban units) inspired by the mechanistic vision but also by theories on biological growth. On that occasion, Kenzo Tange anticipates the establishment of the *Metabolist* movement (Koolhaas and Ulrich Obrist 2011), made up of Japanese architects who, starting from a critical analysis of their metropolis, propose new principles and suggestions for the future environment:

> The reason why we use the biological word metabolism is that we believe design and technology should denote human vitality. We do not believe that metabolism indicates only acceptance of a natural, historical process, but we are trying to encourage the active metabolic development of our society through our proposals (Kurokawa 1977, 27).

These utopian visions, despite some built projects, did not have a real practical response. Probably, the search for a new combination between artifice and nature in the last century finds its maximum expression in the proposal of Moshe Safdie for Habitat '67 in Montreal.[1] The multifunctional complex (residences, commercial and services spaces) offers an experimental solution for dense living, with modules entirely prefabricated in concrete, superimposed in different configurations to include vegetation, create paths and open spaces at high altitude, green terraces, small gardens. The 354 modules are divided into three pyramidal mounds, almost artificial and habitable hills, which also suggest an allusion to a primordial and natural system of aggregation of elements (Fig. 1).

Figure 1. Moshe Safdie, Habitat '67 in Montreal. Source: (Safdie Architects)

After these experiences, the focus on vegetation has gone into the background of other issues to return to be a central theme of contemporary research, also in response to the complex crisis and pandemic underway. The period of isolation has called into question our living spaces (especially for city dwellers): the house has become the threshold that, while on the one hand it has imposed a boundary to collective life, on the other it has returned to be a refuge. This has made clear the new priorities of living with open air spaces and a renewed union with nature that guides architecture since its founding principles. Despite this, the renewed and dutiful interest in the role of vegetation in architectural design risks, in some cases, becoming a mere formal theme.

3. ARCHITECTURE IN NATURE

Outside the urban condition, in those places that can still be considered phenomenologically *natural* (Norberg-Schulz 1992), the presence of vegetation in architecture appears, in some ways, obvious. However, we can recognize among the recent experiences, specific cases in which the nature and the arboreal pre-existences become together essential components of space and form, in which a condition of mutual improvement is built, an internal tension that enriches the meaning of the tree and the architecture (Kräftner 1981, 25) Consider, for example, the Nordic Pavilion by Sverre Fehn at the Gardens of the Venice Biennale (1962), in its construction as an assembly of simple elements (walls, beams, a roof of *lamellae*) around of Mediterranean hackberry trees (*Celtis australis*); the extreme order of the monomaterial space is enhanced by elaborating its exceptions to leave intact the trees, become the fulcrum of the space and, for this reason, exalted in their symbolic value. Eloquently, the corner solution sees the bifurcation of a large beam to dodge (and at the same time include) another large tree (Norberg-Schulz and Postiglione 1997).[2]

The same approach is employed by Giuseppe Samoná already in 1947-50, when he built the house "la quercia" (the oak) in the wood of Gibilmanna, in Sicily; in the context of almost untouched nature, the boulders emerging from the ground and the presence of large trees determine the settlement aspects of the project, until the oak trees penetrate the interior space and pierce some roofs (Purini 1990).

Another relevant case study is the house that Kazuo Shinohara realizes for the poet Shuntaro Tanikawa in the forest of Karuizawa (1974); the architect acts on the space of the *do-ma* (dirty floor) which in tradition is a surface of unpaved land, storage area but also threshold-space between inside and outside.

Shinohara preserves the natural soil even in its inclination and on it erects a wooden pillar that alludes to the presence of a tree that supports the roof. With this sophisticated symbolic action, the expressive emphasis of architecture turns to the service room, which becomes the main space of the house, between nature and artificial construction. The expressive force of the natural component is also present in the Plywood house by Herzog & de Meuron (Bottmingen, 1984-85): the small wooden pavilion is an expansion of the main building that stretches to almost touch the majestic Paulownia tree in the garden. In this case, the placement of the artifact seems to attempt contact between vegetation, which, however, produces a volumetric deformation such as to characterize the shape and the internal space.

To preserve the soil in its natural course and the shrubs, Lacaton & Vassal decide to detach from the ground the house in Cap Ferret (1988), located on the west coast of France, in the Arcachon Bay (*El Croquis*

2015). The lifting expedient is also useful to gain a better view of the surrounding horizon, while the tall pines are literally incorporated into the architecture, which can be crossed vertically through a special supports adapted to their waving, their growth and maintenance in a good state of health; *natural columns* (even if not structurally bearing) between the artificial pillars, which determine the articulation of the plant and the section (Fig. 2). An effective structural tree-house union is realized in the small refuge of the Tree hotel in the north of Sweden (2008-10) by the studio Tham & Videgård: the tree is the real structure on which hangs, suspended in the woods, a high-tech cube with side 4 meters, consisting of a lightweight aluminum frame, covered externally with mirroring glass, creating an effective camouflage.
And again, in Mêda, Portugal, a large chestnut tree protects and shelters under its canopy the refuge designed by João Mendes Ribeiro (2018-20). Starting from a parallelepiped shape, the wooden structure undergoes deformations and inclinations that determine an internal-external, geometric and organic spatial continuity, an extreme and indissoluble mixture of architecture in nature (Mendes Ribeiro 2021).

Figure 2. Lacaton & Vassal, House in Cap Ferret. Source: (Lacaton & Vassal)

4. VEGETATION IN DENSE LIVING

The archetype of the city establishes a precise separation between the natural and the urban environment that, through a fence, delimits the living space with respect to the surrounding territory.[3] Although in the contemporary metropolis the spatial expansion has inevitably dissolved this fundamental rule, the city, in its principle, excludes and separates; and even when nature has been included within the urban structure, it has been as a *fragment* (Espuelas 2004, 50). And if in the past the image of the city was consolidated on the precise idea of the clearing – *empty* space geometrically defined and subtracted from the vegetation – the distorting *natural* metaphor of the current urban condition is the forest (as in fairy tales, place of bewilderment). Overcome the literary similarities, the contemporary city expresses the inattention of man towards nature that is manifested in a tendential action of concealment, so that it remains invisible to the senses with a perception inversely proportional to the urban dimension (Rifkin 1989). At the critical state to which the environmental (and cultural) condition of the urban landscape and the society has reached, the reflection on city and nature calls into question those archetypal conditions that now seem irrecoverable. It appears necessary to make a change of priorities to define new cultural horizons, to orient space research, to address the environmental and climatic needs of contemporary territories (Donadieu 2006).
The contemporary attempt to rebuild a careful dialogue between nature and building in areas with mediumhigh population density, the vegetation becomes an extraordinary element that is usually introduced by the same project as a determining element and principle and as part of the spatial system (Hunt 1993).[4]
Representative examples of this approach are found – also for reasons of different tradition, architectural culture and attention to nature – especially in the eastern metropolises. A

precursor project can be the house in a plum grove designed by Kazuyo Sejima (Tokyo, 2001-03), which builds its theme from the conservation of trees; the white volume, pure and simple, with openings arranged irregularly in the thin walls (in 5 cm thick metal panels) is equipped with a private terrace with vegetable soil. White and light volumes are those of the Moriyama house (2011) by Ryue Nishizawa, where the compact solid and the continuous envelope are avoided in favor of a complex and articulated configuration; the domestic space is decomposed into separate and independent bodies which are accessed from the garden that becomes an open-air inhabited space. Nishizawa himself experimented with this principle according to the vertical development in the Garden & House (Tokyo, 2012): in a small rectangular lot (4 x 8 m) overlap 4 concrete floors, apparently without facade envelope; the vegetation, present in all floors in large pots, to separate the interior of the residence from the street, colonizing and animating all the space. And again, in House N in Oita (2008) Sou Fujimoto proposes a gradual transition from the public road to the private space through three layers (three shells) consisting of perforated surfaces: the first space is the garden intended as a true mediation area, with permeable soil and vegetation; the second shell encloses the space of the tatami and the bed, while in the inner core there is the dining area. Ultimately, however, the unusual distribution of the spaces generates a real internal-external interpenetration, in which home and garden do not have a precise distinction.

The same Fujimoto has recently completed the residential tower *Arbre blanc* (white tree) in Montpellier (2019) drawing some of these concepts in the Mediterranean and with a high-density building. The first two levels of the tower are intended for commerce with public access, while on the roof there is a bar, a hall and a terrace for all residents; the remaining 15 levels develop 113 apartments, each of which has a private open space endowment thanks to the large projecting floors, populated by plants and small trees in pots and flower beds. The size and proportion of these protuberances (it would be mistaken to call them balconies) builds a real space of admixture with nature and vegetation, also acting as a shading system.

It is difficult to understand if the analogy with the structure of a tree (the trunk and the branches that protrude towards the light) is a primordial suggestion of the project or the outcome of a precise research.

The result, however, is a coherent and credible project, which brings about real innovation in the endowment of vegetation and private open space in urban residential models (Fig. 3).

Remaining in the European context, but in a peri-urban context, the project by BIG and JDS architects for the Mountain Dwellings in Copenhagen (2008) – perhaps mindful of Habitat '67 – is based on the spatial distribution of housing towards the best solar orientation. To achieve this, the plans for the car park also follow this configuration and constitute a kind of base for the levels of the residences. It's a variation of the housing typology, so the apartments – which have relatively small areas – are arranged as vegetated terraces, scaled gardens, significantly increasing the spatial endowment of each of them (Fig. 4).

Finally, it is also interesting to analyze the project for 57 university residences in the campus of the

Technical School of Architecture in Sant Cugat del Vallès, realized by H Arquitectes (2010-11), a firm that for years has distinguished itself for the search for economic and sustainable solutions. In this case, vegetation is used as an element of integration in the landscape, for the creation of community spaces and small private areas, responding overall to a strategy of summer shading. The patio building, on two levels, faces consistently towards its

interior, where vegetation composes shady places and meeting spaces. The project also develops the theme of industrialized modular construction that allows the reduction of emissions and production residues and – once its useful life is over – the reuse of modules and its component systems in other configurations. In this sense, the project also responds to an organic logic of architecture, which does not produce residues but resources for new uses.

Figure 3. Sou Fujimoto, Type plan of Arbre blanc residential tower in Montpellier. Source: (Sou Fujimoto Architects)

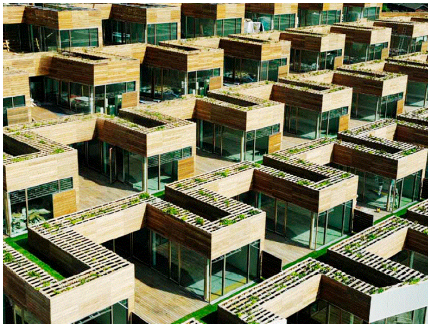

Figure 4. BIG, Mountain dwellings in Copenhagen. Source: (BIG Architects)

5. CONCLUSION. SPACE, NOT JUST SURFACE

The contemporary debate about the relationship between built space and vegetation has often been devoted to the urban scale (the presence of parks, gardens, avenues) and the external and public dimension of buildings. If, as is desirable, studies and theories for the protection and implementation of *urban forests* will lead to improving the endowment and quality of collective greenery on the ground (FAO 2016), to the scale of architecture, however, and especially with regard to the home, the presence of vegetation is often evaluated from the point of view of environmental comfort and its use in energy strategies.

The recent pandemic emergency and the global ecology crisis has exacerbated some issues relating to the domestic space, so much so as to make clear the need to equip our homes with *spaces of nature*. These should therefore be living and customizable vegetal spaces – not only *green* surfaces but places where you can *stay in* and can really be experienced – that also allow the enjoyment of the air and the sun and, why not, also a desirable reconciliation of individuals and society with nature.

However, the presence of vegetation and the adjective *green* is not a sufficient condition to define a horizon of sustainability to the architectural project. The risk, in fact, is that the green tendency reduces the vegetation to a limited epidermal value to the external surfaces or, even worse, that it is reduced to an ornamental device without acting on the actual spatial characters and the quality of living (Pallasmaa 2010). Nor is it possible to reduce the themes of sustainability and vegetation to just a quantitative economic parameter, since it also concerns qualitative, complex and multi-scale issues (architecture, city, landscape, geography) (Bassanelli 2020).

On the basis of these principles, therefore, it is necessary to look for solutions that are easily applicable and implementable, that have fair maintenance costs, that can constitute models that can be effectively extended on a large scale. The contemporary experiences presented here describe a serious and profound architectural research for the introduction of vegetation in the residential architecture project. In the natural context, we can note an interesting relationship of respect for the soil; the trees become priceless spatial devices to be preserved and brought inside the domestic space.

Also, in the urban context, good practices demonstrate a new organic approach, the possibility of spatial coherence and architectural-nature interdependence necessary for the construction of a real and innovative ecosystem: the decomposition and perforation of the *architectural box* to allow an interpenetration with vegetation and increase the open air spaces; the experimentation of new residential typologies less compact and which, however, project the living spaces outwards, with small private spaces

of nature, useful and enjoyable. These spatial innovations have the potential to define a new hybrid landscape of the integration of architecture and nature. Although the presence of vegetation in the city and in buildings still appears today a condition of exception that is artificially introduced, it can actually represent a new architectural paradigm, an ordered and rational system that, finally, it faces a truly sustainable horizon.

NOTES

[1] In the same years there were numerous experiments on the topic of prefabrication of housing modules and highdensity aggregation systems. For example, the Nakagin Capsule Tower in Tokyo by Kisho Kurokawa (1972) or Kafka's Castle by Ricardo Bofill in Sant Pere de Ribes (1968). Bofill himself theorized these concepts of spatial development (Hacia una formalización de la ciudad en el espacio, 1968) put into practice with the projects for Walden 7 and Xanadú. With a fundamental focus on the issue of vegetation, the project of the Espai vert in Benimaclet, Valencia, built by architect Antonio Cortés Ferrando (1990) is relevant.

[2] The recent removal of the tree, in fact, enhances the close dependence that the project has built with vegetation.

[3] The ancient cities in the desert areas included within the walls the oasis (source of life). In this sense, the fence was the separation between two different natural environments.

[4] Starting from the thought of Cicero, in the '500 humanist Jacopo Bonifadio introduces the concept of terza natura (third nature), or a "nature improved by art"; to this category belong the gardens – portions of nature reproduced for playful purposes – which are distinguished from the cultivated nature, that is the second nature of the agricultural systems that man creates for productive purposes; the first nature is instead the uncontaminated and wild, also called wilderness.

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PAPER #5.09

SHIFTING PRIORITIES AS A DECISIVE FACTOR: ETHICS IN ARCHITECTURAL PRACTICE

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ABSTRACT

Every professional offers a unique, precise and basic service to society. This service is vocational from the exemplary models of their profession, with an enlightened and free execution. In the exercise of the profession, the architect tries to provide solutions to the different functional problems that derive from the ideal way of life proposed by today's society, facing ethical, social, political and legal problems in the search for the satisfaction of needs, sometimes economic interests take precedence over the social function of architecture and the principles of sustainability. Trends and intellectual conceptions change. In any case, it is indisputable that the fundamental key to architecture lies in the creation of a habitable environment. Thus, the architect is called upon to act as a civic leader in his or her professional practice. Based on this, the general objective of this paper is to make an exploratory approach to professional dilemmas in the field of urban planning and urban design. This is done from the perception and experience of the urban architect who carries out his work in the Valencian Community, in Spain.
It is a first approach, carried out through conversations with professionals using qualitative techniques of social research, specifically the interview. The profiles interviewed combine the professional role with the teaching role in the university, which allows us to propose keys that can contribute to generating good practices in the professional field of the urban architect, but which are also present in teaching and learning. Among the conclusions highlighted are the disjunctions derived from political, economic and political-economic interests, which sometimes call into question the social function of urban planning as public policy; the necessary break with the elitism that has characterized the profession and the interdisciplinary work in urban planning as a way to act as a civic leader.

KEYWORDS

Ethics; architecture; dilemmas; good practices.

1. INTRODUCTION

Every professional offers a unique, precise and basic service to society. This service is vocational from exemplar models of their profession, with illustrated and free execution. Engineering and architecture belong to advanced service's area, therefore, the social function they should perform is defined by a disciplinarian basis. Thus, in the exercise of their profession, architects try to solve different functional problems that arise from a way of life proposed by today's society, confronting conflicts, politic processes, social legal and ethical in search of satisfaction of the needs, priming at times economical interests instead of social function of architecture and sustainability principles. In this line, we recall

that architecture has been branded as an elitist and formalistic profession (Villalobos-González 2020, 99).

Fashion changes, and intellectual concepts as well. Understanding that the main key in architecture lays in creating a living medium and in improving human relationship with its surroundings, the architect must assume his responsibility to contribute to a sustainable built environment, with a role in decision making that will lead us towards a better world, as the International Union of Architects (UIA) points out in the Dhaka declaration (n.d.). In it, it calls him to act as a civic leader in his own professional practice, and support policies in his projects that reduce opportunities for corruption or unfair labor practices -directly related to Governance dimension of Goals 16 of the 2030 Agenda-.

The achievement of sustainable development and ethics for sustainability constitute an indissoluble association, and in this dimension, architecture cannot be a technological issue or an aesthetic with exclusive values based on its technical code, but rather should entail guidelines towards a common goal in its practical application, basic to its professional contribution to the three axes of sustainability (social, economic and environmental), at the same time it should take action "preserving a political dimension understood as the human search for stability and self-understanding in a mutable and mortal world" (Pérez-Gómez 1996, 23).

Even though here we state that without professional ethics sustainable development will not be achieved, we're conscious of the current demand of consuming societies and professional competitiveness, which not always coerce positively in any professional activity. So we should remember the historical relation between architecture and power, that, even though is not the point of this work, it invites to question the position of the professional as a decision marker of the design of urban project that affects the way of living, usurping freedom of individuals in the application of procedures for its production or, on the other hand, recognize in its project different actors that come into play in the struggle for territory and urban space.

> "The challenge of the contemporary architect is linked to assuming his social role as a facilitator of the construction of the Project through the active and committed participation of stakeholders; This is the social construction of the project that recognizes the role of each of the actors with their contributions and limitations. (Villalobos-González 2020, 99)."

It is clear, therefore, that prevailing social values, principles of sustainability and ethics in architectural practice can be confronted with more force at a time of necessary change of priorities in the face of the current crisis. A crisis that has multiple dimensions, not only climatic, but also economic, energetic, food, health, that is, human.

Under this idea we ask ourselves: which are the current professional and ethical dilemmas that face architects face in the town planning field? How do these dilemmas become related with these sustainability axes? Questions that are beyond the scope of this work due to their breadth, but which feed the curiosity of the researcher. Thus, the proposed general objective is to make an exploratory approach to the professional dilemmas in the field of urban planning and urban design, from the perception and experience of the urban architect who carries out his work in the Valencian Community, in Spain. As an exploratory approach, a first approach is sought through conversations with some professionals, which will allow us to characterize the dilemmas and, subsequently, to propose keys that can contribute to generating good practices in the professional field of the urban architect.

In order to achieve these objectives, we start by thinking on codes of ethics within the discipline at hand and the relationship between application of legislation and ethic.

2. INTERNATIONAL STANDARDS, DEONTOLOGICAL CODES AND LEGISLATION

From international rules for professional architectural practice, established by International Union of Architects (UIA) in 1999, through EU Directive 2006/126/EC linked to services in internal markets, which includes the concept of "overriding reasons of general interest" (article 40) up to deontological codes, service to society is shown as the beginning and end of the activity.

These codes, as it is Architects' Council of Europe (ACE) from 2016 and, specifically, the Superior Council of Architects' Associations of Spain (CSCAE in Spanish) – modified in 2021- , build recommendations and professional compromises based on public interest, in their social function -of service to the communities and society in general-, within the framework of sustainability.

Nevertheless, is the national deontological code the one that imposes obligations, defined as a compulsive rule, coercive in nature and, therefore, affected by the legality of law. Is applying legal rules is already an ethical act? Ethics and legality keep an indissoluble relationship? Should we first reflect about the ethical quality of legislation and its deontological codes?

The 2015 Architects' Deonlologycal Code comes to collect the commitments that, as a minimum, should be complied with in the practice of the spanish architectural profession. It is a profession with a clear vocation for public service, which should not be lost in favor of private interests or other spurious purposes. This code is based on confidentiality, independence, impartiality, regulation of the collision of interests, honesty and integrity, common denominator in other professions of the same nature.

Likewise, Royal Decree 129/2018 of 16 March, which approves General Statutes of the Architects' Associations and their Superior Council, is currently constituted as the regulatory framework that defines for the specific case of the Architects' Associations, within their essential purposes, in their territorial areas, among others, to ensure observance of deontology of the profession and respect for citizen's rights. All this inspired by European Deontological Code, as a reference document, whose last update is from April 2016, and, which addresses the responsibilities towards the public, clients and users of architecture, building companies, art and science of architecture as a framework of knowledge and legacy of the profession to society. It is function of professional associations to exercise disciplinary authority over architects and, where appropriate, over professional societies that breach their collegiate or professional duties, both legal and deontological, ensuring professional ethics and dignity; sending the file to competent collegiate bodies to instruct appropriate informative or disciplinary proceedings, taking into account the regulation of the general sanctioning procedure, provided for in Law 39/2015, of October 1, of the Common Administrative Procedure of Public Administrations.

Spanish Higher Council of Architects' Associations describes its code directly affected by legal system in a hierarchical plane superior to morality and ethics. Is it professionally built, first, a legal being and then an "ethical being", is legal being a substitute for "being ethical"?

Figure 1. Hierarchical position of the deontological code and ethical values. CSCAE. Source: (Author 2022)

A Code of Ethics is the minimum required basis for practical exercise of profession, as a set of different duties and obligations, in relation to society, the city and environment, but also in relation to client, the relationship between the professionals themselves and the professional group of architects. A code debated and agreed upon by architecture professionals, based on respect for human rights and universal ethical principles, identified with the ideal guidelines of the profession (Siurana 2006, 385). Towards society, there is an obligation to practice with discipline, service vocation, honesty and responsibility, always taking into account the social and cultural impact of architecture. Being aware of and respecting regulations in force, with respect to the city and the environment, it must be sought to value, safeguard, conserve and develop in a sustainable way what is built, taking into account the impact of result. The commitment acquired must go beyond political and economic interests, both our own and those of different social groups, and must also go beyond political and economic interests, both our own and those of different social groups. Reflection will be fundamental as "autonomy in the exercise of the activity, in understanding that one should not respond mechanically to what is asked, having to interpret in each case what should be done to follow in the most convenient way the goals of profession", (Siurana 2006, 381). It is worth at least considering that while law consists of a set of mandatory rules that regulate life of community, however, ethics translates into a set of rules of personal conduct. Generally speaking, law affirms and upholds certain values, but legal norms usually set lower expectations of behavior than demands imposed by ethics (United Nations 2019).

3. METHODOLOGY

In order to make an approach to the reality of professional practice through experience and perception of the urban architect in the Valencian Community, which brings us closer to and explores professional problems and ethical crossroads, the chosen methodology is qualitative.

This methodology allows us to observe and listen to the discourse of the speaking actor. Specifically, the semi-structured interview technique has been selected, which has been of two types: a focused interview and a group interview, both with the purpose of gathering referential information about professional and ethical dilemmas of the urban architect, transmitted verbally by its protagonist. Both have been administered by video conference.

The interview was structured by themes, in relation to the objectives and contents collected. These are as follows:

1. Professional practice dilemmas
2. Ethical crossroads.
3. Sustainability as a principle
4. Legality and ethical practices
5.Training and socialization in professional values
6. Future and change

First of all, the focused interviews were conducted with an architects who had developed a professional career at different levels of public administration, first at local and then at the supra-local level, in the Valencian Community. It was held on May 21, 2022.

For the group interview, the participants were selected in relation to the following roles: a) active architecture professionals in private sector; b) specialists in urbanism field; c) specialist in legal architecture; d) professionals with teaching experience to train future architects. Fulfilling these roles, the group consisted of six professionals, four women and one man, architecture professionals, and a woman specialist in urban planning law. In general terms, they focus their work in urban planning, from general architecture and from intermediate scale dimension of the urban project, as well as in planning, urban management, urban regeneration and urbanism with a gender perspective. This is in the Valencian Community. It was held on May 17, 2022.

		Roles in the group			
Participants	Profession	a)	b)	c)	d)
5	Architect	X	X		X
1	Jurist			X	X

Table 1. Panel of interviewees. Source: (own elaboration)

With these selection criteria, the aim was to address, in collection of discourses on professional dilemmas and ethics, two areas of the architect's occupation, professional and teaching in of urban planning' field.

4. OUTCOMES

The result obtained through the conversations held has been organised along the following lines, in relation to the themes that structured the interview, bearing in mind that the semi-structured model works with a previous script, but not a closed one, which gives freedom to the protagonists in the orientation and expansion of their observations. It should be remembered that the professional role is the axis that brings together the dilemmas raised above.
In addition, quotes from the participants, in quotation marks, are included to illustrate the results.

4.1 Dilemmas of professional activity

The dilemmas or current problematic that can be noticed through experience have been condensed in three areas.
The first one establishes a relation between the urban planner' profession, specialization and drift taken by constant increase in complexity of urban planning –a flood of reports from different perspectives -. Here we come across some questions: do you specialize? In what? Choice of specialization in the areas of urban planning becomes a dilemma:

- Labor markets, labor demands, are the ones that finally direct specialization.
- Addressing globalism of the enormous complexity of urban planning is perceived as impossible within the profession

This situation opens dilemmas that reflect relevant issues: where does the progression of the profession lead as a skill and knowledge field? Is there a tendency to specialize, to only handle some aspect of urban planning profession, or just the opposite? Shared visions reflected on the speech of the participants as a whole, consider the current and future complexity of urban planning discipline:

- It is marked by multidisciplinary. It requires working complementary with other professionals, which makes it necessary to approach disciplines within social science, for example, sociology, to share and embed ideas.
- Urban planning' design still needs a general vision. In it's elaborating there must be a professional that leads, so global vision is not lost beneath partial projects that complement it. In this way it's perceived that, in current times, town planner architects might be "losing ground to other specialist that may not be ready to this global vision" that urban planning requires.

Secondly, from a business dynamic point of view, it is argued that this undermines intangible aspects of the profession, such as creativity, which is undervalued. Business demands efficiency, speed, dynamism, getting projects approved. Coupled with the multidisciplinary coordination required and

rigid administrative procedure, creativity is lost in this requirement, "there are no tools or space left for creativity" (group interview). Staying in the urban planning market becomes a dilemma due to the ever-increasing complexity, lack of gratification and fulfilment for the professional.

In addition, two critical voices appear, one directed towards the complete instrumentalization of urban planning "as if it were a regulation", and even as a set of indicators "like it was an excel table" (group interview). Thus, the idea of possible loss of capacity in urban design appears, derived from multiple reports of different specialists who have to be coordinated, whose intervention is obligatory. Urban planning is "very fragmented in subject, scale and time" (group interview). Other voices revise the elitist vision of the profession from a professional's point of view. This specialized fragmentation is another difficulty.

Other voices revise the elitist vision of the profession from a professional's point of view: "we have to put our mark of identity everywhere" (group interview). Elitist positioning detaches the professional from reality.

The interrelationship with the public administration that regulates and approves urban planning is another problem. The experience of participants over the years shows a process in which civil service has evolved from a function aimed at resolving problems to a function aimed at increasing difficulties. City Hall technical teams, in many cases, show that there are internal conflicts and lack of knowledge about urban planning and do not resolve paralyses.

4.2. Ethical crossroads

The relationship with local administration, town councils, which have urban planning competences in Spain, is the area in which the greatest and most frequent ethical crossroads are faced in the architect's professional work. They sometimes go against the aim of achieving greater social welfare. This has been exemplified in cases such as:

- Declaration of the entire municipal area as building-developable against the logic of territory and landowners, ignoring territorial needs and realities.
- Forcing urban design to locate public environment in the worst lands of scope of action, public space becomes residue of the project.

Situations are suffered in which the urban architect is a technical piece subjugated to political power -political-economic and electoral interests- and to economic power "the best land for developers or construction companies" (group interview). Urban design and improvement of citizens' well-being are hijacked by the interests of factual powers. So is the deployment of creativity and vocation.

4.3. Sustainability as a principle

In the field of sustainability, it is perceived that, in day-to-day battle, the notion that urban planning is a public policy has been lost. It is the mission of administration to lead that policy, balancing social forces for the benefit of the common good.

The current dynamic, perhaps provoked by new Agendas aimed at achieving sustainability, or perhaps due to social pressure, makes Administration more and more aware of this necessary leadership to "make urban planning for society and exercise it as a public policy" (focused interview and group interview). For as Fisher (2010, 10) questions "Has the project benefited the greatest number of people and addressed their pragmatic needs?"

Although studies and strategies in environmental sustainability' field are incorporated into all planning, crossroads arise from bureaucratic complexity of processes.

Opinion is dichotomized between a perception of social reality that undervalues environmental sustainability and undervalues

the figure of urban planner "we hear much speech but not action". This is compounded by urban planning regulations that seem to enclose sustainability in a "canned sustainability" formula. On the other hand, current reality is perceived as a time when the "human scale is taking centre stage" and progress is being made in values related to those that make up sustainability in the social and political spheres (group interview).

4.4. Legality and ethical practices

In line with the increase in complexity of land use and town planning work, extensive and complex regulations existing in Spain and in the Valencian Community in particular play an important role.

On the one hand, this situation is perceived as a handicap, derived from the disproportionality of law. The law can be a tool, in a positive sense, but then there is implementation, which must be based on existing values, and professional practice has taught us that "there is a technical part that redirects legal disquisitions". If this is so, there can also be a social and an economic part that redirects the technical disquisitions" (focused interview ang group interview).

On the other hand, in experience, the regulations which constrain processes necessary to carry out planning, do not allow for flexibility and adaptation to different realities, do not take into account the diversity of territory, and therefore they do not diversify. The result is that the same solution is always used, as seems to be observed in the urban planning of large cities. This inflexibility of law means that rural areas are treated in the same way. "Law is the same for all areas", "it looks like a flat rate". This results in legislator's accommodation, "they don't have to think too much" (focused interview).

All this raises major ethical dilemmas arising from the legislator's practice that hinders the achievement of sustainability. How do you work on sustainability if you do not consider the diversity of territories?

4.5. Training and socialization in professional values

The complexity of current urban planning, with multiplication of reports from different professional branches, is one of the dilemmas that has been considered, derived from its direct effect on training that students of architecture should receive: where should complexity of the subjects lead us?

Basically, based on the training situation and current challenges, the main arguments, present in the dialogue held, are as follows:

- Training is generalist from the Spanish point of view. Positively, it allows for creation of a highly adaptable student body that can deal with different levels of complexity in the work of urban planner and is prepared to take on the systemic vision of the urban project.
- The volume of universities, places, fewer years of study, as well as less effort to obtain the degree, has meant that the student's vocation is invisible in the masses and is perceived as a lack of involvement. This situation becomes a challenge and a dilemma to be solved by the teaching role.

In inculcation of values related to profession and sustainability, these are worked on through project-based learning, so the choice of the project proposed to the student is crucial. To this must be added the incorporation of viewpoint of other disciplines in a way that adds to technical reflection, promoting critical thinking and sense, which is a recognized transversal competence, and also creativity. Using multidisciplinary thinking in teaching practices allows learning obtained throughout professional experience to be transmitted: there are technical disquisitions that are redirected through a social approach.

This active and project-based learning opens up the possibility of establishing ethical and normative red lines.

4.6 Future and change

Observations made by participants in relation to the vision of future work in urban planning are part of a series of questions that have emerged from the group dialogue and which reveal dilemmas and visions for the future. The following questions were raised: Where is the progression of profession as a field of knowledge and skills heading, is there a tendency towards specialization, towards handling just one aspect of the urban planning profession, or otherwise, and what will be the role of public administration?

Considerations expressed divides into two lines of opinion: the first takes on the evolution of the last few years, visualizing an increase in complexity derived from constant growth of bureaucracy and regulations. In contrast, another line observes the growing importance of the human scale and its increase in coming years, derived from the awakening of public administrations, which are becoming aware that many public policies depend on a good organization of land, city, and its configuration. The appearance of new structures that promote citizen participation in elaboration of city strategies -such as sectoral councils, neighborhood councils, etc.- is perceived as a step forward in working towards a closer urban planning.

Dilemmas or decisions to be made facing this future are, at the service of whom or for whom are the powerful technical tools available for urban architects to be used? It will therefore be necessary, not only technologically but also as ethical preparation, to open up and understand perspectives of different disciplines in order to integrate them into the urban project and on path towards sustainability.

5. KEYS TO GOOD PROFESSIONAL PRACTICE

Opening a dialogue with architecture professionals is the appropriate methodological route when it comes to establishing keys that direct work towards good practices. These practices should not remain a declaration of intentions in terms of ethical-professional commitments, but they should lead us to positions that incorporate the gaze of the "other", the social subject. In this line, and following the strong ideas extracted from the interviews, we venture keys for good professional practices in the following terms:

- Establish guiding criteria.
- Setting priorities. Prioritize social function of the equipment, infrastructure and public space, in other words, service towards social welfare that it proposes.
- Understand that reality is not unique. Nor are solutions univocal. It is necessary to leave room for flexibility
- Study reality from different approaches. Incorporate the viewpoint of other disciplines, especially in social sciences, to open up mentalities and create new possibilities.
- Typify casuistry and stay close to reality in order to not lose focus and the starting point.
- Abandon elitist positions, because they detach from reality and pervert the social function of the profession.
- Use creativity in order to match solutions between respect for regulations, technical solutions and the well-being of citizens.

6. CONCLUSIONS

Professional dilemmas arise from pressures derived from political, economic and political-economic interests, which sometimes violate the prime function of urban planning, as a public policy, and political role that should lead this policy. This role should be centered on looking after general interest and welfare. This is where ethical dilemmas of the architect's professional practice appear and confront person with his or her profession.

> "Las políticas urbanas constituyen la dimensión espacial del Estado de bienestar y la regulación pública de la división económica y social del espacio. Estas tienen el reto de diseñar y poner en práctica nuevos y potentes instrumentos de regulación pública de la ciudad, si no se quiere que ésta sea el resultado estricto de la lógica del mercado (Barenboim 2012, 32).[1]"

Political-economic interests generate dilemmas in professional decision-making that sometimes touch on ethical concepts, such as commitment to social welfare, as these interests sometimes push public space towards marginality within the urban project. This criticism appears in a multitude of works. Professional dilemmas of the architect in urban work, in short, are capital, economy, time, lack of fulfilment, a lot of effort and little gratitude. All this becomes a source of bewilderment in urban planning and in the urban planner.

On the other hand, the dissolution of the general vision can become a problem, derived from incorporation of a multiplicity of professionals from other disciplines and approaches, not so prepared to direct the necessary global vision in urban planning.

If, as H. Lefebvre (1974) states, space, called territory, is a "social production". In this line, values that have been extracted from interviews have focused on the recovery of "urban planning for and with people", which incorporates the processes of citizen participation in the construction of the sustainable city, on which regulations and legality have been advancing in recent years. These aspects are increasingly emphasized in the field of education. Likewise, a high value is attributed to attitudes related to curiosity that leads us to self-learning both in the training of the architect and in order to face day-to-day professional activity.

In professional practice, decision making is often a complex process, as decisions must be taken with limited information, sometimes with little time, and trying to reconcile conflicting interests. Ethical and responsible professional practice involves developing one's own criteria identifying and dealing with ethical problems in real work situations, and collaborating in integration of values in decision-making structures of organizations. Still, it is important to be aware of the risks associated with professional practice in different types of architectural activities, their legal and personal consequences, and mechanisms to cover possible situations of legal liability.

Education, information and training in ethical competences are crucial in university education. They are cross-cutting interpersonal competencies in the performance of the profession.

The conclusions obtained, despite not being generalizable, provide referential information that helps and invites us to broaden and diversify the research methodologies on the objectives addressed.

ACKNOWLEDGEMENTS

This document has been made possible thanks to the participation of several architecture and urban planning professionals. We are grateful to them for lending us some of their time and expertise to initiate these discussions.

NOTES

[1] Original text in Spanish. Free translation: "Urban policies constitute spatial dimension of welfare state and public regulation of economic and social division of space. They face challenge of designing and implementing new and powerful instruments of public regulation of the city, if the city is not to be the strict result of the logic of the market."

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6

HERITAGE, RESTORATION, CONSERVATION AND RENOVATION

PAPER #6.01

PIVOTAL CONSTRUCTIONS OF UNSEEN EVENTS: BUILDING THE AMERICAN DREAM

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ABSTRACT

Is important that architecture is the product of more than the aesthetic concerns of the architect and the practical concerns of the client. It straddles two realms: that of the fine arts and that of the highly practical and utilitarian. In its dual nature, architecture is most often cast as a high art; the outcomes of architectural thinking and making are celebrated, analyzed, and documented for their aesthetic significance as art objects. Architecture's impact as a service, being practical and useful, are deemed less worthy by both the discipline and profession. *Pivotal Constructions of Unseen Events* reconstitutes a new reading of American history from 1871-2020, a period marked by tremendous national growth and building, alongside the rise of new shared ideas, practices, and customs that have shaped—and continue to shape—the structures of American society *alongside* the structures of its built environment.

Through the construction of five narratives for five buildings *of architectural origin*, this research examines the social, technological, material, and economic forces that led to their emergence and construction, as well as the outcomes that arose in society afterward. *Pivotal Constructions* demonstrates—through the close reading of buildings—how to understand architecture as historical *event* rather than historical *artifact*. Whereby architecture's historical significance is not solely as a static object (or artifact), but rather as something that *happened and happens* (an event), transforming and shaping history in unexpected and significant ways. This approach gathers and reassembles evidence of architecture's historical significance, elements hence claimed by other narratives, absorbed by other disciplines, and told by other actors. This method of re-constructing architectural history, is meant to recapture a fuller gamut of architecture's impact on and in society.

For VIBRArch 2022, this author presents one of these narratives: "*Building the American Dream*", the history of how the arrival in 1908 of the Gamble House (Greene and Greene Architects) played a part in the genesis of the *single-family, detached house*, which has become a potent and defining symbol of American values and morals.

KEYWORDS

US Housing; Single-family house; American Dream; Inequity; Event.

1. INTRODUCTION

It is important to understand that architecture is the product of more than the aesthetic concerns of the architect and the practical concerns of the client. It straddles two realms: that of the fine arts and that of the highly

practical and utilitarian. In its dual nature, architecture is most often cast as a high art; the outcomes of architectural thinking and making are celebrated, analyzed, and documented for their aesthetic significance as art objects. *Pivotal Constructions of Unseen Events* is a research project that reconstitutes a new survey of architectural history, examining periods of tremendous growth and building, alongside the rise of new shared ideas, practices, and customs that have shaped—and continue to shape—the structures of society alongside the structures of its built environment. For VIBRArch 2022, this author will present one case study, or chapter, of the five original narratives of the project currently underway. *Pivotal Constructions* identifies and studies these five buildings, as they emerged in the United States during the period from 1871 to 2020 and links them to the outcomes that arose in society afterward. They are: The Gamble House (1908), Pasadena, California, Greene and Greene; The Home Insurance Building (1885, demolished 1931), Chicago, Illinois, William LeBaron Jenny; Ford River Rouge Complex (1917-1928) Detroit, Michigan, Albert Kahn; Supreme Court Building (1932-1935) Washington DC, Cass Gilbert; World Trade Center Site (2001), New York City, including both the 9/11 Memorial (2011), Michael Arad and One World Trade Center (2014), SOM.

The project also endeavors to introduce a new pedagogical approach to the "close reading" of a building—whereby students will understand architecture as historical event rather than as historical artifact. The project posits that architecture's historical significance is not solely as a static object (or artifact), but rather as something that happened and happens (an event), transforming and shaping history in unexpected and significant ways. This approach gathers and reassembles evidence of architecture's historical significance, elements hence claimed by other narratives, absorbed by other disciplines, and told by other actors. The long-term goal of this project is in the realm of public scholarship; the narratives are geared toward a general audience so as to increase the level of architectural literacy at a societal scale.

Please note: Given the constraints of the paper format, the author will not include as much visual material as is currently part of the research. That said, the author's planned conference presentation will be mostly of images and visual material.

2. BUILDING OF ARCHITECTURAL ORIGIN

2.1. Architecture as Event

Pivotal Constructions begins by setting the distinction between "building of architectural origin" versus a "building." For architectural scholars and practitioners, this distinction is straightforward and understandable. For other disciplines, not fluent or steeped in examples of the distinction, the difference is far less apparent. For this project, "buildings of architectural origin" are classified as those that emerge out of architectural expertise (from a disciplinary perspective), set apart from those buildings that arise without the direct influence of architecture or architects. Since this process is not homogenous, the author has chosen a case-study-based method to better study the unique idiosyncrasies of individual architectures as events.

Many—arguably most—buildings do not have architectural origins. Yet, this project posits the notion that the majority of buildings, the ones that are most in contact with the majority of citizens, can indeed trace their origins to architectural events as major influences. By studying these architectural "events" more closely—what events preceded them and what events came after them—this author hopes to demonstrate how architecture is not rarefied and elite, but rather that it is integrated and integral in shaping a society. The project proposes a pedagogical component as well: to introduce a history course where students

perform their own "close reading" of buildings of architectural origin. While close readings are a common component of architectural history and architectural theory scholarship, this author proposes such study through the addition of social science lenses, including sociology, psychology, economics, and political science, among others. Whereby, a "close reading" is no longer limited to existing discursive boundaries and norms, but expands to include forces and events that brought about the building's origins, outcomes, and consequences.

In *Pivotal Constructions*, this re-reading yields a potentially deeper understanding of architecture's significance in contemporary American society. It can reveal architecture's broader role and influence, fulfilling a desire to find ways of increasing architectural literacy. Especially in the US context, where architecture's status is at the periphery, the public's awareness of the benefits of architectural thinking and making remain very limited, with access available to the elite. In contrast, this project repositions architecture as an active event that touches and impacts many, many facets of society. The narratives of Pivotal Constructions refigure architecture-as-object (something inert) into architecture-as-event (something active that happens and is unusual and significant). Here, architecture-events emerge and unfold over time, giving rise to unexpected, surprising, and important changes in society.

For VIBRArch, this author presents *Pivotal Construction*'s first narrative: *Building the American Dream*, the history of how the arrival in 1908 of the Gamble House (Greene and Greene Architects) played a part in the genesis of the single-family, detached house (SFDH). In the US, the SFDH is a defining cultural, economic, political, and psychological symbol, both immaterially and materially. Founded on ideals of equal opportunity, the establishment and proliferation of the SFDH rather manifested as a means of spatializing racism, exclusion, and inequity.

2.2. The Gamble House Sows the American Home

Although the architects (and brothers) Charles Sumner Greene (1868–1957) and Henry Mather Greene (1870-1954) intended for the Gamble House (1908, Pasadena; fig.1) to serve as a new model (in style and in function) of the home, they could not have imagined how their architectural and tectonic ideas and concepts would penetrate and shape American society in the century to come.

In the last quarter of the 19th century in the United States, the Greene brothers built their architectural practice around ideas of the house as a sanctuary against the ills sowed by the Industrial Revolution, a period that marked the US's tremendous rise as a global power. Originally from the Midwestern United States, the Greenes were drawn to Southern California by way of St. Louis, Missouri, studied architecture at the Massachusetts Institute of Technology (MIT), and then on a visit to see their vacationing parents, decided to settle in Pasadena, California, where they opened an architecture office in 1894. Characteristic of the Greenes' early style was the use of simple planks and light-wood frame construction, coupled with their version of the California Craftsman Bungalow style. In their early commissions, such as the Bandini Bungalow (1908), the Greenes borrowed elements from the Spanish ("slender posts and exposed rafters"), the Japanese (temples and gardens), the Swiss (overhanging roof), as well as the Indian (the Bengali *bānglā*, or "low house with galleries and porches"), (Lancaster, 1985).

The Greenes lauded simplicity and modesty, as well as called for a native-born, distinctly modern and American architecture through a return to craftsmanship. These ideas were a reaction to the negative social and physical consequences that emerged from industrialization. Jacob Riis in New York City, as well as Upton Sinclair in Chicago, documented and disseminated accounts of the harsh conditions of living and working

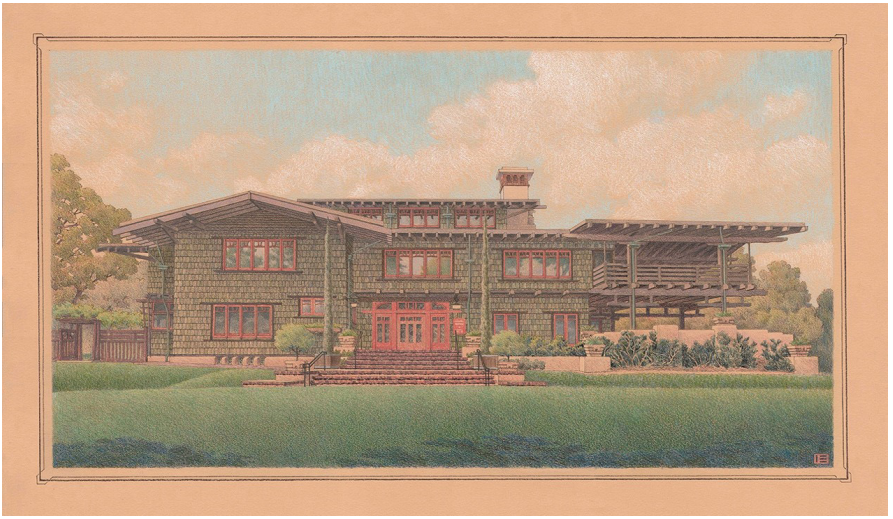


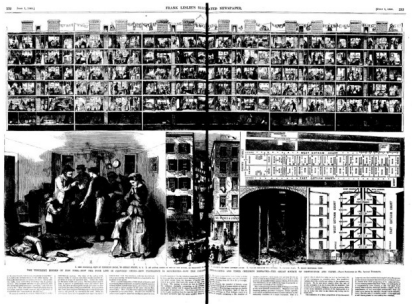
Figure 1. Gamble House Front Facade, Perspective Drawing. Source: (Ian Espinoza)

in the slums, tenements, and factories of America's industrializing urban centers. Hastily built and neglected tenements, which became a symbol of the ills of industrialization, were cheap, nasty, and unsafe, wholly lacking light or ventilation. Many considered them the, "evil offspring of public neglect and private greed." (Riis, 1895) Progressive citizens, especially those in the owner and professional class, saw tenement buildings and slum developments as having the power to literally corrupt the residents inside through occupation alone. Riis describes the process:

> Here "By far the largest part—eighty per cent. at least—of the crimes against property and against the person are perpetrated by individuals who have either lost connection with home life, or never had any, or whose *homes had ceased to be sufficiently separate, decent, and desirable to afford what are regarded as ordinary wholesome influences of home and family…*" (Riis,1895)

Tenements were a contagion and corrupting force. They crammed individuals to live together in unnatural and unhealthy ways. Conversely, the house with light, air, and nature was seen to be "sufficiently separate," providing proper environment for a healthy and prosperous life. (Figs. 2-3)

The Greene brothers' vision for the Gamble House (a vision common to their many California Craftsman style bungalow houses) was first designed for a growing population of wealthy families from established east coast and midwestern urbanized and industrialized centers. These families, such as the Gambles, sought summer residences the newly developing state of California, a vast contrast to the dirty and crowded environments where they had made their fortunes. In the late 1890's, the incredible climate of a still undeveloped Pasadena had turned it into a primary vacation destination. The Gambles, like many of these families, eventually commissioned houses of their own, to be used for passing the winter season in fresh air and a pleasing landscape.

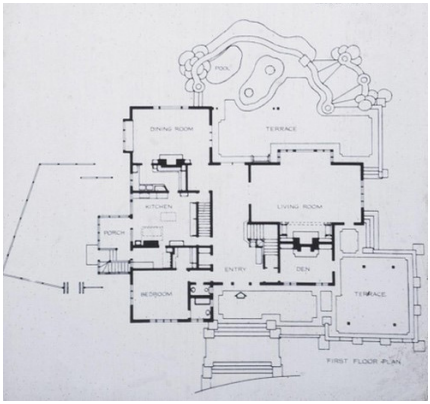


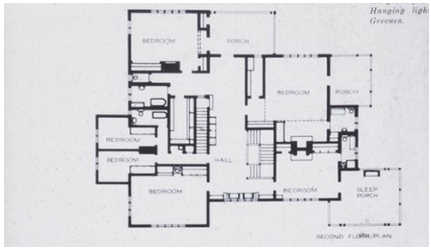
Figures 2 and 3. Period photo of 19th century New York City Tenements (1912, Lewis Wickes Hine, Library of Congress); Illustration from Frank Leslie's Illustrated Newspaper (1865)

David Gamble, the family patriarch, was one son of industrialist James Gamble, who with William Proctor built one of the largest enterprises in the United States. Like the lore of Proctor & Gamble's Ivory soap, "*a product so clean and pure that "it floats!*", the architecture of the Greene brothers was seen to provide all the health-bringing elements of morally correct living. Through the architecture of the Gamble House, it could be said that the Greene brothers offered an act of benevolence, a house whose design brought forth a life that was wholesome and morally correct. Their wealthy clients embraced the progressive ideals of the Greene brothers architecture: modern, *efficient* construction methods like the platform frame; *healthy* plan layouts that included new architectural elements such as sleeping terraces and open porches to bring in air; multiple bathrooms for bodily cleanliness and individuality; and modern kitchens with labor-saving appliances for a household that could function *without* servants. The house offered a set of nested sanctuaries: the home itself settled in protective garden away from industrialized noise and filth; the individual bedrooms and bathrooms forming suites as sanctuaries for each member of the family.

Another touted characteristic of the Gamble House, was its "simplicity." Its original meaning, "coming from Bengali" became associated with a type of building during the English colonial period in India when these low-rise structures, flanked with open-air porches, were used by British imperialists as useful and temporary housing that could easily be constructed in sites and locations to support basic needs of shelter and inhabitation. Featured in the 1893 World's Columbian Exposition in Chicago, the bungalow, alongside examples of global architectures as far as Japan, entered the disciplinary language of turn of the 20th century American architects. Architects like the Greene brothers combined the open layouts from Japanese architecture, with the priorities of homes set in a natural, healthy landscape, and the coziness and modesty of an unpretentious building type (Lancaster, 1958).

As the case today, these many architectural innovations were primarily the privilege of America's most wealthy families. Throughout the Gamble House, the Greenes introduced a series of architectural ideas that were symbiotic with the social and economic events of their time. And, over time, these rarefied architectural spread through wealthy enclaves: the preference of single-family detached dwelling over that of multi-family housing; houses set in plots of land; the reliance on wood frame construction; the multiplication and individualization of programmatic elements such as bedrooms and bathrooms (fig. 4-5).





Figures 4 and 5. Gamble House, Second Floor plan, (Archinform) showing the multiplication of domestic spaces, where bedrooms are paired with individual bathrooms to promote healthy living. (Original floor plans to be found at Avery Library, Columbia University and also the Library of Congress)

Figure 6. Toll Brothers "Milton" model, first and second floors plan; Located adjacent to an individual bedroom, the ensuite bathroom is arguably the precursor to the value and desires that have guided the internal formal and programmatic character of the single-family dwelling in the United States. In figures 4-6, the architectural proposal set in motion by the Gamble House, continues in the plans and construction of dwellings of non-architectural origins, as seen in the Toll Brother's house plan. The plan shows how millions of homes have been and continue to be constructed adhering to not only a planimetric and programmatic concept, but also reflects the values held by Americans today regarding their homes.

At the time of its construction, the Gamble House was a unique luxury, inaccessible to most Americans. Yet, its construction and acclaim cast an originating archetype of what the ideal American home should and would be: the wood frame, single-family detached house, sitting within a plot of grassed lawns and gardens, a haven every family. (Ellickson, 2021; Hirt 2015). That image endures through today: In 2020, 89 percent of US homebuyers still most prefer a single-family detached house over any other type of housing. In the United States, the single family detached house represents over 60 percent of homes, a figure that has not budged since at least 1940. In comparison, attached, single-family homes, like a townhouse or rowhouse, represent only ~5.6 percent of homes. Apartments and other types of multifamily housing constituted 17 percent of the housing stock in 2000, rising slightly to ~25 percent in 2018. While the actual numbers have varied small amounts over time, most US citizens have and continue to overwhelmingly prefer to be homeowners over renters (over 60 percent own their homes) and to live in single-family detached houses over multifamily dwellings (Fig. 6). This has not only shaped the physical character of the entire US residential landscape in the image of the Gamble House, but it has also shaped the moral and economic attitudes of the American people when it comes to houses and home.

> "Housing tenure—whether a home is owned or rented by its occupant—is as much a social experience as a financial one. In nations dominated by home ownership, renting is a marginalized form of housing tenure and therefore considered far less desirable. Housing scholars have tied tenure prejudice to issues of race and class, as rental housing is disproportionately occupied by low-income earners and racialized minorities. One dimension of tenure prejudice concerns perceptions of crime. Research suggests that affordable housing projects are perceived to bring higher levels of crime and violence to the neighbourhood. These perceptions exist in the face of research suggesting that there is little effect of public housing on the actual rate of crime in a neighbourhood." (Rollwagan 2015, p. 2)

How did the elite architecture of the Gamble house serve as an event in US history? How did a rarefied house, conceived as a one-of-a-kind art object influence and impact the development of how Americans live today? One part of the narrative looks back to early in the 19th century, to the development of the US timber industry.

2.3. The Development of the US Timber Industry

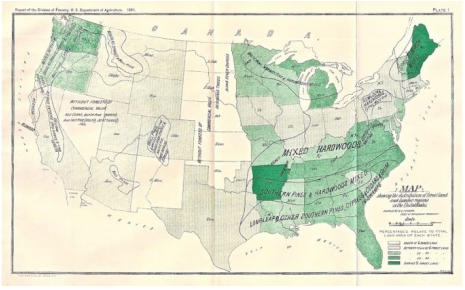
> "Civilized man lives in houses, and as the house that does not contain wood in some form is practically unknown, the lumber industry accompanies civilized man in all his migrations and progress. It was, in fact, a condition of his migration and advancement until the railroad brought forest and prairie together and made habitable the barren places of the earth. A treeless world might not be uninhabitable, but it is a historical fact that migration, racial progress and growth of population have been guided by the forest distribution of the world—modified, of course, by other conditions, but having these as one of their chief controlling influences." (Defenbaugh, 1909)

In his 1909, two-volume, over 1000-page history of the lumber industry, James Elliot Defenbaugh, editor of the periodical "American Lumberman," writes that of the "total land surface of the continental United States, excluding Alaska, is 2,972,594 square miles." Of that nearly 3 million square miles, "it can be asserted with confidence that the original

forested area of the present United States was at least 1,400,000 square miles, or nearly one-half of the entire land area." (Defenbaugh, 1909). In the years since colonization and the time Defenbaugh published his work in the early 20th century, nearly 400,000 square miles of forest had been consumed, either through the lumbering industry, or through settlement and agricultural development. (Figs. 7-8)

Two things are clear from Defenbaugh's introduction to *The History of The Lumber Industry in America*: 1) wood was a vast and mostly *free* resource; 2) civilization is dependent on wood houses. Untouched for millennia, the forests in the United States had become entire ecosystems, with mature growth trees as old as the Egyptian pyramids. Unlike the same forests in Europe, North American forests had not been harvested and replanted over many centuries. In fact, as late as the early 20th century, redwoods felled by timberman in the Pacific states were as large as 30 feet in diameter and 300 feet tall, cut down and turned into planks exceeding 60,000 cubic feet of lumber from a single tree. "From a lumberman's viewpoint, the huge trees were unsurpassed in the quality of their lumber. The trunks rose 150 feet before even the first branch, thus producing incredibly straight and clear-grained lumber." (Gordon, 2010) These vast, virgin forests, which covered half of the country, were a consistent and frictionless resource that not only helped settle and establish the United States as a young country, but also helped to first kickstart the country's rapid era of industrialization and to then sustain the massive proliferation of wood-framed, single-family, detached housing in post-war America.

The same industrialization that enabled the rapid conversion of virgin forests into dimensional lumber, was further impacted by the development of more and more efficient, unskilled labor construction methods. Combined, the abundance of natural resources, cheap and vastly available land, and low-cost, unskilled labor, merged in the first half of the 20th century to provide Americans with a seemingly endless capacity to produce new single-family, detached dwellings on acres and acres of individual plots. What had begun as a rarefied luxury for a small group of wealthy elites, a new vision of the "home" would convert the Greenes' architecture into a cheap, affordable, and accessible commodity for all Americans.



Figures 7 and 8. Woodland density map (circa 1873) produced by William H. Brewer for the "Statistical Atlas of the United States..." based on results from the ninth census (Walker 1874), Library of Congress; Map Showing the Distribution of forest land and lumber regions in the United States (Division of Forestry, US Department of Agriculture, 1893)

2.4. Spread of Wood Light-Frame Construction

In 2020, the National Association of Home Builders reported that 91 percent of new single-family houses constructed in the United States were wood framed. While this was slightly down from 2015 when 93 percent of new single-family houses were wood framed, the absolute number of new wood framed homes in 2020 was 831,000, or some 226,000 thousand more. Brought to North America by British carpenters, *efficiently braced frame construction*, which depended on wood joinery and hand-hewn wood timbers, took hold during the first 200 years of colonization and settlement. In the time before industrialization, these timber members were made by hand, and very costly (in terms of time and energy) to produce. During industrialization, the use of water-powered saws and then steam-powered saws initiated a shift from expensive and laborious hand-hewn timbers to the abundant and far cheaper machine-sawn timbers. Next, skilled-labor intensive joinery was supplanted by machine-made nails. Like the machine-sawn timbers, these factory-made nails were much cheaper and abundant than the earlier hand-forged nails (Allen and Iano, 2009). Railroads then created new supply chains that vastly increased the access to cheap, plentiful machined lumber. Finally, the realization that the smaller framing elements, between larger timber members, were themselves enough for constructing a sufficiently strong structure, led to the development of the balloon frame construction method in the United States. In 1865, G.E. Woodward would write,

> "A man and boy can now attain the same results, with ease, that twenty men could on an old-fashioned frame… the Balloon Frame could be put up for forty percent less money than the mortise and tenon frame." (Allen & Iano, 2009)

Given the lightness and ease of handling the smaller, machine-saw timbers members, and the "lightning rapidity" of only one person securing hundreds of joints with "two or three nails," the skilled knowledge and labor required in heavy-timber post-and-beam construction evaporated in deference to light-timber-frame construction. (Jackson, 1987; Allen & Iano, 2009) In 1830's Chicago, regional builders and architects popularized balloon-frame construction. Spreading eastward, the new "Chicago Construction" took advantage of the excessive, seemingly endless supply of lumber flowing from the industrialized timbers center in the east such as those in Maine, as well as those in Baltimore, to the south, and Chicago in the Midwest. (Jackson, 1987; Curtis, 2018). As old-growth forests were consumed by the timber industry, the industry was left with more and more smaller "sticks" to sell. In comparison to the heavy timber, sturdy joinery of braced, heavy-timber construction, the balloon frame seemed impossibly flimsy and light. How could thin studs, only 2x4 inches in dimension, support the stresses (load and weather) that a house would regularly experience? Yet, as the balloon-frame construction method spread, it proved itself sufficiently sturdy, over and over again. As full-length timber fruther to dwindled to extinction, the balloon frame (multi-storey members) type of wood light construction evolved into the platform frame (single-floor-height studs).

The onset of the platform frame brought the possibility of the private house within the reach of a much, much wider swath of the population. Not only did platform framing make use of the cheapest and most plentiful type of industrial lumber, it also was incredibly easy and simple to master and execute.

> "The plane surface—the flat wall of wood, brick, or stone—has always been a basic element in American architecture. In part this has been due to the simplicity which a scarcity of skilled labor enforced; in

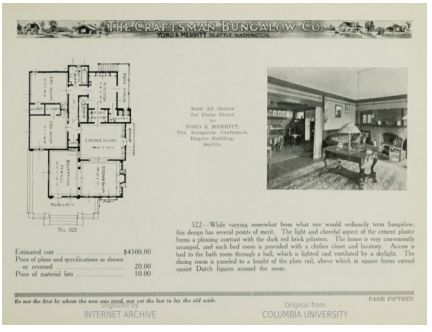
part it directly continues late eighteenth-century tendencies...wooden houses have kept to traditions established by the first settlers…The brick wall, to be cheap, must be kept flat and simple. All openings are cut very cleanly into the flat surface of the brick wall. (Giedion, 1941)

2.5. Publishing A Pattern: Cottages And Bungalows

House pattern books of the late 19th century first helped to spread the concept of the single-family house through the expanding populations and territories that were spilling out from urban centers. These pattern books, such as *Practical Bungalows*, published by the Los Angeles Investment Company, sold an entire set of architect's drawings, along with a full cost estimate of materials, for $5.00 in 1912. Often, pattern-book authors were architects hoping to promote their work and to secure future commissions. On the contrary, pattern books served to cast architects as unnecessary middleman, and to "reinforce the suspicion that an architect's fee was an unnecessary and luxurious item in a building budget" (Wood, 1983). From the start of the 20th century, companies such as Aladdin, Gordon Van Tine, and Sears Roebuck established kit-house companies that provided design patterns for the customer's house, along with all materials. From nails, to lumber (all studs and beams), to the plaster and lath, to the finish paint. The house-kit, branded as "ready-cut" or "readi-cut," provided everything a homeowner would need to construct a house in as fast as one day, without special tools, expert knowledge, or extra help. In their 1917 catalog of kit-houses, Aladdin attests,

> "Remember, you can erect your own Aladdin home and save the cost of skilled labor. Hundreds of Aladdin customers have erected their Leota homes from the complete instructions for erection that are sent with every order." (Aladdin, 1917)

The catalog's description of "The Leota," as a "most interesting bungalow" featuring a "Craftsman front door, casement windows grouped in pairs and side walls shingled," demonstrates how extensively the impact of California Craftsman ideas and values (amplified, elaborated, and refined by the Greene brothers) had permeated into the popular imagination (Aladdin, 1917) and the market economy. (Figs. 9-10)



Figures 9 and 10. Practical Bungalows, Los Angeles Investment Company, cover (1912), Model 322 by Craftsman Bungalows, Yoho & Merritt, Empire Building Company, Seattle, 1922

Pattern books and kit-house catalogs quite exclusively focused on single-family, detached houses, often promoting designs and variations on the "California bungalow." This focus was built on patriotic pride and populism. By the 1930's, "bungalow" was synonymous with the modest, everyman's American home (Lancaster, 1958). Only four years after the completion of the Gamble house, the 1912 Bungalow Company introduced their collection of XX houses with "A Word About Bungalows:"

> "The bungalow, as it is known today, practically originated in Southern California and was almost unknown elsewhere until recently. Its characteristics are straight lines, wide projecting roofs, numerous low windows, plain woodwork, rough timbers, and usually rough siding or shingles. In fact, the bungalow is a combination of log cabin, Spanish architecture, and a few Oriental ideas which the inventive mind of the American has combined with some ideas of his own to make a style of architecture really new. It allows the use of almost any building materials and in such combinations that it is easily adapted to any locality. The interior arrangement is usually quite simple and designed to save steps for the housekeeper, everything being on one floor. The parlor has given way to the living-room which is all that the word implies." (The Bungalow Company, Seattle, 1912)

2.6. Bungalow Courts

Builders, architects, and the general public of Southern California found the new style of the California Craftsman Bungalow, pioneered by the Greenes, incredibly attractive and desirable. The Gamble House combined modern technologies with progressive values, in a uniquely American way, one that also employed traditional building methods.

For many new residents flooding into an exploding Los Angeles, the need for new housing was unassailable. The bungalow provided a vision of a comfortable and wealthy lifestyle, accessible to many, instead of the few. First via architectural and lifestyle press, the California bungalow became the preferred type of housing for the populace, especially those wanting "respectability." At the national level, policymakers, clergy, reformers, architects, and learned experts united in their disdain of multi-family housing types, associating such denser housing with the squalid slums and tenements of New York and other urbanized centers. Instead, they promoted and elevated single-family, detached houses and homeownership, while marginalizing and shunning multi-family rental housing (Gish, 2010). Southern California's abundance of empty, undeveloped parcels, its pleasing and temperate, steady climate, enticed residents who clamored for their own single-family, detached dwellings. Such homes were transformative; a way to prove respectability and disprove being backwards (e.g., poor or immigrant, and morally lacking).

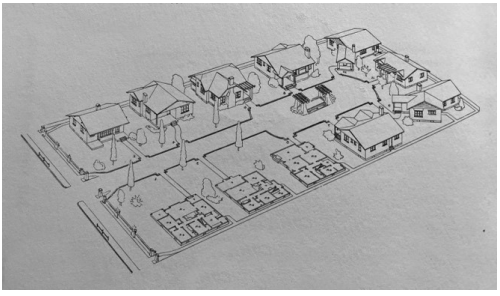
As the bungalow grew evermore popular, builders and speculators invested in a new type of development real-estate speculation. Composed of single-family, detached houses, the "bungalow court" drew on the architectural language of the Greenes' architectural style and innovations and multiplied it to take advantage of economies of scale. (Figs 11-12) As the bungalow court model swept across developing suburban regions of the United States, architects, like the Greenes, remained critical and skeptical of the new phenomenon. They chose to distance themselves from its successes and to diminish its architectural influences:

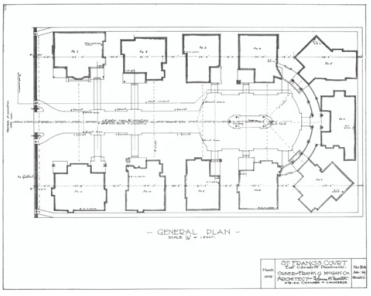
> "No less an authority than Charles Sumner Greene wrote, "The bungalow court idea is to be regretted. Born of the ever persistent speculator, it not only has the tendency to increase the cost of the land, but it never admits of home building." Of the Bowen Court, the arch-individualist

> Greene remarked, "In this bungalow court, the speculator and designer seem to have been of the same mind or the same person. It would seem to have no other reason for being than that of making money for the investor. The style and design of each unit is uniform, making for the monotony and dreariness of a factory district. Added to this, the buildings are hopelessly crowded." And he ended with unwanted didacticism: "This is a good example of what not to do." (Winter, 1980)

In the same way that industrialization transformed house building from a "specialized craft" into an unskilled industry, so did the proliferation of the Craftsman bungalow transform a highly nuanced and layered architecture into a mass cultural phenomenon, which has seeded the near entirety of the American residential landscape as single-family detached dwellings, supporting the "wholesome" lifestyle of individual families above the interests of a cohesive community. For the architect, the bungalow had become the antithesis of its original progressive ambitions: it was no more valuable than a bar of soap and cast of the same predatory impulses that had brought about the ills of industry (Figs. 13-15).

> The spirit, if not the fact, of these bungalows was that they were a non-professional, do-it-yourself product. The hundreds of small builders' bungalows which came to line the streets of Los Angeles, Pasadena and elsewhere throughout California suggested that any





Figures 11 and 12. St. Francis Bungalow Court, Sylvanus Marston, drawing by Clay Lancaster; St. Francis Court, plan, 1909 (Pasadena Museum of History), Gish, 2010

Figure 13, 14 and 15. Gamble House (Richard M. Bravo); Lexington Floor Plan, Pittsburgh, Wayne Homes; Split Level Ranch (architecturessyle)

> middle-class citizen who knew one end of a hammer from the other could put the whole thing together and furthermore could build the furniture needed within and plan and plant the gardens, which surrounded the dwelling...these houses were not for the elite but rather for the middle and artisan classes of American society. Traditionally, architectural imagery had had its inception at the top of the social ladder and then slowly percolated down to the middle and lower classes. The California bungalow seemed to imply that this natural God-given process had been reversed. Put in the terms of the time, the popular California bungalow was too "democratic." It suggested far too much egalitarianism. (Gebhard foreword, Winter, 1980)

2.7. Homeownership and the American Ideal

Although this era in American history deserves more in-depth attention, for the purpose of the VIBRArch conference, this author will provide a summary of the federal government's role in establishing the fabric of residential housing in the United States.

In the years after the 1917 Russian Revolution, president Woodrow Wilson and his administration acted to counteract the invasion of communist ideology on many fronts. In the domestic sphere, the government began with a strategy to promote homeownership to the American public. In doing so, each homeowner would have a vested interest in the capitalist system of individual property. Aligned with the Puritan beliefs of hard work and determination, families received a message from the federal government that hard work and thrift would lead to a straightforward path to owning one's own home.

In his book *The Color of Law*, Richard Rothstein describes the federal government's role in shaping US metropolitan areas. During the first quarter of the 20th century, early mortgages had exorbitantly high interest rates and 50 percent down payment requirements, making homeownership a difficult goal to realize for most Americans. By the time of the Great Depression, the federal government had expanded the administrative state through many new organizations. The Home Owners' Loan Corporation (HOLC) was created in 1933 to provide long-term, amortized mortgages with much lower interest rates. For the first time, low-interest mortgages gave those borrowers who consistently paid their payment, the option to own their homes at the close of their loan. A year later, the federal government created the Federal Housing Administration (FHA), which provided federally backed mortgages to middle-class families, who had been unable to secure such loans in the past. This new system that subsidized homeownership in the name of national strength meant that the number of Americans who could and did own their homes, vastly increased.

The process of assessing and issuing mortgages entailed that the FHA would conduct their own appraisals: as the HOLC conducted appraisals of property values, the FHA conducted appraisals of potential borrowers. The survey and creation of color-coded risk maps was fundamental to the HOLC appraisal process. Neighborhoods that were deemed a good, safe investment, were colored green. Other neighborhoods, those that were close or adjacent to industrialized areas, or those which had much denser, rental housing, were colored red for "high risk." In these "redlined" areas, investment and development were highly discouraged. Predominantly poor and Black, these areas and their residents were unable to benefit from FHA and HOLC subsidies and low-interest mortgages. Additionally, the FHA's appraisals explicitly encouraged the establishment and preservation of racially homogenous neighborhoods, and specifically stating that "no loans will be given to colored developments," even when the potential borrowers were solidly middle-class with good credit ratings (Rothstein, 2010).

For three decades afterward, the federal government escalated its support of housing development in post-war America to meet the exploding need for housing veterans and baby booming families. (Jacobs, 2015) That support, which greatly benefitted communities like Levittown, was completely contingent on the inclusion of racial covenants that prohibited non-whites from owning, leasing, or renting properties. The FHA went as far as to deny and stop the sale of properties by white homeowners to Blacks. In effect, the morals of the FHA became solidified into the suburban and urban geographies of the United States. These exclusionary and racist views were first sown and hewn by the federal government, then fully infected by private development, public opinion, market demand, and politics. These events have enshrined the detached, single-family house into the physical, legal, economic, and social fabric of the United States. Today, the US, a country with a huge landmass, abundance of natural resources, and tremendous wealth (as measured by GDP), is locked into a wasteful, inefficient land use policy that remains wholly dominated by the detached, single-family dwelling. Even as the country's needs change, its capacity to house its people remain "straightjacketed" (Ellickson, 2021).

The houses that were built during the post-war era became the backbone of American suburban housing, with the inherited architectural legacy of the Gamble House. Born out of a philosophy and values that sought to create a modern, distinctly American type of housing architecture, the Gamble House, a Greene and Greene Craftsman bungalow, was an event in history that occurred because of and in response to industrialization. Once the Gamble House happened, its architecture seeded the tectonic and symbolic values of the distinctly American ideology of the single-family, detached house as the defining element and symbol of a patriotic, respectable, and honorable American life. Yet, as subsequent events occurred—the rise of Communism, the Great Depression, the world wars, the rise of the corporation, the accessibility of print media, mass production, the entry of the federal government into housing development—the effect of the Gamble House's emergence rippled through the built and psychological fabric of America. Had it not been for the Gamble House's enactment of the values of bungalow living, or its proving/celebration of the wood frame construction and the lure of its respectable way of living, the current landscape of American housing would not be as it is today.

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PAPER #6.02

TRANSLATED ANTHOLOGIES: (RE)ESTABLISHING ADAPTIVE REUSE AS A TRANSDISCIPLINARY CULTURAL PRACTICE

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ABSTRACT

The immediacy of the climate crisis has necessitated a paradigm shift away from endless cycles of demolition and reconstruction towards more ecologically and socially sustainable architectural practices that focus on the *adaptive reuse* of existing buildings. Many recent approaches have tended however to concentrate on the technical, material and economic aspects of reuse at the expense of the equally important social and cultural aspects.

This paper discusses a recently-launched project at Hasselt University in Belgium that attempts to address this myopic imbalance through the development of a *conceptual framework* that firmly repositions adaptive reuse as a *transdisciplinary practice*, engaged not only with 'hard' values like technical and material concerns, but also 'soft' values encompassing the integral cultural and social aspects that give places *meaning*.

The project sets out to curate an *anthology* of textual and non-textual sources from both within and beyond the discipline of architecture that can contribute to the emerging theory of adaptive reuse and situate it within wider contemporary discourses. Through an exploration of anthologising as a critical practice, the paper highlights how the proposed theoretical foundation for adaptive reuse will (re)establish its cross-cutting nature as a *cultural activity*, at the same time emphasising the critical role it has to play in any future sustainable development.

KEYWORDS

Adaptive reuse; architecture; transdisciplinary practice; anthologising; translation.

1. INTRODUCTION

How and by whom should an anthology of adaptive reuse be written? Who gets to select the featured works, to curate and edit the collection? Should it feature single or multiple authorship? Is there a hierarchy of collaboration? These are some of the questions that have been encountered so far during the first few months of a recently-undertaken PhD research titled *Meaning and Translation – Towards a Conceptual Framework for Adaptive Reuse*. The project emerged in response to the immediacy of the climate crisis, which has necessitated a paradigm shift away from endless cycles of demolition and reconstruction towards more ecologically and socially sustainable practices that focus on the adaptive reuse of our existing built environment. It aims to develop a conceptual framework that will contribute to re-establishing adaptive reuse as a transdisciplinary practice engaged not only with 'hard' values like technical and material concerns, but also 'soft' values encompassing

the integral cultural and social aspects that give places meaning.
The methodology involves firstly the curation of an anthology of textual but also non-textual sources from both within and beyond the discipline of architecture, that aims to contribute to the emerging theory of adaptive reuse and situate it within wider contemporary discourses. The second stage is to explore this collected body of knowledge through the critical lens of translation, investigating the acts of translation involved in reconciling different traces, time periods, interventions and actors.
An important thread running through the research is the exploration of processes of co-creation, given that adaptive reuse raises fundamental questions regarding the role of authorship in architecture. In a similar way, I want to take a pluralist and inclusive approach to the collecting and curating of the anthology, remaining aware that canonical theories have tended to be dominated by white, Eurocentric, straight male thinkers, writers and theories. While this has begun to change in recent years with a movement towards more balanced representation in architectural theory, in particular with regard to gender balance, we still have a situation today in which women, but also people of colour, queer, feminist, indigenous, 'non-Western', anti-colonial and other marginalised voices, continue to be underrepresented in architectural practice and theory. This makes it all the more important to re-read existing and historical texts through a critical lens that recognises the narrow focus of the existing canon and re-examines it by situating it within broader, more inclusive contemporary discourses. It also makes it equally crucial to find and re-evaluate previously overlooked practitioners and theorists, and invite new voices to contribute.
This paper describes the first stage in the methodology that is currently underway, explaining how the process of collecting and curating an anthology or atlas of adaptive reuse mirrors the very practices and theories which it gathers by outlining the parallels between practices of curation and practices of care, maintenance and repair in adaptive reuse.

2. BACKGROUND

2.1. Our current unsustainable paradigm

The adaptive reuse of sites and buildings is not new, being at least as old as the practice of architecture itself. Throughout history, buildings were viewed as physical, material and cultural resources that were passed down from one generation to the next and therefore lent themselves to being appropriated and adapted according to changing situations and needs. However, with industrialisation, the division of labour and the streamlining of construction processes and techniques in the late 19th/early 20th century, architectural production entered a cycle of demolition and reconstruction in which buildings were seen as disposable, to be knocked down once they had reached what was deemed to be the end of their useful life (Jager 2020, 38). The current dominant capitalist-based model of architectural production (which originated in the Global North and was subsequently exported with globalisation) and the culture of extraction and consumerism that it spawned coincided with the abandonment of more sustainable patterns of building, land use and production that had developed over centuries in a slow process of adaptation between communities and their environment (ICOMOS 2019, 2). This artificial separation of nature and human culture can be traced as the source of the current climate breakdown, caused by the alarming decline of the ecosystems that underpin all human well-being. The construction industry is in large part responsible - in the European Union, the built environment consumes 50% of all extracted materials, produces 35% of all waste and emits up to 12% of total national greenhouse gas emissions (European Commission 2020, 11).

2.2. From *tabula rasa* to *tabula scripta*

Faced with the immediacy of these intersecting challenges, it is clearly no longer feasible to continue with the *tabula rasa* approach that has dominated architecture since modernism. A paradigm shift is needed, and indeed has already begun: recent EU research initiatives and policy frameworks recognise the need to radically change our existing models, away from endless cycles of demolition and reconstruction towards more ecologically and socially sustainable practices, specifically identifying the renovation and reuse of the existing building stock as a critical strategy. In April 2021, in her opening speech to the New European Bauhaus Collective conference entitled C*ommon Ground: Making the Renovation Wave a Cultural Project*, European Commission President Ursula von der Leyen stated "one of the most important trends is the focus on renovation and re-use of buildings. In the future it should be an exception that a building needs to be scrapped. We should use our resources in a more responsible way" (European Commission 2021, 4).

However, in spite of these intentions, the recently-published EU Renovation Wave Strategy concentrates on technical, material and economic aspects of reuse, with no mention of a strategy to engage with the social and cultural aspects. The current lack of any conceptual or theoretical framework that specifically addresses the cultural aspects of adaptive reuse is especially surprising given that the European Union itself has called on institutions and policy makers to pay particular attention to the cultural aspects of architecture rather than focus solely on technical standards or material innovations (Council of the European Union 2008, 2).

Likewise, the Davos Declaration, signed by representatives from UNESCO, ICCROM, the European Commission and the Architects' Council of Europe, similarly states that culture and cultural heritage are essential components of high-quality *Baukultur*, and highlights the urgent need for a holistic, culture-centred approach to shaping the built environment (Davos Declaration 2018, 11).

Despite these and many similar statements and ambitions, limited effort has been made in this respect, even within EU research and policy. Unfortunately this apparent oversight is not an isolated incidence but reflects a wider recurrent pattern. An overview of current policies and research on adaptive reuse reveals an approach that focuses on developing material knowledge, technical solutions and financing mechanisms, with little or no mention of social and cultural issues.

This lopsided situation poses a significant barrier to the to the wider acceptance, increased uptake and further development of adaptive reuse, given its complexity and specificity as a practice that intersects a wide range of disciplines – architecture, interior design, planning, engineering, conservation; that encompasses many different sectors – not just technical and environmental, but also cultural and social. While I would argue that a conceptual framework remains undeveloped, it should be noted that the past year has witnessed some movement towards compiling resources for adaptive reuse that take a more conceptual approach. Graeme Brooker's *50|50 WORDS FOR REUSE – A minifesto* (December 2021), positions itself as a "lexicon of language, an expression of vocabularies, and a glossary of terms used to distinguish the transformation of the existing, into something new", and consists of 50 entries illustrated with examples and anecdotes from the author.

Another recent book that takes a similar approach is Sally Stone and Edward Hollis's *Inside Information* (March 2022). While this slightly more substantial volume does not restrict itself exclusively to concepts of adaptive reuse, nevertheless states its intention to engage with the past and uncover the future potential of the interior that "transcends the boundaries and genres that often define interiors, providing a comprehensive view of the concepts and vocabulary of interior design." A lexicon of

interiors organised alphabetically, Hollis likens it to a thesaurus (in its original meaning as a treasury or repository of words) rather than a dictionary, a resource that lists terms and ideas in groups of related concepts arranged according to a certain sense, "rather like how you might arrange objects in an actual interior."
Both these have been published within the last year, and while they represent a welcome development in the effort to establish some concepts for adaptive reuse, they differ in form, aim and scope from the project currently being discussed.

2.3. Developing a conceptual framework: anthologising as a critical practice

What sets this research apart from other contemporaneous and recent projects is its collaborative and transdisciplinary approach; the research methodology addresses the current lack of a conceptual framework by focusing on how textual and non-textual sources from both within and outside the discipline of architecture can contribute to an emerging theory of adaptive reuse through a *critical practice of anthologising*. Anthologies have long been used to give form to architectural theory through the collection and classification of referential texts. In *Theory into History or, The Will to Anthology*, Sylvia Lavin notes how they provide an important strategy for "setting into practice a philosophical spirit of critical reflection" (Lavin 1999, 494). The intention is to draw from scholarship in other disciplines - literature, art, translation, history, urbanism, sociology, geography, communications, new media, political science, ecology, and so on, borrowing vocabulary and methods that have the potential to inspire, enrich and support new strategies, and engaging with narratives from a range of non-architectural sources as a way to broaden existing knowledge and situate adaptive reuse within wider contemporary discourses. Indeed, the very choice to create an anthology in itself reaffirms the transdisciplinary nature of the endeavour, the format being borrowed from literature and literary theory.

In establishing the aims of the proposed anthology, I have been guided by two questions posed by Theodore O. Mason, Jr. in his 1998 essay, *The African-American Anthology: Mapping the Territory, Taking the National Census, Building the Museum*, namely "To what vision of cultural production does the making and the reading of this anthology commit us?" and "What are some of its critical and theoretical implications?" (Mason 1998, 187) The answer to the first question appears fairly straightforward – a vision of adaptive reuse as a collaborative, cultural practice, which is what I intend to explore further in the course of this paper. In terms of its critical and theoretical implications, as well as possible future applications, the anthology aims at a crossover audience and therefore strives to be a pedagogical, educational and practical resource, that can be used in different ways by students, educators, academics, policy-makers, practitioners, professionals, as well as the wider public. In relation to practice, being aware of the perceived risks of working with the unknowns that come with reusing existing buildings as well as the many and wide-ranging responsibilities of the architect, the aims is to encourage practitioners to change their approach by offering guidance and support while at the same time raising cultural awareness amongst practitioners.

3. TRANSLATED ANTHOLOGIES

3.1. Anthology and canon

The word *anthology* is defined by the Cambridge English dictionary as "a collection of artistic works that have a similar form or subject, often those considered to be the best." The term was first used in the modern sense in the 1630s; its meaning is metaphoric, derived from the Greek *anthologia* meaning "collection of small poems and epigrams by several authors," but translated literally as "flower-gathering," from *anthos* meaning "a flower" and *logia* meaning "collection" or "collecting."

Barbara M. Benedict emphasises how "this characteristic of collecting explains how the anthology works", going on to define an anthology as:

> "a book of no less than three distinct works of literary art, each registered and read independently of the others, yet all understood by readers as part of the anthology as a whole… Anthologies are more than one work, at the same time as they also are one work." (Benedict 2003, 236)

Anthologies emerged as a result of (as well as a response to) the sudden superfluity of books precipitated by the invention of printing processes which rapidly displaced manuscripts and oral literature. Key to their success and popularity was the way in which they "purveyed "novel," time-sensitive information to a dispersed audience: the quick production and wide distribution of print was essential" (Benedict 2003, 233).

The word canon similarly has Greek origins, being derived from *kanon* meaning "measuring line", "rule", or "standard of excellence". While historically in English the word referred to the rules and laws of the Church, today its most common usage relates to "the writings or other works that are generally agreed to be good, important, and worth studying" (Cambridge Dictionary, 2022).

Scholars have discussed at great length the decisive role played by anthologies in establishing and consolidating canons, and how the so-called 'canon wars' of the 1980s and 1990s were fought to control anthologies' tables of contents (Benedict 1996, Price 2003). Christopher M. Kuipers posits that "The anthology is a literary storage and communication form", whereas "the canon, on the other hand, is not a form, but a literary-disciplinary dynamic: it is a field of force that is never exclusively realized by any physical form" (Kuipers 2003, 51). This idea of a collection of works that is continually shifting and mutating according to the tastes and standards of the era, context and circumstance is as applicable to the notion of an architectural canon as it is to a literary one. Like literary canons, architectural canons can also be problematic, since as there will never be complete agreement on what constitutes a 'great work', there can never be a definite list. I do not believe that the main role of the anthology is to canonise, and this project does not wish to become bogged down in binary arguments of what should or shouldn't be included in any given canon. In this respect, it prefers to retain the freedom to include both major and minor works, including voices from the non-canonical fraction.

3.2. The question of authorship

As Ankhi Mukherjee notes, as "works with multiple authors and editors, anthologies defer and displace authorship" (Mukherjee 2019, 751). Just as questions of authorship tend to be somewhat ambiguous in relation to anthologies, adaptive reuse likewise raises fundamental questions regarding authorship in architecture, even going so far as to question the role of the architect in a broader sense. What Benedict refers to as "the consensual dynamic of multiple authorship" central to all anthologies can also be observed in projects involving the adaptive reuse of existing buildings and sites. However, despite being pronounced dead over 50 years ago, the spectre of the author continues to haunt contemporary architectural production. Protective of a profession perceived as threatened by the erosion of their autonomy, many architects continue to jealously guard authorship as if it were the sole possession of a singular genius who alone "has the capability to conceive the idea for a building and has an elevated taste that allows them to make judgements as to what is right and what is wrong" (Olgiati and Breitschmid 2019, 139). Arrogance (and moral and aesthetic absolutism) aside, such narrow and antiquated definitions of authorship do not reflect the transversal, intersectional and

collaborative nature of current architectural practice, nor the reality of building in a context that is increasingly characterised by uncertainty.

As well as denying the agency and contribution of other actors, this notion of a single 'author-architect' presumes that a finished building represents a *fait accompli*, existing in an ideal state as envisioned by its author. Yet this imposes an artificially-constructed limit on architecture by failing to take the temporal dimension into account and neglecting to acknowledge the fact that buildings can adapt and change over time, as was the case throughout the entire history of architecture until the advent of a streamlined construction industry premised on the infinite exploitation of finite resources. Societal and environmental challenges are forcing the architectural profession to move beyond anachronistic 20th century practices, but it has so far proven difficult to transcend the associated, deeply-entrenched definitions of authorship.

Positing that the processes of negotiation involved in engaging with existing buildings and with other actors neither limit nor diminish the creativity of the architect but rather have the potential to enrich it, practices of adaptive reuse allow and encourage us to explore more inclusive theories of authorship.

3.3. Anthologising as an act of adaptive reuse

Acts of anthologising mirror architectural practices of adaptive reuse in the sense that it is a dynamic and ongoing process of reading, interpreting or translating, and rewriting that often involves simultaneously adding a new layer to the existing, while at the same time scraping away a layer that is already present to reveal other previously hidden ones. Deciding what to retain, what to remove and what to add represents a key responsibility or judgement of the practitioner who has to negotiate the multiple existing conditions and traces, much like the processes of selection for inclusion (or exclusion) in anthologising.

Both Benedict and Price remark on how anthologies, unlike other literary forms such as short stories or novels, encourage reuse in a variety of ways, and indeed are specifically intended to be use and reused, inviting readers to reread existing works, to make connections between similar but different elements and to choose their own reading, from which to create their own meanings (Benedict 2003, Price 2003).

3.4. Practices of care

A pertinent and topical question that has repeatedly come to the fore during the first few months of curating this collection is whether the move away from demolition and reconstruction in the built environment towards an approach based on maintenance and repair represents a mirroring of a shift in our wider society in general towards practices of care. This is exemplified by the current exhibition Critical Care organised by the Flanders Architecture Institute in collaboration with Architekturzentrum Wien at de Singel in Antwerp, where care in relation to the built environment is the broad theme for this entire year's public programme. Scholars Erica Lehrer and Cynthia E. Milton remind us that the root meaning of the word *curate* is "taking care of" or "caring for":

> This is to say that to "care for" the past is to make something of it, to place and order it in a meaningful way in the present rather than to abandon it. But how does one "care for" the past? (Lehrer and Milton 2011, 4).

One case study which can perhaps suggest an answer to precisely this and similar questions around care involved the renovation of a group of dilapidated buildings on Place Masui in Brussels to become the new home and ateliers of Zinneke, a social-artistic organisation that specialises in the art of creating shared spaces. Zinneke's

aim is to connect what isn't connected by building bridges across the different types of boundaries that exist in Brussels, between communities, cultures, and languages, but also between already existing organisations and initiatives across different sectors. All of this work culminates in a huge parade through the centre of Brussels every two years. What is particularly interesting is that this architectural project represents a literal translation of Zinneke's philosophy and can be read as a physical manifestation of their approach to processes of co-creation, which always begin with the reflection:

- *why do we do what we do?*
- *who are we doing it for?*
- *who are we doing it with?*

I would argue that these questions are equally pertinent to keep in mind for anyone working with adaptive reuse, and indeed architecture in general.

3.5. The form and structure: from printed collection to digital archive

Discussions concerning the curation but also the form of the project output have spurred me to further investigate a wide range of potential options. With regard to an actual printed anthology, which is hopefully what will constitute the final outcome, I have been inspired by references of books that collect existing essays and canonical works and combine them with critical reflections as well as newly commissioned texts. As discussed earlier, this can in itself be seen as a form of adaptive reuse.
We are currently in a transitional phase with regard to publishing and how research is shared, having moved from a longstanding tradition of commercial publishing towards an open access model. The serials crisis of the early 2000s was the tipping point that set this transition in motion – the moment when escalating subscription prices of journals were adversely affecting the ability of universities and libraries to pay to such a degree that academic publishing had become unsustainable. This led to a wave of protest and a publishing revolution, from which Open Access was born (initially as a DIY response, published by and for academics), all made possible by the advent and development of online publishing which meant print was no longer the only way to share and access information (Van Orsdel and Born, 2007). Since then, however, the ease and availability of online publishing has created a situation where we are now living in a ridiculously over-published world – Routledge alone publishes more than 1,500 journals and approximately 7,000 new books each year, with a backlist that encompasses over 140,000 titles.
Just as the genre of printed anthologies emerged in part due to printing and book making becoming more affordable and copyright laws becoming more relaxed, it makes sense to similarly take advantage of contemporary developments in how information is shared. In a similar manner to how 17th century anthologies embodied "the great shift in the nature of literature over the early modern period from an oral to a printed form, and from an elite to a mass-produced commodity" (Benedict, p.235),
the more open and contributary nature of the web offers a way to overcome what she refers to as the "paradox of the anthology", with both remaining simultaneously inclusive and exclusive. This has encouraged me to look to experimental online formats that can offer new possibilities that are innovative, digital, open access, transdisciplinary, accessible, non-linear, and horizontal.

3.6. Information wants to be free, and shared

The most interesting references of online repositories for knowledge building and sharing source expertise from a global

network of scholars and practitioners, thereby bringing together multiple stories and voices. Some of these have also resulted in an eventual publication – for example, Spatial Agency. Particularly inspiring is the format of Women Writing Architecture, which has at its heart an ever-growing annotated bibliography and open-access list of texts written by women about architecture, a clever way of neatly sidestepping copyright issues. Created collaboratively, it is a free resource that invites contributions and suggestions, and allows users to easily create their own personalised reading lists.

Digital collections in this way build on what Benedict described as the anthology's "rejection of linearity, its hospitality to a multiplicity of reading procedures, its invitation to readers to read nonteleologically" (Benedict 2003, 249), offering virtually unlimited connections and networks that can be accessed from anywhere around the globe with an Internet connection.

3.7. Anthologies as makers of meanings

The second stage in the methodology of this PhD research, briefly mentioned earlier, will involve exploring the body of knowledge collected in the anthology through the critical lens of translation. While this paper will not discuss this step in great detail since it constitutes a forthcoming exercise that has not yet begun, it is still useful to include the notion of translation in our discussion of anthologising as it has a large bearing on the current act of collecting.

The word translation derives from the Latin trans meaning "across" or "beyond" and latus meaning "borne" or "carried". As such, it refers to carrying over or transferring meaning, engaging with existing languages and narratives to arrive at new meanings and understandings. As well as relating to buildings and sites as carriers of meaning, this idea of moving beyond is also relevant to practices that cross boundaries - for example between disciplines, but also between material and immaterial, tangible and intangible, past and present.

In *Assembling the refugee anthology,* Emma Bond asks the questions "what makes an anthology better equipped than a single authored piece of writing to respond to contemporary themes?" and "how are they assembled by various stakeholders at different stages in production and reception processes in such a way that enables them to offer diverse sets of meaning to different readers?" She theorises that "The answer might lie in their heterogeneous form, which allows anthologies to be assembled and reassembled by various stakeholders during their production and reception so that they mean differently in different times and places" (Bond 2019, 1).

Rather than focusing on the canon-making capacity of anthologies, my research is much more interested in the potential of anthologies to create meaning - meanings that are more than the sum of the individual parts. In choosing not to concentrate solely on the canonical functions of anthologies, the project hopes to sidestep narrow binary discussions of inclusion and exclusion. In this regard, Gilles Deleuze and Felix Guattari encourage us to "make a map, not a tracing":

> "What distinguishes the map from the tracing is that it is entirely oriented toward an experimentation in contact with the real… It fosters connections between fields... It is itself a part of the rhizome. The map is open and connectable in all of its dimensions; it is detachable, reversible, susceptible to constant modification. It can be torn, reversed, adapted to any kind of mounting, reworked by an individual, group, or social formation." (Deleuze and Guattari 1987, 12

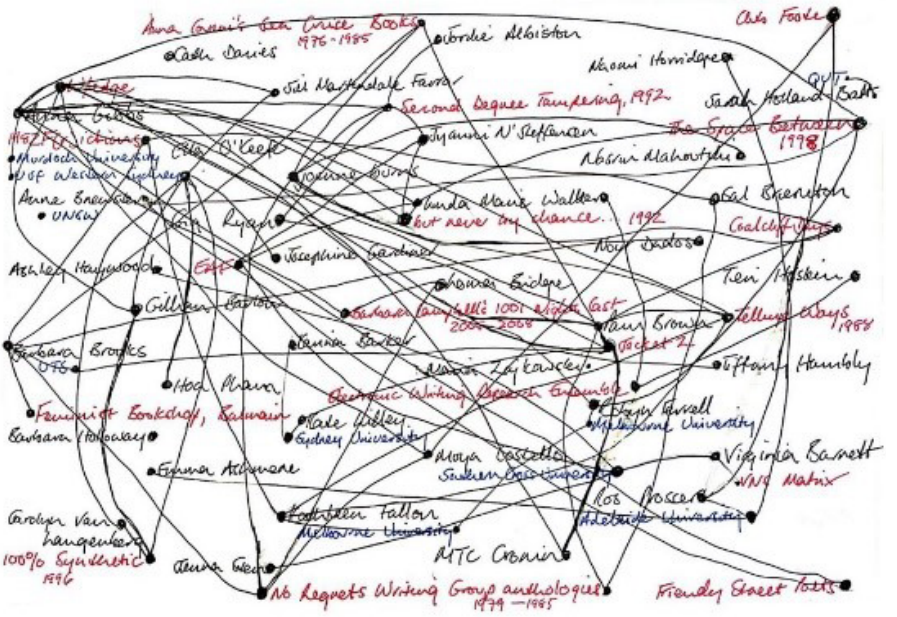

Figure 1. Mud map of connections created through publications, reading venues and university writing programs. Source: (Anna Gibbs 2013)

Thinking in terms of the rhizomatic, inspiration can be taken from the mud map (a simplified diagram or map, used to outline directions and showing only essential features) sketched by Anna Gibbs that accompanied the eponymous 2013 anthology of Australian Women's Experimental Writing which she co-edited along with Moya Costello, Barbara Brooks, Anna Gibbs and Rosslyn Prosser. It shows overlapping networks of connections "that persist, shifting and mutating over time, and growing as new writers emerge and new publications appear." Gibbs points out how:

> "this mud map (and the collection itself) represents nothing so fixed as a community, nor a hierarchy of influence (as from teachers to students), but a rhizomatic, dynamic network of enabling connections creating a shifting terrain which will look like a completely different landscape in another ten – or even five – years.
> The point of this cartographic exercise is less to represent and codify what already exists, than to orient the vibrant energies of the present towards a 'something else,' an open possibility unable to be specified in advance." (TEXT No 17, 2013)

This anthology took the unusual form of a special online issue of TEXT, the journal of the Association of Australasian Writing Programs, who stepped in after the editors'

proposal was rejected by every print publisher in Australia they approached. This serves to highlight the important role of more experimental and non-traditional forms of anthologising and publishing in the face of refusals from more traditional outlets, where narrow selection criteria based on profitability can serve to lock out or deny a platform to less financially viable projects and voices outside of the mainstream.

4. CONCLUSIONS

This project hopes to develop more than an anthology in the traditional literary sense, in that it aims to go beyond merely cobbling together and repackaging existing thoughts, texts, theories and ideas. Much like the endless adaptation of the built environment, it aspires to assemble a open access body of knowledge that is constantly evolving and being added to, creating a digital palimpsest that will be gradually built upon to become a repository of adaptive reuse. The proposed anthology creates a space for dialogue, exchange and learning, inviting users to participate in a collaborative act where they can not only freely discover, collect and reuse existing resources, but also assemble, shape and adapt new resources that can in turn be freely read, reread and reused by others.

Whether or not this participatory activity of collecting texts via an online repository represents the first step towards an eventual printed anthology remains to be seen – in a way, this could be seen as defeating the purpose of having a more open-ended collection, since the curation of a book would involve further acts of selection with the result that certain entries would be rejected and excluded, and perhaps it might seem regressive to revert to a more restrictive format that offers less flexibility. At the same time, there is undoubtedly a sense of satisfaction and a certain immediacy about being able to hold a physical object in your hand that is hard to replicate with a purely virtual creation, and working towards a publication gives the project a tangible output that can complement rather than render the online version obsolete, and can also help to legitimise the project and its findings. For the moment, it is impossible to know for certain the final form that the project might take or how successful the experimental online format will be, since it remains a work in progress.

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PAPER #6.03

CHANGES OF MEANING AND PERSPECTIVES FOR THE DESTINIES OF THE BUILT HERITAGE

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ABSTRACT

It is difficult to say what Restoration is today and what place it occupies among the disciplines of architecture, in the fields of education, research and profession. Equally complex is to delimit the concept of Cultural Heritage, which is increasingly extended and differentiated by scale, types of artefacts, age of formation, etc. Furthermore, it is increasingly subject to risks of various kinds that cast doubts on its survival and transmission to the future. On the other hand, we still live in a "liquid" and ever faster changing contemporaneity, according to Zygmunt Bauman, while for the philosopher Umberto Garimberti it would be almost "cemented" and blocked (Palese 2014). Our relationship with the traces of the many pasts that preceded us cannot ignore this fragile, uncertain, but also open nature of the time we live and those that await us. Marc Augè, in this regard, questioned about the two great ways of relating to the future in different human societies - one that makes the future a consequence of the past: the intrigue, the other that makes it a birth: the inauguration - which find their institutional and cultural expressions (Augé 2012, 14). Even the ways in which each era and each community have lived, recognized, interpreted, preserved, or innovated their own built heritage of cultural interest and value seem to be attributable to the metaphorical figures of "intrigue" and "inauguration". Many protagonists of the life of our cities, landscapes, and territories, on the other hand, now claim the right/duty to act on that heritage, often generating radical conflicts between different ideal and operational visions and perspectives and, at times, irreversible losses of its "relevant parts". The contribution therefore proposes an ideal reflection on these themes and similar perspectives, also with reference to current events and concrete and operational situations at the local scale but not only.

KEYWORDS

Cultural Heritage; memory; values; conservation; innovation.

1. SPACES AND GOALS OF RESTORATION, BETWEEN CONSERVATION AND INNOVATION

The discipline of Restoration has been formed, for some, over many centuries since ancient times. For others, starting with Eugene Emmanuelle Viollet Le Duc, "the word and the thing are modern", that is, they were born between the 18th and 19th centuries. Whatever the shared point of view, there is no doubt that in the past decades and in the most recent years, we have experienced a radical transition from a conception of "monuments," true homeland glories, masterpieces of art depositories of

collective historical memory, selected through processes of an "aristocratic" character, to a more "democratic" vision of what constitutes the built Cultural Heritage, in the words of Alois Riegl (Riegl 1903) and then of Gustavo Giovannoni (Giovannoni 1945). The interest has gradually extended from monuments (considered intangible but, often, extensively redesigned, for various reasons including ideological) to works of 'modest entity', if they are rich in testimonial values, up to including in the Heritage to be protected the widespread construction of historic centres, the so-called minor architecture, serial, without architects and then also the poor and fragile one of rural environments. The 'choral' (or systemic, we would say today) values have thus joined the 'individual' or strongly identifying ones, while History (historiography) was engaged in a parallel re-reading of the many pasts of which those constructions are a tangible surviving trace, irreproducible and irreplaceable and moreover the bearer of an equally important and precious heritage of intangible assets (knowledge, traditions, collective memories, rituals, folklore ...). The built heritage of the twentieth century also required unprecedented attention, as a product of a recent history and perhaps not yet completely 'historicized', understood and accepted but, in any case, not elidable and sometimes more fragile and at risk than the older one. Many researches have been developed in this direction, as demonstrated by the recently concluded European JPICH program entitled CONSECH20 (https://consech20.eu, Musso and Franco 2021, 240-261) dedicated to the heritage built in so-called 'historical' reinforced concrete, that is, belonging to the early twentieth century, a pioneering period for the material and for the construction technique, but also for many 'types' of buildings built in European cities to mark lifestyles, emerging social needs, innovative ways of living and using the urban scene. Even this new extension of what many now consider the contemporary built heritage of cultural interest and value has given rise to unprecedented ideal and theoretical reflections and parallel technical and design proposals (Di Biase 2013, 195-236; Musso 2009, 24-35). We have thus progressively arrived at a very broad vision of what today is the Cultural Heritage to be protected, safeguarded, preserved, and restored. Entire parts of the contemporary city, as well as ancient, vast landscapes built and shaped by man during the past ages, are today the center of interest. UNESCO has opened new frontiers in this direction and has shifted the initial and exclusive interest in 'things' towards their intangible meanings and values (traditional construction skills and techniques, symbolic values, rituals, etc.), making even more complex the problem (Fiorani 2014, 9-23) The international organizations operating in this area (UNESCO, ICCROM, ICOMOS, ...) have gone so far as to ask that the States protect various human expressions which, apparently and only superficially, can be considered without links with the material heritage of the places they belong to. The immaterial, in fact, often needs many and different "material" supports to be able to express itself, to consolidate, last and be transmitted between generations (thus becoming a tradition). Matter, however, perishes, spoils, breaks, sometimes to the point of disappearing. However, with its disappearance, even what it kept or transmitted immaterial is in danger of being lost forever. On these aspects of the question, today more than yesterday, we must carefully reflect and work, even in the face of the risk of loss of conspicuous parts of our contemporary cities which, for ideological, political, economic, or artfully technical reasons are under the pressure of the much invoked "Urban regeneration". Demolishing buildings built during the twentieth century, only because they are considered an expression of historical periods and regimes that were later rejected, or because they are 'ugly', or bulky and useless compared to the new needs of the cities, risks annihilating even the memory, the memory of that "brief century" initially recalled that it is an essential part of

our being citizens of Europe and of today's world. We cannot erase the history that we do not love, that we do not respect and that we even abhor and condemn. Demolishing the material traces with bulldozers, thinking that with this we will obtain the desired result, can only increase the damage compared to the delicate themes of the collective memory of our societies and an immemorial civilization is destined to repeat the mistakes made and to get lost in the future. Of course, nostalgia and opposing historical revisionisms are always lurking and this constitutes a constant danger and a challenge never won forever. However, there have been dark times in recent European history that we cannot ignore or simply obliterate. Not everything, as also for the ancient, can and must be preserved, much can be transformed and modified, even before simply demolished, also for the respect of the much-heralded sustainability of the future in our territories. In any case, the traces of that past often refer to oppression, injustice, segregation, and other nefarious expressions of the power of some over others. These are terrible things that we had hoped to be completely overcome, at least in Europe, but which in any case we do not have the right to cancel as if nothing had happened. However, there are also expressions and creations of those dark moments that speak not only of violence and abuse, but also of individuals, families, social and aggregate life, education, care, and work. Emblematic, among the many cases of cities founded by the Fascist Regime in Italy, is the case of Carbonia (Musso 2012, 19-32). This small town in western Sardinia won the European Landscape Award a few years ago with an ambitious plan / project for the recovery, conservation and revitalization of the settlement wanted by the hierarchs of the time to settle the miners of the coal mines in the area, in full period of economic self-sufficiency of the country. Even in the dramatic historical phase that Italy and Sardinia then experienced, the planning and subsequent construction of Carbonia drew some of the best design energies of the moment from the rest of the country, reflecting the most modern theories on urban and territorial planning as well as building typology at the service of living and community living. For these reasons, here as in other places, the duty is not only of the defense or recovery of memory and of the rigorous and non-ideological historical reconstruction, but it is also that of the material safeguarding of that settlement, of those places, of that landscape built by the man.

2. WHICH HERITAGE? CENTRAL ISSUES AND NODES

Many disciplines, as is natural and proper, today deal with this 'dilated and extended' built cultural heritage, each offering their own methodological and ideal contribution, their own tools and pursuing their own specific scientific, cultural but also operational objectives, to the conservation/ sustainable transformation of the world we live in. Among them, the Restoration also tries to deal with the many challenges just mentioned, albeit with some complications and many delays, together with the architectural and urban design, the disciplines of building and landscape architecture. Each stage of the process of expansion of what we now consider "Cultural Heritage", initially mentioned, on the other hand, has resulted in inevitable changes in the ways of thinking and acting on it. Every moment of those events marked, in some ways, the closure of a cycle, which was answered with the opening of new questions that now require answers at least in part unprecedented. The progressive and impressive increase in the number and types of artefacts, ignored or depreciated yesterday and today the object of unexpected interest, of research and design experiments of various kinds and purposes, was accompanied, as recalled, by the parallel extension of attention towards previously unknown eras or devalued, overcoming the disputable historiographical selections, of various origins and foundations, proposed above all in the more distant past, in

the nineteenth century when the first requests arose to 'preserve' at least some fragments of previous eras, in the face of the risk that the new society of industry risked completely erasing all traces of it. The extension of our gaze into space has similarly pushed us out and beyond the only large sites or monumental complexes, traditionally considered as worthy of conservation and restoration, beyond the cities of art and their central places, towards the suburbs, the marginal and rural areas, fragile or depressed inland zones and yet rich in evidence of a past that we cannot forget, if we want to have a future. We must take note of all this and face the new challenges that this unexpected situation proposes to the Restoration and to contemporary architectural and urban planning culture, even if certainly not only to them. In fact, one of the most pervasive consequences of the processes mentioned is a substantial and potentially positive change in the same concepts used in this area. Everyone, in fact, now intends and wants to deal with Heritage, a term now widespread also in Italy but not directly identifiable with the term 'Cultural Goods' which is the basis of our legislation about protection. Those who intend to act to effectively take care of it, with conscious responsibility towards the citizens of the future, is not always very clear and evident, but it will be seen. It is indisputable, however, that the expansion of the temporal, spatial, material and ideal horizons of the idea of 'Cultural Heritage', combined with the progressive narrowing of the spaces of new buildability and modifiability of the environment in which we live - a reflection of a thousand reasons and processes of change in contemporary society - has caused an explosion of interest in existing, ancient or recent artifacts and sites, to which we recognize some values and different potentialities, including use or re-use, more or less 'adaptive'. To face the new challenges posed by the destiny of the Heritage, new skills, innovative disciplinary, scientific, technical, and operational tools are required, in addition to those referable to the traditional world of Restoration alone. This can result in an enrichment of all those involved in the world of protection, with many benefits for the transmission to the future of those assets, in the most intact state possible, so that they reach those who will follow us with all the material and intangible values of which they are bearers. and, if possible, enriched with new values. Everything depends, however, on how much and how we will be able to govern the complex processes that develop in this area by the work of many and different subjects, each bearer of legitimate requests, needs, intentions which, however, can often prove to be conflicting with each other and potentially capable of destroying what, on the contrary, one declares to want to 'enhance'. This, even overcoming the logic of physical intervention considered as a singular and definitive event, autonomous, closed in on itself, strictly authorial and self-finalized, capable of definitively 'closing' the history of the artefacts and sites subject to attention. In fact, it is necessary to avoid the risk that the enormous power of attraction that the Heritage (from the artistic artefact to the building, from the city to the landscape) seems to exercise on the most diverse disciplines, professionalism, skills, abilities and on many sectors of administration, politics, industry, and finance, produce more damage than we would like. Every era and every community, on the other hand, have the right and duty to question themselves about the relationships they intend to establish with their past and, therefore, also with the material traces that are still part of the current living environment. Rather, it is necessary to clearly pose some fundamental questions to those who intend, or must, deal with a heritage that belongs to everyone but, of course, no longer to the past and not exclusively to our transient present. On the other hand, the patrimony should not be for anyone a hunting territory, of free and autonomous expression of singular interests (individual or category), or a simple 'resource', understood as an asset of economic income or multiplier of profits, not even for the State and local institutions. Indeed, forms of collaboration, subsidiarity, or synergy between

public and private sectors in this field are welcome, without ever forgetting that cultural heritage is a 'Common Good'. It is a matter of civilization.

3. DIFFERENT VIEWS ON HERITAGE AND ITS DESTINY

For the reasons highlighted so far, it is important to consider the many and frequent reflections that sociologists, philosophers, historians, and not just architects or urban planners, propose about the role that the material traces of the past can have in the present and in the future, as well as on how to ensure they can fully express it. On the other hand, there are many implications and sometimes contradictions that any intervention on those 'traces' entails, while also attempting to save the intangible meanings and values with which they are impregnated, or with which they can be vehicles towards the future. The problem, on the other hand, goes beyond the restricted area of restorer specialists and, in explicit or implicit ways, involves many protagonists of contemporary culture who offer interesting suggestions for thought capable of proposing a new "inauguration" of the theme, towards the future that awaits us (Hobsbawm 2013).
Zygmunt Bauman argues, for example, that "Concern for the present moment leaves no room or time to reflect on the eternal. In a fluid and constantly changing environment, the idea of eternity, perpetual duration, or lasting value, immune to the passage of time, has no foundation in human experience" (Bauman 2009, 117 - translated from the authors from the Italian edition). Also, for this reason, the tendency to save the 'traces' of the past often clashes with the situation of the present (cultural, training, educational, political, social, economic, productive ...), triggering a radical contradiction and partially undergoing its effects devastating. "The speed of change deals a fatal blow to the value of durability: "old or durable become synonyms of 'obsolete', 'out of date', something that resists despite having lost its 'usefulness' and therefore destined shortly to end up in the garbage basket" (Bauman 2009). On closer inspection, two centuries later and with the necessary differences in language and style, Bauman's words seem to echo those of John Ruskin and bring back to the fore the ancient theme of the duration and durability (or durability) of architecture, opposed to the eternal becoming (and inevitable disappearance) of individual men and entire social communities or civilizations. It is a crucial theme in ancient and Renaissance treatises, partly abandoned or overtaken by the Modern Movement in architecture aimed at the search for other and different values. However, it seems today to re-emerge, for example, in the many reflections on the themes of sustainability (environmental, economic, social, and cultural), to which restoration and conservation can perhaps make important contributions, together with the other disciplines of architecture and urban planning. Not destroying, conserving, re-using existing buildings - even more so if in reinforced concrete, very difficult to 'dispose', respecting their built substance and their characteristics, is an important contribution to the protection of existing resources, also from the energetic point of view and not just the consumption of land and space. Limiting the use of synthetic chemicals, especially in restoration sites, contributes to respect for the environment and the health of operators and citizens. Intervening with the caution of the minimum intervention avoids economically unsustainable investments, or which discriminate a few valuable objects to the detriment of the conservation of larger, articulated, and widespread sets of common goods of the community. This also contributes to ensuring a more acceptable social impact for each intervention, especially if you try to make the restored building universally accessible, in physical or alternative ways. And the examples in this sense could go on and on. However, it is necessary to ensure that

we can first of all overcome the bitter situation denounced by Bauman according to which "There are fewer and fewer, with the exception of objects stolen from the flow of everyday life and mummified for the pleasure of the tourist, the things that have seen previous eras at the birth of the individual; and even less those who, born later, have reasonable hopes of outliving their spectators" (Bauman 2009, 117-118). The relationship that culture and society seem to express today with respect to the artifacts and monuments born before the contemporaneity in which we are immersed is however very contradictory. It is also deeply linked to the question of the use that, of those objects, sites, or monuments, we can ensure to guarantee, as has always been argued, a permanence with meaning in the current and future life environment, i.e., an unrestricted presence. a mere fetish or a simple appeal for the "pleasure of the tourist".

4. NEW RISKS FOR HERITAGE

The built cultural heritage, now so extensive, varied, and widespread on the territories, suffers every kind of attack by nature, with greater violence, depth, and recurrence than in the past, without forgetting the continuing havoc caused by men and even by those who it should take care of it directly. Marc Augè denounces this when he argues that "There are ongoing processes of standardization and 'spectacularization' that distance us both from the traditional rural landscape and from the urban landscape born in the nineteenth century [...] restorations and lighting stiffen the landscape of the city. The palaces of the Marais or other "historical monuments" in Paris become the virtual objects of the gaze of spectator tourists destined to see them for a few moments, in passing. By their virtual nature, the restorations - such as reconstructions, reproductions, simulacra - belong to the field of the image: they conform to the image, they are the image of distant or vanished realities which they replace" (Augé 2004, 75-76 – translated by the author from the Italian edition). In these processes, those who in various ways and in many ways are involved in restoration certainly have something to say. At the very least, it should be done by those who deal with it as researchers and scholars but also as educators and as designers. In fact, according to Augé, "The fourth ambivalence of tourism, which is also that of our world in general, is the ambivalence of reality and its copy at a time when copies are more and more realistic, and reality is increasingly penetrated by simulacrum and fiction" (Augé 2004. 57). It thus happens, more and more often and at every latitude, that "[...] the commercial success of the parks in which simulacra of the present or of history are offered corresponds to the spirit of the time [...]. The spirit of the times is first and foremost the privilege attributed to the present over the past and the future, a spirit of immediate consumption that is very well suited to the spectacle of the world. The 'spectacularization' manifests itself at other levels and in different ways: plastering of buildings, flower villages, restoration of ruins, "sound and light" spectacles, lighting, regional parks, arrangement, and protection of large natural sites, but also theatricalization of current events for images, simultaneity of the event and its political, sporting, or artistic representation [...]. This 'spectacularization' makes the border between reality and its representation, between reality and fiction more tenuous every day. It has perverse effects: the nuance is foreign to it; if diversity is its raw material, it always treats it in the same way, with the same language, in the same style, uniformly [...]" (Augé 2004, 57-58). This situation also gives rise to the widespread tendency towards homologation of the surface treatments of monuments, or of the design solutions adopted for new parts added or inserted within or alongside the restored monuments. For this reason, we are witnessing the increasingly striking contrast between a heritage that is peripheral in various aspects, left to a destiny of progressive

abandonment and deterioration, and the more "central and attractive" one, the beneficiary of large public and / or private investments only because it is more easily exploitable, i.e., 'salable'. The former will perhaps have the sad fortune of disappearing, sometimes arriving 'authentic' at his "funeral service", as John Ruskin wished. The second will live as many new lives and often only cosmetic interventions as there are more solicitations for his perennial resurrection (or reproduction/ reconstruction/re-presentation/interpretation). This is pursued with respectfully pseudo-ancient forms or, on the contrary, genuinely innovative, and contemporary, but sometimes very invasive and destructive. On the other hand, according to the philosopher Jean-Luc Nancy: "[...] the city that is feared to lose is the city without its «banlieu», while the one that is feared and nothing more is the city with and in its «banlieu». What one would like to preserve is the governing and commercial city, the 'bourgeois' capital which gives itself, as a city, the representation of its power. The city that moves away its «banlieu», while preserving its castle, its cathedral"(Nancy 2002, 18). For this reason, not only in the Los Angeles of which the French philosopher speaks "[...] the city of today offers itself as a spectacle to the city of yesterday: it preserves and restores it, revives its facades, monumentalizes and patrimonializes the city that passed into the very moment in which it deconstructs it. It opens the excavations of its future circulation corridors, bringing to light older layers that it will then put under glass, leaving them visible along the new roads. On the area of a destroyed prison, where a parking lot will be built, a group of young archaeologists is grappling with the remains of a primitive Greco-Roman ruin. The city looks at itself, searches for itself and eludes itself at the same time in its annals and in its layers crushed on each other. If once, take the case of Troy, successive kingdoms stacked their cities on top of each other as successive layers of power, now a single kingdom extends to all horizons, and the exhumed ancient ramparts are no longer foundations, but curious inclusions within a bottomless and borderless expanse" (Nancy 2002, 43-44).

5. HISTORY – MEMORY - OBLIVION

Memory and oblivion thus enter in continuous mutual fibrillation, precisely because they are fundamental dimensions of human existence and of every culture, as Martin Heidegger recalled. Paul Ricoeur has dedicated to the theme of the traces of the past some fundamental reflections that concern us directly even if his discourse develops on the more general level of history and of the relationships between past, present and future. He first proposes a fundamental distinction between the Greek 'eikon' (image), the 'trace', the 'imprint' (like the seal imprinted in wax), the sign and the document and argues that not everything is a document, while everything can be a trace of the past. The problem is that "[...] the metaphor of the imprint of a seal on the wax reinforces the idea of a localization of the memory, as if it were collected and stored somewhere, in a place where it is preserved and from where we will be able to extract it to evoke it, recall it to memory [...]" (Ricoeur 2004, 5). This "place", on closer inspection, is for many precisely the monument. Ricoeur invites, however, "[...] to be on guard against the tendency, also typical of language, to treat the past as an entity, a locality, in which its forgotten memories would stay, and from which they would be extracted from anamnesis" (Ricoeur 2004, 6). Monuments, in this perspective, are certainly traces and documents of the past, as Jacques Le Goff already proposed, but Ricoeur in this regard points out that "Documents are traces and archives are reserves of inventoried traces. Now what is a trace, if not the modern equivalent of the footprint for the Greeks? [...] the trace left is also an imprint offered for deciphering [...]. Thus, the enigma of the footprint is repeated in that of the trace; It is necessary to have a preliminary theoretical

knowledge about the habits of those who have left the trace, and a practical knowledge about the art of deciphering the trace, which, only then, acts as a sign-effect of the passage that has left the trace" (Ricoeur 2004, 14). Even thinking about the destiny of the monuments, a theoretical and a practical knowledge is invoked that, certainly not exclusively, the world of Restoration has elaborated in more than two centuries of history. We must be aware of this, and we can talk about this, in comparison with anyone who intends to deal with those material traces. Among many others, the opposition between "true" and "false" (or between likely, authentic, or counterfeit) has always characterized, for example, the ideal dialogue and the comparison between distinct design solutions. Paul Ricoeur, however, recalls that "The true-false opposition is at the same time also a trust-suspicion opposition. The critical undertaking of history therefore does not liquidate the suspicion of having been deceived by false testimony. The historical truth thus remains pending, plausible, probable, contestable, in short, in continuous re-writing. Therefore, it is on inscribing the problematic of the 'passeness' of the past in the great circle of temporality that the destiny of this suspended truth, of this forever incomplete truthfulness, ultimately depends" (Ricoeur 2004, 19). Also, for these reasons, the future we would like for monuments and cultural heritage in general takes on extremely delicate characteristics, which cannot be solved with simple technical or formal recipes. Restoring implies, in fact, being deeply aware of the fact that "memory and history have a relationship with oblivion [...] (which concerns) recalling to memory - what is currently defined as remembrance or simple memento - and not inscription, conservation, keeping in memory. From the memory that "keeps", from the memory that "remains", we pass to the memory that "evokes", to the memory that "returns". The notions of presence and absence of the past take on a strictly phenomenological tint at this level, in contrast to the ontology of fundamental oblivion: it is the game of appearing-disappearing-reappearing at the level of reflective consciousness" (Ricoeur 2004, 103-104). Restoration and architectural design in general have great responsibilities in this sense when they often play with these terms. Planning the future of monuments and historical buildings requires, on the other hand, to recognize that "The values expressed by an ancient work [...] are no longer contemporary: they have deteriorated, they no longer speak to us. The work tells of its time, but no longer tells it comprehensively. Those who contemplate it today, whatever their erudition, will never have the gaze of those who saw it for the first time. It is this lack, this emptiness, this gap between the disappeared perception and the current perception that the original work expresses today [...]. The perception of this gap between two uncertainties, between two incompleteness, is the essential reason for our pleasure: at an equal distance from the historical reconstruction and the actualization operated by the forceps (Oreste and Antigone in jeans, Egisto and Creon in suits and ties, etc.). The perception of this gap is the perception of time itself, of the sudden and fragile reality of time, erased in the blink of an eye by erudition and restoration (the illusory evidence of the past) as well as by spectacle and updating (l illusory evidence of the present)" (Augé 2004, 25-26). For this reason, someone invokes restoration as a rare and precious ability to make the ancient work speak again, in clear and understandable ways, restoring its lost unity, completeness and "beauty". On the other hand, the illusory evidence of the past and that of the present now seem to have won everywhere, in our 'liquid' contemporaneity, starting with some Unesco sites and the infinite reconstructions implemented by recalling the ancient and fortunate motto of "how it was (of course not!) and where it was (maybe yes!)" (Musso 2015, 95-110). Basically, it is a simple recipe that certainly requires considerable technical skills, but which does not solve the problem of the relationship of our contemporaneity with the material traces of the worlds that preceded us.

The reconstructions can do a lot, but they do not contribute to the construction of a future that is not forgotten and not even a hostage to a past which, in any case, is no longer and will never be able to return to being.

6. NEW CHALLENGES AND NEW HORIZONS FOR THE BUILT HERITAGE

For the many reasons mentioned, it is no longer just the great and ideal contrasts of the past that mark the current debate on Heritage. They are still present but expressed in partly new words and actions. The most complex and risky challenge now seems to have shifted to the conflict between the reasons for conservation and the aspirations to enhancement. The relationship between the two polarities is delicate and sometimes conflictual and they do not always find clear and autonomous ideal and operational expressions. The correspondence between the ends and the means used to satisfy their requests is not always strong and crystalline. It can thus happen that extreme and courageous defenses of a conservative nature are implemented with profound gradients of transformation of the existing artefacts, due to the many interpretations of the restoration that have been offered throughout history. Conversely, an action of an admittedly transformative nature which not only modifies the existing one, but which deliberately produces new "forms", can sometimes allow, or help the conservation of the artefact. It all depends, after all, on how much it really affects your body. The Restoration, despite its many variations, expresses a particular attention, a real debt, towards the matter stratified in the course of history (of all stories!). Matter is not a fetish, nor does it represent the only value, meaning or interest of the artefact inherited from the past. However, memories, values, symbols, traces of lives, skills or rituals and everything immaterial that can be linked to it (already known or yet to be discovered), will only be able to survive our actions if these do not change its consistency. physical and formal more than is strictly necessary to ensure stability and durability. The difference, after all, is that between a consideration of the building (or heritage) as the real reason for being of the intervention, the real protagonist of the protection / conservation / restoration action, on the one hand, and its assumption as simple opportunity for self-affirmation, on the other. The perennial conflict between the rigor (of the surveys, of the analyzes, of the diagnoses, of the research on the origins and conditions of the artefact) and the creativity (of the design solutions), can perhaps only be overcome by the humility of the intervention. After our passage, as John Ruskin and William Morris wished, the monument must still be able to speak of the worlds of which it is a surviving trace, as well as of our present. For this reason, it is necessary to be partly out of phase with the time we live in, to be able to see its risks and contradictions, rather than uncritically suffer its dynamics. Only in this way, will we perhaps be able to say that we are truly contemporary and, therefore, capable of contributing to the future. Even for those who work for the destiny of our monuments, landscapes and cultural heritage, the idea of contemporaneity suggested by the philosopher Giorgio Agamben can therefore be valid: "Only who does not allow himself to be blinded by the lights of the century and manage to see in them the part of the shadow, their intimate darkness can consider himself contemporary […]. Contemporary is he who receives full face the beam of darkness that comes from his time" (Agamben 2008, 14-15 – translated by the authors). Not to be blinded by the lights of the present, in order not to conform to the transient "fashion" of the century, to be somehow "asynchronous" with respect to what everyone thinks contemporaneity is, perhaps also allows us to see its limits and not to sacrifice to it what does not belong to us entirely, nor forever.

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PAPER #6.04

AN INQUIRY INTO THE GENIUS LOCI OF KARACHI'S BOHRI BAZAAR AREA IN PAKISTAN

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ABSTRACT

Genius Loci or the 'Spirit of place' refers to the tangible and intangible characteristics of a place as regards several aspects. This concept relates to a deeper meaning of a place and its relationship with the environment. Genius Loci is not merely associated with the city's urban fabric; instead, it is infused within the experience/ setting of the place. The paper discusses the connotation of Genius Loci as an important lens or a possible vocabulary for a much more layered and in-depth analysis of the Bohri Bazaar area in Saddar Bazaar quarter in Karachi, Pakistan.
Bohri Bazaar is one of the early shopping streets developed during the British era in 1839, parallel with the concept of independent market buildings like Cunningham market (demolished in the late 19th century) or the Empress market, among many during British rule in Karachi. Its location within the Saddar Bazaar quarter in Karachi places it exceptionally at the central commercial spine of the city. The British designed the bazaar in Gridiron geometry to orient the users at their ease. The area is romanticized as an oriental bazaar because of its historical nature that homogeneously absorbs the local narrow street layouts and neighborhood context, giving a unique identity to its urban, architectural, and functional design. The methodology followed for this research is based on different sections. The first section is based on a literature review relating to the concept of Genius Loci and then literature on the Bohri Bazaar. The second section is based on the fieldwork conducted between 2020-21 to articulate a description of the area according to the concept of genius loci by physically visiting the site and surveying the Bazaar. Both sections are combined to develop a discussion on the genius loci of Bohri Bazaar for collective conclusions/outcomes. These conclusions are not a singular or solidified statement but an invitation for further investigation.

KEYWORDS

Genius Loci; spirit of place; Bohri Bazaar; Saddar Bazaar quarter; British heritage.

1. INTRODUCTION

1.1. The relevance of research

Karachi, a city developed by the British, is one of the world's largest metropolitan cities. Due to the economic boost and increase in urban population, the country's largest port city faces many challenges related to the rise in population, shortage of land, and modern comfort amenities (Cheema, 2007; Iqbal et al., 2022; Lari & Lari, 2001). Land developers and building owners are replacing the city's historic fabric with high-rise buildings to overcome these issues. Bohri Bazaar (Fig. 1), located at

the junction of main roads in Saddar Bazaar quarter, is also facing an existential threat due to land mafia. Bohri Bazaar is one of the early shopping streets developed during the British era in 1839, parallel with the concept of independent market buildings like Cunningham market (demolished in the late 19th century) or the Empress market, among many during British rule in Karachi. (Laiq, 2022).

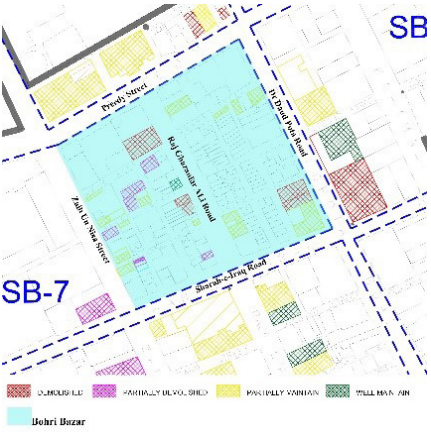

Figure 1. Showing Bohri Bazaar location in Saddar Bazaar Quarter in blue color. Source: Cad Drawing HC-DAPNED, edited by Syed Hamid Akbar (first author)

The concept of bazaar originated from the oriental philosophy of a marketplace, sometimes also referred to as Moorish Bazaar by the west. This concept is generally associated with the middle eastern, Persia, and Indian regions. Bazaar not only has economic value but also has strong communal importance. These were/are the places with which people do not only associate in terms of user value; instead, they play a significant part in their everyday lives.

Traditionally, the bazaars used to be covered with high vaulted ceilings, often decorated with mosaic or frescos. Some examples of oriental-covered bazaars are Grand Bazaar Istanbul, Khan el Khalili Bazaar Cairo, Grand Bazaar Tabraiz, and Dhak (Covered) Bazaar Shikarpur, etc. At present, these bazaars serve as charming tourist destinations, not merely because of their architectural significance but also the experience and knowledge they offer of the ancient times.

In contrast, the Bohri Bazaar was conceptually developed as an open-to-sky shopping streets marketplace accessible to both pedestrians and vehicles. Usually these shopping streets were developed in the historical centers of the cities, with buildings (Historic and often enlisted properties in present time) with a dual functionality: commercial on the ground, and residential on the upper floors. Some examples from the world are Champs Elysees, Paris, France; Istiklal Street, Istanbul, Turkey; Nizami Street, Baku, Azerbaijan Chandini Chowk Bazaar Delhi,India and, Bohri Bazaar, Karachi, Pakistan. The area got its name from the Bohra Muslim community, which owned most of the shops in that area. Despite acquiring its name from a single community, Bohri Bazaar holds a special significance among the various communities residing in Karachi. The research focus is to investigate the spirit of this place in terms of urban, social, and communal attributes, in view of the concept of genius loci and its three core elements of environment, culture, and belonging as proposed by the Norwegian architect Norberg Schulz (1926-2000) making it highly relevant to be studied as a case study for this research.

1.2. Methodology

The methodology for this study is devised into two sections. The first section presents a literature review of the concept of genius loci and then the historical background of Karachi, specifically focusing on the study area of Bohri Bazaar. The literature review of the concept of genius loci helped to understand the meaning of the word 'Genius Loci' and how it is related to people about their built architecture and

the urban environment. The literature review regarding the historic development of Karachi and specifically Bohri Bazaar was helpful in understanding the target area's geographical location and the bazaar's grid iron geometry. The literature review guided the research towards the second section of the study, which was research fieldwork. The first author initiated the research fieldwork from December 2020 to January 2021. The purpose of the fieldwork was to visit the Bohri Bazaar area to have a personal experience of the site and record the observations by taking photographs of the area and interacting with the users. Some informal, semi-structured interviews were also conducted with the building owners and users in the Bohri Bazaar area based on the initial outcomes of the literature review. During the fieldwork, different archival departments were also accessed to collect historical maps, documents, and photographs of the area. The outcome of both activities were combined to provide a collective conclusion of the study.

The first section of the literature review related to the concept of genius loci and Bohri Bazaar helped develop an image of the area. But the second section of research fieldwork conducted from December 2020 to January 2021 and collecting the archival documents, as well as physically visiting the site aided in feeling the three core elements of genius loci: environment, culture, and belonging defined by Norberg-Schulz(Norberg-Schulz, 1980).

2. LITERATURE

2.1. Genius Loci as Concept

Human culture is very strongly linked to places (Vogler & Vittori, 2006). The combined characteristics of its atmosphere define a place, with every place holding unique characteristics that can be tangible and intangible in form. Scholars define these characteristics as the place's genius loci (El-Saqqa & Mohamed, 2011; Jiang & Lin, 2022; Norberg-Schulz, 1980; Vecco, 2020). The Merriam-Webster dictionary defines genius loci as the pervading deity or spirit of a place which was first coined in the 16th century (Merriam-Webster's online dictionary, 2022). But the origin of the concept of genius loci or 'Spirit of Place' goes back to Roman times. In Roman mythology, not only did humans have a special character or guardian angel but also the place had a protective spirit of a place known as the 'Genius Loci'(Christou et al., 2019; Vecco, 2020; Vogler & Vittori, 2006). In the 18th and 19th centuries, the concept of genius loci became a metaphor in literature and poetry of many writers like Alexander Pope and Vernon Lee (Stepanchuk et al., 2020). In the modern world, the concept of genius loci was first used in 1976 by Relph to study the environment. But the Norwegian architect Norber Schulz in 1980 associated the term with the built environment (Jiang & Lin, 2022; Vecco, 2020). In his book (Norberg-Schulz, 1980), argues that genius loci is a long-term process of human interaction and its physical environment to pursue the personal identity and authenticity of the place to find its existential value or meaning. According to Schulz, genius loci fulfills the material and spiritual needs of the people. It is the intangible feelings of a tangible place which the people experience when visiting the site. Schulz and many other authors argue that this feeling can be perceived physically and spiritually (Christou et al., 2019; Norberg-Schulz, 1980; Stepanchuk et al., 2020; Vecco, 2020). These scholars had explained and associated the connection of genius loci to the built environment, whether it be a small room or an individual building or the urban layout.

Schulz has also proposed three core elements: environment, culture and belonging to understand a building's or an area's Genius loci. Different authors have tried to explain these elements in association to urban layout. According to them, 'environment' is the atmosphere which is created by user activities in an area; 'culture' is the architecture, forms, styles condensed in the area and belonging means the intangible association, relation

or ownership of users with the area which is developed by the time (Jiang & Lin, 2022; Norberg-Schulz, 1980; Stepanchuk et al., 2020; Vecco, 2020). Based on the definition provided by different scholars, it is clear that genius loci is the combination of the tangible and intangible aspects of a building or an area which comes together to present a unique character. In 2008, during the 16th general assembly meeting of ICOMOS declaration on the preservation of spirit of place was passed, which gave a precise definition of the spirit of place:

> "Spirit of place is defined as the tangible (buildings, sites, landscapes, routes, objects) and the intangible elements (memories, narratives, written documents, rituals, festivals, traditional knowledge, values, textures, colors, odors, etc.), that is to say the physical and the spiritual elements that give meaning, value, emotion and mystery to place ". (ICOMOS, 2008)

The vocabulary based on the definition of genius loci or 'spirit of place' by different authors and ICOMOS and the three core elements proposed by Norberg Schulz Bohri Bazaar will be analyzed to investigate the genius loci of the area.

2.2. Historic Background of Bohri Bazaar

In 1839, the British saw a strong opportunity in the port location and its activities for the future located at the important maritime trade route from east to west and took over the city of Karachi. It was a small mud fortified town with a population of 15,000 living in the fort city and its sub-urban areas known as 'Kolachi or Kurrachi (later as Karachi)' from its Talpur rulers. (Cheema, 2007; Lari & Lari, 2001). The native town of Karachi in 1839 was not big and impressive as compared to the city of Thatta and Hyderabad. However, it does share the similarity of spatial organization of organically developed narrow alleys with small semi-public and private spaces. (Burton, 1851; Pithawalla & Martin-Kaye, 1946). The British rulers started to develop the city beyond the native town on the European spatial patterns of grid iron layout. The Saddar Bazaar was among the initial areas they developed(Lari & Lari, 2001) Fig 2. After occupation of the city in 1839, the British troops were stationed one mile from the fort near the Rambagh area (a native sub-urban quarter), and later in the same year moved one mile north-east of the Rambagh area to establish a Cantonment area for their troopers, as well as the area adjacent to the cantonment. Their some temporary shops were also laid out to provide basic amenities to the British troopers and their families. The area was given the name 'Suddar Bazaar', which later became 'Saddar Bazaar Quarter'. These shops are thought to be at the place which is now known as the Bohri Bazaar (Burton, 1851; Neill, 1845).

The layout of the Bohri Bazaar also followed the grid-iron patterns, with the open to sky model but the streets were laid out in the dense street network replicating the native narrow alley forms (Lari & Lari, 2001) (Figure 2).

This allowed the area to expand both vertically and horizontally. The temporary shops were in the form of tents to accommodate a large number of sutlers. Later, the tent shops were replaced by permanent buildings following the individual market concept with shops on the ground floor and upper stories for residential and storage purposes. Within no time, the Bohri Bazaar area became a famous shopping center for the European and British officers and their families. Later, in 1841 Seth Naomul Hotchand(1804-1878) constructed the first four houses with the shops in the bazaar and started his own business. (Baillie, 1890; Hotchand & James, 1982; Lari & Lari, 2001). This initiative by Seth Naomul also encouraged other traders to open the grain and cloth shops for the convenience of the resident of quarter. During research field work by the first author, archival maps and drawings of some buildings from Karachi Metropolitan Corporation(KMC) archives show that these shops were located in the area which is now known as Bohri Bazaar.

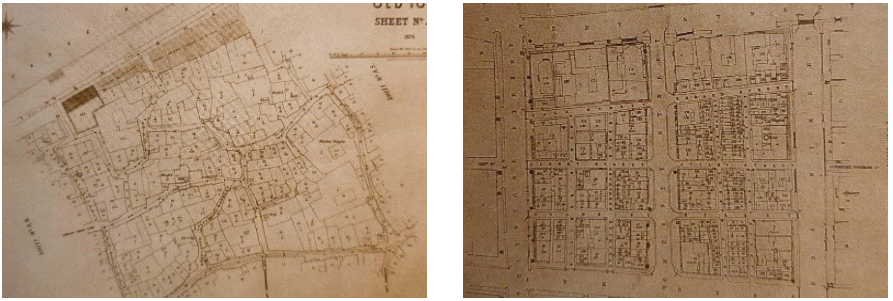

Figure 2. Left-Plan of old town quarter of Karachi from 1874 showing the narrow and unplanned streets of the town. Right-Plan of Bohri Bazaar from 1874, showing the grid-iron pattern of streets. Source: Lari-2001

2.3. Analysis of Literature

The dual spatial quality of the Bohri Bazaar gave the area a unique status to become a famous landmark during the British time. Although, till the late 19th century, native people were not allowed to move into British developed quarters. But after 1880, when the British allowed natives to construct their own buildings in 'White Quarters', the Bohri Bazaar became a focus point for the natives to open their shops. Moreover, until the beginning of the 20th century, Bohri Bazaar was the commercial area where not only British/ European people came for shopping but also the central hub for natives. With the integration of British and native people, Saddar Bazaar became a central hub of social and cultural activities with many cinemas, restaurants and bars, while the Bohri Bazaar area of the quarter was the economic/commercial point.

Although there was the Cunningham market in Saddar Bazaar quarter in the 19th century and in 1889 Empress market was constructed on the independent market concept, but by the end of the 19th century Bohri Bazaar became a commercial center with a different typology of buildings with ground floor having shops while the upper stories were used as the residential or storage floors. The historic timeline of key changes of Karachi in relation to Bohri Bazaar can be seen in the Table 1 below:

3. EXPERIENCING THE GENIUS LOCI OF BOHRI BAZAAR

In the built environment of Karachi, without any doubt, the Empress market is the most famous landmark of British era in Saddar Bazaar quarter and has played an important role in the socio-economic development of the area(Soomro et al., 2020). But Bohri Bazaar also holds a unique status throughout the history. The narrow congested grid iron alignment of streets with commercial activities related to daily use items have created a unique charming environment in the area.

If we see the Bohri Bazaar area according to these elements, then it is the atmosphere of narrow streets, with its user led continuation of commercial activities (environment) which still gives a feeling of a dual spatial quality when visiting the area. Due to the increase in the population of Karachi, the Bohri Bazaar streets have become more and more crowded. Furthermore, the shops' owners use the street to extend their business and put their stalls in the street to extend their businesses in informal way. This has made the streets more congested and difficult to walk through, but it also creates a more local atmosphere for the users (Figure 3).

S.No	Year	Milestones/Key Changes
01	1839.a	Occupation of the Karachi by British, temporary tent shops laid-out at the area Known as Bohri Bazaar.
02	1839.b	Development of new quarter by the British on Grid-iron pattern.
03	1841.a	Seth Naomul Hotchand constructed the first four houses with the shops in the bazaar
04	1841.b	Grain and Cloth shops in Bohri Bazaar.
05	1843	Karachi as the Capital of Sindh Province, Saddar Bazaar Quarter as the main shopping area for Europeans
06	1880	Native people allowed to move to British Quarter,
07	1889	Construction of Empress Market.
08	1888	Boulten Market (circa)
09	1888	Lambert Market (circa)
10	1888	Mesham Lea Market (circa)

Table 1. Historic key dates and milestones of the Karachi city, related to Bohri Bazaar- Table is based upon the literature review and archival data collected by the Syed Hamid Akbar & Tania Ali Soomro (first & second authors)

Figure 3. Present condition of narrow and congested streets in Bohri Bazaar with street encroachment by shop owners Left-View into the Albert Street in Bohri Bazaar from Zaib un nisa Street. Middle- View into the Wood Burn Street in Bohri Bazaar from Zaib un nisa Street. Right-Street view of Bohra Street Source: Images taken by Syed Hamid Akbar(First author) during 2020-2021 fieldwork

During the field work, exploring the streets and photographing the environment of the streets gave a feeling of walking in some old walled city from the Mughal era time. But looking at the facades and the material of the British era buildings, of which mostly are in partially demolished or partially maintained condition, aligned in the streets laid out in the European urban form revealed the symbols of the British past creating a unique culture (Figure 4, Figure 5).
While visiting, interacting with the area users was the key moment to understand that the narrow street layout with British/European style buildings and the present congested spaces in streets is creating a sense of ownership, integrity, and an intangible connection between the people and area. Moreover, users whether they are building owners, businessmen, shoppers or passersby feel a connection of belonging with the area. The whole atmosphere of the Bohri Bazaar streets aligned with historic buildings from British era with the dual spatial quality of commercial and residential activities provide a picturesque backdrop of the past in the present.

Figure 4. Panoramic Street view of Bohra Street in Bohri Bazaar showing the condition of British era buildings and multi-functional activities going-on in the area. Source: Images taken by Syed Hamid Akbar(First author) during 2020-2021 fieldwork

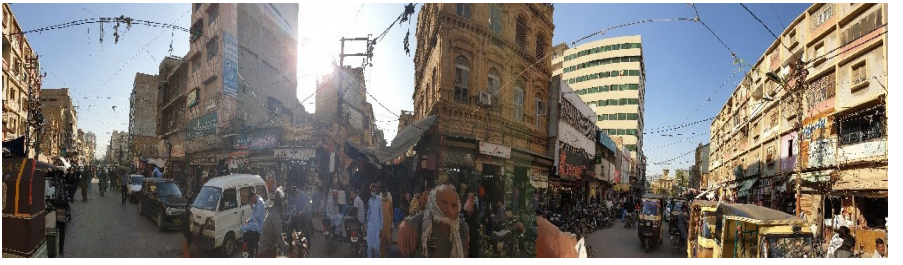

Figure 5. Panoramic Street view of Raja Ghazanfar Ali Road in Bohri Bazaar showing the condition of British era buildings and multi-functional activities going-on in the area. Source: Images taken by Syed Hamid Akbar(First author) during 2020-2021 fieldwork

4. DISCUSSION: GENIUS LOCI AS A VOCABULARY FOR BOHRI BAZAAR

To conserve a place or a building according to users' changing requirements is a difficult task. Specifically when a place has historic value, it is even more difficult to look for the vocabulary to analyze and understand a place. In the context of Bohri Bazaar area which has historic, social, cultural and economic value, the concept of genius loci can be a moderation point. Analysis of the Bohri Bazaar apropos the three elements of genius loci which Norberg Schulz has proposed in his book show that the area has a unique spirit of place.

Karachi is also known as a dual city(Lari & Lari, 2001) holding the spirit of the colonial past and local traditions, planning, and culture all condensed to each other. The Bohri Bazaar area has this dual spatial quality or we can call it a unique spirit of place. And this genius loci has become one of the main reasons the area has survived in its urban and architectural layout till now. The genius loci of Bohri Bazaar has made it possible to withstandthe increase in population growth and changing user requirements.

The spirit of the place of Bohri Bazaar represents both tangible and intangible attributes (Table 2) which make it an outstanding landmark till today since its formation in the early 19th Century.

In terms of value assessment, the organic nature of Bohri Bazaar has always conferred a sense of integrity to the traditional urban culture of the city. It has served not just as a focal point of trade but as a place of socializing and gathering. Besides trade and small-scale industrial/ economic activities, it also operates on a multifunctional bases comprising of various services like eateries, juice shops etc, and even cultural tourism. This emphasizes the importance of the multifunctional character of the area.

Bohri bazaar is a one of its kind open to sky bazaar built during the British era that still survives. The area has not changed much except for the little encroachments and illegal expansions, which are temporary in nature and certainly can be reversed. These are making the streets more congested but create a sense of belonging in the users. In the present time, the concept of shopping streets has somewhat shifted to the centrally airconditioned shopping malls and plazas, following contemporary design and feel of modern urban centers. But the Bohri Bazaar is still a center of commercial buying and selling activities for many people. The shopping streets of Bohri Bazaar still bestow the oriental feel of a souk where the shops are set up in an organic format, often romanticized as middle eastern traditional markets, thus making it a unique asset of the city.

Tangible Values	Intangible Values
Form & Design (Building Facades), temporary encroachments, materiality of buildings and pathways/streets, Bohri Bazaar Location in Saddar Bazaar Quarter.	Street pattern (gridiron layout), uses & functions, Users sense of belonging to area, Bohri Bazaar Connection to its neighborhood. Personal feeling visiting the Bohri Bazaar(by first & second author).

Table 2. Different attributes studied, observed & analyzed to understand the Genius Loci of the Bohri Bazaar

The Bohri Bazaar streets are aligned with heritage buildings are very picturesque and can be compared with the Istiklal shopping street in Istanbul, Turkey and Nizami street in Baku, Azerbaijan. Unlike Bohri Bazaar, the neighborhood of the latter two examples have been gentrified to a great extent and purely dedicated as tourist destinations, incorporating high end retail shops. Perhaps, this has caused a good impetus to the economy of the country but has deprived the lower income group of society from benefitting from it. Bohri Bazaar, to great extent, has preserved its original retail typology benefitting all social and income groups of society. In addition, the design that allows/allowed merely pedestrian accessibility bestows a sense of freedom to all the users, without compromising the experience and the touristic attraction of the shopping streets in Bohri Bazaar.

5. CONCLUSIONS

Understanding the Genius loci or the Spirit of the pace is a challenging task, given that its attributes can be found both in tangible and intangible aspects of the place. The study shows that studying Bohri Bazaar from a tangible characteristics' perspective has helped in better acknowledging the intangible concept of the spirit of the place. The spirit is deeply rooted in the 'experience' of the place in presence of the historic ensemble of the city. Thus, it will not be wrong to say that the rich setting of the Bazaar and the heritage buildings create a historic cultural landscape. At present, the Historic Urban Landscape(HUL) of the context has been altered to a great extent, given the fact that most of the colonial buildings have been gutted down and replaced with new (out of the context) structures. But the dual spatial quality of the area has helped it survive the wrath of time and changing requirements. Despite lack of maintenance and neglect, the architectural heritage of the Bohri Bazaar still shows potential to be preserved, which eventually can support in preserving the spirit of the place of the bazaar too. To conclude, it is said that Genius loci is not merely associated with the urban fabric of the city, it is infused within the experience/setting of the place, underlining an invisible wave of the culture.

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PAPER #6.05

OLD METHODS FOR NEW SOLUTIONS: HISTORICAL RESTORATION OF SANTA MARIA LA MAYOR CHURCH IN RUBIELOS DE MORA

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ABSTRACT

The main goal of the patrimonial intervention in Santa Maria la Mayor, the main church of Rubielos de Mora in Spain, has a clear focus on eliminating the humidity coming from the subsoil and its related pathologies. These problems are inherent to the building's structure. Many historical buildings' foundations and walls directly contact the soil, creating a common cause for different pathologies. In our study case, this is aggravated as the church has been built on a ravine with flowing water.
The solution for the new pavement needs to solve two problems. On the one hand, a technical one to solve water access inside the church and its pathologies. On the other hand, a geometrical one, to solve a geometrically accurate mesh of industrial cut stone pavement with the irregular geometry of the church. Historically we can find different individual solutions for these problems. The presented solution comes from a different starting point to unite both problems as one, as they are related. Historically, churches were built based on layouts that tried to solve with the same method different and diverse problems. These layouts looked for spatial harmony and proportions across the church, sizing the structural elements based on numerical relationships. Iconic shapes reference iconic meanings and links between the physical and the metaphysical world, where every element found its exact place.
Following this train of thought laid by the master builders who predeceased us, the solution must be unique, coherent, and based upon the church layout. The new pavement fuses the old and the new, creating a contemporary solution for historical problems, employing historical methods with current technology. It solves humidity and geometry with a mutual solution for Santa Maria la Mayor.

KEYWORDS

Restoration; humidity; historical buildings; Rubielos de Mora; pavement.

1. INTRODUCTION

The objective of the intervention defined by the Autonomous Administration of Aragon carried out in the Church of Nuestra Señora de la Asunción in Rubielos de Mora was to eliminate the humidity from the subsoil and the replacement of the pavement due to the pathologies that it had produced in it, all with a reduced budget.
The humidity assesment is a common problem in historic buildings, aggravated in our case by its location on a ravine, still active today. The flowing wáter on the ravine was channeled, embanked and covered with a vault, to be used as a sewer and to get a suitable surface to settle the projected church plant.

A problem with two aspects, a technical-constructive one, which affects the solution, to limit and if possible eliminate the humidity. And a geometric one that is always posed when placing a regular mesh, defined by the new format of the pavement, on the irregular geometry of the existing floor of the building. The result of which defines trapezoidal and not rectangular surfaces, problem of encounters between geometries, which must always be solved.

2. CHURCH OF SANTA MARIA LA MAYOR IN RUBIELOS

Rubielos entered the Christian geopolitical area in 1204, after the dissolution of the Taifa of Albarracín; being its primitive settlement, the current neighborhood of Campanar, a rocky spur, protected by the river Nogueruelas and the Regajo ravine (currently under the church), at the point where it narrows in its path, between the mountains of Santa Barbara and Punta del Pinar. A settlement of Andalusian typology.

In the thirteenth century, the population had its first expansion on the alluvial plain, to the north, west to reach the bed of another ravine, and east to the river Nogueruelas surrounded by walls (1260). The three backbone axes of this new layout were the pre-existing medieval roads around which the urban warp was traced, that of San Antonio street, the civil axis par excellence, that of the current Félix Cebrián street, and that of José Gonzalvo-Salvador Aranda.

The area was consolidated by the construction of large palaces for the nobility of Rubielos, such as the Marquises of Villaescusa, the Counts of Creixell, and many others. Its economic prosperity in those years rested on the production of cloth, blacksmiths, and potteries, creating a wealthy industrial class who demanded new infrastructure and a church closer to the town center and more in line with its economic boom. The parish church at that time was located outside the city walls, in the convent of the Augustinian nuns. This circumstance led to the construction of a new church inside the walls in the 16th century.

The construction of the church from 1593 to 1620 was the engine of urban development that occurred in the seventeenth century, building the City Hall (Pedro de la Hoya 1571), the Lonja, civil buildings representative of the new bourgeois power, and the convent of Carmelitas Descalzas, contemporary in its construction with the church (1608-1622), is known at that time Rubielos for its prosperity with the nickname of Corte de la Sierra.

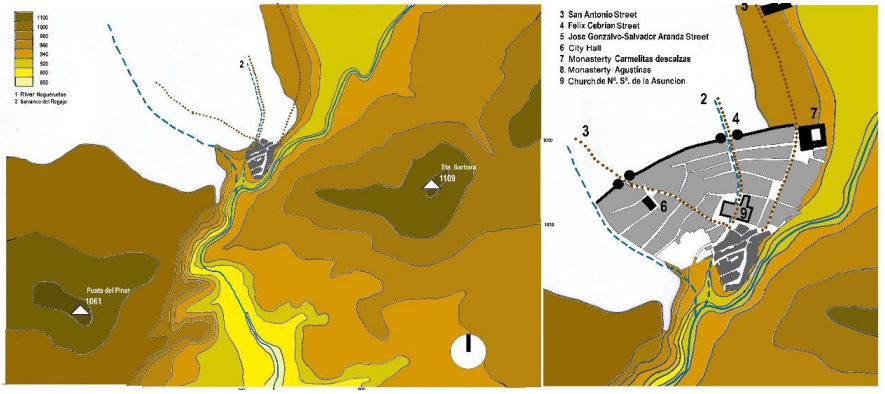


Figure 1. Rubielos de Mora geographical description

The choice for the location of the church was a free space located at the foot of the hill of Campanar, for which complex and costly works had to be done, consisting of the channeling and covering of the ravine that ran through there, the construction of the retaining wall of the current Plaza del Sol and the consequent embankment. There is a description of the place before the church's construction and the consultations made with different "master builders" about such works (Martínez, 1980).

The traces were entrusted to Pedro del Solar. Later they passed to Juan Cambra in 1604. In 1608 Pedro Ambuesa, stepson of the previous one and diocesan architect of Segorbe, seat of which depended at that time, Rubielos de Mora. He was an architect with an extensive curriculum, belonging to the circle of French master builders who built the fortifications of Peñíscola under the orders of Bautista Antonelli.

The traces correspond to a type very consolidated from the Gothic moment, a church of unique nave with chapels between buttresses. Its factories are made of masonry noting the wealth that Rubielos enjoyed at that time.

Two entrance-altarpieces under niches are designed, covered with ribbed vaulting, with lateral entrances to the pulpits, whose design is inspired by books III and IV of Sebastián Serlio, published in Spain in 1552.

In 1627, Pedro Ambuesa was contracted to finish the bell tower and reinforce the foundations. Ambuesa lightened the composition and height of the tower designed by Cambra to reduce its weight and designed and built the current lighter and more sculptural top.

It is interesting to note that, in 1617, the entire church was bricked. The remains of this primitive pavement still exist in different rooms of the church. This pavement was replaced at the end of the 19th century, beginning of the 20th century, in the central nave, by another hydraulic tile pavement, at that time of maximum novelty, drawing the via sacra and four squares for the stay of the faithful, which are finished with wooden flooring.

The importance of the church can be seen not only in the construction elements but also in a characteristic that only some cathedrals (Granada, Cordoba, Segorbe, and others) and some major collegiate churches possess. The existence of a double pulpit, one on the gospel side, reserved only for the bishop, and another on the epistle side, used for ordinary sermons by the abbot of the collegiate church or the beneficiary on duty, who might have been entrusted with the mission of preaching. Their religious function was vital during the 17th and 18th centuries since they allowed theological discussions to be held in the presence of the parishioners.

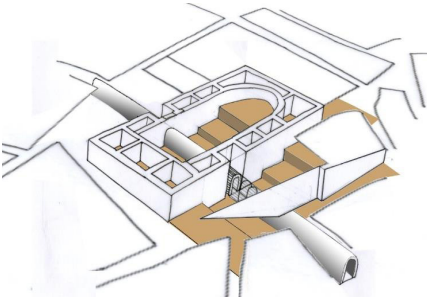


Figure 2. Church's foundations and sewer crossing it

3. CAPILLARY RISING HUMIDITY IN HISTORIC BUILDINGS. STATE OF THE QUESTION

Humidity in historic buildings is consubstantial to them both for the construction process and for the materials used and the correction of the pathologies that originate, a frequent cause for their restoration. Despite its overwhelming presence, its study has not been addressed, understanding it as a cross-cutting problem that affects several disciplines (geology,

physics, chemistry, petrology, soil mechanics) until the seventies of the twentieth century. The doctoral thesis of Soledad García Morales (Morales, 1995) is a good compilation of the state of the question, providing a new methodological vision of the problem and seeking its operability. There have been other contributions since then, among which we highlight those of Toma Pipiraite (Pipiriate, 2017) and Juan Bautista Aznar Molla (Aznar, 2016). The historic building has been constructed with materials permeable to water, in vapor or liquid form. Water entry can come from the rain when beating on the walls and from the ground, whatever its origin.

In the first case, the material gets wet, and two constructive solutions have been used historically to maintain a comfortable situation inside the building. Single or double leaf walls, the latter being known as cavity walls, better or worse ventilated. We will focus on the case of single-leaf walls, as this is the solution with which the church of Rubielos was built, like so many others. The water that falls against the wall from the rain wets the exterior face of the wall, diffusing in liquid form through the interior of the wall, reaching a depth called the wet front, which advances until the precipitation ceases. If conditions are favorable, the wall begins to evaporate, releasing the water it had absorbed on both sides. This wet front depends on the material's porosity, the degree of exposure to air and sun, the relative humidity, and the outside temperature.

In the second case, the rain also infiltrates through the permeable layers of the soil until it reaches impermeable levels, clayey soils flowing through them due to gravimetric phenomena, establishing a water-saturated soil stratum. The upper part of this stratum is called the water table. The saturation level of the strata above the water table is variable, close to 100% on the surfaces closest to the water table, decreasing upwards. These are wet but not saturated soils.

The foundation absorbs this water, which rises through the inside of the walls towards the outside, to dissipate up to a height, forming a capillary base strip. The design will be correct if there is no moisture stain in the capillary base because evaporation is rapid. The effectiveness of this solution lies in adequately managing the thickness of the wall and the permeability of the material so that the wet front does not appear inside the room and so that the evaporation time is less than the climatic interval between precipitations.

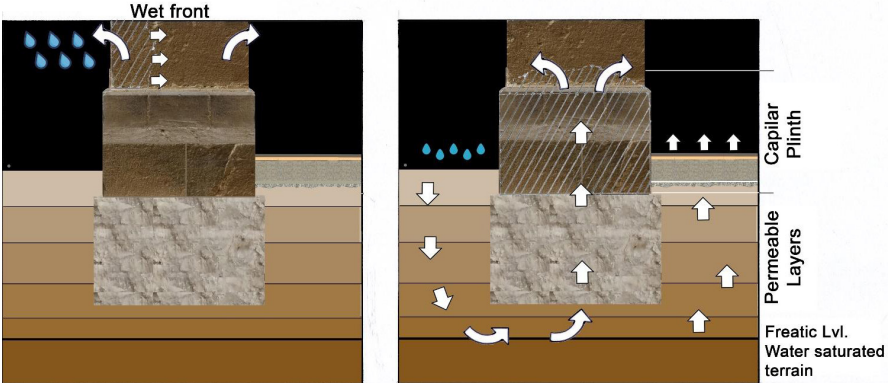


Figure 3. Humidity behavior

This solution was formally reflected in the existence of plinths thicker than the wall, up to an empirically established height.
The following graphs can represent these flows, and their quantity and movement depend on variables such as the precipitation regime, relative humidity, temperature, sunlight, wall composition, the porosity of the materials, type of soil, the existence of soluble salts, depth of the foundation, the situation of the water table, being dynamic variables and some, interrelated with each other, modify their initial values over time. The knowledge of these variables in the humidity process is ancient (Jurin's law 1684-1750), but their recent systematic study is recent. (Massari et al., 1985; Ortega, 1989).
The solutions given have depended on the knowledge of the intervening variables and the importance given to them in the whole process. However, they have always been based on balancing the moisture content of the wall with the external environment in evaporation surfaces that do not produce undesirable visual effects, such as salt deposits.
Returning to the case of churches, three solutions were generally employed. At first, buried spaces were created that functioned as aeration chambers, the crypts, and the foundation galleries between piles in the Gothic period. The effectiveness of these solutions always depended on good ventilation, which was not always easy to achieve. Later the solution of the perimeter barbican of ventilation was introduced, which has its origin in the Roman construction consisting of creating spaces in the subsoil that ventilate to the outside by what is known as the English courtyard.
Of these, the most efficient system was that of chambers between piles, but its diffusion was lesser due to the cost involved. The evolution of the first two systems led to the use of ventilated slabs, ventilated floors, and the cavity system. The Knappen system and electro-osmosis have recently been added to this typology of solutions.
This diversity of solutions now allows the designer to choose the solution or solutions, depending on the particular casuistry of the building in which he intervenes.
The most exhaustive knowledge of this process will determine the procedure's suitability to be chosen. In the works reviewed above, methods are proposed based on establishing water curves on the walls, which plot the moisture content. It is proposed to measure the temperature and humidity of the air, the temperature and humidity of the walls, the moisture content in the walls, and the salt content in the walls. This diagnosis of rising damp has been systematized in recent years. A British test standard (Pinto, 2008) is proposed to differentiate whether the moisture in a material is due to rising capillarity or hygroscopicity.
These curves obtained should be used to try to know the causes, to be able to choose a solution or set of solutions appropriate to the case, and to control its evolution and the effectiveness of the chosen solution.
When intervening in a historic building, the systematic study of the humidity of a historic building is not a generalized practice. When such a diagnosis exists, it is usually carried out based on a measurement of the humidity and temperature of the walls and sometimes of the floor slabs, which are represented as humidity level curves on elevations of the walls or sections of the wall. The state of the studies still does not provide data on the threshold of "normal moisture content" of a material, which would serve as a basis for understanding it.
It would be desirable to have these studies available prior to the intervention, over as long a period as possible and for at least one year, with data corresponding to the four seasonal moments. If it is not done previously, preparing it in the time available for drafting the project is challenging.

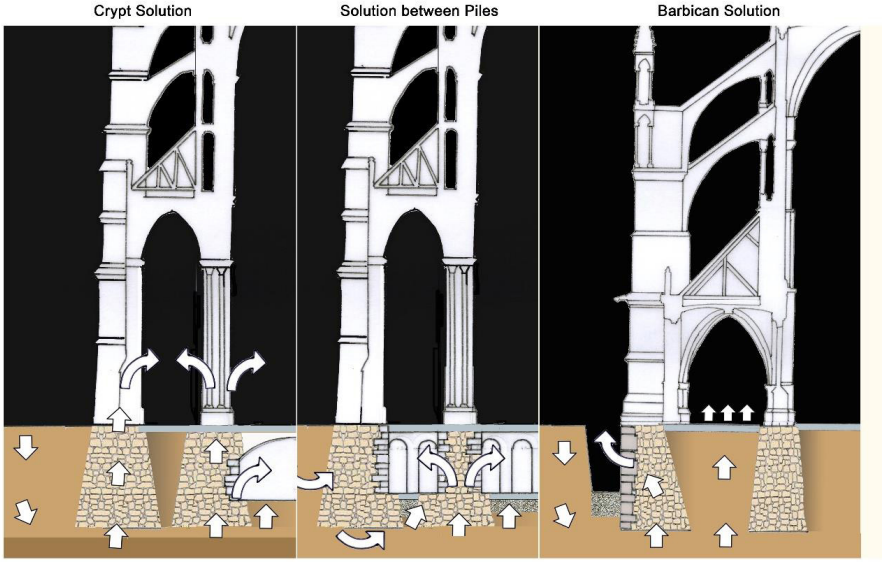


Figure 4. Historical solutions for humidity control

4. METHODS FOR HUMIDITY CONTROL IN THE CHURCH

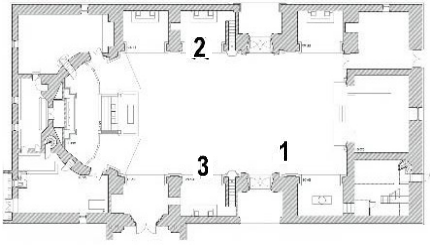
As we have already mentioned, the two aspects of the problem are traditionally approached independently. Our starting point was to relate them from the very beginning. Conceptually it can be summarized by saying that it consisted of creating a ventilation chamber between the subfloor and the pavement, solving the necessary ventilation, giving the pavement a solution that would serve to facilitate this ventilation and, at the same time, solve the transit between regular and irregular mesh, seeking the source of inspiration in the very constructive logic created by our predecessors, based on the regulatory layouts, using which they sought to find harmony in the proportions of the spaces, to dimension the resistant elements based on easily transmittable numerical relations and to seek symbolic relations between the forms generated and the contents to which they referred, the links between the physical world and the metaphysical, not visible, but no less real for that reason. It is about establishing a new spatial order, a universe, where all the elements have a precise order and that this new order established could resolve the conflict between the parts most effectively.

Without previous data and time to obtain them, utilizing ocular inspection and thermographic photographs, it was concluded that its origin was in the phenomena of ascending capillarity. The authors gave a solution consisting of using the cavity method, ventilating by the perimeter, besides establishing crossed ventilation, that started from the gully and had its exit by the sacristy.

A modification of this solution was proposed by the Administration, for economic reasons, consisting of using a layer of the ballast of

great thickness, in our case, 72 cm, which functions as a capillary base and where the spaces created hinder capillary ascent according to Jurin's law, and the air in these interstices is never saturated, due to the ventilation created at its base, by a meshed system of drainage pipes that can also serve as a drain. From the previous solution, the perimeter ventilation was maintained. The result is a more traditional variant of the ventilated floor slab.

During the execution, when carrying out the excavation works to make the box that should contain the ballast, it was discovered, since there was no historical memory or documentary news, that the central nave had functioned as a burial place, probably until 1871, when legislation was enacted for the construction of civil cemeteries, outside the towns. We were at elevation -30 cm, and if we wanted to continue descending to reach elevation -72, the current heritage legislation required an excavation in extension, which was impossible then.



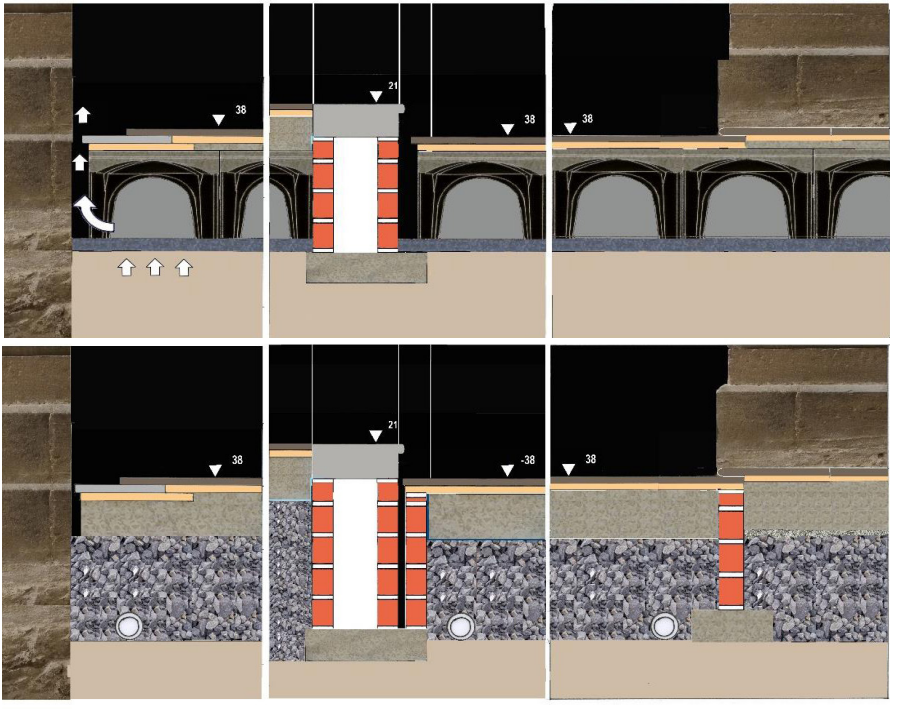


Figure 5. Proposed solutions for the church

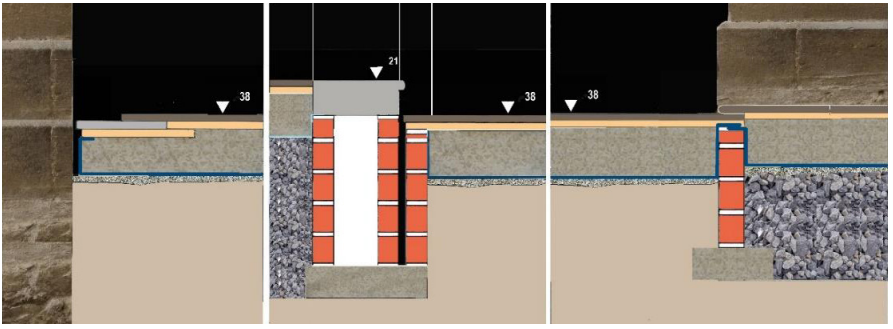


Figure 6. Executed solution for humidity control

A new modification had to be introduced, consisting of creating a cut with the ground with PVC waterproof sheeting, increasing the openings of the perimeter vents, and finishing with lime screed to mitigate the effects of salt migration, which could produce a screed made with cement, in case of punctual breakage of this sheeting. The ballast solution was maintained in the lateral chapels.

5. VENTILATION AND PAVING. JUSTIFICATION OF THE PROPOSAL

The solutions historically tested basically have consisted of the new pavement mesh, established without connection with the existing elements, is altered in the perimeter, generating irregular pieces of transition that were in charge of solving the micro-encounters of rough and irregular surfaces of the historical factory, with the regular and smooth pavement. Four areas with different characteristics and problems were defined of the church's entire surface to be paved. The first block consisted of the two sacristies, the old chapter house nd the tabernacle, which still have the original 17th-century brick pavement, altered by numerous renovations and by the salts deposited on it due to the humidity of the subsoil. After an assessment with restorers, the decision was taken not to intervene in this block because it was decided that if it were to be raised for restoration, it would mean its destruction. The second area was the wooden flooring of the choir, the original of which was lost during the Civil War (1936-39) and restored in the post-war period. Tastings were carried out to check the condition of the wood, and except for some very localized damage, which was replaced, there were no other problems.

The only action that it was decided to carry out, in addition to re-varnishing it, was to make openings to facilitate the ventilation of the space underneath it.

The third area was limited to chapel 4 EPI, which had recently been restored and which the DGP of Aragón decided not to intervene due to cost-effectiveness criteria.

Finally, the fourth area was the central nave and the rest of the side chapels, including the main chapel, the largest surface area, and problems.

The first decisions aimed to restore the lost religious symbolism by recovering the hierarchy of spaces in the Main Chapel, eliminated in the post-war restoration. Specifically, recovering the step that separated the Main Chapel from the rest of the nave. This church was born after the Council of Trent (concluded in 1563). Although this did not favor a specific architecture, the work of St. Charles Borromeo (Borromeo, 1577) gave

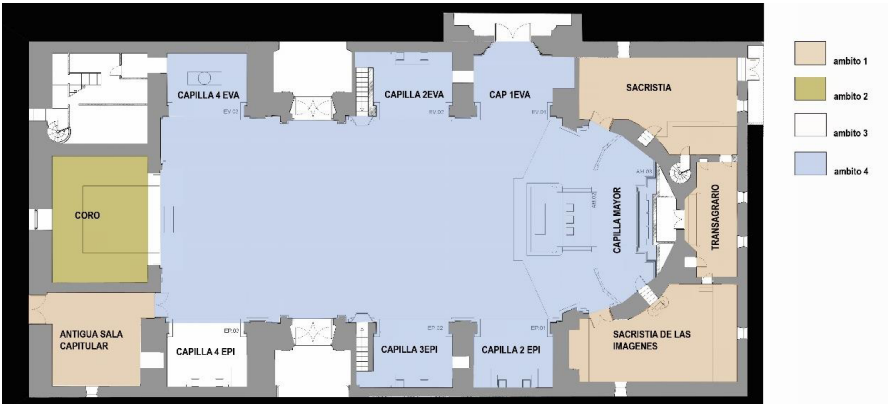


Figure 7. Santa Maria la Mayor floorplan

a series of recommendations to be taken into account in the construction of new churches and especially the most symbolic chapel of all, the Main Chapel. Separating it from the rest of the nave by a step and a low grille. In addition, this elimination made the entrance to the sacristies irregular. This restoration is completed with the opening, which was walled up, of the access to the second pulpit.

The second decision was to choose the mesh size to be implanted, defined by the module of the piece chosen. The first criterion for this was that, given that the decision had been made to ventilate the cavity space around the perimeter, a mesh whose module made this possible had to be chosen, thus relating the geometry of the floor plan to the geometry of the mesh. The problem was not difficult to solve in the central

Figure 8. Pavement double-grid

nave because the irregularities were centered in a trapezoidal plan and the different widths of the pilasters. This first problem was solved by creating a contoured piece (2) parallel to the perimeter that at a lower level overlapped with the mesh of the nave. (3) This piece was separated from the edge to allow ventilation through this joint, the cavity space, and to solve the surface irregularities of the ashlars. This system also ensured that the pieces were always rectangular.

The other decision was that the mesh of the central nave should be extended towards the side chapels. This requirement made us see that the geometry of the piece was going to be defined by the conditioning factors of the geometry of each chapel in the plan, by the width of the entrance to the chapel from the central nave, by the length of the pilaster inside each chapel, by the width of each pilaster, so that the system chosen in the central nave would also be valid in all the chapels. Different attempts led us to a piece of 39 x 59 as the most suitable to solve the conditions indicated.

During the execution of the project, the system created in the project could be maintained, except in the chapel EPI 1, called Villasegura, where when the geometry was checked, it turned out to be different from the one that had been worked on in the project, presenting a solid twist, which forced us to create a particular solution. Due to the discovery of the burial crypt of the Villasegura family, the administration decided to generate another project that contemplated the conservation of the crypt due to the historical interest it represents, and no work was carried out on it.

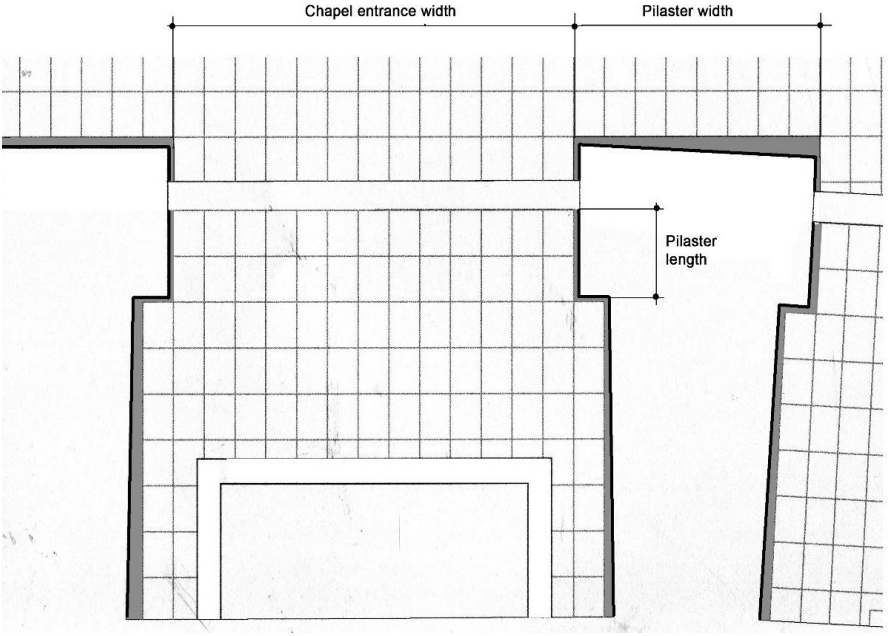


Figure 9. Examples of geometrical corrections onto one chapel

The choice of a system to solve the problem of solving uneven floors with regular meshes obeys multiple factors. As we have already mentioned, in our case, on the one hand, to solve in a simple way and with a clear formal logic, the encounters of the pavement with the existing building, establishing a link with the ventilation system of the subfloor.
After its completion, we have learned that other designers have chosen this solution, as in the Monastery of Caracedo, the church of Santa Candia in Orpi, and the hermitage of Socos de Caudiel, because in addition to the above reasons, this system translates into a balanced vision of space that contributes to dignify it.

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PAPER #6.06

REARCHING AND CATALOGING NEW HERITAGE

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ABSTRACT

The Spanish civil war left a devastated country. The losses were not only material but also of knowledge. Both because of the bombings and because of the ideological struggles, some irreproducible cultural assets were lost. The historical archives of many cities are some of these assets. It happened especially in small towns since their lack of means to safeguard the archives. This circumstance makes difficult to investigate the architecture carried out at the beginning of the 20th century in the affected areas. However, these adverse circumstances should not prevent the cataloging and study of works of deserved importance. Through the architecture of Vicente Sancho Fuster, it is shown how several buildings designed by him have been located despite the lack of written consultation documentation. The first step carried out was the study of la casa Roglà, in Valencia, of which is preserved the project. Subsequently, the defining characteristics of this building were compared with two existing buildings in Burriana and Turís. Finally, through the common characteristics it has been possible to conclude that the authorship of the three buildings belongs to the same architect.

KEYWORDS

Vicente Sancho Fuster; Art Nouveau; Valencia; Heritage research; Burriana; Turís.

1. INTRODUCTION

The devastation caused by wars is one of the greatest attacks that humanity can suffer. In addition to the human and material losses, war causes irreparable damages in the historical memory. One of those is the loss of historical heritage. It is not only caused by the destruction of existing buildings but also affects the archives that can lead us to the location, study and reconstruction of this heritage. The Spanish civil war was no exception. It left a devastated country where the bombings destroyed any king of buildings and, later, the ideological struggles tried to erase the recent past. Because of this, irreproducible cultural assets were lost, such as the historical archives of many cities, especially, those placed in the smaller towns, since they lacked the material means to protect these archives. These losses make difficult to study the architecture of the first decades of the 20th century as it is impossible to search for references that help to locate and verify the authorship of some buildings. However, there are still other possibilities to achieve this cataloging. Focusing on the architect Vicente Sancho Fuster, the authorship of two of his buildings will be demonstrated through the comparative method despite the lack of support of original written documentation.

2. THE AUTHOR AND HIS WORK

2.1. Vicente Sancho Fuster

Vicente Sancho Fuster was born in *la Alqueria of La Comptesa* in 1875. After finishing his primary studies, he completed preparatory studies at the School of Fine Arts in Valencia and at the Faculty of Sciences in Zaragoza. Once finished, he studied Architecture in Barcelona, between 1892 and 1904. He obtained the title on March 30, 1904.Once he finished his studies he returned to Valencia where he made his first work in 1904 during that same year. The most notable during that year was the intervention in the Roglà house. Back in his homeland, he carried out countless works in several towns, such as Valencia, Requena, Turís, Oliva and Burriana, in addition to developing the work of municipal architect in Burriana and Turís (Mora, 1912). He had a very active life within the profession, earning the admiration of his peers, as demonstrated by the words of Francisco Mora in the article he published in *Arte y Construcción* in 1912, two years after Sancho's death:

> "Los arquitectos, verdaderamente condolidos, acudimos a rendir el último tributo a nuestro inolvidable colega; los artistas, ante su compañero y alma del Círculo, supieron hacer sentir cuánto le querían, con delicado homenaje que no olvidaremos; los obreros, más que la pérdida del arquitecto, lloraban la del padre que tanto se afanó por ellos." (Mora, 1912: 259). (The architects, truly sorry, went to pay the last tribute to our unforgettable colleague; the artists, before their companion and soul of the Círculo1, knew how to make you feel how much they loved him, with a delicate tribute that will not be forgotten; the workers, more than the loss of the architect, wept for the father who worked so hard for them.)

He was part of the team that was in charge of drafting the statutes for an Association of Architects of Valencia. And he was the vice president of the Círculo de Bellas Artes, with his friends Vicente Ferrer and José Luís Calvo (Mora, 1912). Unfortunately death befell him at the age of 35, after having developed only his profession for 6 years. Like most of his colleagues, Vicente Sancho developed various styles within the period known as Eclecticism that defined the early stages of the 20th century (Goerlich, 1981). As for Art Nouveau, it arrived late to Valencia and it was first introduced by Cortina. After him, Vicente Sancho, together with his colleagues Vicente Ferrer (Mestre, 2010), Demetro Ribes (Aguilar, 2007), Carlos Carbonell (Valles, 2017) and Francisco Mora (Jimenez, 1987; Magro, 2017), settled the foundations of Art Nouveau in Valencia. These young architects had been influenced both by Otto Wagner who participated in the VI *Congreso Internacional de Arquitectos* held in Madrid in 1904 (San Antonio, 1996) and by the great modernist architects who were already working in Barcelona, such as Domenequec i Muntaner.

2.2. Roglà House

One of the first emblematic works of Vicente Sancho Fuster was the intervention in the refurbishment of Pedro Roglà's house, at 12 Bordadores street in Valencia. He carried it out in 1906. It was an intervention project on an existing building. There are different documentary sources that relate this performance of Vicente Sancho. The most important is the work license file in the Historical Archive of the city of Valencia. It includes the project carried out by Vicente Sancho. Despite the project only includes the modifications to the façade, by consulting the building license application, the intervention was on the entire building. The authorship of this building is corroborated in different journals such as *Arte y Construcción*, where in 1912 Francisco Mora published a laudatory paper about Vicente Sancho.

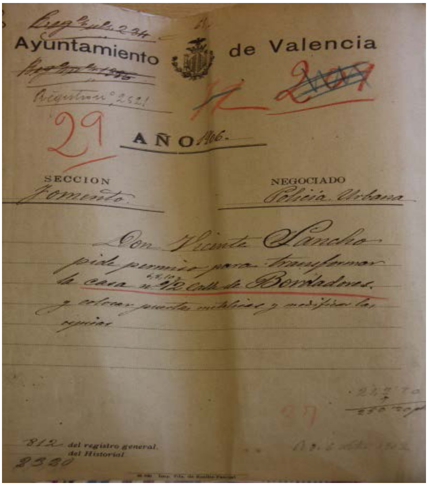

Figure 1. Valencia Municipal Historical Archive works dossier. Source: (Burguete 2017)

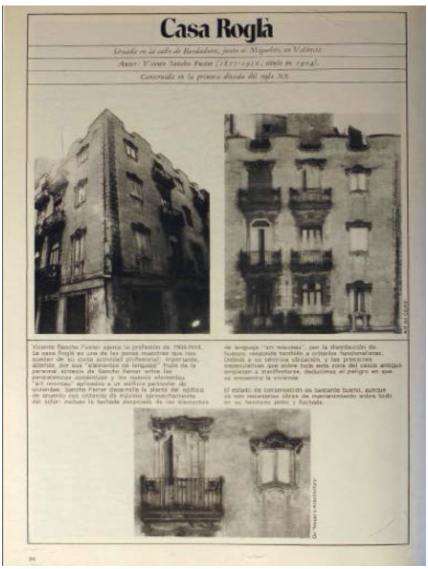

Figure 2. Magazine. Source: (http://www.a16-01.com/pdfs/CAU/1975/CAU750901096.pdf)

Figure 3. Magazine. Source: (Mora, 1912)

In this building, Vicente Sancho showed characteristics that he repeated throughout his work. First of all, he organized the façade openings (windows and doors) in a grid to achieve the proper order of its style, following the characteristics that remind the Secezion. This characteristic is found in another of the reforms carried out by Vicente Sancho, Espert Building and also in other of his new buildings such as the House of the Swallows or in the projected building on Felix Pizcueta Street, all of them located in Valencia.

Another characteristic of Vicente Sancho's work is to place the windows in the plain panels of the façade and the decoration around them. With this stylistic device he highlighted the decoration which usually was based on floral elements reminiscent of the JungenStil (Mestre, 2007). This resource can be seen in another building by the same author in Valencia, such as the House of the Swallows.

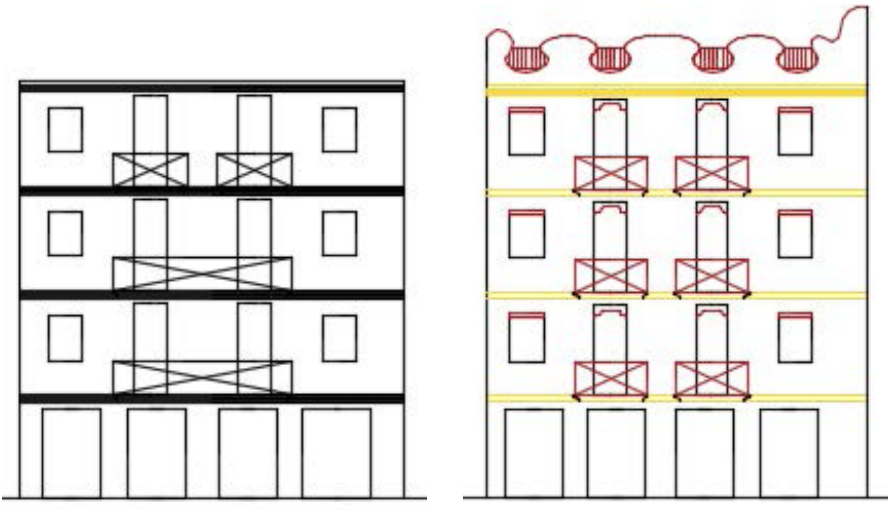

Figure 4. Drawing of the original façade and the refurbished façade. Source: (Burguete, 2017)

A third characteristic is the treatment of the materials of the façade. The treatment of the ground floor is different from the rest of the façade so that it becomes, in all its height, the plinth on which the building sits. In the same way, as it has been said, the parts of the façade where the decoration is placed have flat finishing so as not to get mixed up with this.

Finally, one of the most notorious characteristics of this building was the cornice made through warped shapes that seem to give the building a finish formed by harps. With this, Sancho hid the roof of the façade while giving it dynamism.

In conclusion, in this building we can discover several characteristics that Vicente Sancho will reproduce in all his works. These are the composition and symmetry both on the facade and on the floors, the treatment of the materials, the decoration and the cornice.

3. ANALYSIS

In the magazine *Arte y Construcción*, Francisco Mora names two buildings designed by Vicente Sancho, the house at 7 Mayor Street in Burriana and the house of *Lamberto Lacasa* in Turís. Unfortunately there are no historical archives in these towns in which the license application of these constructions were collected. On the other hand, inquiries to the corresponding Cadastral Offices provide confusing data. In the house placed in Burriana, 1920 is the year of construction according to the Cadastral Office. On the other hand, the house in Turís is dated in 1940 by the same office. Both dates prevent the assignment of their authorship to Vicente Sancho, since he died in 1910. But, the National Cadastral Agency advice that the dates included in both files are approximate, due to the lack of data indicating the exact year of its construction. So there is still the possibility that both buildings were built by Vicente Sancho.

Given the lack of written documentation, the only remaining possibility is to carry out a comparative study of the characteristics that define the work of Vicente Sancho in order to corroborate or reject Vicente

Sancho's authorship of the Burriana and Turís buildings.
As previously mentioned, there are 4 essential points in the architecture of Vicente Sancho:

- Order and symmetry
- The decoration
- Treatment of materials
- And the originality of the cornice

Analyzing each point separately it could be verify the similarity of these three buildings.

3.1. Order and composition

Following some trends marked in Art Nouveau, such as it is observed in Otto Wagner's work, composition, order and symmetry characterized the work of Vicente Sancho. These characteristics were reflected in all his buildings. In the House of the Swallows these concepts were taken to the extreme since symmetry and order not only affected each building but, at the same time, were extrapolated to the group formed by the three. In other of his works on an existing building, Espert house, one of the main actions he carried out was the modification of the windows so that they remained within the grid that marked the order of the façade. In the house in Bordadores street, the windows were also located within this grid on both façades. This characteristic was also used in the Lamberto Lacasa's chalet, since the windows of all the facades are places in the same grip.
Symmetry is an important characteristic represented both on the façade of the house in Burriana and in that of Turís. On the main façade of Lamberto Lacasa's chalet, the axis of symmetry is marked by the central balcony. This was designed in a different size and coincided with the access door. In this way, both openings marked the central axis on which the façade folded. In the case of the house in Burriana, the axis of symmetry is located in the center of the façade, not being highlighted by any characteristic element.

Figure 5. Symmetry axis of the façade. Turís and Burriana building. Source: (Burguete, 2017)

3.2. Decoration

One of the most outstanding characteristics of the work of Vicente Sancho was the decoration. Due to his training as a sculptor, he pampered the details and production of his work. In all his buildings, he placed the decoration on the flat panels of the façade to highlight it. At the same time, he placed it around the windows. In another element in which he focused his attention in terms of decoration were the cast iron balconies.

In the Roglà house this decoration was of floral motifs. In this case, the decoration consisted of a central cluster of flowers completed in both corners with a flower vine. The whole set was framed in a sinuous frame in relief. In the same way, plant elements were observed in the balconies.

Plant motifs were repeated throughout the work of Vicente Sancho. The decorative set of the windows in the Roglá house coincided with the design of the stained glass windows by the same author in the British cemetery in Valencia. The decoration of the windows in the house in Mayor street of Burriana was identical to that of Bordadores street, both in design, composition and execution.

The Chalet located in Turis lost all its decoration. It only preserves the shape of the outer frame that encompassed it. The shape of said frame coincides with the two previously described, which suggests that it would contain a decoration similar to the one they have. This idea is reinforced by the decoration of the central balcony. This one, although in a simpler way, is decorated with plant forms in the same way as the other two houses.

Figure 6. Window decoration. Casa Roglà. Calle Bordadores, 1. Valencia. Source: (Burguete 2017)

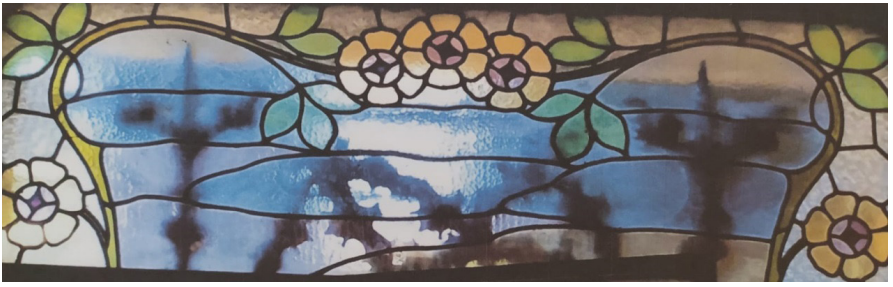

Figure 7. Stain glass window. British cemetery. Valencia. Source: (Benavent 2017)

Figure 8. Window decoration. Calle Mayor, 17. Burriana. Source: (Burguete 2017)

Figure 9. Window decoration. Lamberto Lacasa House. Turís. Source: (Burguete 2017)

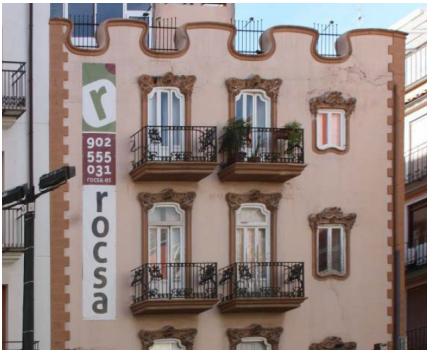

Figure 10. Cornise of the three building. Source: (Burguete 2017)

3.3. Treatment of the materials

The use of different finishes in the façade materials was the third characteristic commonly used by Vicente Sancho. In the Roglà house he used a much repeated resource in his work, which is to give a different treatment to the ground floor in all its height. In this way, it managed to settle the building in a very powerful way by making a one-story-high base.
In this way, it also contrasted the upper floors by giving them a flat finish. This finish allowed emphasizing the decoration of the windows, highlighting it, since there were no interferences between the decoration and the finish of the materials.

3.4. Cornice

The cornice used by the architect in the finishing of the house in Bordadores street reflected originality. It was formed by curved lines that resembled lyres. This action was not found in any other building in Valencia. However, it was reproduced in the two buildings under study. Both in Burriana and in Turís, this unusual type of action was repeated, showing the originality of the author of both.

4. CONCLUSIONS

During the study of the work of Vicente Sancho Fuster, reliable information about it could only be found in the Municipal Historical Archive of Valencia, apart from the data collected in the article by Francisco Mora published in 1942 and in some sporadic mentions of his work in other publications. Due to the disappearance of the historical archives in the smaller cities, information about of the chalet of Lamberto Lacasa in Turís and the house located at 17 Mayor Street de Burriana was not possible to be found. For this reason, the procedure that was decided to follow to corroborate the authorship of these buildings was to compare them with the defining characteristics of the work of Vicente Sancho extracted from the study of those buildings that do have prior documentation. Those were order and symmetry, reminiscent of the Secession, and the special treatment of materials and decoration with more representative tendencies of the JungenStil. Added to these generic characteristics, there was an especial characteristic of one of his most emblematic works, the performance he carried out in Pedro Roglà's house, which is its special cornice. According to all the characteristics extracted, a study of the buildings of Turís and Burriana was carried out. They fulfilled both the generic characteristics of Vicente Sancho and the particular characteristics of the Roglà house. All the facades were design according to a grip, with the same material treatments and with a symmetry axis. But at some points, comparison was not necessary since the decoration of the windows and the cornice are exactly the same in the three buildings. The result of this analysis allowed to affirm that, despite the lack of documentary data, the architect of the three buildings was the same, Vicente Sancho. In this way, new buildings can be cataloged both for their study and for their conservation.

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PAPER #6.07

INTEGRATION OF RURAL ARCHITECTURAL HERITAGE: THE CASE OF THE ALQUERÍAS IN NORTHERN VALENCIA

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ABSTRACT

This work deals with the conservation and integration of the so-called "alquerías", the traditional rural houses scattered in the historical agricultural landscape of the Huerta de Valencia, which has been surrounding this Spanish city for centuries. The first alquerías were built during the Medieval Muslim period, for farming and housing purposes. Their uses have been evolving throughout history, following the agriculture and cultural changes, thus resulting in a great diversity of shapes, sizes and types. Today, these buildings are considered as an important part of the local heritage of Valencia, testifying of the traditional way of life and construction.
However, the urban growth and modern lifestyle have not been always respectful towards the alquerías: many of them have been demolished to make way for new neighborhoods. Others have been sadly abandoned and left in a state of ruin. Cases of absorption have experienced unequal situations, from forced accommodation to full integration. In general, the remaining alquerías are threatened and require protection actions, as well as a quality integration to the urban fabric in order to prevent their deterioration, marginalization and even destruction.
This research work consists in an analytical study of the alquerías of four northern districts of Valencia –Benicalap, Rascanya, La Saïdia and Benimaclet– aiming at providing an insight of the current situation regarding the issue of rural heritage integrated into urban fabrics. General conclusions will be extracted from a statistical study of the collected data, and highlights will be given to the good practices' cases as potential solutions for the future integration projects.

KEYWORDS

Vernacular architecture; conservation; heritage; urban integration; absorption.

1. INTRODUCTION

The Huerta de Valencia (*huerta* meaning orchards or fruit trees garden) is a vast irrigated plain where market gardening is intensively practiced. Although it was already cultivated during the Roman period, the current structure of the Huerta is inherited from the medieval Muslim society (8th to 13th century). Therefore, it is a landscape heritage by itself. It also gathers other forms of heritage, such as architectural, like late medieval alquerías (13th to 15th century), silk alquerías (16th to 18th century), *casas de labrador* (19th and 20th centuries) (see Fig. 1), modest vegetal roof *barracas*, and

hydrological elements (irrigation network, mils, etc.). Since the second half of the 20th century, the landscape of the Huerta de Valencia has been nibbled by the colonizing expansion of the city, to the point of endangering its survival. In addition, the Valencian agricultural production has been facing a crisis due to the strong competition with other markets, which led to the gradual abandonment of agriculture activities, and thus, the abandonment of some alquerías.

The architectural heritage of the Huerta which has already been absorbed by the city can be categorized in five different states of urban integration: ruin (partially or completely destroyed), abandonment (unused but not yet ruined), absorption (unexpected in the urban context), adaptation (forced to fit into the urban context), and integration (the context adapts itself to embrace the alquería).

Hopefully, in the recent philosophy of heritage protection and integration, different actions are being set up to prevent the disappearance of the Huerta and its forgotten heritage, such as informing the general population and the city stakeholders about the cultural and historical wealth of the alquerías, and the threats they face. For example, one of the objectives of the *Plan de Acción Territorial de la Huerta de Valencia* (PAT 2018) is to maintain the landscape and rehabilitate the existing architectural heritage as a sample of historical and traditional ways of life. Indeed, the *Catálogo de Protecciones* of the PAT constitutes an inventory of the protected constructions, precising their legal preservation figure: BIC (*Bien de Interés Cultural,* meaning "Asset of Cultural Interest", a national recognition since 1985) and BRL (*Bien de Relevancia Local*, meaning "Asset of Local Relevance", a Valencian recognition since 1998). However, the alquerías of the region of Valencia are not all inventoried, and even when they are, this does not ensure their good state of conservation as the analysis will show in this paper.

This article is part of this initiative of spreading awareness about this local topic, which can also be applicable to other similar urban development and heritage conservation cases all over the world. The main objective is to conduct a study on the current state of the urban integration of the alquerías of four northern districts of Valencia. It was done in the context of D. Gosselin Calvignac's master thesis (Gosselin 2022). This study aims at providing with specific knowledge about the problematics of the rural heritage when integrated into the urban fabric. The analysis of the data will aim at enlightening the cases of good practices, shown as examples for future projects. This will also be the opportunity to give more alternatives and advice to the ones that have already been developed.

Figure 1. The three main historical types of alquerías: late medieval alquería (alq. del Moro), silk alquería (alq. de Falcó), casa de labrador (alq. Visquet). Source: (Gosselin 2022)

2. RESEARCH METHOD

This research work was conducted by following the scientific method of the case study. Indeed, it provides an in-depth analysis of 16 individual cases, with multiple variables: architecture, heritage, urban and integration aspects. Thus, the research takes place in two main phases: an analytical phase (detailed study), followed by a synthesis phase (generalization of conclusions from the statistical study).
The research process followed several steps. First, a bibliographic review was necessary to get into the subject of this investigation, which is defined more precisely afterwards. A compilation of possible cases was established while reading the literature and searching on the web. When not enough information on an alquería was available, the case was regretfully abandoned for this study. The information about the selected alquerías was implemented into a database. The study was narrowed to the four districts of Benicalap, Rascanya, La Saïdia and Benimaclet, which were involved in the rapid urban expansion of the 1960s. The next step was to visit the selected cases to collect on-site information, such as photos, sketches, and notes about the alquería's conditions and perception of the surroundings. Then, the information collected was encoded in the different sections of the database. For each of the 16 alquerías, it provides an in-depth analysis that was displayed in individual information cards (Gosselin 2022). By analyzing the different aspects of the study through statistical graphs and tables, it was possible to extract general trends, make comparisons and then conclusions.

3. RESULTS

In this section, several aspects of the analysis are explained based on a statistical study, aiming at providing insight on the current urban integration state of the selected alquerías.
Therefore, the information gathered in the database is synthetized here, giving a general overview on the cases encountered, by comparing them and highlighting the trends that could stand out. The analysis of the results is presented following the order established in the information cards: Architectural and Typological approach, Historical and Heritage approach, Urban approach, and Integration analysis. In order to give complete explanations about some results, relations could have been established between different aspects and/or different sections of the study.

3.1. Architectural and Typological approach

This first part focuses on the historical typology, the volumetric typology, the structural typology, and the number of floors. Indeed, the understanding of the original shape of the alquerías is crucial to propose the most respectful intervention solution to the current building for a successful conservation and integration.
There is no predominant type of alquería in the studied set of cases, though it is interesting to notice that there are still quite a significant number of late-medieval alquerías left today (the most ancient type), spared from abandonment and demolition throughout history. The assignment to a defined historical type was done by looking simultaneously at the general architecture of the alquería and its supposed century of origin stated in the literature. However, sometimes this last information lacks precision and could be contradicted by different experts. Most of the alquerías that remain today underwent several architectural modifications throughout the centuries, so the assigned historical type is the one whose traces are still obvious today.
An interesting thing to notice regarding the volumetric study is that only six alquerías out

of 16 can be assigned to a single volumetric type (compact house, several bodies, with patio, or with turret). All the others have intersecting volumetric types. This is why this volumetric classification, proposed by Del Rey (2010), is not enough representative of the different types of alquerías. Most of them were compact at the beginning of their existence, and then new bodies were progressively added, enclosing even a patio. Turrets are remarkable attributes that give personality to the building, but cannot have the same classification level as a compact volumetry, for example.

The most common structural type encountered among the studied cases is a structure of several rows, parallel to the main facade (69%). The few others have rows perpendicular to the main facade. Only one alquería kept one single row.

The majority of the studied alquerías (88%) are composed of 2 levels: one ground floor and one upper floor. This upper floor was originally present in some cases or was added in a later extension phase in others, but every time it was for a specific function related to the fields (silkworms breeding, crops storage, etc). Thus, the rather low height of these buildings has to be taken into consideration when studying their integration in the urban landscape and in case of rehabilitation projects.

3.2. Historical and Heritage approach

This second part focuses on the date of construction, the current property status, the state of conservation, the legal preservation figures, and finally, the contemporary interventions. Indeed, the understanding of the history and current situation of the alquerías is also necessary to propose the most respectful intervention solution for a successful conservation and integration.

The buildings showed a rather regular distribution between the centuries of origin, though more than half of the alquerías remaining today were built from the 17th to the 19th century. Alquería del Moro (Fig. 1) and alquería de la Torreta are the oldest, supposedly built during the Muslim period (13th century, before the Christian reconquest). Thus, it is interesting to notice that, even though the alquerías were invented by the Moors, the great majority of today's remaining alquerías were built after their period of influence.

All the studied cases are located on the map below (Fig. 2), featuring their state of conservation. We can surprisingly notice that more than the half of the studied alquerías are in a good condition of conservation (well preserved or slight deterioration), which is a positive point given the little consideration paid by the great public to this vernacular heritage. Indeed, the cases concerned have benefited most of the time from some refurbishment interventions. Five of the studied alquerías are quite deteriorated (medium to advanced deterioration). Some of them, like the alquería de Falcó, have only undergone a very few conservation measures to prevent them from collapsing or being demolished because of the safety risk they could represent for the people going inside or around them. The alquería de Albors is in a heterogeneous state of conservation because one half of the building has been rehabilitated, but the other is in a state of advanced deterioration (one wall collapsed and thus an entire row is left to open air).

Nearly half of the studied alquerías belongs to private owners. They have often been passed down by the families through generations, and are still used as housing or farmhouse, or in some cases, have been abandoned. The public alquerías, acquired by the municipality of Valencia, have been rehabilitated into new public spaces (library, museums, social services, offices…) or are still waiting for intervention, as the cases of alquería de Falcó (Fig. 1), de la Torre, or de Albors (which is partially ruined).

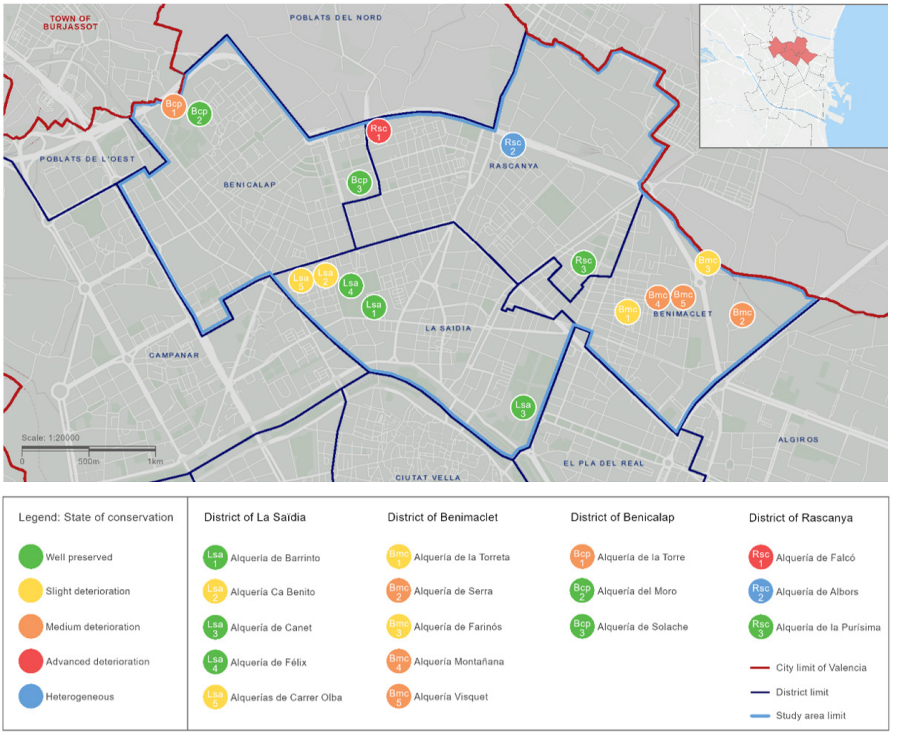

Figure 2. Location and conservation state of the studied alquerías in the districts of Benicalap, Rascanya, La Saïdia and Benimaclet. Source: (Gosselin 2022)

The results show that three quarters of the cases benefit from a local figure of protection (BRL), but only one, the alquería del Moro, is nationally protected (BIC). However, this encouraging information does not ensure the good state of conservation of the buildings, as we can see from the previous results. The four alquerías with no protection figure are not all in the same condition: the private ones (Montañana and Visquet) suffer from medium deteriorations, whereas the public ones (Félix and Solache) are well-preserved.

The great majority (nearly 90%) of the studied alquerías has undergone some contemporary interventions, ranging from the refurbishment of a structural element (wall, roof) for conservation or safety purpose, to a complete rehabilitation. In some cases, like the alquería de Félix, contemporary bodies have been added to the original building to meet the new usage requirements. We can also notice that the cases which do not have any visible intervention, or only minimal conservation works, are often private properties, probably due to economic reasons.

3.3. Urban approach

This third part focuses on the urban context and the direct surroundings. Indeed, the

understanding of the relationship between the alquerías and their environment is necessary to propose the most respectful intervention solution for a successful conservation and integration.
More than 80% of the alquerías studied are in an urban area (Fig. 3.a), since the area of study, the northern districts of Valencia, was chosen as so. Only two of them, the alquería de Serra and the alquería de Farinós, are still in their original-looking rural environment, although the urban growth threatens the border of the fields. Because the great majority of the studied cases are in an urban area, their surroundings are generally housing buildings and public spaces (Fig. 3.b). One notable point to underline is the presence of parking lots found in half of the cases, which are often the ones in the worst state of conservation. Indeed, these spontaneous parking lots are frequently dirty and anarchic, and thus degrade the quality of the alquería's environment and its overall value.

3.4. Integration analysis

This last part focuses on use integration, height integration, spaciousness, urban fabric integration, ground level integration, accessibility, contemporary intervention integration on the heritage, and finally global state of integration.
The use of a heritage building is a critical aspect to ensure its good integration to the neighborhood, and thus, its good conservation. The assignation of the "use integration" quality (same use, compatible use, contrasting use, incompatible use) was established based on various aspects: the relevance of the new use compared to its past one, the adequacy between the available space and the use, its benefits and perennity for the neighborhood. Thus, the alquerías with an "incompatible use" are those which are abandoned: their past productive activities have become obsolete, or spaces no longer offer the necessary functionality of today's lifestyle. A building without any use does not have a bright future, because it is seen as a useless stain in its environment. The alquería Visquet and alquería Montañana are used as familial second house, and thus look abandoned most of the time. Because they are located in the middle of a public space surrounding by high housing buildings, they lack some privacy. Their private use is in a way contrasting to what the neighborhood could need as public services. The cases of compatible use are hopefully numerous (44%). They are often the public alquerías owned by the municipality, which combine the protection of the heritage and the implementation of public services.
The results about height integration (Fig. 4.a) show that most of the adjacent or nearby buildings have the same height as the alquerías or are drastically higher (a difference of 4 floors or more in 40% of the cases). None are slightly

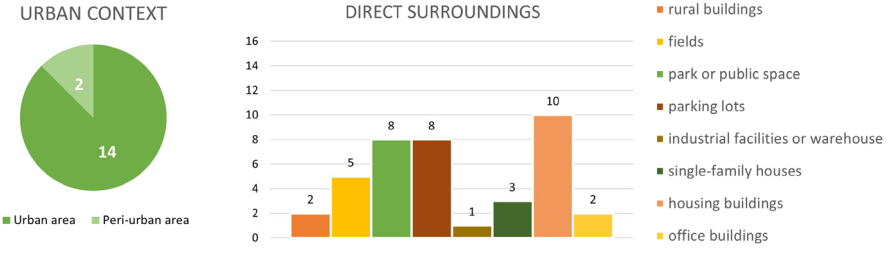

Figure 3. a) Graph of the urban context; b) Histogram of the types of surroundings encountered. Source: (Gosselin 2022)

higher (a difference of 1 to 3 more floors). This huge difference of height points out the oppressive ambient that many alquerías suffer from.

The height of the adjacent buildings plays a great role in the impression of spaciousness of the alquería's environment. Though, it is not the only criteria to spaciousness: the distance between the alquería and the other buildings is also taken into consideration and could explain why some cases are in a rather intermediate ambient instead of an oppressive one. However, a spacious ambient is not always considered as a positive point: some alquerías are just lost in the middle of an urban wasteland, such as the alquería de Falcó, and thus lack integration into the urban fabric.

The assignation of the "urban fabric integration quality" (Fig. 4.b) was established based on the streets and buildings' layout in regards to the alquería's layout. In fact, the urban fabric that has formed around the existing alquerías does not always contemplate a transition to the orientation and alignments of the original building, which shows a lack of consideration for this rural built heritage that was supposed to disappear soon. The most obvious example of a poor urban fabric integration is the group of alquerías in Olba street (Fig. 4.c): the 1970's high housing buildings have been built in a 45° angle with the original Olba street alignment (probably because there was no intention to preserve these buildings). The surface area of the built elements is also one of the aspects that define the urban fabric: most of the alquerías appear to be really small and isolated compared to the large adjacent sets of housing buildings.

More than half of the studied alquerías has a slightly sunken ground level. This could be explained easily: the alquerías are ancient rural buildings, whereas the urban space that has been built around them gained throughout the centuries several layers of backfill, asphalt, etc. This difference of level can create a feeling of being left out in the middle of its context, even more if the exteriors have not been properly designed to create a link between the alquería and the street.

Only 13% of the cases are assigned with a "poor" accessibility, meaning that they have impassable or undeveloped pedestrian paths, often with a steep slope and gravels. The cases judged as "intermediate" could have better accessibility: they are lacking a ramp or are quite far from the public space, such as the alquería de Serra and the alquería de Farinós which are private and in a peri-urban area. The level of accessibility is often related to the type of property, public or private. Indeed, in a public building, good accessibility is needed for everybody including disabled people, thus it requires the addition of ramps and lifts, that can sometimes however impact the original architecture of the building, like the case of alquería de Albors, where the glass lift disfigures the back facade of the old alquería.

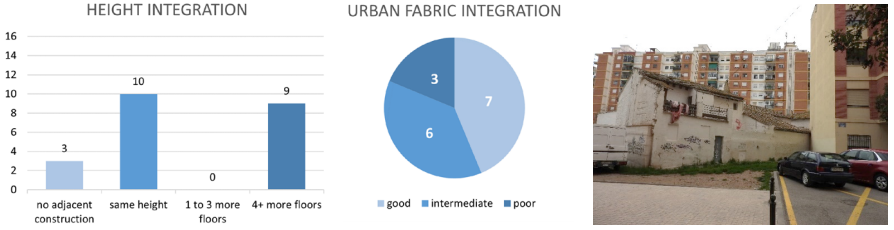

Figure 4. a) Histogram of height integration; b) Graph of urban fabric integration; c) Picture of the alquerías in Olba street. Source: (Gosselin 2022)

Out of the 14 cases which have undergone some kind of contemporary intervention, only one is considered "very respectful" to the heritage: the rehabilitation of the alquería de Barrinto, designed by architect and alquería expert Miguel del Rey who insisted on showing the building's history marked into its walls. The "intermediate" cases are those where the contemporary intervention is not well integrated to the heritage building or is not respectful enough. It is often difficult to distinguish the old from the new. The history of the alquería is hard to guess by just looking at its walls (e.g. smooth facade coatings hide the texture of the original brick and stone walls). Finally, the "invasive" cases do not respect the integrity of the building, by only rehabilitating the part of the building visible from the street in the case of alquería de Albors, or by affecting the building's conservation in the case of alquería de Solache (the added low wall is causing rising dampness in the facade).

The evaluation of the global state of integration of the alquerías is based on different aspects of the analysis, including the state of conservation and all the previous sub-criteria of integration (use compatibility, height of the adjacent buildings, urban fabric integration, accessibility...). It acts as a synthesis of the integration analysis. We sadly notice that 1/5 of the studied alquerías are abandoned or in a state of ruin (Falcó, de la Torre, and de Serra), and more than one quarter is absorbed, meaning that their presence is unexpected in the urban context. Hopefully, half of the cases are in a rather good integration status (adaptation or integration). These are the cases which gather the better points and that could be taken as examples for future integration projects.

4. DISCUSSION

4.1. Synthesis of the results

This analysis allowed us to observe certain facts. First, the state of conservation of the studied alquerías in the chosen urban area is very variable (Fig. 5.a). Even though the great majority of the cases has undergone some contemporary interventions (from basic conversation works to full rehabilitation), the integrity and/or heritage value of the building are not always respected, the work done is not always reversible either, and the conservation of the alquería may be jeopardized unintentionally.

Second, this study shows that the quality of the surroundings and the compatibility of use have also a significant impact on the long-term conservation of the alquerías absorbed by the city growth. Indeed, a correlation has been highlighted between the urban integration quality and the state of conservation.

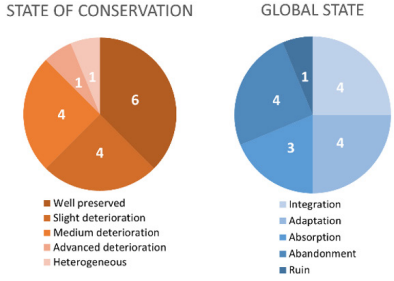

Figure 5. a) Graph of the state of conservation; b) Graph of the global state; c) Picture of the alquería de Barrinto. Source: (Gosselin 2022)

Finally, among the 16 studied cases, 3 alquerías could be considered as particularly endangered (Falcó, Torre, and Serra). These buildings are abandoned or already in ruins (Fig. 5.b). If serious actions are not taken soon, their existence would not be guaranteed. On the opposite, one of the best examples of a well-integrated heritage building is the alquería de Barrinto (Fig. 5.c) which certainly benefits from a privileged setting (a building with high historical and artistic values in the middle of a public park). The intermediate cases, absorbed or adapted into their context, must be monitored as themselves and their surroundings include a specific set of opportunities and threats.

4.2. Recommendations for heritage integration

These observations and findings justify the development of principles to be respected during an intervention project on heritage itself or any urban development project in the surroundings of the specific alquería, which would also be applicable to other heritage buildings.

On the one hand, interventions on the building itself must respect its heritage value (based on its historicity, oldness, aesthetic, and/or usage). Consolidation and reinforcement should prevail over a complete substitution of any structural element. Indeed, it is usual to see cases where the roof, floor slabs, or wood frames have been totally substituted, although they might provide great value. The traditional building techniques should be maintained and reproduced when it is possible, because they are often more sustainable and compatible for the building, as well as being part of the local heritage. For example, the use of traditional lime coatings for the facades allows the building to breathe, alleviating humidity problems, instead of the cement coatings which are counterproductive. The contemporary additions should be identifiable with respect to the old elements, as well as being the most reversible and minimal as possible. They should not erase or impact the traces of the building's history which have been preserved through the centuries, but rather enhance them. A common mistake observed on the alquerías is the loss of the texture of the original wall sand and lime coating, repaired or hidden under a modern smooth coating with a very different texture.

On the other hand, the urban planning of the surroundings of the heritage building should be designed to integrate it in the best way. When applicable, the new function of the alquería should be useful to the neighborhood, which thus participate to its preservation. Indeed, a private use of an alquería in an urban context can be somehow contrasting and lead the building to degradations and possible abandonment. In the case of the peri-urban alquerías that are jeopardized by urban growth, like the alquerías de Serra and Farinós, it will be necessary to surround them with public spaces to offer them spaciousness and accessibility. The main access to the alquería should be preserved when new buildings are being built around it, and when it is possible, parts of the historic access road could be even conserved (e.g. alquería de Barrinto). Overall, the new urban fabric should be made compatible with the preserved alquería. The volumetry of the new adjacent buildings should not overshadow the small-scale alquería, although real estate developers have the tendency to favor profit and habitat density.

4.3. Limitations

The studied cases constitute only a sample of the alquerías present in these districts, those which are already inventoried and on which there is enough information. The other alquerías not studied in this work may be in even more risky conditions. Therefore, it coud be advised to take a step back from the results, as they are not entirely representative of the current situation of the whole city.

Nevertheless, they offer a general insight of the issues. Besides, some of the studied aspects are sometimes non-quantifiable (like the use compatibility, the urban fabric integration quality, etc.), thus their interpretations may be somehow subjective and may be contradicted by someone else, but they are based as much as possible on factual data.

5. CONCLUSIONS

The objective of this research work has been to carry out an assessment on the current urban integration state of the alquerías in four northern districts of Valencia, as means to raise awareness about the conservation issues of the rural heritage when integrated into the urban fabric. By selecting a sample of 16 alquerías in the districts of Benicalap, Rascanya, La Saïdia and Benimaclet, a picture of the state of conservation and integration has been drawn up, as well as giving an overview about the architectural types and history of these local heritage constructions. Then, the collected data has been analyzed through a statistical study, whose results are more or less alarming.

Thus, the contributions of this new study are to extend knowledge on the numerous alquerías of Valencia and the current issues they are facing. The conducting of a general case study enabled to extract some trends that could be useful to identify and treat an endangered heritage building. In the future, this study may in turn be extended to other districts of Valencia or surrounding areas which could constitute the subject of next research works.

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PAPER #6.08

THE HERITAGE CONSIDERATION OF THE VIRGEN DEL CARMEN GROUP (VALENCIA): A HISTORICAL REINTERPRETATION

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ABSTRACT

The conservation of Modern Movement architecture as a built architectural heritage requires also its renovation to reach today's standards of comfort and efficiency. It is even more necessary when it is still in use, as in the case of residential architecture. Moreover, it is a living heritage that, to be understood holistically, requires consideration of the experiences of its inhabitants.
The Virgen del Carmen Group in Valencia is a residential complex designed and built by GO-DB Arquitectos between 1958 and 1963, and included in the DOCOMOMO Ibérico database. This architectural complex has been taken as an object of study to analyse the interpretation of its past based on exhaustive historical and archival research. This is the necessary first step towards its heritage consideration on which its future revitalisation and energy upgrading will be supported.
This paper will detail the main results of the historical and archival research carried out. The changes and transformations, that the Virgen del Carmen Group has undergone over the years, have been evidenced by comparing the original project, the renovation projects, and its current state.
To this end, the documents kept in the main national archives and those of the Valencian Community and the city of Valencia were consulted, as well as various historical photographic, newspaper and video sources.

KEYWORDS

Modern Architecture; historical and archival research; Virgen del Carmen Group; conservation; renovation.

1. INTRODUCTION

The Virgen del Carmen housing group was commissioned by the Ministry of Housing to the GO-DB Arquitectos Asociados studio, formed by Fernando Martínez García-Ordóñez and Juan María Dexeus Beatty. The architects Vicente Valls Abad and Mauro Lleó Serret collaborated in the direction of the work.
As a result of the tragic flood of 1957, the housing policy of Franco's regime carried out several actions in Valencia, among which this complex stands out. Within the framework of the "Plan Riada" (Flood Plan), the Valencia City Council and the Obra Sindical del Hogar were entrusted with the construction of 2,500 social housing units on duly developed plots of land, of which 1,812 were finally built. The third part corresponds to the Virgen del Carmen Group, which consists of 614 homes, 28 commercial

premises and a school group. It is located in the Poblados Marítimos area, on a site next to the cemetery of the old town of El Cabanyal and the Valencia-Barcelona railroad line. The plot is shaped like a quarter of an ellipse, whose major and minor axes follow a north-south and east-west orientation, respectively. The east-west orientation is the direction of most of its longitudinal blocks, 4 or 5 floors high, resolved with exposed concrete structure and two dwellings per floor. Along the curved perimeter and also in a second, practically parallel line, are the towers, raised 3 to 5 stories high with load-bearing brick walls and three dwellings per floor (Jordá Such 2009).

The urban planning of the complex shows the assimilation of the principles of the Athens Charter in the separation of traffic, as well as the definition of green and living spaces between parallel blocks. As for the dwellings, all of them have double orientation and a minimum area for 2, 3 or 4 bedrooms, and are inspired by the chain houses of Miguel Fisac (1950). They are located around the stairwell, modulating the living room and bedrooms by means of the structure perpendicular to the façade. Its floor plan stands out for its large terraces on both sides, thanks to the arrangement of structural porches perpendicular to the facade. The expressiveness of the blocks is accentuated in their original accesses, with free-standing lobbies of curved perimeter and rustic finish. The structure combines load-bearing wall systems for the towers and reinforced concrete for the rest of the buildings (Jordá Such 2007). The innovative project had an important media repercussion at the time, being published in the prestigious journal Informes de la Construcción in 1963, where it was explained in the following way:

> "This set comprises 614 flats, which have been contained in two distinct types of buildings to avoid monotony; low blocks and tall ones. The heights of the buildings vary, and increase from the centre outwards. The schools of only one level, and also five storey buildings, are situated near the lower boundary of the site.
> Each space between parallel blocks is limited at one of its ends by a higher building, thus becoming an outdoor resting space, and not merely a thoroughfare.
> The shops have been located on the most important street which runs round the set of blocks and then runs inwards towards a garden square, which is reached through this commercial zone. The roads for vehicles have been so placed that do not interfere with the pedestrian pathways.
> The satisfactory organization of the blocks, volumes and circulation patterns makes this set of apartment blocks one of considerable interest from the urban planning of view" (García-Ordóñez and Dexeus Beatty 1963, 25).

Figure 1. Aerial view of the complex. Source: (García-Ordóñez and Dexeus Beatty 1963)

This paper will detail the main results of the historical and archival research carried out. The changes and transformations, that the Virgen del Carmen Group has undergone over the years, have been evidenced by comparing the original project, the renovation projects, and its current state. To this end, the documents kept in the main national archives and those of the Valencian Community and the city of Valencia were consulted, as well as various historical photographic, newspaper and video sources.

2. THE PROJECTS OF THE VIRGEN DEL CARMEN GROUP IN VALENCIA: CHRONOLOGY AND PECULIARITIES

The flood of Valencia took place between October 13 and 14, 1957, causing serious damage and the loss of housing for many families. Only four days later, on October 18, the newly created Ministry of Housing approved the so-called "Plan Riada" (Flood Plan), which entrusted the construction of 1,500 houses to the Valencia City Council, and another 1,000 to the Obra Sindical del Hogar (Gaja 1989, 178). Although the architects were commissioned quickly, the land could not be definitively acquired until January 1960, which delayed the entire execution of the buildings.

The Valencia City Council was in charge of the construction of the 382 dwellings that make up the South zone and the Obra Sindical del Hogar carried out another 232 in the North zone. The project undertaken by the City Council included a group of stores and the necessary sewage system, and was divided into three phases: the first, of 128 homes, was awarded to the construction firm Colomina GS; the second, of 140 homes, was executed by Sicop, and the third, of 114 homes and 28 stores, was carried out by Dragados y Construcciones. The contract was awarded to these three companies on July 16, 1959, and the deadline for completion of the works was September 30, 1961. For its part, the northern zone, promoted by the Obra Sindical del Hogar, was divided into two phases: a first phase of 142 "Limited Income Housing Units", executed by Focsa, and a second phase, which included 90 "Social Housing Units" and the urbanization project, carried out by the company Cleop. In this case, the contract award was granted on April 29, 1960, establishing the date of October 30, 1962 as the end of construction (Gaja 1989, 190).

The works were carried out between 1960 and 1965, although the projects had been drawn up in 1958. The plot belonged to a French industrial company, the *Société des manufactures des glaces et produits chimiques de Saint Gobain Chauny et Cirey,* which had acquired it for a possible long-term expansion of its factory. The land was being farmed by tenant farmers and was classified as "urban reserve". It was necessary to modify the planning and reclassify it as "urban building land", which delayed the start of construction until 1960 (Gaja 1989, 188).

On July 26, 1960, the document verifying readiness for construction of all the houses in the northern zone was signed. On December 21, 1961, the final construction certificate was signed for the 90 homes of the second phase of this northern zone, and on December 21, 1965, the final acceptance was signed. On October 26, 1964, the final acceptance of the 142 dwellings of the first phase was signed on October 26, 1964. In December 1962 the provisional acceptance of the works in the southern zone was signed, and on December 22, 1965 the final acceptance of the 114 dwellings and the 28 stores of the third phase of this southern zone (Rosa Báguena and Gallart Torán 1994, 25).

All the plans for the project were drawn between April and June, 1958, while the two preserved memories (corresponding only to the actions of the Obra Sindical del Hogar) are dated October 20 of the same year (EVha.GODB. 1-2-2 II and 1-3-2 II). In them are found some interesting comments. For example, that:

> "[…] due to the requirements of the high density foreseen, it has been thought to establish a series of volumes as articulated as possible, so that the whole does not appear variegated." (García-Ordóñez and Dexeus Beatty 1958, s/f).

In addition to the linear blocks A and B, the so-called type D is conceived:

> "[…] the concentrated type D, in its different heights, allows a good use of the land, and volumetric variety, while closing perspectives, allows the creation of pleasant interior spaces" (García-Ordóñez and Dexeus Beatty 1958, s/f).

From a constructive point of view, the commitment to standardization is total, as was otherwise frequent in GO-DB projects (Palomares Figueres 2009; 2018; Palomares, Portales and Blasco 2018), since "it was intended to use as many standardized pieces as possible":

> "[...] In the A blocks, with a concrete structure, the aim has also been to make it as expressive as possible, while at the same time acting as an enclosure [...] the structure is reduced to a linear series of porticoes braced by longitudinal façade planes, which also act as parapets along the entire length of the building." (García-Ordóñez and Dexeus Beatty 1958, s/f).

On these beams, whose position will coincide with the partition walls, a slab of prefabricated joists, simply supported, would be laid. As for the buildings of concentrated floor plan type D, "their structural system is reduced to four parallel walls of brick masonry", whose edges are accentuated externally "to distinguish their function from the strictly screen walls" (EVha.GODB. 1-3-2 II).
The plans were reviewed by the technicians of the Obra Sindical del Hogar and, with the required modifications, were submitted to the Colegio Oficial de Arquitectos on December 4, 1958. It lacked the Economic Study that, for lack of time, was provided on December 12 of that year, within the eight days announced in the report (EVha.GODB.1-2-1 and 1-3-1). The magnitude and urgency of the project probably led to take advantage of some detail drawings already prepared. This is evident in the carpentry plans, which are undated. All except two, one dated December 1957 (EVha.GODB.3-3.7-34 Door 10 P1) and the other in November 1956, in Madrid (EVha.GODB.3-3.7-38 Bulding D Window 6 V1c).

2.1. Original project vs. constructed project

The executed work seems to have been quite faithful to the project. However, it must have undergone modifications during its drafting, of which we have only partial evidence. In this sense, it is interesting to compare the urbanization plan of April 1958 (EVha.GODB.3-3.6-5) with the urbanization, sanitation and general lighting plan dated the same month and year (EVha.GODB.3-3.6-6). Although at first glance they appear to be the same, a closer look reveals that there have been changes in the position and typology of some of the isolated buildings in the northern zone, and that many of them appear rotated. This second plan coincides with the current layout of the complex. The commercial area also respects the GO-DB design, but not the school, which was the last building to be erected (it does not appear in the 1963 photographs) based on a project independent of the one presented for the housing in 1958.
At the construction level, the most important differences refer to the foundations and the construction solution of the suspended floor. In March 1962, two other complementary foundation projects were drafted, corresponding to phases I and II executed by the Obra Sindical del Hogar (EVha.GODB.1-1-1 and 1-1-2). The project reports indicate that it had not previously been possible to carry out soundings on the land, since the problem of its occupation had not been resolved. Finally, these studies were carried out, showing that the characteristics of the subsoil made it advisable to discard the footing foundation system and use a piling system to guarantee the stability of the constructions. On the other hand, in order to allow the discharge of the collectors into the general local sewerage system, the ground level had to be raised. This resulted in a considerable layer of backfill, which would not be excessively serious in the general terrain, but would be so in the buildings, where a complementary backfill had already been planned to raise the level of the first floors. The sum of the two backfills led to a very high level, so it was preferred to solve the first level floors by means of an additional suspended floor slab, which would guarantee the stability of the first floor and the absence of dampness. These reports were accompanied by a complementary measurement and three plans (similar for the two phases), also dated

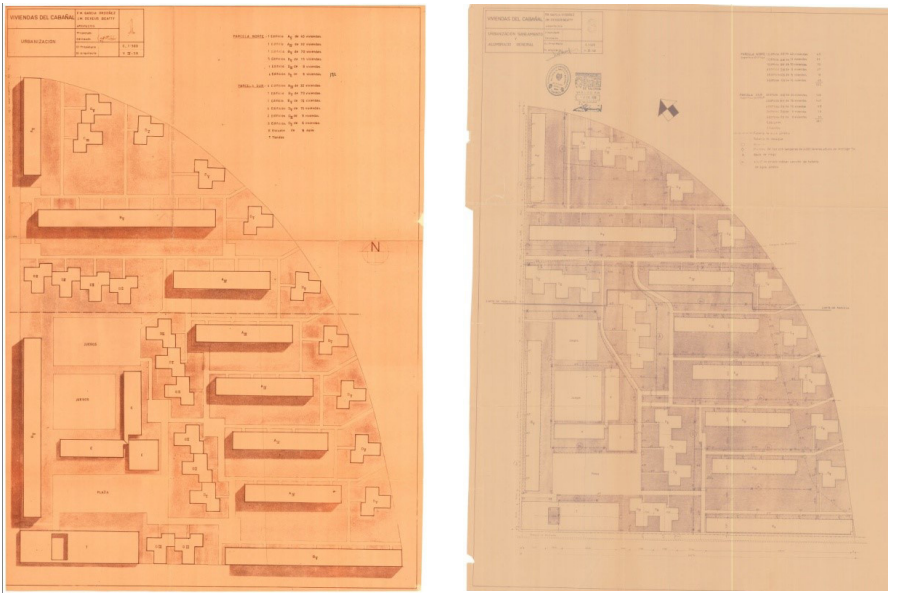

Figure 2. Two versions of urban planning in the 1958 project. Source: (EVha.GODB.3-3.6-5 y 3-3.6-6)

March 1962 (EVha.GODB.3-3.3-1; 3-3.3-2; 3-3.3-3; 3-3.3-4; 3-3.3-5 and 3-3.3-6).
The same problem had arisen two years before with the housing built by the City Council. Although the memory is not preserved, there are two plans dated July 1960 of the piling for the block of 70 dwellings called Bv (EVha. GODB.3-3.4-1 y 3-3.4-2).

2.2. Reform and repair projects

At an undetermined date, after 1963, a proposal was made for the construction of a "Home for the Elderly" and a "Nursery", represented at the level of the floor plan in the plan inventoried as EVha.GODB.2-2.3-2 and its copy EVha.GODB.2-2.3-3. The sheet appears already with the definitive name of "Virgen del Carmen" and has the indication of 15 million, perhaps referring to the budget in pesetas. We have no further news of this proposal.

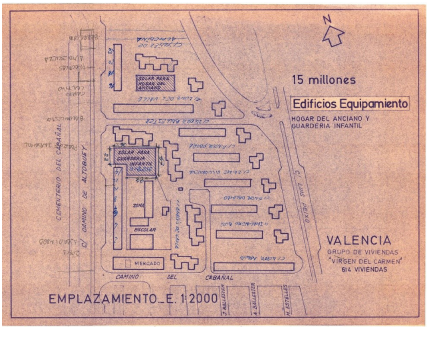

Figure 3. Plan showing the site for the Home for the Elderly and the Nursery 1963. Source: (EVha.GODB.2-2.3-2 y EVha.GODB.2-2.3-3)

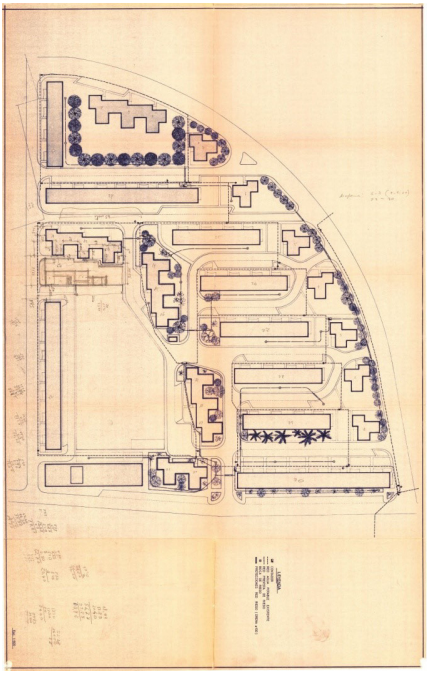

Figure 4. Plan showing the modification of the road system in the complex n/d. Source: (EVha.GODB.2-2.3-1)

The avant-garde urban planning approach of traffic separation was not respected. As the number of vehicles among the owners increased, in 1977 the initial pedestrian proposal was abandoned and vehicular traffic was introduced. This modification was managed by Mauro Lleó, who indicated in the project report (July 1977) that:

> "The use that has been given to it has been devastating for this urbanization. The users, most of them with their own vehicles, have wanted to drive their cars right up to the doorways of their homes, invading the land destined for landscaped open spaces" (Gaja 1989, 187-188).

To this project may belong the undated plan catalogued as EVha.GODB.2-2.3-1, which already shows a road layout similar to that shown in one of Lleó's plans published by Gaja (1989, 188).

In May 1986, architects Juan Luis Gastaldi Albiol and Jaime García Matarredona presented an intervention project for the social housing complex. Cracks and spalling had been detected in the exterior supports of the rectangular blocks. A comparison with the project plans showed that there were hardly any significant changes, except for the aforementioned replacement of the lower slab by a suspended floor slab. It was noted that the problem could derive from a poor dosage of the concrete aggregate, with oversized gravel and an increase in the water/cement ratio during construction, as well as significant carbonation. The structural design was correct, although it does not meet current standards. The damage affected all the exterior supports, consisting of cracks in the concrete parallel to the reinforcement and spalling where the rusted steel appears. There were vertical cracks on the exterior front of the supports, and horizontal cracks on the lateral faces, parallel to the abutments, especially at the junction of the girders with the supports. The problems accumulated in the lower part of these supports. The direct cause of the problem would have been degradation by carbonation, accompanied by a decrease in the Ph of the concrete. All this would have affected the passivating effect of the concrete on the reinforcement, which would have corroded. The planned action consisted of pitting and repair with epoxy resin mortars (Gastaldi and Garcia 1986). The works were carried out by the company TEXSA between November 21, 1986 and December 31, 1987, with provisional acceptance on July 20, 1988 and final acceptance on September 6, 1989 (Rosa Báguena and Gallart Torán 1994, 26).

The other major intervention was the "Proyecto de Actuaciones de Rehabilitación y mejora del Grupo Virgen del Carmen Cabanyal-Valencia" promoted by the Instituto Valenciano de la Vivienda in 1994 and completed in 1999. It

consisted of an intervention in the buildings, the redevelopment and sewerage of the neighborhood and, finally, the construction of a nursery school (Córdoba Vallet 1999). The intervention on the buildings was signed by the technicians Carmen Rosa Báguena and Vicente Gallart Torán and, in addition to the structural reinforcement to guarantee the durability of the complex, it included the renovation of the horizontal and vertical sanitation network, as well as the repair of roofs and the façade.

In the Municipal Archives of Valencia, a part of this project has been located, which was drawn up for the partial rehabilitation of one of the largest linear blocks, with seven doorways and five floors (Municipal Archives of Valencia, Exp. 5922/94). At the express request of the neighborhood, in order to avoid problems of citizen insecurity, the vestibules were demolished and the affected facade was remodeled (Rosa Báguena and Gallart Torán 1994, 20-22). These vestibules, perhaps inspired by the staircase of Le Corbusier's Swiss Pavilion, were one of the most original elements in the design of the complex, and were described in this way in the aforementioned article in *Informes de la Construcción*:

> "The entrance portals to the blocks have been taken out of the stairwell and covered with a small concrete membrane hanging over their edges. The outer edge is a curved wall that contrasts and stands out against the modulated background of the facade." (García-Ordóñez and Dexeus Beatty 1963, 26).

Although it is not expressly stated, it is likely that the original vestibules, which protruded from the façade, generated angles with poor visibility that could be exploited by criminals. The new project proposed the construction of canopies made of translucent polycarbonate sheets on a metal structure to mark the entrances and protect them from the rain. The doors would also be replaced by more modern ones of better quality. Finally, the facades would be treated to solve the humidity problems, with the application of a single-layer mortar consisting of a hydraulic binder modified with plasticizing, water-repellent and resin additives. This coating would receive a scraped finish, and should be permeable to water vapor to allow the substrate to breathe, as well as being unalterable against UV rays. The same mortar would also be applied on the facing brick walls, with a previous preparation to fill the joints. All the existing sliding shutters were also dismantled and repaired in the workshop, stripping and replacing the paint, replacing the bearings and also the guides of the sliding doors that were in poor condition (Rosa Báguena and Gallart Torán 1994, 20-22).

Figure 5. View of the block in a photograph from the 1960s. Source: (IVVSA Archive)

The redevelopment and sewerage project was designed by architect Juan L. Gastaldi, whose overall approach envisaged a renovation of the infrastructure and durable finishes facilitating social relations. For this reason, the electrical, lighting, telephone and gardening installations were refurbished. In addition, the problem of humidity in the complex was solved with the renovation of the entire sewage system. The new sewerage system was connected to the Serrería sewer and the solution adopted eradicated the periodic flooding of the basements.

Finally, the new kindergarten building was designed by the architect Miguel Campos, also at the request of the neighborhood to complete the neighborhood's educational facilities. For this reason, the neighborhood association has been in charge of managing its operation (Córdoba Vallet 1999).

Date	Event
1958	Start of drafting of the original project
1960	Start of construction works
1962	Completion of first blocks
17/06/1962	Franco visits the group
1963 (July)	Housing delivery (first occupancy)
1965	Completion of all works
1986	Drafting of a project for the repair of the facade pillars.
1994	Drafting of the renovation project. Intervention of the GVA in facades, pillars, terraces, elimination of vestibules.
1999	Completion of renovation works

Table 1. Timeline with the most significant dates. Source: (Authors 2022)

3. CONCLUSIONS

The historical and archival research carried out has allowed us to know in detail all the vicissitudes of the Virgen del Carmen Group in Valencia, not only after its construction, but also from the drafting of its project until its execution. This work is considered essential and necessary for its valuation as architectural heritage, since it is a project of special interest due to the use of standardized elements and the avant-garde of the complex from an urban, constructive and formal point of view. Likewise, the information discovered is of great importance to be able to promote its material conservation and to propose an adequate revitalization and energetic updating of the buildings and their surroundings, in order to adapt them to the current standards of comfort and efficiency, and even more so when they are still in use, since it is a residential architecture.

ACKNOWLEDGEMENTS

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PAPER #6.09

THE HERITAGE CONSIDERATION OF THE CHESTE WORKERS UNIVERSITY: HISTORICAL REINTERPRETATION

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ABSTRACT

This communication proposal is part of the Research Project "Conservation Management Plan: Cheste Worker University Auditorium-Paraninfo", of the Universitat Politècnica de València, directed by Professor Carmen Jordá, awarded and funded by the Getty Foundation of Los Angeles in its international programme "Keeping It Modern" Grant.
The subject of the project is framed within the field of the conservation of Modern Movement architecture as heritage and refers to the Universidad Laboral de Cheste, a 1967 project by the architect Fernando Moreno Barberá. It was built in 1969 as part of the Mutualidades Laborales plan, whose official propaganda boasted of the magnitude of the work in Cheste and its rapid execution, in a very short period of little more than a year.
The project sets out the archival and historical research carried out in order to achieve the heritage status of the complex. This paper will detail the main results obtained during the documentary research process. In addition, the comparison between the original project, the previous project, other contemporary works by the same author and the current state has been able to narrate the evolution of the project and the work, as well as highlighting the changes and transformations made over the years.
It should be noted that the research includes in the analysis documentation compiled through oral and visual testimonies that allow us to understand the value of the monument in its entirety.

KEYWORDS

Modern Heritage; modern movement architecture; Fernando Moreno Barberá; Cheste Workers University.

1. INTRODUCTION

This communication proposal is part of the Research Project "Conservation Management Plan: Cheste Worker University Auditorium-Paraninfo", of the Universitat Politècnica de València, directed by Full Professor Carmen Jordá, awarded and funded by the Getty Foundation of Los Angeles in its international programme "Keeping It Modern" Grant.
The object of the project refers to the field of the conservation of Modern Movement architecture as heritage and refers to the Cheste Labour University, tackling the analysis of the Paraninfo, its most iconic building, as a model that can serve as a paradigm in the definition of a Master Plan that guarantees the rehabilitation and conservation of the entire complex, assuming parameters of heritage

consideration. The need is therefore defined to develop a specific Master Plan that recovers and preserves the original architectural values, systematically implementing the elimination of inadequate actions and inappropriate elements, establishing appropriate intervention criteria under technical premises and qualifying future actions.

The Cheste Labour University, designed by Moreno Barberá in 1967, was designed for a population of 5,000 people, larger than 88% of Spanish municipalities at the time. It was planned on a hill 23 kilometres from the city of Valencia, and was built in 1969 as part of the Mutualidades Laborales plan, whose official propaganda boasted of the magnitude of the work and its rapid execution, in a very short period of little more than a year. The different parts, grouped by function, are staggered on the slope, adapting to the topographical irregularities. The extensive complex appears as a synthesis of the experiences of modernity: the vibrant rhythm of Corbusier's concrete parasols, the Miesian delicacy of the buildings, the sculptural canopies - with a clear Latin American accent - and the Mediterranean and Californian appropriation of the exteriors.

This text sets out the archival and historical research carried out in order to achieve heritage status for the complex. This paper will detail the main results obtained during the documentary research process. In addition, the comparison between the original project, the previous project, other contemporary works by the same author and the current state has been able to narrate the evolution of the project and the work, as well as to highlight the changes and transformations carried out over the years.

2. ARCHIVAL RESEARCH

The main source of information during the documentation process of the project has been Fernando Moreno Barberá's personal archive, to which Professor Carmen Jordá Such had access several decades ago, provided first-hand by the author himself, who even donated the original planimetry of the project for the Universidad Laboral de Cheste. The cordial and fruitful personal relationship with Moreno Barberá also resulted in a series of lectures and master classes that managed to capture his personal view of architecture and his reflections on his work, which are reflected in the document.

After the architect's death, his archival legacy was deposited at the Colegio Territorial de Arquitectos de Valencia, where it has been possible to empty and classify it, obtaining reproductions of all the planimetry of the Paraninfo and contrasting the rest of the documents conserved. Among the most significant information, the documents corresponding to the Basic Project phase are conserved, including the Planimetry and Project Report, as well as Measurements and Budget. Likewise, some plans of the Execution Project are also conserved, although in partial form and not as a complete single file. Other documents relating to the Works Management are also catalogued, such as various Modified Budgets, which include the justification of cost overruns derived from the readaptation of the project to its definitive location; or Minutes of reception of buildings. Of great value are the photographs preserved, both of the execution process and of the finished work, most of which have already been widely disseminated. Finally, this technical information is complemented by a large amount of correspondence -mainly institutional-, advertising and press clippings -true testimonies of the spirit of an era-, as well as manuscripts written by the architect for the preparation of the project's publications.

Despite this significant amount of information, it was considered relevant for the purpose of the research to locate the complete Execution Project of the Cheste Labour University which, according to the bibliography consulted, would have more than 700 plans. Although the material elaborated for the initial phases of the project reaches

a level of detail that allows its execution with sufficient solvency, the development of the Execution Project should include plans of installations, water evacuation and, above all, of structural definition, with specification of the dimensioning of the reinforcement. Equally important would be the annex with the calculation report, especially in the case of the Paraninfo, since the large fan-shaped beams were made of post-tensioned concrete and the stresses at which the reinforcement elements were requested are not known.

The architect did not keep in his personal archives the complete construction design, perhaps as a consequence of its voluminous size. In addition, it is very likely that most of the specific plans for the Construction Project were drawn up during the works with the support of technicians from the construction company that was awarded the contract: Agromán S.A., one of the main construction companies in Spain at the time. This hypothesis is based on the specific circumstances of the execution of the works, readapting the original project to a new location in a very short space of time, and is supported both by the numerous detailed plans made up of freehand sketches made on site - preserved in the archives - and by statements made by Moreno Barberá himself who, in personal correspondence, referred questions relating to the execution of the works to the engineers Mr Enrique Cebrián (Site Manager) and Mr José Díaz Palos (Works Coordinator). The information in the Specifications was complemented by a series of freehand construction details - also preserved in the Pando Archive of the Instituto de Patrimonio Cultural de España, together with a magnificent collection of photographs - prepared as additional documentation for the tender for the award of the works. Going to the construction company's archives was the first step in trying to locate the complete construction project, as well as the documents pertaining to the works management. However, Agromán was in a situation of economic ruin in the 1990s, when it was taken over and refloated by Ferrovial, after the sale of a large part of its assets and the dismissal of a third of its workforce. Attempts have been made to contact Ferrovial, without success, although it is unlikely that the current company will retain the 1969 works project carried out by the absorbed construction company.

At the same time, an attempt has been made to locate the administrative file of the Cheste Labour University project. This would contain all its processing, with notifications, repairs, modifications, etc., as well as another copy of the Basic Project and, perhaps, of the Execution Project. The main problem lies in the fact that the Labour Universities ceased to exist as an institution in the 1980s, so it is not possible to contact directly with any responsible administration, having to locate the archive where this information would have been deposited.

First of all, the Arxiu Històric de la Comunitat Valenciana was approached, since the Cheste complex is currently managed by the regional administration, which is responsible for education. The archivist, Mr. Javier Sánchez Portas, provided the little information available, consisting of three dossiers of authorisation for the use of explosives during the work to prepare the land, and a series of photographs relating to the execution of the closure of the atrium of the Paraninfo in the 1990s.

It was also consulted the Archivo General de la Administración, where the Head of the Departamento de Referencias, Ms. Evelia Vega, confirmed that they did not have funds on Cheste, suggesting that we go to the archive of the Ministry of Education. There is generic material on the Workers Universities, specifically some photographs in the Delegación Nacional de Prensa, Propaganda y Radio del Movimiento, but this information is outside the scope of this research.

In the Archivo Central de la Secretaría de Estado de Educación, there are a few collections relating directly or indirectly to

the Workers Universities, but these mainly deal with economic and teaching staff management issues, and nothing related to the architectural projects of the educational centres built.
The archives of the Ministry of Labour were also consulted, as the Workers Universities initially came under the Ministry of Labour and not Education. In its archives there are references to the Labour Universities in the collection of the Dirección General de Promoción Social, which for a time was responsible for the Delegación de Universidades Laborales, but these references do not include architectural projects. The Head of Documentación Administrativa, Mr. Luis Casado de Otaola, directed the search towards the Delegación de Universidades Laborales which, although linked to the Dirección General de Promoción Social, had among its functions the "direction and management of the Workers Universities and other teaching centres dependent on the Ministry of Labour", with its own headquarters outside the Servicios Centrales del Departamento building in the Nuevos Ministerios. During the period in which it remained attached to the Ministry of Labour, the Labour Universities Delegation did transfer documentation to the Central Archive of the Ministry of Labour. However, in 1975, the Delegación de Universidades Laborales was integrated into the newly created Dirección General de Servicios Sociales, and in 1977 it became part of the new Ministerio de Sanidad y Seguridad Social (1977-1981). On this occasion, according to two letters dated February-March 1979, the following actions were carried out with the agreement of the Labour Universities Service and the General Archive of the Ministry of Labour:

- Elimination of 1306 numbered files of the Servicio de Universidades Laborales: 400-583, 585-941, 943-946, 949-1031, 1038-1090, 1105-1424, 1435-1521, 1524-1534, 1546-1692, 1726-1748 and 1759-1789 (12/02/1979).
- Transfer of the remaining 84 files selected by the Servicio de Universidades Laborales to its facilities in the Ministerio de Sanidad y Seguridad Social (register of departure no. 23 of 9/03/1979, numered files 584, 942, 947-948, 1032-1037, 1091-1104, 1425-1434, 1522-1523, 1535-1545, 1693-1725, 1749-1758).

In 1978, the Workers University Centres came under the exclusive control of the Ministerio de Educación y Ciencia through an autonomous body called the Instituto de Enseñanzas Integradas. Thus, when the responsibilities for Social Security returned to the Ministry of Labour, those relating to the Workers Universities never returned, and therefore neither did the documentation. In 1980, the Instituto de Enseñanzas Integradas was abolished and the assets and resources of the Workers Universities passed to the State Administration through the Dirección General de Enseñanzas Medias. In 1982, all the staff working at the Workers Universities were integrated into the D.G. for the purposes of new postings, and the following year their facilities were handed over to the Autonomous Regional Administrations at the same time as educational powers were transferred.
This being the situation, it can be deduced that the file on the Cheste Workers University Project, if preserved, should be among the 84 boxes of documentation that were transferred to the facilities of the Ministerio de Sanidad y Seguridad Social. The archives of the current Ministerio de Sanidad were checked, where the archivist, Mr. Ignacio Anchuela Galán, confirmed that this archive was created at a later date and, therefore, nothing relating to the Workers Universities was preserved in its archives. The archives of the Ministerio de Fomento were also consulted, where the Head of Section, Aurelia Álvarez Cubero, indicated that they do not hold any information relating to the subject of this research.
The transfer of powers from the central state to the autonomous regions was accompanied,

in certain cases, by the transfer of the corresponding archival material. In the case of the Comunitat Valenciana, some of this material was transferred to the Arxiu del Regne de València. However, after consultation, the person in charge, Ms. Eva Soler, indicated that there is no file related to the Universidad Laboral de Cheste in their archives either. The same result was obtained in consultations with the Archive of the Caja de Ahorros de Valencia -the entity that financed the execution of the works-, the Arxiu General i Fotogràfic de la Diputació de València -neither in the Sección de Proyectos Técnicos de Patrimonio de la Diputación de Valencia-, or the Arxiu Històric de l'Ajuntament de València -the administration that owned the land ceded for the original site of the project-.

Some tangential information on the project has been obtained by consulting projects of contemporary educational facilities designed and built in Valencia by Moreno Barberá, all of which are kept in the Archivo de la Universidad de València. Information on the execution projects and construction management of buildings such as the Faculty of Law (1956-59), the School of Agricultural Engineering (1958-67) and the Faculty of Philosophy and Letters (1960-70) has provided data on suppliers and industrialists who regularly collaborated in the works of Fernando Moreno Barberá. Similarly, information of little relevance has also been obtained in the review of the Archivo Municipal de Cheste, limited to an activity licence to establish three LPG tanks in the Workers University of Cheste, dated 14 March 1969. According to the head of the municipal archives, Mr. Gabriel Herráiz, an application for a licence to sell churros during the course of the construction of the Universidad Laboral, dated 31 October 1968, was also found.

After this documentary search - largely unsuccessful-, it can be considered that all the information currently conserved in archival collections relating to the project to build the Cheste Labour University has been located and classified.

3. HISTORICAL APPROACH

3.1. The cosmopolitan background of Fernando Moreno Barberá

The architect Fernando Moreno Barberá (Ceuta 1913-Madrid 1998) appears as a point of reference in Spanish modernity. The assimilation of the architectural culture coming from Le Corbusier unfolds as a splendid reference, manifesting itself in the vigorous plasticity entrusted to the expressive possibilities of reinforced concrete and in the powerful identity of an image associated with different systems of protection against solar incidence.

The open-plan layout of numerous buildings, the segregation of pedestrian traffic away from road traffic, and the coexistence of architecture with nature, with buildings scattered among the vegetation, are also immediately recognisable.

His projects also show a conscious interest in bringing together architecture and the arts, with Javier Clavo being a regular collaborator: a recurring theme for modernity. Nor should we forget the media impact of the projects in Brazil, Mexico and Venezuela, where there were splendid examples of artists' participation in architectural works.

3.2. Workers Universities

The Francoist phenomenon of the Workers Universities was inspired by a Belgian model, that of the Charleroi Labour University, devised by the philanthropist Paul Pastur for the technical training of miners and workers in the province of Henao-Haimut and inaugurated in 1911. (Jordá Such, 2005).

The educational establishments built were intended for the vocational, technical and human training of workers. To this end, active, constructive and functional teaching methods had to be introduced which would individualise theoretical and practical activities for the pupils. Workshops and laboratories were therefore needed, in order to develop,

in addition to cultural training, the necessary preparation for a trade.
Education was considered to be the activity that offered the greatest expectations for social improvement and progress, so the State - through the Mutual Labour Mutual Societies - covered the cost of the scholarship students with their corresponding board and lodging in the case of boarders, as well as the necessary material. The pupil's family was free of any direct or indirect burden that might arise from schooling.
The first labour university to come into operation was the one in Gijón (Luis Moya Blanco, 1946-1957), which was followed by another twenty centres built up to 1978 throughout the country. This educational project, which began under a Falangist philosophy, evolved over time, so that its ideology was diluted throughout the developmental stage of Franco's regime, until it became a pragmatic project with a rationalised training plan in which each centre had total autonomy.

3.3. Cheste Workers University

The Cheste Workers University was conceived as a "Workers Universities Orientation Centre", constituting an authentic school city with a capacity for five thousand inhabitants, more than double that of larger centres such as Seville or Gijón.
This large teaching complex came to signify the obligatory gateway to the teaching system of the labour universities, channelling all new students between the ages of eleven and fourteen, so that they could join one of the other centres, homogenising the educational level of students from all over Spain.

3.4. Project philosophy

Consequently, the programme required the provision of accommodation, care, teaching and recreational facilities for 4,800 pupils, aged between 12 and 14. As Moreno Barberá himself expressed, the life of this large number of people had to be organised in such a way that the activities were divided into independent units of a maximum size of 200 people. (Moreno Barberá, 1969).
The architectural ensemble tries to reconcile, through the urban layout of the different parts, all the facets of life to be housed, introducing considerations of a sociological and psychological nature. Three areas of social relations are distinguished: a disciplined life, such as that of the schools; another ordered by the needs of the community, but in which the individual is not subjected to mental impositions, and a final one of free time or expansion, which must be developed in large, non-formalist spaces that are part of the landscape.

3.5. A project for El Saler

The original project to build a Workers University in Valencia was to be located on land in El Saler, on a plot of 243,700 m2 owned by Valencia City Council. In May 1967, a group of teachers and psychologists drew up an outline of needs regarding the facilities, premises and services required for a centre of this type, which would serve as the basis for the preliminary architectural project, already commissioned to Fernando Moreno Barberá at that time.
The organisation of the initial proposal, adapted to a practically flat terrain, was linear and a zoning criterion was applied according to the different functions of the educational centre, following a longitudinal axis from north to south.
Perpendicular to the previous longitudinal axis, a transversal axis appeared where "eternal values and temporal power" were "represented" - according to the project report - through the oratory at one end and the management office at the other. Based on this scheme, the different buildings began to be designed in detail.
However, the site was not to the architect's liking. From the outset, Moreno Barberá warned that there was not enough space to carry out the ambitious programme he had

been commissioned to design. He stated that, if rational criteria of modern architecture were taken into account, the group of buildings would be too concentrated, even for an urban site.

On the other hand, the flat terrain, lacking perspectives, forced a solution where some buildings hid the views of others. In addition, the location next to the coastal lagoon of La Albufera caused other health problems, as the site is damp and has a large number of mosquitoes.

From a technical point of view, moreover, the poor quality of the subsoil meant that a costly pile foundation had to be built, as well as an extraordinary amount of earth to drain the site.

Faced with so many problems, the Ministry of Labour decided to look for a new location for the future school. However, fearing that the educational complex would end up being moved to another province, in November 1967, the València City Council called a tender for the acquisition of new land, and the Cheste City Council's proposal was the winner.

3.6. Readaptation of the project to the new location.

With hardly any time to develop a new project, work had to be done on adapting the old one. Of course, the biggest advantage was the increase in the surface area of the site from 24 to 156 hectares and from 5.10 m2 per pupil to a standard of 32 m2. Its height above sea level from 160 to 232 metres was presented as a health advantage compared to the situation at La Albufera. In addition, the site had steep slopes and promontories over most of its length, so that there were now wide views of the surrounding landscape in all directions.

Organisational improvements were to be tackled quickly, although the original El Saler project was considered functionally efficient. The main change affected the classroom and workshop buildings, which were split up and separated. In the rest of the buildings, the initial project remained practically unchanged.

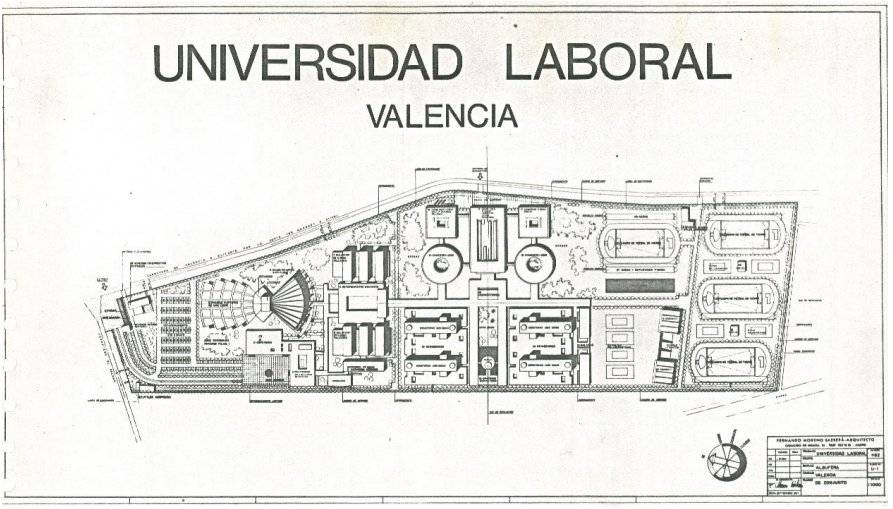

Figure 1. Valencia Workers University, Original Project for El Saler, Site Plan. Archivo Histórico del Colegio de Arquitectos de Valencia: (Fernando Moreno Barberá, 1967)

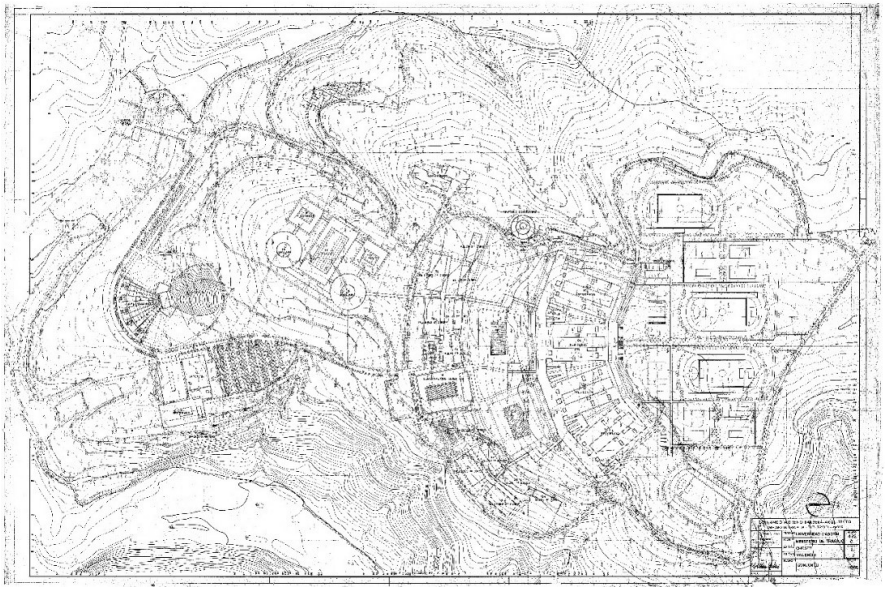

Figure 2. Cheste Workers University, Site Plan. Archivo Histórico del Colegio de Arquitectos de Valencia: (Fernando Moreno Barberá. 1968)

The plans for the modifications had to be drawn up at the same time as the work was being executed. Many of them consisted of hand sketches by Moreno Barberá himself, as urgency prevented him from instructing a draughtsman to redraw them.

3.7. Commissioning of the Works

On 16 February 1968, the Cheste project was awarded by auction to Agromán Empresa Constructora S.A., with a deadline for completion set for 15 December of the same year. The valuation was based on the budget of the project planned for El Saler, of which most of the projected buildings were to be preserved. The plot had grown from 243,700 to 1,485,828 square metres, with a completely different topographical configuration, which meant that a series of budget items not foreseen for a flat terrain would have to be introduced, such as cuttings, retaining walls and the supply of the different installations, which still had to be studied by the architect.

The geotechnical survey report turned out to be an unpleasant surprise and a reason for an increase in the budget, as it revealed that the site, consisting of rocky ground, was perforated in all directions by galleries and caves that were difficult to locate. In addition, the terrain was made up of layers of stone of varying thickness, which could lead to differential settlement of the buildings. It was therefore decided to increase the size of the foundations planned for almost all the buildings.

Another important increase in the initial budget was the cost of the general urbanisation, both because of the need for additional facilities not foreseen in El Saler, and because of the greater extension of the Cheste site.

Furthermore, it should not be forgotten that a bridge of considerable size had to be built over the ravine to access the educational complex. The magnitude and complexity of the work are aspects that are constantly highlighted and which, of course, were exploited by the propaganda of the time, which referred to the Universidad Laboral de Cheste as the largest educational complex in the country and a record building in Spain, even calling it the "Valencian Escorial". The figures offered were overwhelming, which truly corresponded to a reality that involved an unprecedented mobilisation of men, machinery and materials. Suffice it to say that the total built surface area represented some 170,000 m2, the number of workers amounted to 4,000 men, two concreting plants were installed on the site and 27 tower cranes worked simultaneously.

3.8. Paradigm of modernity

Seen as a whole, one observes, above all, a criterion of superior order, now not marked by the presence of strict axes and softened by topographical irregularities. The different parts of the building are grouped according to functions and take advantage of the small natural promontories.

Figure 3. Cheste Workers University. Teaching blocks and workshops general view form the Services building. Fernando Moreno Barberá, 1968. Instituto del Patrimonio Cultural de España, Archivo Pando: (Juan Miguel Pando Barrero, 7th July 1969)

But a condition that could not be missing in any self-respecting modern experience, having taken on board the lessons of the Athens Charter, would consist of an organisation of traffic based on the radical segregation of road and pedestrian circulations, so that the former follow the contour lines around the perimeter of the entire site. The pedestrian circulations are particularly well cared for and are transformed into architectural elements, or directly architecture itself, with their great presence in the Cheste educational complex. Again, one must think of Latin American experiences such as Oscar Niemeyer's long, undulating canopy in the Conjunto Ibirapuera (1951) in São Paulo, or even his earlier canopy in the Casino de Pampulha (1942) and, above all, Villanueva's sculptural covered walkways (1952-1953) in the Ciudad Universitaria in Caracas. But Moreno Barberá, more of a builder than an artist, felt at ease working with simple rectilinear lines.

It is also worth commenting in this section on the delicate way in which the architect gave his buildings to the ground. It would seem that they are perched rather than cemented, with cantilevered sanitary wrought ironwork accessed by miesian staircases without risers.

The design ideas in the treatment of the landscape also show the architect's mastery of his craft. Taking advantage of the natural topography not only greatly reduced the cost of earthworks, but also integrated the new buildings into their natural setting as if they had been born there with the trees. Moreover, the coherent decision to introduce only native vegetation would ensure easy conservation and its subsequent growth would harmonise the built environment.

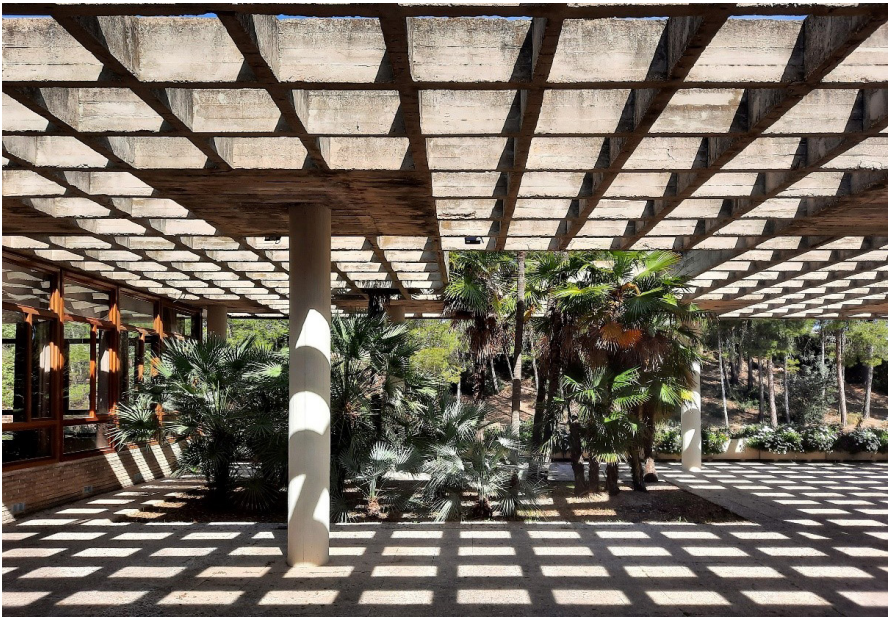

Figure 4. Cheste Workers University, Pergola and garden of the Cafeteria terrace. (Fernando Usó, 2021)

4. CHANGES AND TRANSFORMATIONS

The change of political regime meant the transformation of the educational model and the immense Cheste complex was, with the consolidation of democracy, left empty of function.
Over the last decades, local, regional and state institutions have tried to fill the Cheste complex with content. In 1985, the Centro de Enseñanzas Integradas de Cheste was regulated, transforming it into an Educational Complex. In June 2012, the Directorate General of Sports of the Higher Sports Council classified the Cheste Educational Centre as a Sports Technification Centre of Cheste. Various educational and training uses have been incorporated, being managed by two departments: the Regional Ministry of Education, Research, Culture and Sport and the Regional Ministry of the Presidency of the Generalitat, through the Security and Emergency Response Agency. At the educational level, it is a public centre where medium and higher level training courses are offered, such as the School of Hotel Management, Aeronautics Degree, Agricultural Vocational Training, or sports, with the Sports Specialisation Plans (P.E.D.) that are taught in the IES nº1, as well as the Sports Technification Centre. The readaptation of the buildings to the new uses and the usual maintenance work - or lack thereof - without including considerations of a heritage nature, have over the years generated improper actions that detract from the original architectural image and jeopardise the aesthetic and material value of the work. In this sense, the modification of openings, the clogging of porticoed ground floors and the replacement of the original wooden joinery with aluminium or plastic joinery have been detected. Special mention should be made of the intervention carried out in the 1990s, consisting of a perimeter enclosure of the open atrium of the auditorium to adapt it to the standards of theatre premises. This unfortunate action, which, moreover, has not solved any problems, needs to be reversed as soon as possible in order to restore the complex's main image of recognition.
Despite the efforts made by the institutions to make use of the colossal educational complex of Cheste, its scale and its conception of a single function mean that the diversification of uses that it currently houses does not manage to take advantage of the large public facilities, such as the Paraninfo or the Services Building, which have been left underused or abandoned.

5. APPLICATION FOR THE INITIATION OF THE PROCEDURE FOR BIC DECLARATION

The work of historical and documentary review, as well as the analysis of the current state, have served as a theoretical framework and documentary support for the preparation of the preliminary report linked to the application for the declaration of the Universidad Laboral de Cheste as an Asset of Cultural Interest. Upon receipt of this letter, signed by the Rector of the Polytechnic University of Valencia, the administrative procedure began. The Dirección General of the Conselleria de Cultura will request reports from two external advisory bodies, probably the Real Academia de Bellas Artes de San Carlos and the Consell Valencià de Cultura, which must deliberate on the proposal and issue their opinion in a collegiate manner. On the basis of these reports and the observations of the Dirección General's own technicians, the latter will take a decision that will finally be ratified by the signature of the Directora General de Patrimonio.
The monumental declaration of the Cheste Labour University complex would guarantee its protection by preventing demolitions, improper construction in the vicinity and, above all, by controlling minor maintenance work which, consciously or unconsciously, can seriously alter the image of the buildings.

From the point of view of the administration, there are two possible arguments for refusing the declaration. The first would be related to the valuation of modern architecture as a heritage site, a subject on which, however, there is a growing awareness. In this sense, the application report submitted refers to the guidelines of ICOMOS and UNESCO regarding the conservation of 20th century heritage, and the special interest shown in the Universidad Laboral in general and its Paraninfo in particular by important foreign institutions, such as International Do.Co.Mo.Mo and the Getty Foundation.

The second argument that could generate a negative response is the operational complexity of the General Directorate, through its Territorial Services, to manage an architectural, archaeological and ethnological heritage of great wealth. The protection of the Cheste complex, given its size and vitality of use, would multiply the bureaucracy of this administration when it comes to studying and resolving each of the small or large repairs or remodelling carried out on it. That is why, with very good judgement, José Ignacio Casar, the Administration's representative on the team, has suggested that the application for the declaration of the whole of the Universidad Laboral as an Asset of Cultural Interest should not be made under the category of Monument, but as a Historic Site. A Historic Site is defined as "the grouping of immovable assets, continuous or dispersed, clearly delimitable and with its own cultural entity and independent of the value of the singular elements that make it up". The main difference, in terms of management, is that the supervision and guardianship of the group can be delegated to the Town Council, provided that a Master Plan is drawn up which clearly guides or establishes the general criteria for action. We do not rule out proposing that the Paraninfo building in particular, as the most emblematic of the whole educational complex, could be declared an Asset of Cultural Interest under the category of Monument, under the direct supervision of the General Directorate of Heritage. It would be the first example of Modern Movement architecture to obtain this distinction in the Comunitat Valenciana.

6. CONCLUSIONS

With all the previously compiled infor¬mation, a synthesis of that data is undertaken. The results of the various studies and investigations have been coordinated in one single document set up so that the building can be considered from the greatest number of viewpoints possible.

This will allow interventions to be made on the building in a rational and well-informed way. In short, the aim here is to establish the basic objectives that any intervention must follow. Lastly, proposals will be made, based on the information gathered and the data synthesis undertaken. Intervention proposals are understood not as single solutions, but as the programmatic and management basis that later interventions should reflect.

The Conservation Plan for the Paraninfo of the Cheste Worker University will include a Management Plan for the building that can serve as a model for the entire complex. This plan, just like the usage proposal, will be drawn up during the Conservation plan process, supported by the Participative Process that forms part of the Conservation Master Plan's Methodology.

Thus, a participative management proposal will be designed suited to the management model that the agents involved agree upon as being the most appropriate. One outcome of that plan will be an organizational chart headed by the Generalitat Valenciana (Valencia Regional Government, the owner of the property). Also forming part of that chart will be the Ayuntamiento de Cheste (Cheste Town Council), the surrounding towns and public agents, and private and public individuals interested in the conservation, management and exploitaton of the center.

Commitments and responsibilities in drawing up the Plan will have to be agreed upon for the correct management, conservation, and use of the center, and management bodies will, when necessary, have to be created with their defined roles.
There is a total conviction that the setting up of our Conservation Management Plan will stimulate the appearance of other initiatives for future actions aimed at conserving other buildings belonging to the Cheste Worker University.

ACKNOWLEDGEMENTS

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PAPER #6.10

MOSTEIRINHO DE SÃO FRANCISCO IN PAUDALHO, BRAZIL: BUILDING TYPOLOGY ADAPTATION IN COLONIAL ARCHITECTURE

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ABSTRACT

The *Mosteirinho de São Francisco*, in the city of Paudalho (Brazil), is a unique example of Franciscan religious architecture that reflects a very specific historical context of the area. It was built during the period of Dutch domination of Northeastern Brazil (1630-1654), characterized by territorial disputes and religious persecution between Dutch (Protestants) and Portuguese (Catholics). Designed in this emergency context, the building was conceived with a simple and compact layout, adapting the typology and spaces of a Franciscan convent to the site and specific circumstances. An example of this is the addition of two connected aisles to the nave, providing an architectural *promenade* around this main space: a modest but ingenious adaptation of the cloister concept. Nowadays the building is completely abandoned, in an advanced state of decay and in a judicial process regarding its property. Even its heritage protection is at risk. This paper presents the results of an architectural research about this building with the aim of claiming the importance of its preservation.

KEYWORDS

Architectural heritage; religious heritage; building typology; Dutch Brazil; cloister.

1. INTRODUCTION

The Mosteirinho de São Francisco is located in the rural area of the city of Paudalho, in the province of Pernambuco, one of the first regions colonized by the Portuguese when they arrived in Brazil. The building is protected at a national level since 1966. It is included in the Municipal Master Plan as part of the Special Preservation Ensembles and Properties, and in the Zone of Historical and Cultural Interest since 2006. However, today it is abandoned, decayed, and its ownership is in dispute.
This paper presents the results of the analysis of its architectural typology, with the aim of enhancing the historical significance of the building and claiming its protection and preservation. It is part of the results of a broader study in which an exhaustive documentation of the building, and architectural and conservation analyses were performed to design a proposal for its adaptive reuse, taking into account the feasibility and with the purpose that this built heritage asset can contribute to the sustainable development of the area (Rolim, 2021).

2. HISTORICAL CONTEXT

According to Wätjen (1938), during the 16th century the Dutch had a good commercial relationship with Portugal and its colony Brazil, but that started to change after the Portuguese

succession war in 1580, due to the strict restrictions imposed by the new monarch on Flemish traders. From that moment the Dutch began to look for new trade routes and identified Brazil as an opportunity to increase their wealth and territory.

In May 1624, the Dutch began attempts to invade Brazilian territory and gained control of San Salvador, the capital of the colony, although inefficient management and a reduced fleet allowed a counterattack and the Portuguese recovered the city in March 1625. Four years later, the Dutch returned to Brazil stronger economically and with greater knowledge of the colony's weaknesses (Boxer, 1961). This time their target was Pernambuco, a rich territory and the most productive province, based on sugar cane cultivation sustained by slave labor (Wätjen, 1938).

In 1630, the Dutch naval force arrived in Olinda, capital of the province, a city built on a hill by the sea with a strategic port: Recife. The site had a population of 2-3,000 people and sumptuous churches from where missionaries departed to propagate the Christian doctrine and evangelize the natives of the region. Aware that his troops would not withstand the invasion, the Pernambuco's governor set fire to his warehouses and ships and fled inland. From there, he gathered troops, resources and war materials, and organized constant attacks against the Dutch (Wätjen, 1938).

Due to the defensive fragility of Olinda and the lack of supplies, the Dutch decided to abandon and destroy the city, and focus their defensive forces in the town of Recife, transforming the old port facilities into new fortifications (Wätjen, 1938). There they established the capital of what is known as Dutch Brazil (1630-1654), from where they conquered almost half of the European area settled in Brazil at that time (Fig. 1).

Religious persecution of Catholics by Protestants during the period of Dutch domination of Northeastern Brazil is reported with different points of view according to the author's origin or confession, so sources require careful consideration and using the least subjective data to obtain reliable conclusions. Jaboatam (1858) reports murders of Franciscans during the destruction of Olinda in November 1630, in the attempted invasion of the nearby province of Paraíba in December 1630, and in an attack to the Convent of São Francisco of Olinda in 1633. Wätjen (1938) states that when the Dutch settled in Recife they had orders to treat locals and especially clergy with kindness to avoid being labeled intolerants, and also relates that they did not try to impose Protestant doctrine or seize church property so that they would resume sugar production.

In 1634, Dutch authorities launched an amnesty for Catholics and Jewish to freely perform religious activities, which was not approved by Calvinists. Religious persecution continued and was further accentuated when the Dutch intercepted letters of support from Franciscans and Jesuits to the Portuguese governor, which led to the end of tolerance, the expulsion of the Jesuits and strict vigilance over the Franciscans as stated by Wätjen (1938).

The amnesty was reinstated during Count Maurício de Nassau-Siegen's government (1637-1644), until another alleged conspiracy of Franciscans, Carmelites and Benedictines was discovered in 1638, which led to arrest 40 friars and ban Catholic activities. After the Count's abdication in 1644, religious intolerance flared up: in 1645 Catholic leaders and parishioners were captured and killed in the massacres of Cunhaú and Uruaçu, conducted by Dutch troops with allied natives led by Jacob Rabbi (BBC, 2020; CRB Nacional, 2020).

Religious persecution continued until the expulsion of the Dutch in January 1654 and obviously affected religious architecture. When the Dutch arrived in Pernambuco in 1630, there were six Franciscan convents in the region: Convento de São Francisco, in Olinda; Convento de Santo Antônio, in Recife; Convento do Senhor Santo Cristo, in Ipojuca; Convento de São Francisco, in Sirinhaém; Convento de Santo Antônio, in Paraíba; and Convento de Santo Antônio, in Igarassu (Carvalho, 2009) (Fig. 1).

Most of them were abandoned, destroyed or transformed into defensive or military structures.

3. FRANCISCAN ARCHITECTURE IN NORTHEASTERN BRAZIL (1585-1630)

Franciscan convents of Northeastern Brazil are one of the most original examples of religious architecture in the country, since they combine Portuguese metropolitan models and construction standards spread by Jesuits. Logical but unprecedented solutions were used in their construction, seeking to adapt to the context and climate. As a result, a regional architectural school emerged whose knowledge spread through groups of specialized builders, as evidenced by homogeneous layouts and similar architectural elements (Bazin, 1956).

Topography and proximity to water sources played an important role in the selection of locations for the construction of convent complexes (Fernandes, 2013). It required long times, resulting in modifications and adaptations of the original projects. The initial core was generally the cloister, followed by the church and an exterior atrium with a distinctive cross that stood out in the landscape (Fig. 2).
The construction of a convent began with the cloister (Fig. 2), where the friars' cells were located. According to Fernandes (2013), square cloisters in medieval religious architecture have their origin in the Roman domus, in which life developed around a central patio with fountains and vegetation. Over time, cloisters acquired a spiritual function linked to prayer, silence and reflection. Symbolically, they represent the transition between earthly and spiritual life, and were also a burial place for Franciscans (Fernandes, 2013).

Figure 1. Map of Dutch Brazil (1630-1654) with existing Franciscan convents

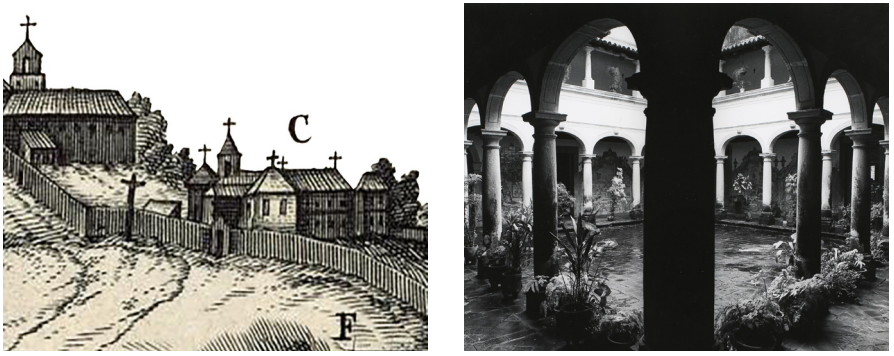

Figure 2. (left) Cross in front of the Olinda Convent, detail from "Views of Olinda and Recife" - Anonymous 1644. Source: (Koninklijke Bibliotheek 2022); (right) Cloister of the Olinda Convent in 1981. Source: (Rede de Arquivos IPHAN 2022)

In Northeastern Brazil, Franciscan cloisters of this period had two stories: the chapterhouse, and dining and study areas were on the ground or first floor, and the library and the friars' cells on the second floor (Bazin 1956). They were usually built in Renaissance style, although in many cases the classical columns were replaced by square pilasters supporting the arcades. All other buildings and spaces were located around the cloister. The church used to be on its left side, although there were some exceptions.

Churches have a single nave plan with a slightly narrower chancel (capela-mor) preceded by two side altars. The sacristy was located behind the church (Fig. 3), usually in a transverse direction spanning the width of the nave. According to Fernandes (2013), the sacristy was one of the most important places, where the priest prepared himself physically and spiritually before the ceremony and sometimes attended parishioners.

On the gospel side and running perpendicular to the nave was the chapel of the Third Order (Fig. 3), a brotherhood integrated by distinguished members of society, such as nobles, military and merchants. Originally, this chapel was connected to the nave of the church by an arched opening, although later in many cases, a direct outward entrance was added. As a consequence of the strengthening of the Third Order, in some cases side aisles were added to the chancel to allow visitors to access the sacristy without walking through the church (Fernandes, 2013).

The atrium (Fig. 3) was an outdoor extension of the church where people used to congregate and official announcements, festivities and some ceremonies took place. It was also used as a scenic space due to the importance of the Christ's Passion for the Franciscans (Fernandes, 2013). On a stepped pedestal stood the above mentioned cross, initially made of wood, which could be seen from a distance.

The churches had a bell tower located on one side of the facade, which consisted of a low pediment preceded by a porch or gallery, a typical element of rural chapels that was frequently used from the 16th to the 18th century (Fig. 4).

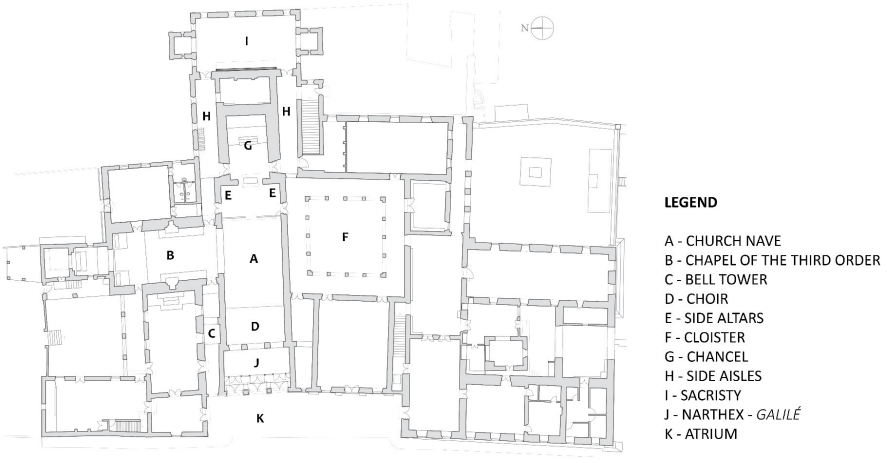

Figure 3. Ground floor plan of the Olinda Convent in its current state. Source: modified from (Aguiar 2009)

Figure 4. Igarassu Convent, detail of the painting by Frans Post, 1663. Source: (Thyssen-Bornemisza Museo Nacional 2019)

3.1. The Franciscan convents during the Dutch period

When the Dutch invaded Olinda in 1630, most of the friars of Convento de São Francisco fled with the Governor to the camp that the Portuguese resistance was building in Parnamirim. The convent was attacked after the destruction of the city and the friars who had remained there were killed or captured (Jaboatam, 1858). In 1635 the Parnamirim camp was seized by the Dutch and the friars had to move further inland to seek refuge in Mussurepe, a sugar cane mill run by Benedictine monks (Mueller, 1949). It has not yet been possible to verify whether the friars who built the Mosteirinho sheltered directly in Mussurepe after escaping from Olinda in 1630 or whether they all arrived after the attack on Parnamirim in 1635.

The friars of Recife also fled to the Parnamirim Camp (Jaboatam, 1858). The Dutch added walls and bastions to the abandoned convent and turned it into a fortress called Forte Ernesto,

and its church was used for Protestant worship until 1954 (Instituto do Patrimônio Histórico e Artístico Nacional, 2010).
The Convent of Ipojuca was occupied and converted into military barracks, but the friars could stay in private homes in the town and some Catholic services were allowed in the church. Sirinhaém was active until 1635, when it was taken by the Dutch. The friars fled to Bahia and the convent remained empty until 1649 (Jaboatam, 1858).
The Convent of Paraíba was active until 1634, when the friars were expulsed and they left with some parishioners to the Parnamirim camp. After 1635, the population returned to Paraíba and the friars remained dispersed in scattered mills or other Portuguese camps. Igarassu was active until 1632 and then the friars were expulsed until 1635, when they were able to return, although in 1639 they were accused of conspiring with the Portuguese and deported, leaving the convent empty until 1654 (Jaboatam, 1858).

4. THE MOSTEIRINHO DE SÃO FRANCISCO

When the friars from the Convent of Olinda were seeking shelter inland in the province, Bernardo Gonçalves Lobo, a mill owner devoted to St. Francis of Assisi, offered them part of his land to build a small hospice and chapel: The Mosteirinho de São Francisco. They remained there until 1654, when could return to Olinda after the Dutch expulsion from Brazil (Jaboatam, 1858).
The word *mosteiro* was used for Benedictine religious buildings, while Franciscan buildings were known as *convento* –or *conventinho*, in Portuguese diminutive. One of the probable causes of the anomalous name of the Mosteirinho de São Francisco could be its proximity to a Benedictine mill.
Mueller (1949) and Bazin (1956) suggest the Mosteirinho must have been part of a larger complex with similar characteristics to those of the Franciscan convents from the period before the Dutch invasion. However, no record of other buildings or their demolition has been found, nor any traces of foundations in the surroundings of the existing building. In addition, there is no evidence that the Mosteirinho was ever connected to any other structure, and its features are those of an isolated building. Its diminutive name in all records also seems to confirm that it has always been a small structure.
Based on the above premise and the study of the building, it has been found that the architectural typology of Franciscan convent underwent adaptations and simplifications in the Mosteirinho de São Francisco which, in light of the historical context, indicates that it was an "emergency" construction made to house Franciscan friars in times of war and religious persecution.

4.1. Building typology adaptation

The location of the Mosteirinho follows Franciscan principles: it is on top of a hill and very close to the Capibaribe river. Its plan is of a single nave, connected to a narrower chancel preceded by two side altars (Fig. 5), following the Franciscan standards influenced by the Jesuits (Fig. 5).
The main facade has a symmetrical composition with a triangular pediment and a central double wooden door. It faces a small atrium flanked by two buttresses with two attached benches (Fig. 6). According to Mueller (1949), the buttresses may be a vestige of an old front porch. Ahead of the atrium stood a wooden cross on a stepped masonry pedestal (Fig. 6). Beyond this standard Franciscan central axis, its distribution starts to be adapted in order to optimize and simplify spaces as much as possible.
While in other convents two aisles on the sides of the chancel served to access the sacristy, located behind the church, here they became primary spaces themselves: the sacristy on the gospel side and the consistory on the epistle side (Fig. 7).

Figure 5. (left) Main altar and side altars of the Mosteirinho de São Francisco in 1955. (right) Main altar and side altars of the Igarassu Convent in 1955. Source: (Rede de Arquivos IPHAN 2022)

Figure 6. (left) Front facade of the Mosteirinho de São Francisco in 1955. (right) Cross of the Mosteirinho de São Francisco in 1984. Source: (Rede de Arquivos IPHAN 2022)

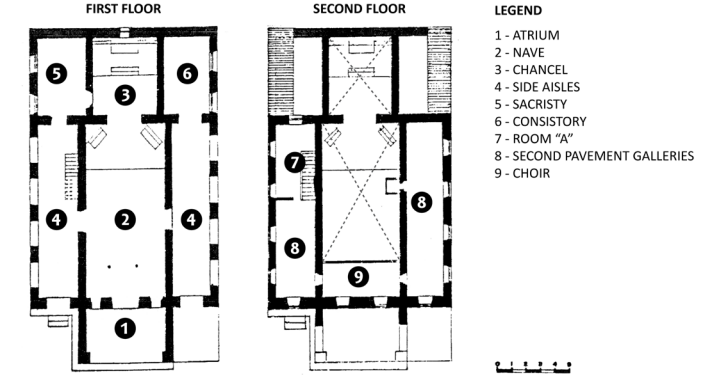

Figure 7. First floor and second floor of the Mosteirinho de São Francisco. Source: modified from (Fundação de Desenvolvimento Municipal do Interior de Pernambuco 1982)

Two halls connected to the nave and opened to the exterior by arches, some of them with benches for seating (Fig. 8), work as a simplified version of a cloister. These spaces served at the same time as circulation areas, since they connect the nave with the other dependencies of the convent. As in traditional cloisters, these corridors had an upper floor where the most private rooms were located, but instead of facing a central patio, in this case they are opened outwards through arcades (Fig. 8), another indication that the building was an isolated structure.

The typical bell tower of Franciscan convents of this period (Fig. 9), according to Bazin (1956), is replaced by a simpler bell gable, although in this case located on the epistle side instead of on the gospel side. Today the Mosteirinho has two bell gambles, one on each side of the facade and over the arches opening the side "cloister-halls", but old photographs (Fig. 9) and some documents (Barros, 1949; Mueller, 1949) evidence that it originally had only one.

In 1954 the Diretoria do Patrimônio Histórico e Artístico Nacional (DPHAN), now Instituto do Patrimônio Histórico e Artístico Nacional (IPHAN), added another bell gamble on the gospel side to achieve a symmetrical facade and possibly influenced by Viollet-le-Duc's restoration theories, popular at the time (Silva, 2017).

Figure 8. (left) Benches in the lateral aisle of the Mosteirinho de São Francisco in 1966. (right) Lateral facade of the Mosteirinho de São Francisco in 1955. Source: (Rede de Arquivos IPHAN 2022)

Figure 9. (left) Igarassu Convent in 1637, detail of engraving no. 11 by Jan van Brosterhuyzen after drawing by Frans Post, 1645-1647. Source: (Rijksmuseum 2020); (right) Front facade of the Mosteirinho de São Francisco in 1954. Source: (Rede de Arquivos IPHAN 2022)

5. CONCLUSIONS

The architectural layout of the *Mosteirinho de São Francisco* is the result of an ingenious adaptation of the Franciscan convent typology that reflects the convulsive historical context in which it was built. In its design, the basic components of the Franciscan convents of Northeastern Brazil of the late 16th and early 17th centuries are reduced and highly simplified. Only the essential parts remain and a very compact layout is achieved, allowing the main functions of a convent by using the minimum possible elements and optimizing the resources.

The current state of degradation of the building has already caused it to irreparably lose part of its values and threatens to completely lose a cultural heritage that is primary testimony of such a relevant historical period for the cultural development of the province and the country.

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PAPER #6.11

SUSTAINABLE DESIGN PERSPECTIVES FOR HERITAGES' RECONSTRUCTION

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ABSTRACT

Natural disasters and conflicts effects, on a large scale, on communities and their heritages, together with the semantic expansion and democratization of the concept of heritage itself, have determined recently a shifting attitude towards the idea of reconstruction. The contribution, moving through theoretical positions and operational experiences, intends to explore the role and perspectives of design for heritages' reconstruction, framing this crucial issue between contemporary urgencies and sustainable development scenarios promoted by the Agenda 2030 and its SDG. The intense ongoing debate, also in the design disciplines, shows the need for a reflection on reconstruction, seen, without prejudice, as a design possibility for communities to imagine different forms of existence for their destroyed heritages. But also, to understand approaches, methods, tools and ways through which the project shapes reconstruction. Through a series of emblematic case studies, which move between re-building and re-constructing and their reciprocal overlaps, this contribution will also highlight the "order of similarities" that each reconstruction project interprets within a sustainable development framework. Both built an un-built projects will be presented as possible references to orient a debate and a critical reflection on contemporary heritage reconstruction, seen as strategical for heritage enhancement and an opportunity for promoting sustainable development for places and communities.The proposal for the International competition on the Buffer zone of the UNESCO site of Villa Adriana will be presented as a design experimentation, showing how sustainability could inform design strategies for reconstruction according to global agendas[1] .

KEYWORDS

Vernacular architecture; conservation; heritage; urban integration; absorption.

1. INTRODUCTION

Large-scale conflicts and present and potential natural disasters not only show the fragility of heritage in general, but also of that special category of places recognized as World Heritage (WH) Sites. The destructions that have affected UNESCO sites in Iraq, Syria, Yemen, etc., have, in recent years, renewed interest and re-energized the debate about perhaps the most controversial practice for those involved in heritage design: reconstruction. And UNESCO sites, precisely because of the experimental dimension, concerning innovative approaches, methods and practices of management, constitute

an interesting field of research for the reconstruction topic. Through specific cases and interdisciplinary debate between UNESCO, its advisory bodies and those involved in heritage studies, emerged a shifting attitude towards the reconstruction projects, from the issuance of the *Carta di Venezia* (1964), which depowered its as a design possibility concerning heritage. The conteporary scale and scope of destructive events, together with the redefinition of the concept of heritage, call for an a new approach towards reconstruction, including through a redefinition of the concepts of authenticity and integrity as well as, in the case of UNESCO sites, of the Outstanding Universal Values for the site reconstructed or to be reconstructed. The ancient city of Sana'a in Yemen, a UNESCO WH Site since 1986 and included since 2015 in the list of WH Sites in Danger, has been subject in recent years to bombings, explosions and firefights and, in 2020, to exceptional rainfalls, an effect of contemporary climate change, which have produced massive destruction of an heritage by its very nature fragile. A heritage made up of mosques, hammams and more than 6,000 houses made of dried brick that a exhausted population is rebuilding by resorting thanks to traditional building techniques, making them alive. Although the reconstruction of the Yemeni city is a borderline case for a number of reasons-primarily the autonomy and cultural autarky of a country that is not as highly globalized-it highlights a number of crucial issues that, at different times, have run through the debate on the reconstruction of UNESCO sites and whose redefinition with respect to the current cultural context represents one of the major challenges for the international body in the near future. Why reconstructing? For whom to reconstruct? What role in the present and future of reconstructed heritage? What the meaning of concepts like authenticity and integrity for a reconstructed site? What balance between tangible and intangible dimensions in the reconstruction process? If and how can the local and global dimensions find a synthesis? How to reconstruct? How to cope with documentary uncertainty, which is often frequent in marginal contexts? How to ensure the preservation of heritage while improving the conditions of those who inhabit the places? Within this problematic framework, the aim of this contribution, intersecting positions elaborated in the UNESCO framework and case study of reconstruction included in the WH List, will be to understand what are the current trends and future perspectives concerning reconstruction; what is the possible role of the contemporary project for reconstruction, with a focus on its sustainable dimensions, inside global agendas framework.

2. RECONSTRUCTION. A SHIFTING ATTITUDE

An important premise concerns the critical redefinition of the concept of heritage over the past three decades, which has seen its processual and participatory dimensions consolidated, partly because of the role accorded to the intangible dimension. Heritage is dynamic; destruction and reconstruction are the extreme events in a process of continuous modification of heritage. Moreover, the latter is the result of cultural significance processes in the hands of communities that recognize in what they had inherited a value system based on their own needs, redefining its role, meanings and purposes (Bandarin and Van Oers 2012, 178) in the present and for their future. Heritage status is not inherited a priori, it is extrinsic; how to transmit the values attributed to it and, in the case of a destroyed site, the possibility of rebuilding it, is a process that can be activated by communities in the present. The scale and acceleration of destructive events require 'change management' and a consequent redefinition of preservation

practices (ICOMOS 2019, 41) with respect to the contemporary socio-cultural condition. Both the negotiation of loss, mediated for example also through virtual reconstruction, and the physical reconstruction of the destroyed or altered asset are possibilities within the process of transmitting the values associated with it, according to an approach that puts local communities, their needs and desires in the present at the very center. Especially today when heritage, and culture more generally, is recognized as playing a crucial role in post-disaster social and economic reconstruction processes, promoting forms of resilience and sustainable development (UNESCO and World Bank 2018) that integrate local and global dimensions.

> All reconstruction work should however be ruled out "a priori". Only anastylosis, that is to say, the reassembling of existing but dismembered parts can be permitted. (ICOMOS 1965, art.15)

In the "Operational Guidelines" for the inscription of a site within the UNESCO WH List, reconstruction:

> "[...] of archaeological remains or historic buildings or districts is justifiable only in exceptional circumstances. Reconstruction is acceptable only on the basis of complete and detailed documentation and to no extent on conjecture." (UNESCO and WHC 2015, par.86)

The Venice Charter has profoundly influenced the documents of Unesco and its advisory bodies, outlining the scope and modalities for WH sites' preservation, and with it marginalizing reconstruction among possibilities for heritage transmission. The exceptional nature of the circumstances in which it could be contemplated as an operational possibility, actually, prevented the flourishing of a debate that would clarify issues or at least define the limits within which it was possible to operate. In subsequent years, attempts will be made to better specify the conditions that make reconstruction possible, opening, however, to further interpretive problems:

> [...] where reconstruction is necessary for the survival of the place; where a "place" is incomplete through damage or alteration; where it recovers the cultural significance of a place; or in response to tragic loss through disasters whether of natural or human origin; and providing always that reconstruction can be carried out without conjecture or compromising existing in situ remains, and that any reconstruction is legible, reversible, and the least necessary for the conservation and presentation of the site. (ICCROM 2000, 258)

It is difficult to say how much, even if endorsed by scientific documentation, a reconstruction operation can be conducted 'without conjecture' since subjective interpretation is the basis of any design process, and therefore also of reconstruction (Semes 2009, 167); as well as it is rather difficult to always guarantee the reversibility of the intervention. Doubts remain as well as the highly restrictive (Petzet 2009, 19) and material-focused position concerning reconstruction which is allowed

> only where a place is incomplete through damage or alteration, and only where there is sufficient evidence to reproduce an earlier state of the fabric. In some cases, reconstruction may also be appropriate as part of a use or practice that retains the cultural significance of the place.(ICOMOS 2013,7)

However, in the light of destruction of different kinds that threatens the survival of the cultural significance as well as the material dimension of many sites of global interest, the need for a

changing approach emerges from the intense debate that has been generated. Redefining the theoretical and operational framework that the destruction/reconstruction dialectic activates is one of the greatest challenges in the near future for UNESCO and its advisory bodies. The propagated exceptionality of the Warsaw's reconstruction (Jokilehto 2013, 2) does not seem so, given the number of sites affected by this practice. The Polish case study (1980) was followed by others: the monastery of Rila (1983), the mosques and mausoleums of Timbuktu (1988), the walled city of Carcassone (1997), the mausoleums of the Buganda kings (2001), Bam and its cultural landscape (2004), and the Bridge of Mostar (2005). In addition to these sites are those that will be subject to reconstruction in the future, as in the case of the cities of Sana', Aleppo, and Palmyra whose destructions have had a strong impact on world public opinion. The case of the Warsaw Old Town has, in fact, set a precedent, for example, for the reconstruction of the Mostar Bridge (ICOMOS 2005, 182). Meticulously destroyed by Nazi reprisal in 1944, its recognition concerns the scale and techniques employed in its reconstruction (about 85 percent of the historic core had been destroyed), a symbol of a patriotic feeling among Polish people; its authenticity

> may not be applied in its strict sence. [...] Its authenticity is associated with this unique realization of the years 1945 to 1966 (ICOMOS 1980, 2)

While the methodology adopted involved a reconstruction of buildings datable between the 14th and 18th centuries through meticulous documentation and interdisciplinary collaboration, the reconstruction proceeded selectively towards certain urban facts, also reducing the urbn density to create quality public spaces, following the principle that would later be summarized in the expression "Build Back Better" (UNISDR 2017). It is difficult to say whether this is a reconstruction or rather a re-creation aimed at maintaining cultural significance and simultaneously improving the quality of urban spaces in the historic center, integrated into a more general project of reconstructing the contemporary city. It is certainly far-sighted, moreover, the definition of the site's authenticity contained in the justification for inclusion on the WH List, which is not rigidly concerned with its material dimension, but rather with its realization that it has strengthened the relationship of continuity through use between the urban heritage and its community.

3. TOWARDS DYNAMIC AUTHENTICITY

Since its introduction in the Preamble of the Venice Charter (1964), authenticity has been assumed as one of the fundamental criteria for the inclusion and permanence inside the WH List for a site that must "meet the test of authenticity in design, materials, workmanship or setting"(UNESCO and WHC 1983, 8). Closely linked to the material dimension in a Eurocentric perspective, it had been later questioned, for example regarding the reconstructive practice of Shinto temples in Japan in which

> authenticity being essentially attached to function, subsidiarily to form, but by no means to material" (Pressouyre in Jokiletho 2013, 3)

In fact, in some cultures, the desire to reconstruct has a different value, depends more on the intangible dimension, as in the case of the cyclical demolition and reconstruction of the Ise temple in Japan, a ritual of renewal that enables the preservation and transmission of heritage. Temple architecture is not a fake, it is authentic contemporary architecture, the result of a system of traditional knowledge and practices that re-create what is intentionally missing.

The debate that had arisen found its synthesis in the "Nara Document of Authenticy" (1994), which broadens its gaze from a Eurocentric, material view, placing greater emphasis on the dynamic dimension of authenticity and cultural diversity:

> It is thus not possible to base judgements of values and authenticity within fixed criteria. On the contrary, the respect due to all cultures requires that heritage properties must be considered and judged within the cultural contexts to which they belong.(ICOMOS 1994, art.11)

Moreover, the concept of authenticity is not an a priori; coherently with a vision of heritage as dynamic and processual, it's a mutable human construct, affected by a continuous redefinition in the present (Bortolotto 2007, 42), starting from processes of cultural significance, activated by communities in places. Although the Nara Declaration had a considerable impact in the processes of value assignment, the emphasis on the tangible dimension and the dogmatic tone against the reconstruction for WH sites, or at least its character of exceptionality, continues to be prevalent: reconstruction continues to be considered a mystification of the traces of the past, however, to be contextualized with respect to the cultural substratum of belonging and to be shared through the participation of local communities and groups. More recently authenticity has been defined as

> the ability of a heritage place or site to express its cultural significance through its material attributes and intangible values in a truthful and credible manner. It depends on the type of cultural heritage place and its cultural context.(ICOMOS 2017, art.1)

So what authenticity for UNESCO Heritage sites that have been reconstructed or are to be reconstructed? It is the "continuity that sustains and guarantees authenticity" (UNESCO 2004, 168) of a reconstructed site; it is the permanence of its cultural relevance and in the use made of it by the community, through processes of value assignment that over time guarantee its authenticity, in a transformative vision of heritage but also of the concept of authenticity itself, understood as 'progressive authenticities' (Jerome 2008, 4) recognizing its stratified dimension. One example is the reconstruction of the mausoleums in Timbuktu. The reasons why it was decided to reconstruct about 20 mausoleums between 2013 and 2015 lies in the role that these places have had but especially have in the present with respect to local communities. The destruction perpetrated intentionally disrupted a continuity in the use of these places that local communities felt needed to be overcome through reconstruction, assigning these places a symbolic value of reconciliation as well. The local communities were involved by UNESCO in the reconstruction process based on the collection of extensive documentation regarding the state of the places but also of rediscovery of traditional building techniques; a working methodology was developed with a strong degree of participation in which local knowledge, also reworked with the contribution of contemporary technical knowledge (for example, to safeguard the reconstruction from the future effects of climate change) according to the needs of the present became the crucial point. The extent of destruction in some cases makes it difficult to recognize reconstruction from the 'archaeological' datum, but the primary goal was to reconstitute a traumatically interrupted continuity of use to the community, ensuring its integrity. The Mostar Bridge and the historic center in which it is embedded are interpreted as an expression of cultural continuity, as well as a symbol of dialogue, cooperation and rebirth. The criteria for its inscription include:

> is an exceptional example of physical reconstruction and cultural and historical rehabilitation, and this realization process (1999-2004) is now a part of city's identity and authenticity" (ICOMOS 2005,7),

recognizing that principle of dynamic authenticity introduced by the Nara Declaration. The 're-appropriation' of the artifact to its community inspired the process; reconstruction, we read between the lines, is part of the palimpsest of the compendium and as such the traumatic event and re-construction are part of the history that binds the community to the places.

4. INTEGRITY AS COMPATIBILITY AND DIFFERENCE

Introduced in the Operational Guidelines, the concept of integrity is defined as "a measure of the wholeness and intactness of the [...] cultural heritage and its attributes" (UNESCO and WHC 2015,18). As related to the material and especially visual dimension, the integrity of a site, we also speak of visual integrity, is interpreted as the absence of change detectable by the human eye from an original stage or assessed as relevant. Hence the need for any intervention on heritage, and therefore also on reconstruction, to be compatible and visually distinguishable from the archaeological-patrimonial datum in order not to compromise the integrity and Outstanding Universal Values of the site. The issue of integrity, then, which has become relevant to transformation processes both within UNESCO sites and in their immediate vicinity, is also crucial with respect to the reconstruction of a destroyed site, and requires further reflection. Although the visual reading continues to guide the prevailing approach in UNESCO, some specific cases of reconstruction show the emergence of a more current reasoning on integrity, the result of a more complex vision, sensitive to differences, capable of accommodating social and cultural, material and immaterial dimensions. The experience of reconstructing the citadel of Bam and its cultural landscape in Iran, which, badly damaged by an earthquake in 2003, was placed on the WH list the following year to ensure its transmission into the future, can be read in this framework. Initially covering only the citadel, a very important example of earthen architecture, the perimeter was extended to its cultural landscape, made up of desert areas, rural landscapes, and the water infrastructure that enabled its development, traditional settlements, and contemporary Bam, included in the Buffer Zone. Here the concept of integrity was interpreted from a socio-functional perspective that involved the identification of functions and processes that have shaped the landscape over time such as people flows, social interactions, cultural processes, belief system, resource use, etc. The spatial identification of the elements currently present expression of these uses and processes enabled the definition of the structural integrity of the landscape as a whole, interpreted as a living landscape. The Bam case shows how a holistic view of the concept of integrity can contribute in understanding the Ouv of a place and a management of the trans-scalar reconstruction process from the intangible dimension of heritage and how reconstruction itself can be understood "as a chance to perpetuate the living identity of Bam" (UNESCO and ICOMOS 2004, 4) The destruction produced by the earthquake made it possible to deepen the archaeological knowledge of the place, to rediscover forgotten building techniques that together with those still in use and the contribution of scientific knowledge, made it possible to develop re-constructive techniques that improved the seismic behavior of the reconstructed buildings. Here it emerges how the intangible dimension of

Bam's heritage as uses, practical knowledge, and traditional building techniques become the foundation for a re-building process that moves at different scales and that, based on cultural signification processes that communities activate on the basis of present needs, are able to translate living heritage into the future. From the experience in Bam's cultural landscape, the above definition could be revised as follows for sites under reconstruction processes:

> Integrity is a measure of the compatibility and distinction of the re-created cultural heritage and its attributes. (Khalaf 2018,10).

The critical categories of compatibility and difference can be interpreted as criteria for defining the integrity of a re-created site, moving beyond the currently prevailing material dimension in favor of the intangible one.

5. SUSTAINABLE RECONSTRUCTIONS. A RESEARCH BY DESIGN EXPERIENCE

The design experimentation on Villa Adriana Buffer Zone (Basso Peressut and Caliari, 2019) intents do deal with the issue of reconstruction through the aforementioned critical categories of transformative continuity, progressive authenticities, compatibility and difference, between heritages' tangible and intangible dimensions; it intends to pose questions, identify approaches and tools to orient a sustainable reconstruction process inside the UNESCO perimeter and beyond. Inside the Buffer Zone, intepreted as an experiemental laboratory, our proposal tries to re-connect heritages and fragments of traditional landscape, tangibile and intangible dimension, global/ local contemporary needs and challanges, with the objective to enhance resilience and support sustainable development strategies inside a very frigile economic, social and environemental context. Interstecting complex topics such global issues, cultural landscape and sustainable recontruction requires an ecological and interdisciplinary approach to heritages inside global agendas framework (UN Agenda for Sustainable Development 2030, the New Urban Agenda, the Sendai Framework for Disaster Risk Reduction, the Paris Agreement, and others). The design process starded from a recognition of cultural significance communities recognize to specific places but also from and inquiry of present and potential fragilities. During interviews and meeting with local community emerged the traumatic sence of degradation/destruction and also sence of loss, concerning traditional rural/archaeological landscape and the need to overcame it and recall its traces in the present; an other issue concerns the desire to enhance the quality of life for community, also implenting public accessibility to open green/rural spaces and archaeological sites. A simoultanously top-down bottom up cultural mapping process derived, which led to indentification of critical places that became part of a dynamc operational topography for sustainable reconstruction. Re-generation of abandoned or degradated places became the occasion to experiment sustainable reconstruction inside this cultural landscape, through strategical actions which intepreted reconstruction through different degrees of transformative continuity compared to what exists/ had existed in places and local communities desideres. These actions represent an abacus of possible design solutions that communities could elaborate in time inside this living landscape in a socio-ecological perspective.These action are supported by a dynamic knowledge of this landscape, which connects past uses and morfologies, with present and potential pressures and risks (i.e. soil erosion, water scarcity, climate changes impacts), present and future needs, interwaving scientific and traditional knowledge.

Figure 4. a) Histogram of height integration; b) Graph of urban fabric integration; c) Picture of the alquerías in Olba street. Source: (Gosselin 2022)

With this approach, the masterplan (Fig.1) is concieved as an open project in which replaces the Grande Villa Adriana territory inside its own field, subtracting it from the spreading no-place, in order to give it back to the meanings place, that lives the relationships between human being and natural environment. A contemporary *locus amoenus*, that looks into the relationship between antiquity and contemporary without romantic sense, configuring a possible future where past and present are recomposing with continuity. The idea of transformative continuity lies in an overall logic – unitarity but not totalizing – capable of linking nature and artifice. This is the biggest lesson that we can draw from Villa Adriana: beyond the formal quality evoked by its powerful ruins, its plan suggests that the settlement principle of architecture (dispositio) determines the transformation of a place, its managing the inhabit. And this lesson is a current issue today. The project identifies differents gradients and ideas of reconstruction, that correspond as many to different actions on the landscape. Outside, into the Buffer Zone, the project aims to redefine the relationship with the Aniene river, which has been denied by the most modern constructions that have favored the 'via Maremmana' as a settlement principle. Two different, overlap and relating layers rule the design proposal. The first, hypogeum or the 'under-ground one', follows the direction of via Maremmana, that becomes an underground and distributional internal street. At this level are placed the commercial facilities, parkings and service spaces of the hotels. The second layer, of the 'upper-ground', derives from the existing directions of trees and the transverse east-west axis, that links the exedra of the 'Pantanello' with the main entrance of the Villa (retracing the track of the modern one drawn by Piranesi) and finishes in the Travertino quarry beyond the Aniene. This axis is not only an infrastructure: it is a sequence of remarkable places that starts from Villa Adriana, it passes through the *Domus agricola*, the *Porta al Parco*, the commercial Hub and the visitor center, it reaches the travertine quarry, the Aniene and the renovated paths that lead to Villa d'Este. The 'under-ground' and 'upper-ground' layers are strongly related, creating tension in the vertical section ("*from the ground to the sky*", as Marguerite Yourcenar said) thanks to courtyards and holes that allow lighting and air diffusion inside the hypogeum spaces, as the roman architecture way. All the architectures are inspired by the compositive and typological principles of Villa Adriana, applying the 'enclosure' issue in its different morphological shape. Inside the Villa, in the archaeological area, the project thinks about a different form of reconstruction, formal and ideological, which reaches the completed forms of the ruined architecture through the rewriting of the same compositional elements that distinguish the architecture of the Villa. So the new volumes of the new Museum (on the terrace of Antiquarium faced on the Canpo), the Library and the Hall

(in the Plutonium area) and the Archeological Village (on the terrace of Pretorio) , are simple shaped as pure volumes, inspired by the ruins. They are conceived with low prefab technolgy, with wood or steel structure and hardwood pannel coating. The construction is intended in the classical sense: a strongly expressive action toward the 'exact construction' in which architectural shape, built shape and materials are involved. Finding the 'new' Grand Villa Adriana.

6. CONCLUSIONS

As just described in the research by design experience, destruction and reconstruction are the extreme events in a process of continuous modification of heritage, reflected in the changing of both its material dimension and in the values over time assigned to it by community generations. What is reconstructed is a work of contemporary re-creation (Grimmer in Khalaf 2018, 3); it belongs to the contemporary layer of the heritage palimpsest, reinterpreted through a design process that 'exchanges' with the social, cultural, economic, and even physical context, and whose outcome is an expression of the needs and desires that the community projects onto the rebuilding asset, as a result of processes of cultural signification in the present. The concepts of authenticity and integrity turn out to be difficult to apply to reconstructed sites when referred predominantly to its material dimension; rather, by leveraging the importance assumed by the intangible in heritage processes, these concepts can be respectively interpreted through the categories of continuity, compatibility, and difference, for that matter present within the Venice Charter (Kalhaf 2018, 202). It is continuity that ensures the 'sence of place' of a site; compatibility and difference are measures of the change introduced by the contemporary layer. Reconstruction is a contemporary project of construction, developed on the basis of an 'ancient' palimpsest. In light of the framework albeit briefly outlined, the contribution that the architectural discipline and its design can offer in the reconstruction of damaged/ destroyed heritages appears to be broader than that expressed so far in these contexts, establishing itself as a shared space and a place of confrontation between the different disciplines that work for heritage; a contribution that looks at reconstruction in a complex sense, capable of supporting processes of reappropriation and re-interpretation of the heritage palimpsest in light of the local/gloabl needs of the present so that "when changes occur it is not entirely at the cost of cultural continuity." (Appadurai 1981, 2018)

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NOTES

[1] The paper is the result of a collaboration between the two authors and reports reflections developed in different research experiences. Introduction and conclusion paragraphs are common; paragraphs two and three are attributed to A. Raffa; paragraphs four and five to V. Tolve.

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PAPER #6.12

TECHNICAL, CONSTRUCTIVE AND ECONOMICAL FEASIBILITY TO TURN OFF-GRID AN EXISTING BUILDING

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ABSTRACT

Existing educational buildings built with old normatives suffer a lack of technology, even though they are the frame of reference for our future society's architects(/builders). These buildings, usually promoted by the public sector, don't have significant economic investment, even if they are going to affect our children's world perception. The object construction of this study is a building from 1978. It has an educational use located at the Pamplona campus of the Universidad de Navarra. The building is part of the Living Lab of the Campus, where technologies, solutions and strategies can be proved It is a protected building by the "Documentation and Conservation of buildings, sites, and neighborhoods of the Modern Movement" (Do. Co,Mo.Mo.), so all actions that can affect its aesthetic aspects need to be justified because of the value of the building. The methodology presented concerns the development of a replicable technical, constructive, and economical feasibility model to reach an off-grid disconnection of an existing building. The steps followed for this study are classified in seven main steps. This proposal aims to define a replicable solution that is going to be applied to other buildings of campus Universidad de Navarra in Pamplona.

Even that the first solution is going to be limited by the aesthetic aspect, the final objective is to develop a Plug & Play solution following the methodology, answering the energetical deficiency and complexity of existing constructions.

KEYWORDS

Off-grid; plug&play; existing; building; efficiency; saving; refurbishment; integration; renewable; replicable.

1. INTRODUCTION

Buildings are responsible for 40% of the total energy consumption, according to the United Nations Environmental Program (UN Environment 2019). Thus, the concern around energy usage in buildings has been under focus; fossil fuels still being the world´s most used energy source, alternatives to their consumption are among the primary policies in consideration.

Buildings need to be refurbished, and not for aesthetical or economic reasons. It is just part of their normal life cycle. This necessity is explained in the document of the "renovation wave," where they argue that 85% of the building stock has been built before 2001. Furthermore,

85-95% of the existing building will still be in use in 2050. A proposal of the Climate Target Plan 2030 has been the reduction of greenhouse gas emissions in the European Union by 55% at least by 2030 (European Commission 2020).

> Energy efficiency is essential for action, with the building sector as one of the areas where efforts must be ramped up.

This demonstrates and measures the contributions of refurbishing our buildings. Energy technical saving shows that there can be around 30-60% in various Member States. The saving on energy consumption and the reductions of CO_2 (?) (Mata, Kalagasidis, and Johnsson 2018).

The public sector, in particular educational institutions, needs to step up and be a referent. In this context, it is important to remember that this type of building influences students directly through its interior and exterior layout, and could foster the creation of an atmosphere conductive to learning, as well as an awareness of what we need to do . (Le et al. 2018). This is already possible at new buildings, since they have the technology of control, actual building services and elevated enclosure requirements. However, historical buildings used by many education institutions would require an energy efficiency evaluation, as well as effectiveness and sustainability refurbishment solutions (Balocco and Colaianni 2018). 17% of the nonresidential buildings in the EU, are educational constructions under public control. They have high impact, public visibility, and can show a best-practice example (Österreicher 2018).

The main problem of a successful building retrofit is the complexity of the whole process. As Ma et al.(Ma et al. 2012) explains, it is not just about money. There are some key elements that have significant impact on building retrofits, including policies and regulations, client resources and expectations, retrofit technologies, building specific information, human factors and other uncertainty factors.

2. OBJECTIVES

The Universidad de Navarra's 2025 Strategy aims to contribute to the attainment of the challenges posed by society through its work researcher, professor and assistant, and in collaboration with other actors and institutions. Sustainable development and care for people and the environment are the point of reference for the orientation of its projects. Thus, sustainability in its triple dimension -environmental, economic and social- becomes the transversal purpose of the entire Strategy 2025 of the Universidad de Navarra and the projects to which it gives rise will be aligned with the Sustainable Development Goals. (Navarra n.d.) This study is focused on the School of Architecture at Universidad de Navarra from Pamplona, a city in the north of Spain where the climate regarding the Döppen Geigger classification is considered Cfb (warm temperature, fully humid and warm summer), has an average of 27 ºC (80,6 ºF) of maximum and 2 ºC (35,6 ºF) of minimum. Built atop a tufa -a variety of limestone- plateau, with an average solar radiation of 1.000-1.300 kW/m2 and main northern wind of 5-10 m/s. The building of 1978 is located near a small river, in the south part, down the hill, of Pamplona (Fig.1). The building orientation is NNE-SSW and is surrounded by trees of high elevation with a car park at the West side. (Fig.2)

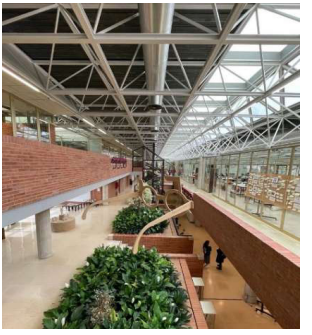
Following the Living Lab project on the Campus, this building will become the seed for diverse actions, showroom of solutions and technologies that are going to be replicated in other buildings of the Universidad de Navarra.

Even though the building is 44 years old, it maintains its contemporary character (Fig.3, Fig.4). The construction follows a perimetral brick enclosure with external concrete pillars that support the metallic roof. The section shows the complexity of the building (Fig.5). The internal surface distribution is homogeneous with a big and open central space. In total it has 9.486 m^2 (102106,5 ft2) distributed in four floors. All the complete nformation of the building characteristics can

be found at XL book of Tárrago and Cidoncha (Tárrago and Cidoncha 2020). Other relevant and conditioning aspect of the building is that it is catalogued at the Do.Co.Mo.Mo. It means that actions related to the aesthetic aspect that affect the image have to be limited and will need to be justified.

The final objective is to create and design a replicable Plug & Play solution for existing campus buildings at the Universidad de Navarra. The School of Architecture is going to be the pilot project to study and incorporate different solutions replicable in other buildings and thus becoming off-grid constructions.

Figures 1, 2. Left image of Pamplona and the Campus Universidad de Navarra. Right, image of School of Architecture



Figures 3, 4. Image of the exterior and interior of the School of Architecture at Universidad de Navarra

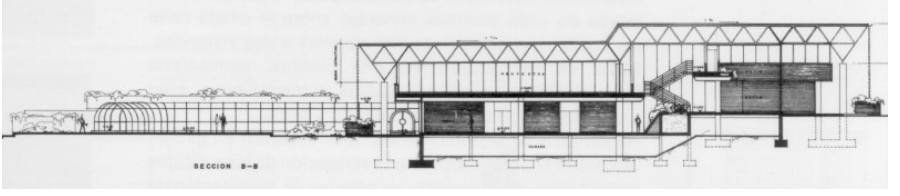


Figure 5. Section of the School of Architecture at Universidad de Navarra

3. METHODOLOGY DEVELOPMENT

To create a replicable solution, it is necessary to develop a methodology that defines the best technical and economical solution for building grid disconnection.

1. Energetical analysis. It can be gathered from the data of the electrical and thermal consumption, from an evaluation of heat losses and from a digital simulation. Thus, construction and building services are analyzed and evaluated from different levels of precision.
2. Reduction of energy requirements. It's the reduction of the effort that needs to be done to maintain certain conditions in the interior space. Adjusting the operating mode of the building and users into a more energy-efficient one, as well as following technical recommendations of referential institutions, affects positively into energy needs of the construction. The reductions can be seen in electrical and thermal consumption and in interior space requirements.
3. Space distribution for current and future needs. A correct space distribution adapted to the use of the building, can be perceived when minimum energy is required. This minimum is going to be quantified by comparing the effort required to maintain a comfortable range in other building spaces.
4. Renewable energy resources. Study compatible and more efficient energy sources depending on the characteristics of the building and its surrounding space. Production and accumulation, commercial solutions, and disruptive technologies.
5. Match requirement and production. Calculations of demand and production to determine storage needs of thermal and/or electricity energy.
6. Control development. Optimization of energy control system of the building, with a correct control of energy use and needs.
7. Integration of plug and play solution. Creation of a replicable element, with its relative parametrizations that can "off-grid"- existing buildings. Technology implementation with capacities to develop more.

4. DISCUSSION

The replication of the developed methodology in a timeline can be seen in the following image (Fig.6). Starting from an energy audit, followed by energy reduction actions, a study of renewable energies, planning of spatial distributions and the development of control and a plug & play solution. As a result, if the methodology is correct, by 2025 the School of Architecture will be off-grid. Thus, the followed steps are going to be implemented at the Campus Universidad de Navarra by 2030.

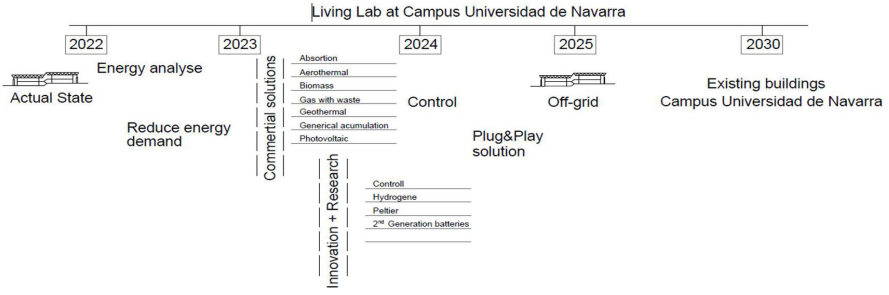


Figure 6. Process of the working scheme of this proposal at the School of Architecture at Universidad de Navarra

4.1. Energy consumption

The first step is the energy audit of the building. The process concerns the construction and building services of the School of Architecture. The electrical consumption (lights, computers, devices and HVAC system) during 2021 has an average of 60 kW, the maximum being 195,76 kW and the minimum 8,52 kW. Figure 7 shows the energy needs during 2021. Adjacent to it, the gas consumption is detailed at figure 8, needed to boilers.

There is a particular highlight found during the energy audit, the schedule of HVAC machines and temperatures; during the heating period, the air handling unit injected air into the ducts at 60ºC (140ºF), which is a unnecessary (if the system works correctly) and risky action due to burns and flames. Some findings, such as faulty machinery, uninsulated and broken ducts were found as well. More details of HVAC system can be found at the publication "El aire acondicionado como factor de diseño en la arquitectura española: Energía materializada" pag.316-321 (Martín-Gómez 2014).

In conclusion, we could observe and demonstrate the high energy loss due to the inefficient properties of the building's enclosure (lack of insulation, thermal bridges and ancient windows). This result can be extrapolated to other buildings that also have those deficiencies. Furthermore a lack of adequate use of building services, such as poor condition of ducts and machines (Fig.9) are contributing to this consumption data, forcing the need to overheat the spaces to attain a correct temperature at the building.

The system management is the same in the whole campus, so the findings can be applied to other buildings.

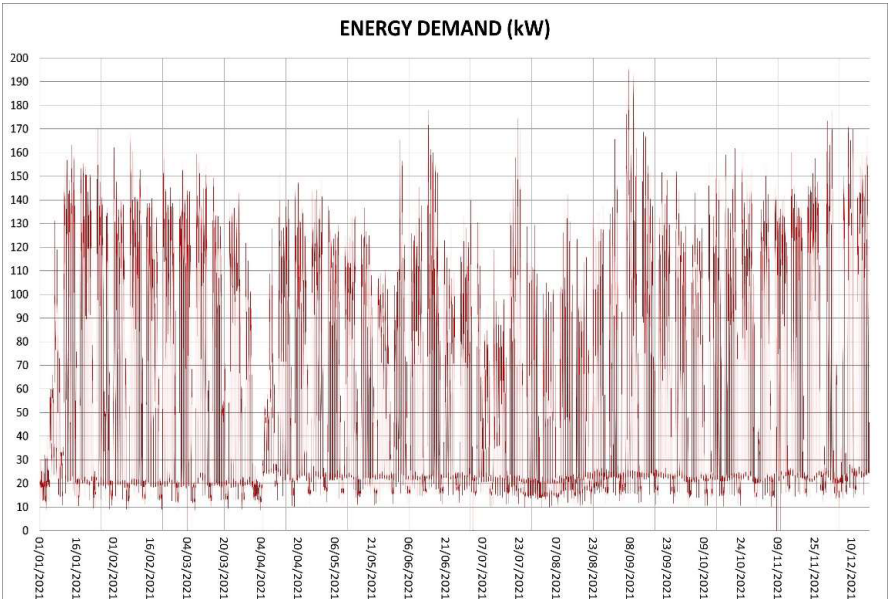


Figure 7. Electrical consumption during 2021 at School of Architecture. Hourly energy consumption during 2021

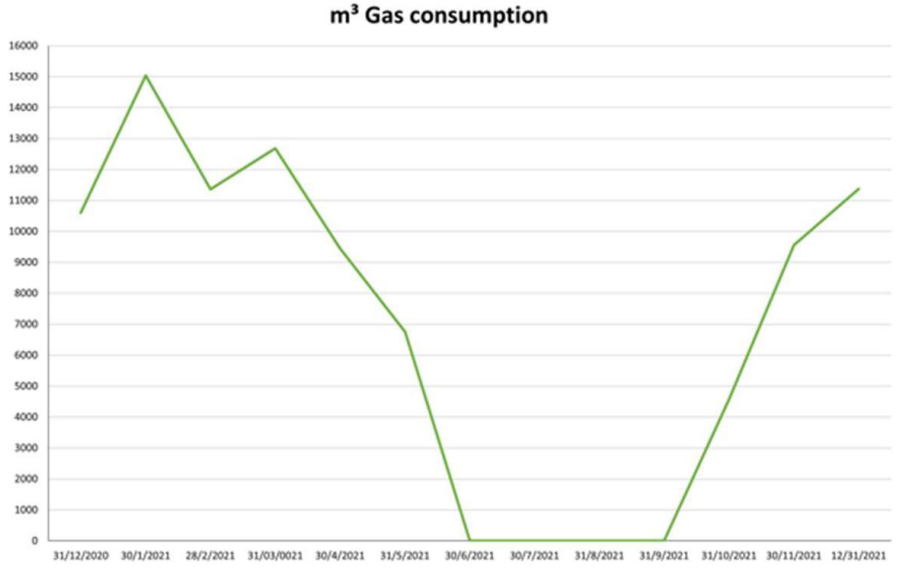


Figure 8. Gas consumption during 2021 at School of Architecture. Monthly gas consumption during 2021

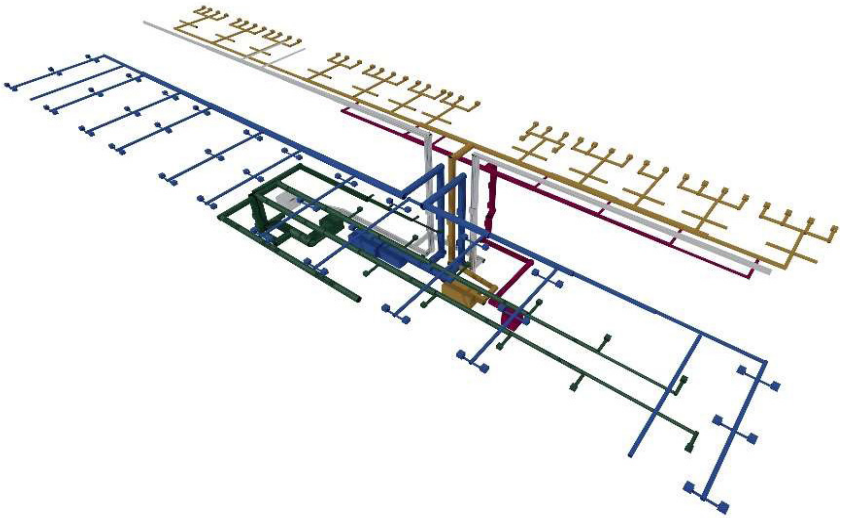


Figure 9. HVAC duct distribution at the School of Architecture. Orange offices, blue workshop, pink classroom and green laboratory

With demand response actions, for example, adjusting working hours on the schedule, the temperature of heated water, heating temperature, lighting, and conscious actions, it is possible to reduce energy consumption. In this case, the building reached a 23% of electric energy consumption decrease compared to the same year period , 2022-2021, achieved with an investment of zero €; Constructive elements haven't been modified. These actions are based in ASHRAE and the Código Técnico de la Edificación, CTE, (Spanish Construction Technical Code). The conscious actions are: The revision of the use of lighting, implantation of free-cooling, detection of refuge zones, and natural and cross-ventilation to avoid stratification.

The following constructive elements have been evaluated: Lights, walls, windows, and roof.

Lights will be changed by LEDs control with presence detectors in representative zones of the building. The budget is 25.000€ . The walls could be improved with blown insulation, not modifying the aesthetic part, and with an approximate cost of 50.000€. Windows can be replaced with ones recommended by the CTE and with a new type of glass but maintaining the original aspect, and an estimated cost of 600.000€. The roof can be prepared to have Photovoltaic systems and absorb NOx, after reaching a better thermal property, which would be the most expensive renovation at an approximate price point of 1.500.000€.

These solutions are commercial ones, viable, and their results could be quantified and compared with the ones of the energy audit. The possibility of comparing the results can allow the investigation and development of possible combinations. This control is essential and relevant to knowing if a solution is more or less viable before implementing it to other educational buildings of the Campus of Universidad de Navarra.

It is detected that the space distribution is not the optimal one too. Studies explain how a proper space occupation can make users more efficient and consume less energy (Zuazua-Ros et al. 2016). At the School of Architecture, the areas more exposed to sub-optimal interior conditions are those that have the longest period of occupation. It is recommended that offices be distributed on the ground floor and punctual activities on the 3rd floor.

4.2. Renewable energies

Regarding Pamplona's natural resources, (water, sun, and wind), the School of Architecture can generate between 500-800 MWh with photovoltaic panels and 11,2 W/m^2 with wind turbines. Information have been obtained from different budgets required, thus can be extrapolated to the rest of the Campus. The objective of this first approach is to have an array of scalable solutions in one building, the Living Lab.

The current market and technology offer a wide range of solutions. Table 1 shows a comparative analysis of each of them from a technical, constructive, and economic point of view.

- Technical feasibility: technological level of development of the solution.
- Constructive feasibility: installation of the system and its problems or barriers.
- Economic feasibility: Comparison of the final cost of the installations. Usually related to the return period.

As it can be seen, the best solutions in our case are photovoltaic, aerothermal, and biomass. Of course, not being viable solution for this building doesn't mean they aren't for others. The following lines show some of the incompatible solutions for this case study:

- Production of gas through organic waste: in this case, there is a low quantity of dust (?) production to be affordable.
- Generation with wind energy is discarded due to the airport's proximity, which limits the allowed height of elements.
- Solar thermal production: elevated weight for the existing roof.

Regarding storage, the market offers less product diversity, as can be seen in Table 2. The evaluation criteria of it is the same as in Table 1.

	Technical feasibility			Constructive feasibility			Economic feasibility			Price
	1	2	3	1	2	3	1	2	3	
Absorption			√		√		√			Not available
Aerothermal			√			√			√	300.000€
Biomass			√			√			√	Not available
Gas production with waste		√				√		√		60.000€
Geothermal			√			√		√		Not available
Hydro energy			√		√			√		Not available
Photovoltaic			√			√			√	40.000€
Peltier		√			√		√			Not available
Solar thermal			√			√			√	110.000€
Wind			√	√				√		160.000€

Table 1. Table of evaluated solutions of production of energy. 1 not feasible, 2 low feasible, and 3 high feasible

	Technical feasibility			Constructive feasibility			Economic feasibility			Price
	1	2	3	1	2	3	1	2	3	
Generical accumulation			√			√		√		Not available
Hydrogen		√		√			√			Not available
Thermal accumulation			√			√		√		900.000€
2nd generation batteries		√				√		√		40.000

Table 2. Table of evaluated solutions of storage of energy. 1 not feasible, 2 low feasible and 3 high feasible

Conclusion of Table 2 is the low economic feasibility of energy storage. The most feasible options are the thermal accumulation and generic storage. The School of Architecture has a big surrounding area and building services allocation that makes it possible to insert a wide range of accumulators, from a buried tank to a series of batteries.
Control and energy require-production is not developed because the study is still in a theoretical phase. In any case, the charge cycle will be deeply analyzed to improve energy production maxims, and for that a connection with a weather database is going to be needed. Thus intelligently (?) the energy requires aren't going to be affected thanks to a good control system.

4.3. Plug & play

Last phase of the methodology is the integration and development of a Plug & Play solution. This technologycal result can be extrapolate to the rest of the campus thanks to the spaces that surrounds the buildings. This solution isn't going to affect the buildings aesthetic.
Knowing that compatible solutions of energy productions for the School of Architecture are

photovoltaic, biomass and aerothermal the next hypotheses is proposed: Installations of 400kWp of photovoltaic panels to feed building requirements, with the surplus being stored. Photovoltaic panels are going to fulfill the electrical needs of the building during its academic period, and during summer are capable of generating a surplus.

Main energy storage will be done with interseasonal thermal accumulation. This is going to be materialized with a tank of 10.000 m2 that is going to pre-heat the water with the electrical surplus. Of course, it will maintain the energy until the heating period.

As a last point, even the feasibility study shows that hydrogen is not the first feasible solution: it is going to be part of the solution. This technology can give a constant and adjustable energy source thanks to its capability of be stored for long periods of time.

The following image show the concept of installing the three technologies around the School of Architecture at Universidad de Navarra. (Fig. 10) Photovoltaic panels at the parking and on the roof of the building, interseasonal thermal accumulation on the back side next to the chiller machines room, and finally the hydrogen in the left back side as an annex to the School of Architecture.

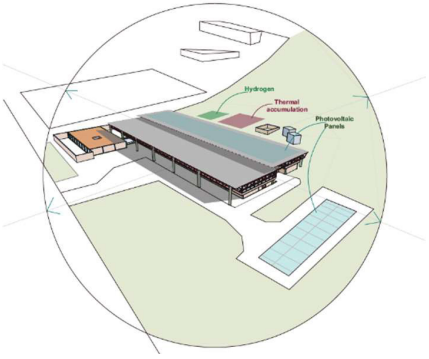


Figure 10. Draft of technology implantation at the School of Architecture of Universidad de Navarra

These three technologies can complement each other without conflict in this theoretical hypothesis. Even if energy require-production and control are not developed, the idea allows the opportunity to adjust if needed.

5. CONCLUSIONS

In this paper, we present a methodology developed to analyse the viability to turn a building off-grid. Implemented actions respect the aesthetic aspect of this building but it is not a condition in the case of other buildings, where other implementations can be possible,. In general, existing buildings are complex and there are hundreds of variables that have a significant influence in the behavior of them. A real evaluation of the actual state gives an idea of quickly affordable solutions, especially knowing that the decarbonization process is going to be slow.

A correct space and interior distribution of buildings allows a reduction of demand. So, it is recommended that the distribution of the building of the School of Architecture be changed due to the existing one not being the optimal one, and even being detrimental for its users' health. Thus, a distribution involved from he design point of the building will have better results of comfort and energy consumption (Zuazua-Ros et al. 2016)

One key point of the methodology is the development of a control and energy management system, that is going to allow the modification and adjustment of the developed solution.

We conclude that the best solution is the combination of photovoltaic panels with thermal interseasonal accumulation and hydrogen. The idea of the industrialized solution of green energy generator and accumulation can be interesting for society. If this production is managed with an efficient control, the processes can be optimized without affecting the user's comfort.

The working group of researchers and campus managers considers the implementation of plug&play solution next to buildings. Universidad de Navarra's campus offers free spaces that is going to helps intouse new technology implantation. If the results of the School of Architecture are favorable, into 2030 the work is going to be developed.

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7

PARTICIPATION, DIVERSITY AND INCLUSIVENESS

PAPER #7.01

CITIZENSHIP AS AN ACTIVE SUBJECT FOR RECOVERY OF THE HERITAGE OF SOCIAL HOUSING IN MODERN MOVEMENT AT VALENCIAN COMMUNITY, SPAIN

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ABSTRACT

Given the complexity of the heritage project and current urban regeneration processes, citizen participation, as central point for good governance and sustainability, is of vital importance. Contributing to the knowledge of architecture of social housing in the Modern Movement requires an approach to social reality of its residents, identifying and recognizing the living heritage values from social perception and practice. That is why accession of residents as active subjects in this process is essential, but also for subsequent elaboration of strategies for revitalization, updating and sustainable recovery, environmental and social, which will not affect the preservation of existing values in this historical-cultural heritage of our cities. Likewise, participatory processes in this field of work have, at the same time, a pedagogical task, in the way of publicizing values of modern heritage in order to achieve its recognition and appreciation by society. This paper presents the approach from field of citizen participation and potential participatory methodologies that guide the research work, specifically, within the framework of the *Momovivso* research project, focused on possibilities of recovery and conservation of social housing of the Modern Movement in the Valencian Community, Spain.

KEYWORDS

Citizen participation; social housing; Modern Movement; Valencian Community.

1. INTRODUCTION

Standards of international professionalism and ethical bases for professional practice of architecture in Spain frame their commitments in a triple axis. The first, establishes the main or general function that fulfills, which is always social in the sense of working to satisfy the basic needs of the population and safeguarding the general interests of society as a whole through the administration of territory, natural resources or inherited heritage. The second, towards the direct recipients of its services and respect for their interests. The third axis can be situated in relation to the profession itself and how its exercise becomes an example, not only for other architects, but also for future professionals who are being trained.
On this triple axis are based the fundamental components that constitute the pillar of the work presented here. The inherited heritage in the field of social housing, the needs of the residents and their homes, as well as the application of participatory tools are related to it. These tools constitute part of the methodology to be implemented by the

architect in his professional and research practice, and especially in the field of revitalization of heritage values in cultural properties where there are residents.

The *Momovivso* research project,[1] directed by the Valencian group *Arquitectura del Movimiento Moderno y Contemporáneo*, focuses its work on the possibilities of recovery and conservation of the social housing of the Modern Movement in the Valencian Community, in Spain, since it constitutes part of the heritage. Recognizes that contributing to the knowledge of the architecture of social housing (generated in that period of our history) requires an approach to the current reality of its residents. The possibilities of projecting a proposal for housing recovery and conservation must unquestionably start from identify and recognize living heritage values from the perception of its residents and therefore from daily social practice. These strategies of revitalization, updating and sustainable recovery have not to affect the preservation of existing values and have to be built from the reality experienced by its protagonists, the residents. The general objective of this paper is to present the approach from the field of citizen participation and the potential participatory methodologies that guide the research work in the *Momovivso* project.

2. CITIZEN PARTICIPATION, REHABILITATION AND SUSTAINABLE GOVERNANCE

The preservation of the heritage values of the buildings in the processes of revitalisation and recovery of the historical and cultural heritage - which constitutes the social housing of the Modern Movement - makes the incorporation of the resident neighbours as active subjects of the process fundamental.

Let us recall here that any process of urban rehabilitation and regeneration should focus on two aspects: on habitat - living space, morphological aspects - and on inhabiting, in the sense of H. Lefebvre, insofar as it places its attention on the interrelations between the inhabitants, the dwellings they inhabit and the concrete social organisation in which it takes place. Focusing, on the one hand, on the social processes that have housing as a central axis (Cortés, 1995, p. 136) from its social significance, function and form of coexistence in the coverage of needs throughout the life cycle of individuals and families. In addition, on the other hand, incorporating the sociological notion of "appropriation" which refers to the links that are generated with the inhabited space, with the passing of time and coexistence, from the home to the street, to the neighbourhood and to the city itself.

> The appropriation is materialized by individuals in a certain space and time, it is related to a very close link between the urban and daily life. It is not something that is conquered, but something that is incrementally achieved, the appropriation of space implies temporality: duration and continuity.
>
> This appropriation can be done at an individual-familiar level, characterizing itself in the house; and at a more difficult to define level, that is part of an individual-society relationship, in the street, in the neighbourhood, in the city (Sá 2019, 1691).

Inhabiting and habitat must be seen holistically in architectural practice in general, and in the rehabilitation of social housing heritage in particular. This is why citizen participation should not be conceived as a benevolent yielding on the part of the political-technical powers, or as a result of a legal obligation.

Participation is a methodology and, as such, must be integrated into the elaboration of a strategy for urban regeneration and rehabilitation of buildings and housing. This within the framework and sense of governance, in which the resources of public power, the resources and advice of technical specialists and the potential of the social organization and

its networks. Horizontal relationships between these resources are what make the citizen an active subject for the recovery of the heritage of social housing, preserving the building heritage values and the socio-cultural values of their communities, created throughout their inhabitation. Therefore, citizen participation, as the axis for good governance and social and environmental sustainability of spaces and housing, is essential to satisfy the needs of residents, as safeguarding heritage values (Falls 2016, 61).

Community and neighborhood-based approaches are part of the policy for sustainable development of the 2030 Agenda, its goals and targets. The empowerment of communities is a transversal axis and citizen participation is the instrument to achieve it insofar as it allows to collectively building actions aimed at change, elaborated in a participatory manner within the neighborhood and with the neighborhood as protagonist.

The idea is to make the path to meeting the Sustainable Development Goals (SDG) more operational by involving people and their organizations. These foundations are also present in the *Strategic Framework of the Spanish Urban Agenda* (AUE) 2019 and the housing policy that it promotes, recognizing the social function of housing and the need to incorporate a people-centered approach.[2] In conclusion, housing rehabilitation projects, in terms of sustainability, should not be done at the expense of the collective construction of the life that exists in them. It is necessary to adopt a humanistic perspective.

Likewise, it is necessary to underline the learning and educational function of citizen participation. This occurs in two ways: 1) for the technical specialist from the citizens, 2) for citizens from the technical specialist. Therefore, the gain is circular, typical of proximity and horizontal relations, where hierarchies and the superiority of the technical specialist die. Understanding it in this way contradicts some statements that, perhaps, limit this conception of learning:

> Los procesos de participación ciudadana (…) son una forma de construir ciudadanía comprometida, ya que es una vía de comunicar, formar y transmitir los límites que pesan en cualquier proyecto (Pernás y Román 2017, 125-126).[3]

Who trains whom? Citizen participation is not unidirectional, where the technician is kind enough to inform about the project and try to train about it. Learning must circulate in all directions; it is part of the great synergies to which participation must give rise. Within the subject, that concerns us and based on this clarification, the pedagogical function of participation for the *Momovivso* project is essential.

Capital in the sense of publicizing the values of modern heritage to achieve recognition and appreciation, not only by public authorities, but also from the collective imagination of its residents and Valencian society. As well as discovering, throughout the participatory process, practices and social situations that may be producing positive and/or negative effects on the buildings, learning from the situation of residents and with residents, in the neighborhood, in the home. Since as Antequera (2015) points out:

> El patrimonio urbano que no se hace consciente en el imaginario ni se encuentra protegido por la Administración: es patrimonio invisible, un patrimonio en riesgo (Antequera 2015, 9).[4]

Walking towards an intervention architecture, in terms of environmental and social sustainability, for the conservation and revitalization of the historical heritage in social housing, cannot attend exclusively to image and/or technical values linked to the history of the buildings, but must collect, in its performance and for it, the collective memory of the "place" and current practices. In addition to taking channels that, allow co-decision in rehabilitation actions.

3. MOMOVIVSO PROJECT AND PARTICIPATORY METHODOLOGIES

As has been pointed out in previous lines, the approximation to the reality of the residents in the social housing groups built between 1925 and 1975 in the Valencia Region is of vital importance when preparing a proposal for housing recovery and conservation. It is not just about investigating the state of conservation or material deterioration of these buildings, establishing the causes and proposing the application of current construction technologies that redirect the houses and the building towards an environmentally sustainable model. The aim is to incorporate in the intervention proposal a reading of the social space that make up these housing groups, through the study of the social processes, practices and discourses that are put into play among the different stakeholders, while identifying intangible assets that are part of the collective identity, its evolution and current state.

Heritage rehabilitation and conservation, in the case at hand, must incorporate readings from the social actors who have experienced its historical process. Bear in mind that the residential building is a material part of a social space and that life flows from the private and exclusive sphere (housing) to the public space. The building is not a product, it is a place, it is a space perceived in the Lefebvrian sense (1974), where social relations are produced and reproduced, which have continuity in the public space. It is in living where architecture is completed (Martín 2015, 90) and the complexity of the heritage project for recovery of social housing.

That is why *Momovivso* faces the study of the state of the buildings and collective spaces, to develop a strategy of conservation and intervention in the social housing of the Modern Movement, in order to preserve in them patrimonial, material and immaterial values. It works from two aspects: applying the humanist perspective not only through a participatory process giving prominence to the resident and their associations, but also from the perspective of inclusion, diversity and gender.

The existence of social stratification due to aspects related to diversity and gender, derived from the position of inequality in the scope of life possibilities and opportunities between men and women, exists in Spanish[5] and Valencian society.

Working to achieve equality involves knowing the different realities inscribed in terms of gender and the different life cycles. In addition, taking into account that developing strategies aimed at building the caring city implies the rehabilitation of buildings, but it also involves knowing the female role in the formation of living and the needs in terms of inclusion and functional diversity.

The implementation of this view is justified by the characteristics of the case that this research project specifically addresses. The study is carried out on the *Virgen del Carmen* housing group, located in the Beteró neighborhood, belonging to the Poblats Marítims district, in the northeast of the city of Valencia. It was built in 1962 and was used entirely, at the time, for social housing within the programs developed under Franco's policy.

At present, this complex constitutes a census section classified by the Valencian Autonomous Government (GVA) as an area with integral vulnerability.[6] Concept related to socio-spatial segregation and that draws attention to an environment in decline that has been suffering processes of downward vertical social mobility, which means that its residents have worse possibilities or opportunities for participation and integration in society.

Figure 1. Grupo Virgen del Carmen. Satellite photography. Source: (Autor, from Google Maps Satellite 2022)

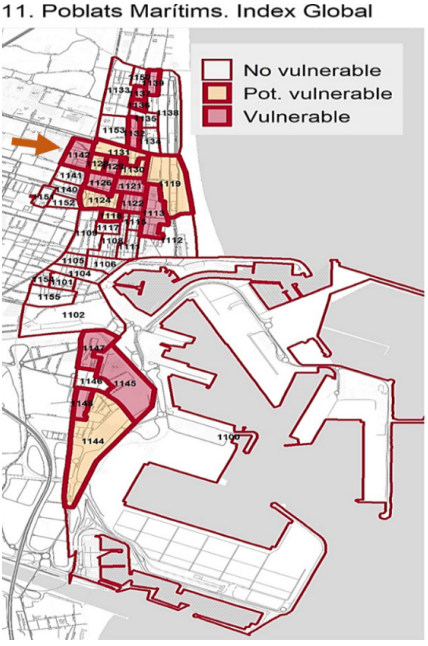

Figure 2. Census Section 1142 (RES DT 11M) Virgen Del Carmen Group and vulnerability. Source: (Àrees Vulnerables a la Ciutat de València, 2019. Seccions Censals. Oficina d'Estadística. Ajuntament de València).

> El concepto de vulnerabilidad (…) es un término que se refiere a la movilidad social descendente y que viene a significarse como la antesala de la salida o caída en la exclusión social, también se suele referir tanto a colectivos sociales como a territorios en situación de riesgo o de declive, aunando por tanto el doble vínculo entre territorio y estructura social. (Alguacil 2006, 161).[7]

3.1. Participatory methodology

Citizen participation, insofar as it means building collectively, so that the different voices have place in decision-making, becomes a transversal element in all those processes that affect the way and state of living, which undoubtedly includes the urban policy from its different and multiple dimensions. Therefore, it cannot be reduced to a punctual space to contrast proposals already raised.

Within participatory processes, we move in a continuous line between conflict and consensus. Participatory work is directed by a double dynamic: we receive from the population and social agents; we return results to the population and social agents.

- Phase 1. We diagnose with the residents and from the residents. We return results.
- Phase 2. We propose with the residents and from the residents. We return results.

The citizens, owners and neighbors for that matter, become subject and object of reflection on their problems, on the proposals and their prioritization, so that a dialectic is established between them and the technicians, in order to achieve a collective construction of knowledge and actions to take. It must be a synergistic process. We start from action research where social interests are articulated with scientific interests" (Santos 2004, 38) and with technical interests.

Thus, active listening and the creation of social conversion are the axes that should guide the selection and application of participatory techniques in the Momovivso project.

The application of the tools should be oriented to collect the neighborhood experience and perception, along the following lines:

a) Of the historical processes that have marked social life and the perception of changes up to the present time;
b) The daily life of the neighborhood, in domestic and public spaces (from inside to outside);
c) Of the relationship with social and institutional agents, etc.

The potential techniques that can be used are briefly listed in the following table. It must be taken into account that this is a selection of techniques; this selection does not invalidate many others that exist and/ or are created from the creativity of the professional for each case:

PHASES	THEMATIC	POSSIBLE TOOLS
1. DIAGNOSIS	a) Social-historical process. Historical analysts	Oral histories Timelines
	b) Elements of social and cultural value	Direct and participant observation Informal and formal interviews (open-ended, semi-structured; individual and group) Focus groups Drifting Mental map
	c) Community structures and institutional relations.	Stakeholder mapping Map of social actors Sociogram
	d) Perceived problems. Actors involved	Drifting Brainstorm Talking map SWOT; SWOT with actors DRAFPO[8] Sociodrama Self report Themed tables
2. PROPOSAL	a) Participated proposals	Brainstorm Nominal group Flowchart Themed tables Reflective matriz Projective matriz Future scenario matrix Method EASW[9]

Table 1. Tools for participation Source: (Authors 2022)

It must be taken into account that the phases are in a dependency relationship, as well as the themes. They are applied in a concatenated manner or with feedback between experiences and results, influencing each other. They have the characteristic of being flexible, that is, the same tool can be used to obtain information within different themes or serve different objectives. The results obtained are treated through a content analysis.

4. CONCLUSIONS

The current architectural culture must continue to grow in the incorporation of the humanistic perspective of the city, to improve its position regarding the scope of the principles of Governance contained in the 2030 Agenda and in the Spanish Urban Agenda, where community-based approaches constitute an important part of sustainable development policy. The incorporation of this perspective and within it the citizen participation, worked under principles of coexistence in diversity and gender, continues to be one of its workhorses.

The *Momovivso* research project, which affects the patrimonial consideration of social housing in the Modern Movements, has a particularity or specificity compared to the proposal for the rehabilitation and regeneration of other cultural assets, and that is that these houses are inhabited. They make up neighborhood communities, that is, the building structure has produced a model of sociability and community socialization, this being one of its important heritage values. These values can be affected, modified or destroyed by public administration interventions derived from building rehabilitation or urban regeneration actions. How and to what extent?

Being able to answer such questions drives the application of participatory research strategies, whose axis are the conversational processes where the protagonist, the neighbor, ceases to be an observed object and becomes an observing subject. These techniques will allow knowing and recognizing the existing socio-cultural values formed in the course of living, building this knowledge from the experienced reality by its protagonists. This reality transits between the home and the public space, and both should not be dissociated in research on the current state of social housing in the modern movement.

The case study that the research deals with places us in an urban space qualified, by the Valencian Government itself, as completely vulnerable, which makes it more pressing to highlight its heritage values and propose intervention strategies for its rehabilitation, elaborated with and for the host community.

We agree, therefore, that residential buildings are places, and as such, they must be treated in rehabilitation strategies aimed at sustainability from their multiple orientations. In addition, the multitude of participatory techniques that can be applied in diagnosis processes and in the collective construction of proposals is clearly shown.

The generic tools described here are being selected in relation to the objectives of the research project and will be applied throughout the year 2022. Their specification, development and results achieved will be addressed in future publications.

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NOTES

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24.11.2020 https://dogv.gva.es/datos/2020/11/24/pdf/2020_9956.pdf. Record AICO/2021/253.

[2] Spanish Urban Agenda, 02. Diagnóstico y síntesis territorial (Spain: Ministry of Transportation, Mobility and Urban Agenda, 2019), 37 https://www.aue.gob.es/que-es-la-aue#Agenda_Urbana_Espanola

[3] Original quote in Spanish. Free translation: "Citizen Participation processes (...) are a way of building committed citizenship, since it is a way of communicating, training and transmitting the limits that weigh on any project".

[4] Original quote in Spanish. Free translation: "Urban heritage that is not made aware in the imaginary nor is it protected by the Administration: it is invisible heritage, a heritage at risk".

[5] The data of the European Gender Equality Index, 2021 continue to show a poor score for Spain in the variables referring to "Money -related to financial resources and economic situation- and "Time" -in relation to the performance of care activities and time dedicated to social activities-. In the former, Spain ranks 16th and in the latter 14th, both below the European average. Instituto de las Mujeres. "España ocupa el sexto lugar en el Índice Europeo de Igualdad de Género presentado en 2021". Ministerio de Igualdad. Gobierno de España, October 28, 2021. https://www.inmujeres.gob.es/actualidad/noticias/2021/OCTUBRE/informeEIGE.htm

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[7] Original quote in Spanish. Free translation: "The concept of vulnerability (...) is a term that refers to downward social mobility and that comes to mean the prelude to leaving or falling into social exclusion, it also usually refers to both social groups and territories in a situation of risk or decline, thus uniting the double link between territory and social structure".

[8] This is the Spanish acronym for the terms weaknesses, resistances, threats, strengths, potentialities, opportunities. It is a technique developed in Spain by the RED CIMAS, it has no equivalent in Anglo-Saxon terms.

[9] European Awareness Scenario Workshop.

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PAPER #7.02

DESIGN EFFICACY AT A DISTANCE: COLLABORATION BETWEEN REMOTE DESIGN TEAMS

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ABSTRACT

Design problems in the best instances are intensely complex and very demanding. Given that most buildings are unique -- that is, not mass-produced -- each design project must be considered as a precedent-setting experiment. While we learn from successes and failures, building projects remain distinct and demanding. Added to the conventional complexities is the distributed nature of design production in a globalized world. The present paper addresses several key queries: What are best practices in facilitating collaboration between remote design teams? What are the implications of working from home for design team members? While the practice of design has become increasingly digital, there are inherent tensions between the principals' insistence to work in the tangibility of the physical studio and the younger practitioners' preference to optimize flexibility via remote delivery. More significantly, what are the barriers and challenges to working on collaborative design projects globally, including but not limited to being overwhelmed by multi-tasking, power imbalances, different cultural dispositions, technical challenges, different time zones, data privacy and proprietary concerns, shifting from studio-based practice to online work, physical model making, communication pitfalls, screen burnout, and loss of personal/leisure time? Such important yet perplexing questions loom large. The research involves literature reviews exploring the ways that design teams collaborate remotely. Building from this analysis, the paper delineates a number of familiar challenges and proffers solutions tackling design practice using remote teams. The research considers administration (design leaders and project managers) on one hand, and production (interdisciplinary design teams) on the other. Drawing upon organizational and human development theories, and utilizing the reflective practitioner's approach, the paper situates discussion within broader topics of human dignity, workplace psychology, career mentorship, and continuing education. Also examined are architects' persona, culture, practices and mindsets - crucial factors shaping the conduct of distributed design. Further, this paper elaborates on Zoom virtual collaboration platform with respect to suitability and effectiveness. In the end, a conceptual model and a setup for satellite studios for distributed design are proposed that aim improve communication, heighten collaboration and strengthen design in an increasingly complicated and interconnected ethos.

KEYWORDS

Architecture; collaboration; innovation; systems thinking; distributed design; culture.

1. INTRODUCTION

Designers need to collaborate to work on real-life problems that require a diversity of expertise, attitudes and styles:

> Some of the forces driving increased collaboration in architecture and design are larger than the design disciplines by significant orders of magnitude. At every turn, we face problems that are simply too big to solve alone. Horst Rittel, the design theorist, coined the term wicked problems to describe these complications [that] have complex, contradictory, and interdependent variables and are difficult to solve because they are difficult to define (Rittel, 1973).

The need to collaborate with other disciplines practitioners and professionals who are external to the design teams means, often, utilizing virtual platforms.

The design process itself in providing a solution to a wicked problem is a wicked problem as it involves the complexities and the contradictions of human interactions. The process is equally important as the end design solution. Every wicked problem is a symptom of another problem; wicked problems have no solutions: "At best are only re-solved, over and over again…such as sustainable urban development, poverty, homelessness" (Olsen, 2022). Collaboration in physical studio space is already extremely challenging and the pandemic has pushed everyone, usually unwillingly, to think about how to make virtual and remote meetings effective and conducive.

> Leadership and management capability are prerequisites for effective teamwork. Because the approach of many of the consultants arises from a dissimilar education and professional culture the patina of unity that overlays the joint work of a team may sometimes conceal a disappointment with the ideology, working methods, presumed superior status, and even remuneration of other members (Herbert, 2013).

In this paper, we start with a literature review and then propose a conceptual framework to depict the complex intertwined relations between location, virtual and familiarity, a complexity that cannot be simplified and addressed by a one size fits all solution. Our argument is to make the virtual platforms more like the studio space the design teams are familiar with. We will then present two ideas, a plugin for Zoom and suggestions to create more conducive satellite studios beyond a personal laptop.

2. LITERATURE REVIEW

There are a number of reasons design practitioners like other office workers prefer virtual meetings including but not limited to efficient screen sharing, saving on the time to commute to the physical office or the meeting venue; more reliability and less worry about traffic jams, road closures, inclement weather conditions; employee satisfaction and flexibility; less overhead cost for a larger head office, the opportunity for staff to travel and connect from different locations, attracting and employing global talent without need to incur immigration and moving expenses. There are substantial sustainable outcomes to virtual distributed work, less travel and prints mean decreased carbon emissions; and assuming every employee enjoys a conducive home or remote setup, going virtual and distributed can contribute to more equity in access to good job opportunities and ultimately a more socially just world.

While there are newly developed challenges human resource managers need to handle, unperceivable in the past, they are generally more at ease that the virtual platforms can have better surveillance to avoid the workplace complaints such as harassment when there is no physical co-presence in an office space with several blind spots!

However, we need to remember most design teams were forced to involuntarily go virtual

due to the recent pandemic restrictions and that there is still a strong desire, at least on the side of older practitioners to resume in-person studio work. This tension alludes to the generational difference of opinion on what will be a more conducive environment to work on design projects and collaborate with fellow practitioners. Unlike other office workers who can work on simple interface cloud-based applications, designers need more co-presence and more intense collaboration in their creative processes. There are of course certain segregated design tasks that can be distributed to individual team members, as in the case of larger design practices, but a portion of job satisfaction for designers is the opportunity to be involved and aware of the whole versus the delegated piece. It is much more challenging to start and onboard staff virtually from the outset than to shift the existing employees to the virtual platform.

For more senior staff who are supposed to mentor the junior members, and who are usually more inclined or required to work in the physical office space, the physical takes priority over the virtual. Remote workers sometimes feel ignored while their seniors cannot understand why a simple delegated task has taken so long and distrust and frustration build up.

> While remote work allows organizations to offer their employees flexibility and harness global talent and markets for business growth, [the] inability to rely on physical interactions between employees imposes challenges specific to operations in highly virtual work environments. Among these characteristic issues are challenges associated with organizational socialization and organizational culture (Asatiani, 2021).

We need to wait and see if the dominance of virtual design work has shifted the weighting for each of the following synchronous and asynchronous means of communication.

Means of communication	Ease of use	Feedback	Interaction	Overview	Informal	Formal	Status
Dialogue	x	X	X	-	x	x	x
Group meeting	-	X	x	x	-	x	x
Informal meeting	-	X	X	-	x	-	-
Telephone	X	X	X	-	x	x	x
Facsimile	x	-	-	-	-	x	X
Postal mail	-	-	-	-	-	X	X
Project dossier	x	-	-	x	-	X	x
Email message	X	X	x	-	x	x	-
Messenger service	X	X	X	-	x	-	-
Video conference	x	X	X	x	-	X	x
Outlook calendar	X	-	-	X	-	X	-
Computer network	x	-	-	-	-	x	-
Project Website	X	X	-	X	-	X	X

X = high level, x = average level, - = low level

Table 1. Properties of synchronous and asynchronous means of communication (Otter & Emmitt, 2007)

The ability to do virtual work has posed new opportunities and challenges for design practices that were formerly location-based.
The staff can now travel overseas and report to work on Zoom or Teams, utilize the company-provided laptops or access the office computers via VPN. Suddenly, local firms have found themselves to be international! There are certain considerations for the uncalled-for internationalization of practice and the managers are usually not well versed in all such implications:

> 1. Global structure 2. Data mirroring across international borders 3. Network security and data integrity 4. Software compatibility with consultants and associate architects 5. Imperial vs. metric units
> 6. Dealing with associate architects—culture and process differences and incompatibilities 7. Establishing a local office/practice 8. Dealing with differing client expectations 9. Language 10. Available "on-the-ground" technology (e.g., poor or nonexistent internet connections) 11. Time-zone differences 12. Local hardware procurement 13. Software licensing 14. Different, less advanced design and documentation procedures—"dumbing-down" 15. Extreme "fast-track" 16. Crisis operations (Perkins, 2021).

We are looking at virtuality and distributedness and how the design process can have holistic quality under the new modes of work:

> virtuality and distributedness can be defined as distinct continua which, when combined, can be used to describe particular work settings…four factors…impact organizational policy in terms of virtuality and distributedness: interdependence of tasks, nature of work, technological environment and temporal distance. Practical implications…Taking the perspective of individual designers working in remote teams… we found that team spirit, shared experience, trustworthiness, and transparency, as well as project management and related micro-practices, are perceived as central to building shared understanding in remote design teams (Kniel, 2021).

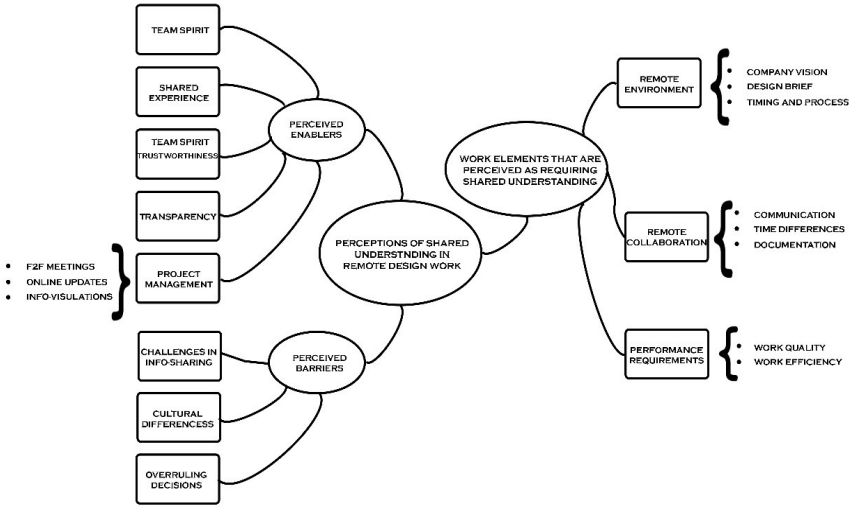

Figure 1. Code structure from thematic analysis (Kniel & Comi, 2021)

Drawing upon capabilities and human development theory, group potency and efficacy will translate into self-efficacy, providing an enabling environment where employees' skillsets, confidence, morale and aspiration are further developed and they have a higher degree of choices to make for their work and life options. Group potency is defined as:

> 'the expectations held in common by group members about the group's collective efficacy; that is, the group's overall confidence or "can do" attitude (APA, 2022).'

Efficacy is defined as 'competence in behavioural performance, especially with reference to a person's perception of his or her performance capabilities'(APA, 2022).

> group potency and computer collective efficacy act as antecedents to virtual team efficacy, and virtual team efficacy is in turn predictive of perceptual and objective measures of performance. Further, consistent with efficacy theory…virtual team efficacy acts on performance outcomes through specific mediating processes (Fuller, 2006).

It is imperative for design managers to embrace the new virtual collaboration platforms, properly plan for them and only demand in-person work where it contributes to team building, social bonding and onboarding of new staff. IT technology while ground-breaking needs to be properly tailored and executed.

> strong relationships were observed between employees' remote work self-efficacy judgments and several antecedents, including remote work experience and training, best practices modelling by management, and computer and IT capabilities. Because many of these antecedents can be controlled managerially, these findings suggest important ways in which a remote employee's work performance can be enhanced, through the intermediary effect of improved remote work self-efficacy (Staples, 1999).

Linking self-efficacy to the capabilities and human development theory, where the end goal for a design team should not be only an award-winning design project, but more significantly the development of team members' capabilities and their sense of confidence, happiness and achievement.

> Design policy [should be] based on the theory of social justice known as the 'capabilities approach', where the measurement of progress in development shifts from outputs such as GDP to indicators of increased capacity to achieve outcomes (Dong, 2008).

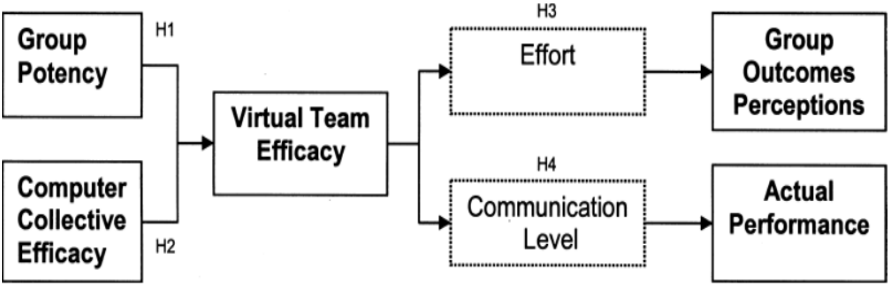

Figure 2. Research model (Fuller et al, 2006)

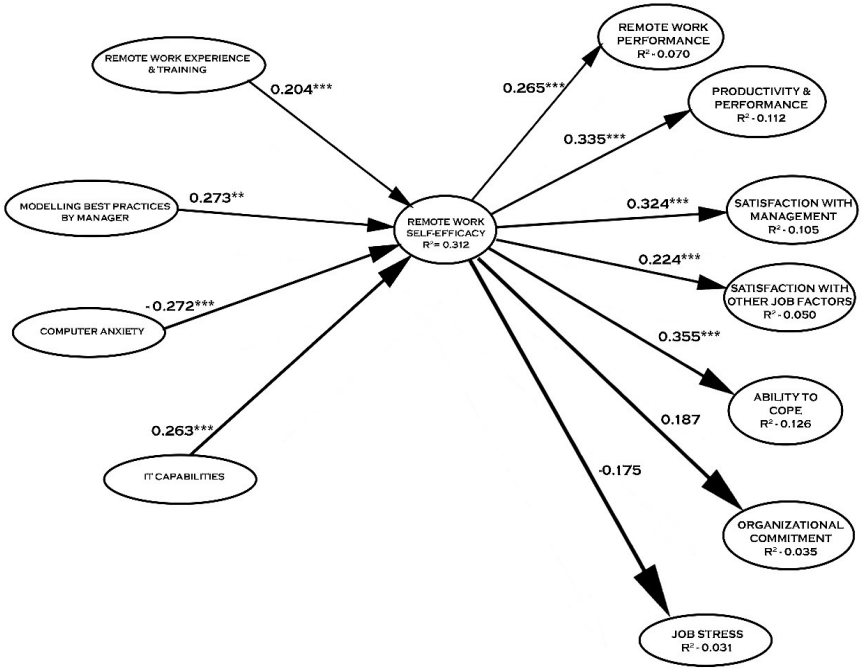

Figure 3. Self-efficacy model for remote workers in virtual environments (Staples et al, 2022)

In the last two and half years, going virtual, was a survival mechanism for design firms during lock-downs and staff sick leaves. During our conversations with many design firm principles in Alberta, they confirmed the loss of revenue and performance by adopting virtual collaboration platforms. We need to ask if virtual collaboration can lead to the overall performance of design practices and their ability to innovate and retain their competitive edge:

> Design management and innovation give companies competitive advantages. In this scenario, the involvement of employees in [the] generation of innovation is an important factor to be developed within the organization (Silva, 2017).

Any technology that can help designers be more aware of one another and better simulate the physical studio practice can potentially be conducive.

> It is critical for geographically distributed designers to accurately perceive and comprehend other remote team members' intentions and activities with a high level of awareness and presence as if they were working in the same room. More specifically, distributed cognition places emphasis on the social aspects of cognition and asserts that knowledge is distributed by placing memories, facts, or knowledge on objects, individuals, and tools in the environment they work. This paper proposes a new computer-mediated

Diagnosis	Requirements
Scope: They have multifunctional and with great power of articulation feature as interact with several clients and several areas internally.	- Create an innovation process that fits within the scope of work; - Take advantage of this interaction with the various Stakeholders.
Planning: Do the agenda planning but during the day changes occur as immediate demands arise.	- Have a flexible interaction regarding deliveries and dates; - Have activities and deliveries not weigh and do not .crash into the daily routine
Safety: Due to security factors and internet connection planning agenda is carried out via the system, but prefer to print and load physically. Similarly prefer to perform the bureaucratic activities at home.	- Create a program that does not require that the team has connection / interaction during the field day; - Think of interactions beyond the computer; - Provide tools that do not endanger their safety.
Idea Generation: New ideas are generated by the field work or for questions and customer demands. Thus the group is composed of people who have ideas proactively and those who are passive because they depend on the verbalization of clients.	- Encourage the creation beyond the field; - To stimulate the generation of ideas to solve problems/ needs.
Labor demand: Routine causes are always in the field with little time or a few stops on the base to concertation times. Furthermore, consider that there is work overload, large displacement and high concentration of night demand.	- Encourage participation in small time slots available; - Reconciling the high demands program; - Make sure they can devote exclusive time to interact with innovation.
Motivations: Group demonstrates motivation towards professional growth, benefits package the company and time for leisure and family. Also, they want to interact and feel part of the process and see it as recognition.	- Promote the role in relation to the professional growth; - Make the involvement in the process will not interfere in; the free time: - Make them involved in the whole process.
Digital interaction: Group has technological tools (notebook, tablet and mobile) but have appreciation for the role. Regarding the innovation initiatives, the group demonstrates little affinity interactions in digitals but state research that has no difficulty.	- Provide a program that does not depend exclusively on the computer; - Provide personal interactions and materials with tactile elements.

Table 2. Diagnosis and requirements (Silva et al, 2017)

remote collaborative design system, TeleAR, to enhance the distributed cognition among remote designers by integrating Augmented Reality and telepresence technologies. This system can afford a high-level externalization of shared resources, which includes gestures, design tools, design elements, and design materials. This paper further investigates how this system may affect designers' communication and collaboration with a focus on distributed cognition and mutual awareness. It also explores the critical communication-related issue addressed in the proposed system, including common ground and social capitals, perspective invariance, trust and spatial faithfulness (Wang, 2014).

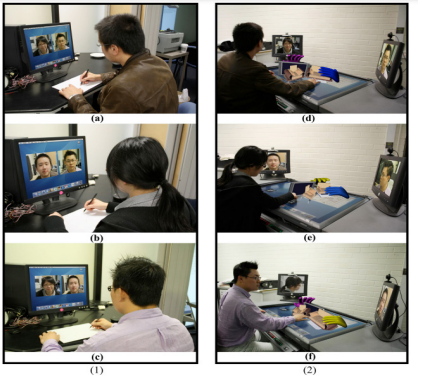

Figure 4. Traditional method (1) versus the teleAR (2) (Wang et al, 2014)

However, the additional technological requirements, the equipment, the internet speed to accommodate additional video streaming and at the same time the digital file content can become a challenge. Designers already deal with great complexity; any complicated technology will take away from the required flawless process of design and the comfort they need to enjoy during design.
Even prior to going virtual, working with design teams dispersed in multiple locations with different cultural, educational and linguistic backgrounds is challenging.

> design thinking in co-located and remote working environments? This paper demonstrates the perceived difficulty of different design activities and how they compare to one another. A framework comprising nine individual design activities is used to map out [the] experiences of six multicultural, distributed student design teams (Tuuli Utriainen, 2017).

Hybrid work environments can be good responses. It can be accommodating a number of staff who prefer physical space in the office while allowing the rest to work remotely; or, allowing flexibility to work remotely from home or farther, coming to the office for important in-person meetings and socializing. Virtual can also occur from separate offices and desks within a physical office, preventing healthcare measures, better sound insulation and privacy and screen sharing without the need to get too close. Meluso et al (2022) identify such flexibility with Buchanan's third and fourth orders of design (Buchanan, 2001):

> virtual forms of collaboration— simultaneously liberating and frustrating—are here to stay. Workers' frustrations demonstrate that challenges remain for work and its design in increasingly "hybrid" collaboration— work in which some people, interacting face-to-face, are co-located while others with whom they work are remote. Using Buchanan's four orders of design, in conjunction with management and information systems scholarship, we present a framework for improving these virtual forms of collaboration (Meluso, 2022).

Based on our own experience, the constant need to stare at a screen, when working remotely, forced by the need to be there to respond and not to ignore one's colleagues, is a major cause for concern. Many complain that virtual work, striving to maintain the coworkers' trust, is more cumbersome that the physical space where co-presence, our body language and other non-verbal clues help us be more comfortable. It is not easy to demonstrate one has taken a washroom break rather than a walk when one is online.

Design Activity	Description
Re(defining) the problem	Working on the problem space and redefining what the team is solving
Grasping external knowledge	Expert interviews, and research, need finding and benchmarking
Knowledge pooling	Sharing results with the team, putting up gathered material on walls and whiteboards, saturating information
synthesis	Working with the gathered materials, getting out key insights, seeing patterns and making sense of what has been done so far
Making decisions	Selecting next steps with the team, converging, path selection
Ideation	Coming up with multiple solutions, flaring, divergent thinking, brainstorming
Concept specifying	Focused work, concept development, getting from a low resolution to a higher resolution
Making* it tangible	Prototyping, realizing, building
Testing & user feedback	Testing concepts and prototypes, gathering feedback, learning from the prototypes

*Table 3. Design Activity Framework (Utriainen, 2017) * original text read as 'magin'*

daily communication quality was associated with daily performance and burnout… Task interdependence moderated the relationship between communication quality and performance, such that the relationship was stronger when task interdependence was higher than when it was lower. Task interdependence also moderated the relationship between supervisor-set expectations and performance such that the relationship was stronger when task interdependence was lower than when it was higher (Shockley, 2021).

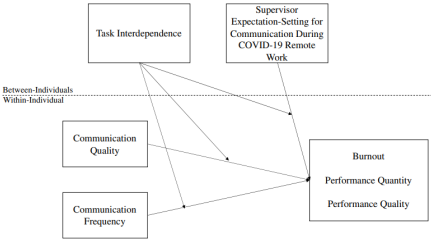

Figure 5. Study theoretical model (Shockley et al, 2021)

3. DISCUSSION

We propose a conceptual framework to depict and correlate Remote-ness, Virtual-ness and Familiarity, the farther a designer is from the centre in this 3D diagram, the more challenging is self-efficacy.

We attribute distance to the base office or between a designer with their immediate colleagues to **location**, the farther colleagues are, the more difficult it is to communicate. Location can be gauged as the same office, same city, same region (e.g. North America or Europe), or same time zone to different global locations with different time zones.

Working in the same physical office beside others can be coded as least virtual, to flexible hybrid schedules to completely **virtual**. The more virtual a designer the more challenging it is to socialize with the team and be fully aware of the overall team dynamics.

We can attribute prior experience with the practice and colleagues, professional practice protocols, educational, cultural, linguistic and technical backgrounds to **familiarity**, the more familiar the design the easier it is to collaborate. The compatibility of design production and representation between physical and virtual colleagues is a source of discomfort. People who prefer in-person work are used to working on hard copies and physical models while tech-savvy younger people do not need to print hard copies for design development, for example.

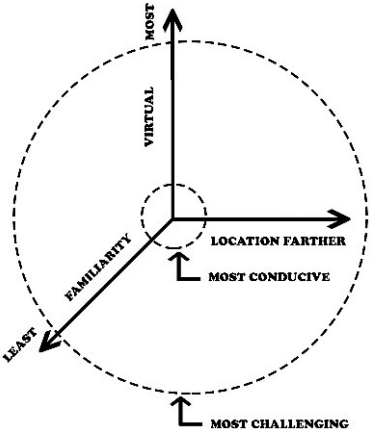

Figure 6. Draft conceptual framework depicting the relation between remote-ness, virtual-ness and familiarity

We need to identify and retain the achievements and potentials of virtual design collaborations and when it is not possible to bring practitioners together in a physical space to socialize and co-create, provide technological, managerial and physical adjustments to remote designers' workspace to make the virtual more like the studio.

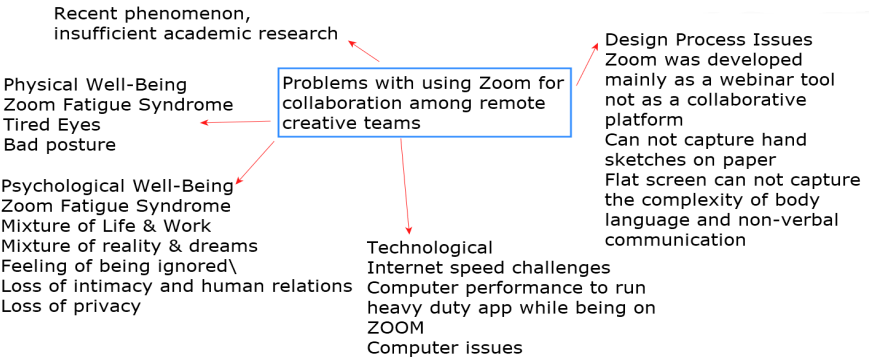

Figure 7. Challenges with using Zoom for design team collaboration

4. DESIGN SOLUTION

4.1. Affinity: A Plugin for Zoom

We are proposing additional capabilities on Zoom to better facilitiate design teams' online collaboration.
Our proposed design solution is to create a plugin for Zoom that can allow team members to populate their profiles beyond a simple thumbnail side screen to represent who they are, their work, capabilities, achievements, and personal profile voluntarily shared in different levels of exposure, and also the context within which they work. This way one does not need to verbally share this background information with colleagues, but something readily available when a colleague is curious to find out.

4.2. Zoom User Profile Now Button

Customizable
Different Exposure levels: Manager(s), colleagues, friends: Hierarchy of Share
How do you feel today? Pull-down menu
What is going on with you and your family right now? e.g. celebrating a daughter's birthday; going to the mountains over the weekend
Available? Select time slots with priorities to talk to others
I will be back in 5 minutes
Upload your family/loved ones' pictures
Local Weather: auto-update hyperlink
Local News Headlines: auto-update hyperlink

Figure 8. Affinity plugin Profile mode

4.3. Studio Mode Button

Will Expand as another user places the cursor on your profile picture
Customizable
Automatically upload pictures of your current projects
Upload your favourite pictures
Ambient sounds

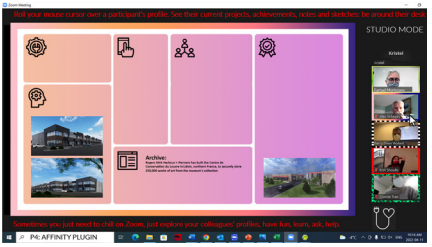

Figure 9. Affinity plugin studio mode

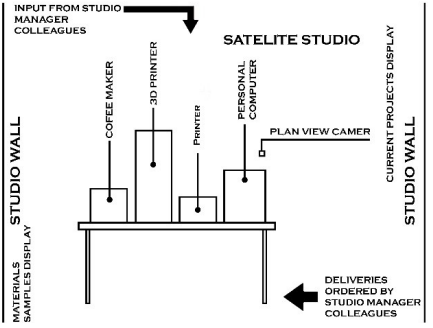

Figure 10. How to better setup satellite studios

5. CONCLUSIONS

We also propose design firms need to reconsider the virtual, remote work and it can not be simply an employee working on their laptop or connecting through VPN. The workspace must be defined as a satellite studio and meticulously designed to represent the design establishment's vision, values and brand, to create a more conducive co-creating environment while still allowing the design to deal with minimum technology. Equipping the satellite studio with an appropriate desk, proper paper-size printer, 3D printer and even a coffee maker and a mini fridge and the IT infrastructure for colleagues to send prints directly to one' desk or replenish the mini fridge, office supplies, and cheer one another by sending goodie bags! There should be a plan view camera to allow designer sketch their thoughts versus the awkward act of scanning it and sending it to colleagues.
The remote and virtual are here to stay, we can no longer treat them as an afterthought, we need to design them!

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PAPER #7.03

ACCESS TO HOUSING. ADVANTAGES AND DISADVANTAGES OF COHOUSING

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ABSTRACT

Access to housing has become a problem for a large number of the population. This work is inspired by the search for new forms of access to housing beyond the traditional system of buying from a private developer. For the future resident, the cost of access between the alternatives is compared. For this, we work from the case method starting from a plot in the city of Valencia on which a comparative cost study is carried out. In the case of cohousing, a management model based on the cooperative is proposed. On the other hand for traditional development, the usual steps of feasibility studies applied to the real estate sector will be followed with the analysis of the profitability of the project. The results indicate that access through the cohousing system is a lower cost for families than access through the purchase from the developer. The analyses carried out indicate that access through cohousing represents a saving of almost 30%. The work also exposes the advantages and disadvantages for families of each of the access systems.

KEYWORDS

Housing markets; cohousing; feasibility; cost; accesibility.

1. INTRODUCTION

Cohousing is a type of accommodation that incorporates aspects of architectural scope that are oriented and conceived to facilitate social interaction. Experts place its origin in Denmark at the beginning of the 70s. From the study of these early experiences arises the publication of Charles Durret and Kethery McCamant "Cohousing a Contemporary Approach to Housing Ourselves" published in 1988. To these authors we owe the most widespread definition, understanding of Cohousing as a set of collaborative housing in which residents actively participate in the design and management of the environment. They combine private spaces with common areas in which the community shares resources. Beyond this definition, in more recent periods, environmental sustainability criteria and measures are essential elements in cohousing. Cohousing must be analyzed from two dimensions, the physical or architectural dimension and the social dimension, which refers to the community dimension and the participation of its members. "It is not enough for a group to jointly design a property but from its own design of the space it seeks to promote interaction and generate community life through spaces and resources conducive to it", (Cuesta el al 2020).

As a result of the last economic crisis, cohousing has gained renewed interest, as a formula that facilitates access to housing, an alternative that faces mercantilist approaches aimed at

maximizing profit where housing is exclusively a product that responds to a logic of the market. This system allows to reduce the cost of access to housing and an alternative to the purely commercial logic understanding housing as a right. The present work tries to provide evidence on the advantages in terms of costs of cohousing compared to the system of access to the property through the purchase from a developer.

The study shows that the cohousing model compared to the purchase of housing from the developer represents a cost reduction of more than 25%.

The work is structured starting with an analysis of the origins and legal framework of cohousing. It continued with a comparative analysis of the costs and the advantages and disadvantages of each of the alternatives considered.

2. THEORETICAL FRAMEWORK

The term Cohousing was first used by American architects Charles Durret and Kathryn McCamant in their book *Cohousing, A Contemporary Approach to Housing Ourselves* published in 1988.This is defined as "a type of community cohesive by its way of understanding the relationship between private life and common life. It consists of a set of private homes and an important endowment of common services. Planned and managed by its residents, according to the model they themselves decide, which allows them to define the project according to their real specific needs". Cohousing is inspired by the original idea of village or community. An environment where all the inhabitants live and work in harmony, following rules imposed by themselves.

The falastery can be considered an antecedent of Cohousing, a community of production, consumption and residence theorized by the utopian socialist Charles Fourier[1] . It proposes an economically self-sufficient community, in which each person can freely choose their profession. Kibbutzs in Israel can be considered another antecent, although initially they were agricultural communities later evolved into industrial activities (Rodríguez 1975). Ebenezer tried to carry out these ideas in England, founding two garden cities, Letchworth and Welwyn, 60 and 30 kilometers from London respectively. Altrought his cities failed to address all the principles he envisioned, they did serve as inspiration for later architects such as Frank Lloyd Wrigth with his approach to the urban growth of the periphery of large cities. In the 20th century, during the interwar period in Vienna, a low-cost social housing project was launched for the working class of the population. The project defines a minimal dwelling, seeking an interpersonal relationship in common spaces, such as living rooms, kitchens and large urban plantations (Chong et al. 2019).

Figure 1. Cohousing WindSong, Canadá. Source: https://fr.cohousing.ca/classifieds/three-bedroom-plus-den-home-for-sale

Figure 2. Cohousing SÆTTEDAMMEN. Source: http://www.xn--sttedammen-d6

Figure 3. Cohousing Aflorem, Badalona. Source: https://www.colab.cat/cohousing-aflorEM/#lightbox[group-16741]/3/

Figure 4. Cohousing Las Carolinas, Madrid. Source: https://www.entrepatios.org/ las-carolinas/

Cohousing is the grouping of people with a common project. In the European models the constitution in the form of cooperatives predominates. Law 27/1999 of July 16, on cooperatives, grants the same rights to all partners and provides a democratic legal tool to manage all situations that may arise. Regarding the regulatory legal framework of cohousing in Spain, it is included in the Law of cooperatives . The cooperative is the owner of the housing and it is in charge of managing the installments with which the payment of expenses such as maintenance, repairs and other situations that may occur in the property will be made. The cooperative model is protected by the right of usufruct regulated in article 467 of the Civil Code. The usufruct allows the use/enjoyment of other people's property and the usufructuaries have the obligation to preserve their form. The cooperative members are holders of the transfer of use of the home, with the obligation to preserve it in the best possible condition. Since it does not have any specific regulation, Cohousing falls under the Urban Leasing Law (BOE-A-1994-26003). The Carolinas building in Madrid is an example of this property system in Spain. A building of 17 housings based on mutual support with their own energy and low energy demand.

Law 27/1999 of July 16 on cooperatives grants the same rights to all partners and provides a democratic legal tool to manage all situations that may arise. This type of cooperative takes the ANDEL model as a reference, implemented in countries such as Germany, Denmark or Sweden. Its characteristics are: 1. The Cession of Use rights are inheritable. 2. Indirect taxes are not faced as there is no transaction of a good. 3. Avoid speculation in the real estate market, cooperative members bear payments based on costs. 4. Each cooperative will be able to establish its own statutes, where all aspects related to the cooperative will be debated, voted on and chosen. 5. As the cooperative is the owner of the land and the property, it will always ensure the general interest of the cooperative members and the common good. 6. In case of wanting to leave the cooperative, the initial investment made would be returned, plus the annual increase in the Consumer Price Index (CPI), without losing purchasing power at any time. The terms would be regulated in the statutes of each cooperative (Etxezarreta et al. 2018).

3. METHODOLOGY

To carry out the comparative study of costs, the techniques of feasibility analysis in real estate projects are used. It starts from a plot located in the city of Valencia and an estimate of the cost for the future resident of the two assumptions is made, access by purchase from the developer and cohousing. In the case of the purchase from a private developer, the price is estimated from the market study. It is necessary to ensure that at this price the promoter will be willing to build the houses for sale. For this we will carry out the feasibility study in which the revenues, costs and profit margin will be estimated.

In addition, a financial proposal will be made and the flow of collections and payments of the project will be estimated. Finally, the profitability will be determined, confirming the project provides adequate profitability from the calculation of IRR. In the case of cohousing, the cost of access for the resident will depend on the different costs necessary to carry out the building. It is considered, for simplicity, that the building costs in both cases are similar. Although it is clear that they differ in certain expenses such as deeds and commercial expenses among others.

The costs of access through cohousing are analyzed and compared to access to property through the acquisition of housing from a promoter. A case study is proposed in a plot of land in the city of Valencia. The site is located at number 30 Brasil street in the Nou Moles neighborhood in the city of Valencia. The plot has an area of 1,780 m². The regulations allow the construction of housing and tertiary use on the ground floor. The construction of a 7-storey block of houses with a swimming pool, green areas and sports area is proposed. The total buildable area consists of 1,248 m² per floor. There are indoor common areas on the top floor and some more outside the building. The construction of 66 homes is planned. Due to the high demand for parking spaces, 66 spaces are projected to be awarded to homes plus another 37 for private sale.

Figure 5. A floor plant of the building considered for the case study. Source: Own elaboration

When purchasing a home from a promoter, the buyer must pay the estimated purchase price based on a market study. It is assumed that for the purchase the buyer will request a mortgage loan, so the financial costs are added. A feasibility study has been carried out to ensure that the option to purchase the home at the estimated prices is a real alternative. The viability of the project depends on generating income above costs with a sufficiently high margin. That is, with a margin that is not less than the expected value in the sector. For this, the IRR of the project is obtained. In the case of access through the cohousing system, those interested in accessing housing must be cooperative members, so they must pay some fees to meet the payments derived from the purchase of the land and the building. Payments are settled monthly.

Comparing both alternatives, several considerations have been made about the financing instruments. In the case of a construction by the promoter, it is considered that the project is partially financed with its

own resources and those of others. External financing comes from advance collections from customers, deferred payments to the builder and the bank loan to the developer. The advance payments of the clients amount to 20% of the value of the house. The conditions applicable to bank financing have been estimated based on market conditions at the time of the study. In the case of access through Cohousing, two types of fees are considered, an entry fee at the beginning of the project, which has been established as equivalent to the total amount of advance payments to the promoter in the private regime, and annual fees. For the payment of the initial amount, the cooperative members have requested financing through a loan from an ethical bank. To simplify the case, it has been considered that the applicable financial conditions, such as interest rates and commissions, are the same as those established in the loan to the developer.

4. RESULTS

The following differences between cohousing and the more traditional access consisting of buying from a promoter stand out: 1. In the promotion, buyers must contribute 20% of the price as advances, in the cohousing system it has been considered that the payment will be the same but it will be returned to the cooperative member if he loses said condition. 2. In the traditional model, a loan for the value of 80% of the housing is requested from the bank and the obligation to pay the entire amount is signed. In the cohousing model, the loan will be requested by the cooperative to finance the costs of promoting the property. This loan will be distributed in fees to the cooperative members, as established in the statutes of each cooperative.3. In the case of the traditional mortgage, there is an obligation to pay the entire loan. In the cohousing model, the cooperative member does not have a personal obligation with their fee. That is, if at a given moment that person wishes to stop being part of the cooperative, they would not have the obligation to pay that loan, but it would be assigned to the person who would replace them. 4. In the traditional model, neighbors will be the ones who decide, through their vote, the changes that occur in the property. In the cohousing model, a full consensus will be sought among all the cooperative members, being able to decide in the way they consider appropriate, as established in the statutes of each cooperative.5. In the traditional model there is always the possibility of selling the property. The value of the home depends on the market situation at the time of sale. In the cohousing model, the cooperative member is not the owner of any property but of a share in the cooperative. In the case of leaving the cooperative, the initial contribution will be refunded plus its increase on the Consumer Price Tax (IPC) as established in the statutes of each cooperative. 6. In the case of death, in the traditional model, heirs will have to face a series of payments derived from the taxes related to the inheritance of properties. In the cohousing model, heirs must decide if they want to live in the house or if they prefer to leave the cooperative. In the second case, they will recover the initial investment of the deceased plus their increase in the annual CPI from the contribution as established in the statutes of each cooperative. 7.In the case of possible defaults, in the traditional model, it can lead to the seizure of the property by the debtor bank. In the cohousing model, the cooperative can contemplate several solutions, from distributing part of the debt among the remaining cooperative members to requesting the withdrawal of the cooperative. This situation will vary in each cooperative since each one will have its own statutes and its way of resolving it. 8. In the traditional model, housing reforms are carried out without requesting permission from the community. In the cohousing model, it will be the cooperative that decides the magnitude of the reforms and whether or not permission

should be requested, according to its own statutes. 9. In the traditional model there is no legal limit of people who can live in the house, in cohousing, the cooperative will decide in its statutes if it establishes any limit 10. In the traditional model one can be absent from the home indefinitely. In cohousing, the cooperative will decide how to act in case of prolonged absence as established in its statutes.

After identifying the qualitative differences between both models, we proceed to compare the access costs for the future resident in each of the cases.

COST OF BUILDING	
Soil	4,123,883 €
Building	6,899,542 €
Additional construction costs	137,991 €
Project costs and construction management	558,288 €
Building License and Fees	258,733 €
Deed expenses	296,055 €
General expenses	873,882 €
TOTAL OPERATING EXPENSES	**13,218,212 €**

Table 1. Estimated building costs. Source: Our own elaboration

Based on the previous building costs, we compare the costs that future residents will have to face in each of the two cases.

In the case of traditional promotion, to determine the cost of acquiring the home, we base it on the purchase price that has been obtained from the market study. The estimated prices have been the following:

1. Pack 1 (housings 1 room): 143,303 €
2. Pack 2 (housings 2 rooms): 178,903 €
3. Pack 3 (housings 3 rooms): 238,011 €

From the prices derived from the market study and the buildability for each type of use, the estimated income amounts to 17,477,634 euros. The gross margin on sales, without considering commercial and financial costs, is 24.37%. The following external financing instruments have been considered to determine the profitability of the project: customer advances payments are established at 20% of the price of the housing, mortgage loan whose available capital amounts to the cost of construction and deferred payments for construction 60 days. The profitability of the project, calculated from the Internal Rate of Return after taxes (IRR) amounts to 19.33%. With these results it is confirmed that at the estimated prices the project is feasible for the developer.

The cost for each buyer includes advance payments of 20% of the purchase price and the cost of repaying the loan, capital plus interest. It is recalled that the capital amounts to 80% of the price of the house and the interest and the loan has a duration of 20 years.

In the acquisition, the price paid to the developer is the cost of the investment. In the case of cohousing, cooperative's expenses, which cooperative members will have to pay, are those derived from the acquisition of land plus construction. In addition, they must pay the maintenance costs of the building in the proportional part that corresponds

	Customer advance payments	Total cost of the loan	Total cost of the housing
Housings 1 room	**28,661€**	**159,571€**	**188,231€**
Housings 2 rooms	**35,781€**	**199,213€**	**234,994€**
Housings 3 rooms	**47,602€**	**265,031€**	**312,633€**

Table 2. Cost in the case of access to the property by adquisition the housing from the developer. Source: Own elaboration

to them. Among these, maintenance costs, lighting costs and reforms are distinguished, in addition to the payment of the tax derived from real estate. In the case of the purchase from the developer, the owner will also have to face the maintenance costs of his housing and must participate in the expenses derived from the common areas. In both cases there are operating costs beyond the building that can be considered similar, which is why at the time of comparison it has been decided to dispense with operating costs.

In the case of access through cohousing, the entry fee to the cooperative is considered a payment equal to the 20% advance payment that buyers must pay in the event of acquisition. Secondly, the cooperative members will have to request a loan to cover the expenses of the project, which must be paid during the 3 years that the lasts. The loan will be requested from Ethical Banking. For the loan, conditions have been established in terms of duration and interest rate equal to that of the previous assumption.

If we compare both assumptions, it can be seen that the cohousing model represents cost savings of over 27%, (see table 4).

Although differences between the two assumptions have already been discussed, when we focus on payment we must take into account two more considerations. In the first place, in the private model it is necessary to make the payment of the amount according to the conditions requested by the promoter; In the cohousing model, before starting, a group will be created to approve the community statutes, where the form of access to the cooperative will be decided. As a second difference, we highlight that in the traditional model, there is always the possibility of selling the property, its value being defined by the market situation at that time. In cohousing, the cooperative member is not the owner of any property but of a share in the cooperative.

	Initial fee	Total cost of loan	Total cost of the housing
Housings 1 room	28.661€	107.239€	135.900 €
Housings 2 rooms	35.781€	131.946€	167.727 €
Housings 3 rooms	47.602€	174.187€	221.789 €

Table 3. Cost in the case of access to the property through cohousing. Source: Own elaboration

	Cost difference	
	Amount	*%*
Housings 1 room	52,331 €	27.80%
Housings 2 rooms	67,267 €	28.62%
Housings 3 rooms	90,844 €	29.06%

Table 4. Cost differential between the two assumptions considered. Source. Own elaboration

In the case of leaving the cooperative, the initial contribution will be returned to them plus the increase of said amount based on the CIP and as established in the statutes of each cooperative.

5. CONCLUSIONS

In the various countries where it is present, cohousing is considered a solid option for part of the population that does not want to own a housing or chooses to share their life with a community related to their interests with whom they can share tastes and hobbies. From the first cohousing in Denmark to the present, more and more people are interested in this option, and there are currently several communities in Spain. In addition, this assumption has turned out to be cheaper than through the private model, facilitating access to housing for people with lower incomes.

The results of the studies carried out indicate that access through the cohousing system compared to access through purchase from the developer represents savings of over 25%. In the study, carried out on a building plot, three types of housing have been considered, the results obtained show that for one of the cases the cost through cohousing represents a saving of 52,331€, 67,267€ and 90,844€ respectively. In percentage terms, 27.80%, 28.62% and 29.06%, respectively.

Although the purpose of the following article is to compare the access costs for a future resident in the two cases considered, it should not be forgotten that there are important differences beyond costs. On the one hand, the fact of accessing the property is something deeply rooted in the culture, on the other hand, we also find important differences in the fiscal aspects, especially in the transmission by inheritance.

NOTES

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PAPER #7.04

LEARNING (IN/FROM/THE) CITY: RECONFIGURATION OF URBAN SPACE INTO A SUSTAINABLE 'MACRO-SCHOOL'

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ABSTRACT

This paper intends to intertwine the fields of educational space, architecture and urban design, as well as sustainable development, and it is grounded in two main arguments. The first argument is that in recent decades there have been trends of breaking boundaries between independent spatial units within the school building, as well as within the planning/design process, with the ultimate goal of opening the educational environment to public space and public debate. Consequently, as the urban environment is progressively recognised as a canvas of multiple learning experiences, open-air space is approached as an environmental tool for informal/non-formal education and sustainability. The breaking of spatial boundaries within the school building to outdoor spaces and the city renders the city as a sustainable 'macro-school'. This discussion is theoretically framed in the educational perspective about the relationship between education and the city defended by Trilla (1993); the city as a context for education; as a medium for education; and as an educational subject; and in the dimensions mentioned by Palmer (2002): education about, in and for the environment. Thus, open-air learning space is explored as a tool of environmental education, through participatory planning processes, the co-creation of liveable urban spaces, and their use for spatial literacy, socialisation, environmental action and bottom-up activism. The interpretation of a set of examples of individual urban sites, that cover a diversity of purposes and geographies, brings some insights into this debate and enables us to understand how urban space is being reconfigured into a sustainable 'macro-school'.

KEYWORDS

Learning city; education and city; environmental education; urban space; participatory processes.

1. INTRODUCTION

In the 21st century society marked by globalisation and the domination of the digital, the nature of education is being rethought. Learning can be achieved in different places with the utilisation of mobile technologies, a condition that has recently intensified by the implications of the COVID-19 pandemic. In addition, we have been witnessing a growing appearance of out-of-school practices, organisational forms, and curriculum regarded as a remediation, a supplement or a complement of local school systems, with a wider social value of learning (Sefton-

Green and Erstad 2019). These forms of out-of-school education emerge as alternatives to the formality of the rituals, organisation and control of the educational system through the informality in which learners are engaged including the lack of a formal evaluation process (Ladwig; Lames G. and Sefton-Green 2019, 25). In this frame, cultural institutions, such as museums or libraries, and outdoor urban spaces, such as gardens or squares, assume a form of semi- or non-formal learning loci. The idea of expanding the learning process beyond the school boundaries does not imply its extinction, but rather the promotion of a broader and more holistic approach to the learning process and to the role of the environment in it.

In recent decades, the use of open-air urban space has been gaining ground in the debate on the role of the environment in learning processes (Tsoukala 2005). The schoolyard and urban space emerge as new learning environments which we approach through the lenses of informal/non-formal learning and sustainability. This discussion around school/out-of-school learning, its correspondence with formal or/and informal modes of learning and its use for environmental education poses new challenges to the design of spaces where learning can take place. At the same time, the boundaries that have been progressively approached in the process of exceeding the school as the exclusive locus of education, lead us to the investigation of the educational potential of outdoor spaces, with particular emphasis given to the urban environment. From the educational perspective, Trilla has pointed out three dimensions in the relationship between (informal/non-formal) education and the city, which lead us to reflect on the challenges to be considered from an architectural point of view: the city as a context for education (learning in the city); the city as a medium for education (learning from the city); and the city as an educational subject (learning the city) (Trilla 1993). Simultaneously, the urban environment has the potential to constitute a valuable resource for environmental education, in all its three dimensions as defined by Palmer (2002); education about the environment, in the environment and for the environment.

Parallel to this, the school environment needs to be re-promoted as a vital social space, with the provision of a multiplicity of locations and spatial types, in order to compensate for the 'attractiveness of the screen'. On this topic, Herman Hertzberger's structuralist compositional approach is of particular relevance to school architecture by using the complexity of the city as a source of inspiration to his school design projects (Hertzberger, Vall, and Vos 2012). The interpretation of the school buildings designed by Hertzberger allows not only to understand how the urban system can be translated into spatial means within the school space (school as a micro-city), but also alerts to the educative potential of the urban space (city as a macro-school).

Framed in this theoretical context, this paper intends to approach and intertwine the fields of educational space, urban design, as well as sustainable development. There are two main arguments that are defended throughout the paper. The first argument is that in recent decades there have been trends of breaking boundaries between independent spatial units within the school building, as well as within the planning/design process, with the ultimate goal of opening the educational environment to public space and public debate. The concept of exceeding the limits of each unit does not imply their abolition but signifies the exceeding of the classroom and the school building as the exclusive loci of education. The second argument is that as the urban environment is progressively recognised as a canvas of multiple learning experiences, open-air space bears significant potential as an environmental tool for informal/non-formal education and sustainability (Raikidou 2022).

The breaking of spatial boundaries within the building renders the school as a 'micro-city', whereas outside of it, the same process

renders the city as a sustainable 'macro-school'. It raises questions such as: how can public space be interpreted in educational terms? How can it be explored as a sustainable tool of (and for) education (environmentally, socially and culturally)? How can architecture contribute to enhance the educational value of the public space? How does the participative planning of an urban educational structure contribute to a more sustainable relationship between members of the wider community?
In the search for answers to these questions, the article presents first the theoretical framework that supports the following interpretation of a set of examples of individual sites, organised according to Trilla's dimensions. These examples cover a diversity of purposes and geographies, bring some insights into this debate and enable us to understand how urban space is being reconfigured as a sustainable 'macro-school'.

2. BACKGROUND

By extending the boundaries of the classroom and school building, outdoor education gives outdoor physical space an important role in the learning process, requiring a comprehensive approach that adequately and effectively supports and stimulates learning in the city taking into consideration the three dimensions stated by Trilla (1993) (learning in/from/the city) and by Palmer (2002) (education about/in/for the environment).
The three dimensions of the relationship between education and the city mentioned by Trilla in his writing "La educación y la ciudad" (Education and the city) (Trilla 1993). deserve a brief explanation to understand their implications for the design of educational spaces, from the scale of the building to the scale of the city. The first dimension, the **city as a context for education** (learning in the city), considers the configuration of an educational network which includes multiple diverse urban spaces and places (from school buildings or educational centres to the entire civic, cultural and commercial urban network) that provide resources and stimuli combining formal, non-formal and informal modes of education. The educational impact of a city must be seen as the result of a synergistic action, considering not only the quantity and quality of the schools, but also the rest of the institutions and means that generate learning, and how they all interact harmoniously functioning as a system.
The second dimension, the **city as a medium for education** (learning from the city) considers the city as an informal agent of education as it is a source that generate education and socialisation, a transmitter of information and culture. The density of encounters and cultural elements in the city promotes communication, the exchange of cultural experiences and thus knowledge. Additionally, it incorporates different means of information transmission, which convey messages in a random way. In this sense, urban environment can be ambivalent since it can promote culture or civility, or generate marginalisation or indifference, and the way it is designed should be seen as an effective educational intervention.
The third dimension, the **city as an educational subject** (learning the city) considers that informal knowledge generated by the urban environment is also knowledge about the environment itself. Making the city the object of education means overcoming the limits of superficiality and partiality that are often present in direct and spontaneous learning about the urban environment, deepening the informal knowledge of the city, learning to use urban resources, to interpret the processes that shape the territory, to understand its dynamics. The city is a vast reservoir of resources for lifelong self-education, and educational institutions should prepare people of all ages to be able to access the educational and cultural possibilities of the urban environment on their own.
The role of education was early on recognised as crucial in addressing the environmental

concerns of the post-war Western world, thus leading to the emergence of environmental education. Palmer (2002) mentions the framework for environmental education in the interconnection of three trends: education about the environment, in the environment and for the environment, which in turn provides an individual holistic approach on the theme based on concepts of concern, experience and action. The first two dimensions relate to the understanding of environmental issues through environmental information and the collection and analysis of data through in-situ investigation. The third approaches environmental concerns through a holistic and critical approach, by analysing the underlying socio-economic causes, engaging in decision-making processes and taking environmental action.

This interest in public space, its interconnections with education, and the intention to exceed the school as the exclusive locus of education, was intensified with the COVID-19 pandemic (Boys and Jeffery 2021). Attention has been focused on outdoor education (Dyment and Potter 2015; Facer and Buchczyk 2019) and, by extension, on the physical attributes and the spatial configuration of the schoolyard and public urban space for informal and non-formal learning, through the lens of environmental and social sustainability. The interpretation of recent cases relating education with the city considers also concepts associated with the spatial literacy that entails familiarising children with the material and immaterial features of their environment, participatory practices applied in the planning/design stage and in the evaluation of the environment leading to the user's emotional involvement with the social and natural environment (Tsoukala 2005) and acting as an interactive pedagogical tool for spatial literacy, as the school/urban environment is the place where the bar is set for the environmental quality that the individual claims as an adult (Fisher 2005).

3. RECONFIGURATION OF URBAN SPACE INTO SUSTAINABLE 'MACRO-SCHOOLS'

The following examples intend to discuss outdoor initiatives in which the outdoor environment (from the school ground to the city) becomes an innovative tool for environmental education and social justice. They are discussed through the lens of Trilla and Palmer's dimensions. The examples include initiatives implemented by public/private institutions, based on participatory processes, and by educational services of cultural institutions in urban parks.

3.1. Climate shelters network in the city of Barcelona

The programme carried out in Barcelona to create climate shelters to regulate temperatures and create more comfortable surroundings for city residents has implemented close to 200 shelters, including the transformation of school playgrounds (Ajuntament de Barcelona n.d.; Urban Innovative Actions 2021). The plan started with the redesign of eleven school playgrounds combining a package of blue measures (incorporating water points), green measures (spaces for shade and vegetation) and grey measures (works on buildings to improve insulation). The archi-landscape solutions are based on the creation of a sequence of paths that connect new shaded areas that can be used both as small classrooms and play areas through new trees and awnings, the replacement of concrete surfaces by natural land with a combination of different plants, and the creation of new water points and play areas (Fig. 1 and 2).

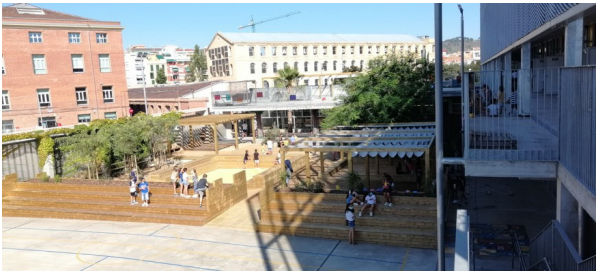
We can read these spaces through the lens of Trilla's dimension Learning in the City: "The city is a container of multiple and diverse education … which is spread throughout most of its spaces" (Trilla 1993, 9). These interventions considered the urban and the physical environment as a context for educational events through the implementation of a pedagogical plan that

involved school community in the evaluation of the benefits of the architectural measures on the mental and physical health of the user. Workshops and participatory activities, besides bringing together three scientific partners of the project, teachers and students, also framed the educational programme in experimentation activities. Students were taught to measure changes in their environment (for example, temperature, humidity, CO2) and to evaluate the effectiveness of architectural interventions on health and how these affect people's quality of life.

Architecture is in the centre of an educational experience through the design of urban spaces that interconnect modes of formal, informal and non-formal education mainly focusing on information and training on climate change. Schoolgrounds design contributes to a broader system of an urban educational environment giving shape to the first two dimensions on environmental education: education about and in the environment (Palmer 2002)

The territorial and social amplitude of schools provides an urban educational opportunity not only for children but also for the community, with the so often neglected outdoor spaces of schools at the centre of an educational programme. The impact at the city level is expressed in the following sentence: "Schools are a strategic intervention opportunity in the city and are assumed to be an equitable space both socially in territorially. All city children go to school, so if we intervene in schools, we give all children the chance to enjoy the benefits because the schools are spread around the city, which means all the districts benefit" (Urban Innovative Actions 2021).

In Barcelona, green spaces and their relationship with educational institutions are mapped on an open access online platform that then can be utilised for the co-creation of participatory strategies, prioritisation and management of green infrastructure projects. Apart from the proximity to educational spaces, other mapped parameters include population density, air and noise pollution and the networks of green and blue infrastructure, as well as sustainable mobility. Learning the City, according to the Trilla's dimensions (1993, 16). Urban greenery has nurturing, healing and recreational capacities and its exploitation presents high potential for the present and future of the city. On the one hand, formal and informal educational activities within green spaces in the proximity of schools could effectively address the health and learning crisis of the Covid-19 pandemic. On the other hand, strengthening the network of existing and future green spaces can contribute to the handling of climate change by identifying and measuring variables that shape the urban microclimate.



Figures 1 and 2. Schoolground in one of the schools in Barcelona. (https://www.uia-initiative.eu/en/news/do-changes-made-climate-shelter-schools-improve-pupils-health and https://uia-initiative.eu/en/news/11-schools-barcelona-project-are-now-climate-shelters)

3.2. Network Community Gardens Berlin

Belonging to the Edible Cities Network, the city of Berlin has a network of free-access public community gardens, collectively managed by citizens' organisations, which act as agents of urban greening, lifelong learning, environmental and social justice (EdiCitNet n.d.). A combination of acquiring gardening skills, understanding ecological conditions, urban politics and the concepts of self-organisation and social entrepreneurship help to develop a sense of belonging in financially deprived neighbourhoods and remind urban populations of their dependence on nature. Usual activities include vegetable production, running cooperative cafés, concerts, art exhibitions and workshops dealing with issues such as urban farming, urban development and social inclusion ("Prinzessinnengarten. Kollektiv Berlin" 2022).

Prinzessinnengarten founded in 2009 in Moritzplatz by the organization Nomadisch Grün is part of this project that has been transforming the concept of urban green spaces, while giving form to an urban network with the main aim of providing education and participation opportunities (Fig. 3 and 4). Herbs and vegetables are grown in built transportable organic plots designing a mobile garden (allowing the relocation of the garden, if needed), disused and converted containers house a café, a kitchen and workshop and storage facilities. These elements design a set of pathways and spaces for working, socialising and learning. Workshops, walks, interventions join activists, artists, architects, researchers and representatives of initiatives working on questions such as gardening, urban and rural resilience, commons, land-politics and social housing. As an example on how architecture provided an opportunity "for a direct and experience-based introduction to a social practice of building that highlights connections between community, city, architecture and environment" is the three-story physical platform built in 2016 in a collective process (with volunteers, students and apprentices, for the Neighborhood Academy and other cultural and educational activities). This vertical platform (The Arbour) created spaces for workshops, film-screening and public discussions, while gaving visibility to the social and ecological dimension of the place (Nachbarschaftsakademie n.d.).

The density of human and cultural interactions that these places offer make the city as an agent of informal education, facilitating the communication and the mixing of cultures, therefore the acquisition of knowledge – Learning from the City, according to Trilla's (1993, 16) dimensions. Together with the organisation Nomadisch Grün, activists and local neighbours worked to put this

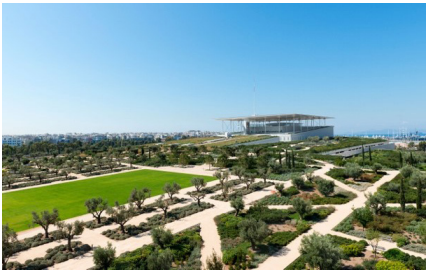
Figures 3 and 4. Prinzessinnengarten, Berlin – general view and training gardening training. (https://www.flickr.com/photos/39367406@N04/11545691785/ and https://www.flickr.com/photos/39367406@N04/11545849803/)

project in practice, transforming temporarily an unused plot into a learning place, As mentioned in the site of the programme: "By trying things out together and sharing experiences and knowledge, we reacquire old cultural techniques, learn a lot together about biodiversity, urban ecology, climate adaptation, recycling, and sustainable forms of urban living"("Prinzessinnengarten. Kollektiv Berlin" 2022). This informal educational approach to urban space, in particular marginalized communities, besides reflecting on new policies and alternative ways of governance the city, also has implications for the design of the city and for the architectural practice by the integration of ecological and social concepts.

3.3. The Stavros Niarchos Foundation Cultural Centre (Athens, Greece) and the Calouste Gulbenkian Foundation (Lisbon, Portugal)

The Stavros Niarchos Foundation Cultural Centre (SNFCC) (2016) is a recent cultural centre designed by Renzo Piano office in collaboration with local architects and landscape architects. The building complex hosts the headquarters of the foundation, the Greek National Opera and the National Library of Greece and is surrounded by a park with an area of 21 hectares (Fig. 5 and 6). The Calouste Gulbenkian Foundation (1969) was designed by Ruy d'Athouguia, Alberto Pessoa and Pedro Cid and is located in a park covering an area of 7,5 hectares. The building hosts also the headquarters of the foundation, a museum, an art library and an auditorium; at one end of this garden is the Centre of Modern Art building. Both parks occupy a central location in city and are recognised by the population from different ages as important outdoor spaces for cultural and educational events.

The park of the SNFCC occupies 85% of the total area and is home to a rich variety of flora, including olive trees and indigenous Greek aromatic plants. It enhances the area's biodiversity, reviving the Mediterranean landscape through its variety of species and the attention to the seasonal blooming, which creates exciting colour schemes and textures, thus attracting various insects and birds to the area. Part of the centre's sustainability strategy is to educate and raise awareness among visitors. In 2017, 2,300 nursery-school, elementary and secondary school pupils visited the park and participated in free environmental awareness programs for schools. There were free workshops on topics related to the environment, gardening, energy and architecture. All the environmental programs are intended to children with special needs and without, adults and the elderly (Stavros Niarchos Foundation n.d.).



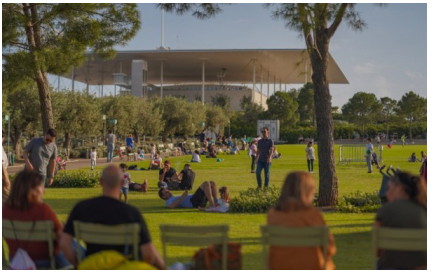
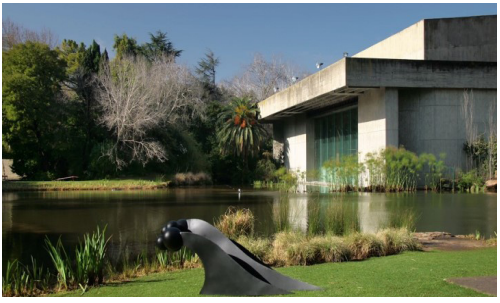


Figure 5 and 6. Park of the Stavros Niarchos Foundation Cultural Centre. (https://www.snfcc.org/en)

The Gulbenkian Park forms an ecosystem which includes more than 230 species of fauna, including 40 species of birds and other various types of animals, and a diverse flora, having a lake, streams, landscaped terraces, trails through groves and an open-air amphitheatre where concerts and shows can be seen. The park has a series of paths that express the main principles which inspired the design of this space: the path of light and shade, the path along the lake and the path along the shore (Fig. 7 and 8). The educational service organises a wide range of activities through workshops, visits, concerts, courses and special projects, which use playful and participatory strategies to captivate, involve and retain the audiences (schools and organised groups, young people, families, adults and people with special educational needs). On the other hand, the environmental, spatial and landscape significance of the park, and the existence of some garden furniture, allows a variety of activities to take place such as meeting, communication, small events, workshops, individual work/study, etc., promoting communication and in- and non-formal modes of learning (Calouste Gulbekian Foundation n.d.).

The concept of the city as an educational subject (leaning the city), the third Trilla's dimension, is explored in both urban parks. Both the biodiversity existing in the park and the architectural attributes of the buildings are used as educational content in activities to a wide range of public. The learning activities promoted by both institutions overcome what Trilla (1993,16) defines as the limits of informal knowledge: superficiality and partiality. Learning the city means a deeper knowledge (not superficial) of its genesis, structure, elements and connections, recognising the diversity of the city's coexisting and juxtaposing urban environments. Collaboration with schools and civil society is an opportunity for children, young people and adults to extend their knowledge to a part of the city that they do not use in their daily life and therefore offers other opportunities for knowledge (not partial). Both parks assume this task of providing informal education, complementing the formal education of schools and facilitating access to knowledge in teacher training and adult self-education from a different part of the city. The nature and its relationship with the built environment are the object of education focused on biodiversity and on the dynamics of the garden as an ecosystem. The



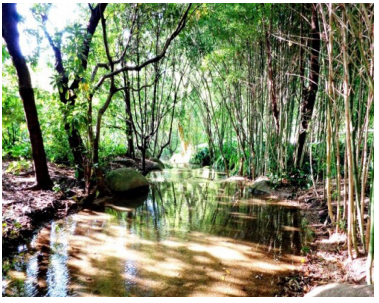


Figure 7 and 8. Park of the Calouste Gulbenkian Foundation. (https://commons.wikimedia.org/wiki/File:Jardim_da_Fundação_Calouste_Gulbenkian_(13943437417).jpg and https://commons.wikimedia.org/wiki/File:Jardim_da_Fundação_Calouste_Gulbenkian_02.JPG)

understanding of their characteristics raises awareness to the role of the urban network of green spaces in promoting environmental regulation, air purification, flood minimisation and to the increase of biodiversity.

4. CONCLUSIONS

One of the main conclusions of the COVID-19 pandemic's impact on education is the consensus that the physical space of school plays a crucial role in guaranteeing equal access to education and in acquiring social competences. But education cannot be restricted within the limits of a building and these goals should also be extended to the physical space of the city and in its relationship with education. The interpretation of the examples confirms that outdoor education is an effective mean to acquire knowledge, complementing local school systems, and to develop life-long learning strategies to promote individual and civic adaptation to social and environmental challenges (Facer and Buchczyk 2019).

Schoolgrounds, urban squares and parks are being rethought by public institutions and private organisations, becoming innovative instruments for environmental education and social justice through participatory planning processes and the co-creation of liveable urban spaces, and their use for spatial literacy, environmental action, social skills or bottom-up activism. Exceeding the intangible boundary of the planning/design process through participatory processes emerges as a crucial tool for the achievement of these goals. At the same time, practices such as combining urban culture with cultural and political action at the community level, collecting environmental data and mapping green spaces, and re-appropriating public spaces by civil society groups give the characterisation of sustainability to newly emerging 'learning cities'. The physical and spatial attributes of the urban space play a central role in the spatial translation of these values and goals.

Architectural design practice is also being rethought by embracing a interdisciplinary and more community-oriented approach in seeking spatial means to enhance urban space as a rich container of educational resources, a transmitter of information and culture and a subject to be learned and decoded in their multiple principles. In the examples above these spatial means are achieved in the form of a system of interconnected outdoor and complementary spaces (paths, open informal 'squares', nooks, supporting indoor facilities) built with sustainable, reused and transportable materials and cost-effective solutions (sometimes self-construction).

With its spatial and programmatic complexity, its diversity of environments and social mix, urban space embodies the distinct forms of education. Improving the relationship between education and the city contributes to more environmentally aware citizens, who will participate more actively in building a better city, based on informed and critical reading. Architecture and urban design have an active role in understanding the educational meaning of the city and incorporating this concept into the design of fairer and more inclusive urban structures (learning cities), considering spatial justice as a form of social justice, a pedagogical tool for spatial and environmental literacy.

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8

SUSTAINABILITY AND CLIMATE CRISIS

PAPER #8.01

AN APPROACH TO THE INFLUENCE OF CLIMATE CHANGE ON THE SEASONAL REAL ESTATE MARKET

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ABSTRACT

The effects of climate change are becoming more apparent day by day. This is reflected in an increasing global warming that produces changes in the climate in the short and medium term with potential and growing consequences in the behavioral patterns of society.
The climate crisis described above may have significant consequences on the vacation dynamics of national and foreign audiences. Effects such as the increase in temperatures, the desertification and erosion of large areas of the territory, or the scarcity of rainfall, reduce or alter the appeal of traditional holiday destinations. The loss of interest in typical tourist areas and the detour of their public to other areas that had never been touristic, cause alterations in the real estate market.
Despite the topicality and importance of this subject, the existing bibliography is scarce and scattered. This paper attempts to compile the existing scientific publications on the effect of climate change on real estate investment, as well as the main factors to be considered.

KEYWORDS

Climate change; tourism; real estate; investment; outcomes.

1. INTRODUCTION

The effects of climate change on the climatology and our environment are becoming more visible every day. So much so, that the European Parliament on November 28th 2019 declared the status of climate emergency and the aim of limiting global warming to 1.5ºC during this century, in order to avoid the considerable reduction of the global biological diversity, in addition to other possible consequences.
Tourism is a sector that requires favourable weather conditions to attract consumers demand and therefore it can be affected by changes in climatology. Variations in climatology can reduce the attractiveness of traditional holiday destinations, or shift the demand away from traditional holiday destinations. Changes will manifest in a wide variety of ways, such as, the increase and intensity of extreme storms, or changes in the precipitation patterns. Furthermore, global warming will cause variations in the environment such as the sea level rise, the glaciers disappearance or the increase of desert areas.
In Spain, the tourism sector is one of the main boosters of the economy and the creation of employment. Proof of this are the record figures for the pre-pandemic situation in 2019, when the contribution to GDP was 12.4%, receiving 83.7 million tourists according to the National Institute of Statistics. In the coming

decades, our country faces uncertainty about how it will cope with the effects of global warming and whether tourism infrastructures will be able to adapt or whether it may already be too late to do so. The variation in demand for holiday destinations is directly related to trends in the real estate market in these areas. In the medium and long term, the value of the assets and the investments of families and companies may be reduced if the weather and natural environments of these destinations change considerably, since it may difficult to perform the activities for which they were chosen (winter sports, coastal tourism, etc.).

The existing literature about the impact of climate change on tourism and the holiday real estate market is very scarce and biased. Particularly, in the case of finding specific literature on south-western Europe or Spain. For this reason, the present study is primarily intended as a literature review of the published bibliography regarding the effects of climate change on the Spanish holiday real estate market. In this way, conclusions could be drawn on future trends in holiday real estate investments and how this will affect the value of the existing properties. However, after an initial screening, it is clear that the number of publications is very limited. Therefore, this literature review is finally approached as the basis for the analysis of the impact of climate change on the seasonal real estate market, as well as on the tourism sector. It also aims to answer the question of whether the tourism sector is adapted to cope with the effects of climate change, by asking to more specific future investigations, whether the main Spanish tourist destinations are adapted, or will be able to adapt to the effects of climate change before it would be too late.

This study is organised into three sections. The first section studies the effects of climate change on the real estate market, in particular, the variations produced in the assets valuation and the changing investment trends on the real estate sector. It also describes some of the strategies being taken by the real estate sector to adapt its properties to the consequences of global warming. The second section analyses the impact of climate change on the tourism sector. Following several areas into which Scott and Stefan divide their research findings, this section distinguishes between three of the main tourism sub-sectors that are most likely to be affected by climate change in natural environments: winter sports tourism, coastal tourism and nature-based tourism. Therefore, some sub-sectors, such as urban, cultural and business tourism, have been excluded from this analysis, as they are considered to be more resilient to changes in climatology and will be more adaptable to the impact of climate change. Trips of these types of tourism are conceived on the basis of the specific destination, rather than the environment or activities to be undertaken. Finally, the third part seeks to answer the question of whether today's major tourist destinations are adapted to cope with the effects of climate change. In other words, whether they will be able to maintain their current attractiveness and demand for travellers, or whether demand will shift to other places that currently are less appealing for tourists. Finally, the conclusion describes the results obtained after relating the impact of climate change on the real estate market and the tourism sector.

2. THE IMPACT OF CLIMATE CHANGE ON REAL ESTATE INVESTMENT

Facing the climate crisis in which the planet is immersed is one of the main challenges that our society deals today. The effects of climate change are becoming more severe day by day. In order to mitigate these consequences, governments and corporations have focused on ESG (*Environmental Social Governance*) policies. As part of the measures they are beginning to implement, these initiatives seek to bring benefits to the environment and to the society. Some of these measures are targeted to reduce energy consumption and greenhouse gas emissions

produced by buildings. Buildings are the origin of approximately 36% of global greenhouse gas emissions. Periodic refurbishments of the existing buildings, based on energy efficiency and the reduction of greenhouse gas emissions, reduces the risk of loss of the property value and the disinvestment liquidity of the assets. Proof of this is the current trend in certificate buildings with internationally recognised environmental seals, such as LEED, WELL or BREEAM at different levels, with the aim of improving their interest for potential users and investors. These certificates also ensure that certain international environmental requirements are fulfilled, promoting the recycling of waste, the production of renewable energy, the use of public transport, electric vehicles and bicycles, the improvement of insulation in building shells and the quality of air inside the buildings, as well as other improvements.

All these actions at particular level are not enough to tackle global warming from an urban and territorial perspective. Neither do they prevent the devaluation of real estate assets or the reduction of investors' interest in certain areas or sectors. To address this, joint action by governments is needed to establish international environmental policies; these should regulate, through legislation, limitations on buildings energy demand and greenhouse gas emissions. They must also promote, through investment assistance and tax exemptions, that private entities and households undertake the appropriate measures to achieve the reduction of greenhouse gas emission targets and to limit global warming during this century. An example of such policies is the Directive 2018/844/EC promoted by the European Union to support EU constituent governments to foster energy efficiency and sustainability improvements in the existing buildings.

Nowadays, although they are increasingly taken into consideration, ecological variables such as the energy savings produced by the installation of renewable energies or the reduction of emissions during the life cycle of a building, whether for the approval by an investment committee of any real estate operation or in the decision of an individual to purchase a home, are not as decisive as more conventional factors, such as short/medium-term profitability, location and services in the surroundings. As Ristimäki et al. determine, the preliminary combined analysis of economic and ecological variables during the life cycle of buildings helps to economically justify the sustainable design of new urban developments.

On the other hand, there is also an emotional factor in the variation of real estate prices, as demonstrated by the study of Baldauf, Garlappi and Yannelis, in which the results obtained confirm the hypothesis that differences in beliefs about climate change are reflected in the price of housing in different neighbourhoods in the US. Specifically, their main finding was that, considering all other parameters being equal, homes located in "denier" neighbourhoods sold for 7% more than homes in "believer" neighbourhoods in the same city. They concluded that heterogeneity in beliefs about long-term climate change risks significantly affected the housing market in their country. As investments in commercial real estate assets, they also are influenced by emotional drivers, such as the interest on the buildings for potential users or the destinations chosen by tourists for their next holidays. Consequently, any variation in tourism demand for a destination will lead to changes in its economic activities and companies' performance, correcting the value of real estate assets from the point of view of profitability investment.

3. EFFECTS OF CLIMATE CHANGE ON THE TOURISM SECTOR

Climate change will undoubtedly affect the development of the international tourism sector, but as Scott and Stefan describe, climate change is only one of several macro-economic parameters (e.g., among others, the cost of travel, political stability, currency exchange or natural disasters) that combined will affect the

prospects for international tourism. According to their study, climate change will affect tourism in four different ways:

- -Direct impact on climatology; varying the length and quality of climate-dependent tourism seasons, operating costs, location decisions, attractiveness and tourism demand of destinations, etc.
- -Environmental changes caused indirectly by climate; affecting natural assets that define the image of destinations and are key attractions for tourists.
- -Socio-economic disruptions caused indirectly by climate; such as reduced economic growth and available wealth, increasing political instability, etc.
- -Policy responses from other sectors, such as mitigation policies, which could alter transport costs and the selection of destinations, adjustment policies related to reduced water consumption, etc.

Depending on the geographical location and type of tourism, the climate crisis will affect tourism destinations differently. Places that are more focused on urban activities, such as business or cultural tourism, will be less affected by the effects of climate change. This is due to the fact that activities are mainly carried out inside buildings and have a greater number of infrastructures, making it easier to adapt to weather inclemencies and changes in the environment. Therefore, based on the division of several areas into which Scott and Stefan divide the findings of their study, this section analyses the main tourism sub-sectors that will be most severely affected by the impact of climate change, excluding cultural and business tourism for the reasons above mentioned.

3.1. Winter sports tourism

Due to its dependence on climatology fluctuations, winter sports tourism is the tourism market with the greatest impact and the most immediate impact of the global warming. The ski industry has been the first and most studied industry to analyse the effects of climate change on tourism. Similarly, today, there is a growing interest from ski industry professionals (such as investors, ski area owners and snow management companies) in climate risk information and expert advice on the implications of climate change. Industry stakeholders need to know in advance the effects of climate change to enable a more climatology-resilient and sustainable adaptation of the tourism sector in mountain regions of the world (Steiger et al., 2017).

Most part of the literature studies the effect of climate change from the demand or supply side. However, as Scott and Stefan state, most of these studies suffer from important limitations that reduce the validity and restrict its relevance for decision-making. The use of inappropriate indicators and the omission of snow-making in regions where it has been an integral adaptation to climate variability are the main limitations of the studies. However, studies that consider artificial snow production, such as the two developed by Steiger (2010 and 2011), conclude that the impact of climate change is substantially lower than those that have omitted it. According to Scott and Stefan, the most likely effect of change will be a contraction in the number of ski operators in the more regional markets, although the variation in demand of different areas should be found out by future researchs.

3.2. Coastal tourism

There is a wide variety of publications that study the impact of sea level rise on the economy (Bosello et al., 2013), even the disappearance of large geographical areas at sea level or the main consequences such as the scarcity of drinking water (Kwadijk et al., 2010). In contrast, the effects of sea level rise on coastal tourism have been less well documented in academic research. As Scott and Stefan suggest, this may be due to the shortage of geospatial information sets available on coastal tourism assets (resorts, beaches, transport infrastructure,

etc.). Several publications have highlighted the loss of high-value beaches, destruction of tourism infrastructure, alteration of biodiversity, increasing need for beach protection and changes in coastal aesthetics as the main effects of sea level rise on coastal tourism. The majority of the literature studying the consequences of sea level rise in coastal areas is based on engineering and geospatial models. However, they do not adequately assess adaptation strategies, such as structural coastal protection, which could be an economic response to land loss and infrastructure damage. By contrast, coastal protection may not be economically viable in some coastal areas, and it will vary according to the density of accommodation and infrastructure for each location. In addition, coastal protection may not be compatible with most of hotels and resorts, as they should preserve sea views, easy access to the beach and the aesthetics of the beaches in order to maintain their attractiveness for tourists.

On top of this, according to Arabadzhyan et al., with regard to tourist behaviour, studies differ considerably in the variables selected (willingness to return to the destination, alternative destinations, reduction in the number of visitors, etc.), as well as in the regions under study in order to share the same conclusions. Likewise, as these are non-linear processes, it is difficult to draw general conclusions; on the one hand, climatology is variable and can affect neighbouring territories in very different ways; on the other hand, tourist behaviour is complex, since, for example, individual heat stress does not increase proportionally with temperature, it appears when a certain temperature threshold is reached.

Tourists seek to escape from the heat of cities by choosing coastal destinations for their holidays despite similar temperatures. So high summer temperatures may have less impact on tourist demand for coastal destinations. Therefore, in order to assess the socio-economic effects of climate change on tourism, it is essential to use non-linear methodologies, or methodologies that complement linear models to draw more relevant conclusions.

3.3. Nature-based tourism

The effects of climate change on natural resources and the environment are becoming more tangible, although this varies heterogeneously depending on the location and type of environment (glaciers, coral reefs, mountains, beaches and fjords, etc.). The impact of global warming on nature-based tourism has been studied in many different regions of the world. One of the natural environments mainly affected by climate change with great attractiveness for tourists are glaciers which, as Wang and Zhou state, are losing their visual attractiveness in some of their environments or even tend to disappear due to ice melting and sliding. This will increase the loss of tourism demand and economic development in certain mountain areas. As the Unesco stated, glaciers in one-third of World Heritage sites will disappear by 2050 regardless of the applied climate scenario and glaciers in around half of all sites could almost entirely disappear by 2100 in a business-as-usual emissions scenario5. Local adaptation measures in these areas will not be able to remedy or slow down the problem; global measures must be put in place to reduce greenhouse gas emissions and global warming. According to Scott and Stefan, after the episodes of coral bleaching on the Great Barrier Reefs during the 1990s and 2000s, surveys were conducted asking divers whether they would return to the destinations if the reefs were degraded. For example, in a survey conducted in Zanzibar (Tanzania) and Mombasa (Kenya), only a small proportion (28 and 45%) were aware of coral bleaching, and a considerable proportion (40 and 33%) indicated that they would return to dive on a degraded reef, showing that there would be some market for degraded reefs. Furthermore, when tourists in the Great Barrier Reef area were surveyed about coral bleaching, only a small proportion (13%) would not revisit the region, but a large group (41%) were hesitant

about their intentions. However, desert areas such as the Middle East, North East Africa or large deserts such as the Atacama Desert will be more resilient to the effects of change as they comprise large areas of arid land with low rainfall and flora and fauna diversity.
Another decisive factor for nature-based tourism is the loss of biodiversity and the reduction of the existing fauna, as this may significantly reduce the interest of visitors seeking to see certain animal species that are currently protected or endangered. As Scott and Stefan state, the findings of the different studies suggest that the effects of climate change on the environment will differ between different tourism markets. There is also evidence that discounted fares may compensate, in some part, for the degradation of certain destinations.

4. IS THE TOURISM SECTOR ADAPTED TO CLIMATE CHANGE?

As discussed formerly, it is crucial to have a comprehensive research framework on the effects of global warming in the different tourism sub-markets, well in advance, so that the tourism stakeholders can implement the correct measures to minimize the impact of climate change on tourist demand.
Governments and, in particular, international organisations should take the immediate initiative to establish international mitigation policies that promote greenhouse gas emission neutrality in transport and energy consumption. The measures to be put in place should be backed by substantial financial support and long-term tax exemptions. As there is a large time bias between the viability of companies' business plans (less time-bound) and the benefit/cost assessment of investment in sustainable solutions. Similarly, major airlines, shipping and energy companies should focus their research on developing new greenhouse gas neutral fuels in order to develop sustainable travel methods. If the main effects of the current climate crisis (such as global warming, changes in climatology, sea level rise and loss of biodiversity) are to be reduced or even reversed, mitigation policies must be taken globally, otherwise the result will not be sufficient or will be accomplished too late.
As well as the tourism sector must adapt on the supply side, there is a growing consciousness among tourists to travel more sustainably (i.e. choosing closer destinations, using more efficient transport methods, selecting accommodation with certifications based on energy efficiency and sustainability, etc.). However, as Scott and Stefan indicate, although a considerable proportion say they are willing to pay some additional charge or fee to offset environmental costs, only less than 5% say they have paid, or always pay, charges for offsetting environmental effects.
All measures put in place to mitigate the effects of climate change and its consequences on the tourism sector will bring results in the medium and long term. In the short term, the tourism sector and public administrations will have to invest collectively to remedy the effects of climate change, such as damage on infrastructures, nourishment of environmental resources such as beaches after severe storms or forests after wildfires, artificial snow-making, etc. Thereupon, developing countries and small archipelagos, which have fewer resources and are more dependent on international tourism, may be more affected by the effects of climate change and the slowdown in economic development that tourism entails for them.

5. CONCLUSIONS

This study analyses the impact of climate change on the seasonal real estate market by examining its effects on the tourism sector. Any variation in tourism demand of a region will lead to changes in its tourism activity and in the operational profitability of sector companies, these will produce a correction on the value of the properties from the point of view of profitability as an investment.

Despite the topicality of the issue, the effects of climate change and its impact on the seasonal real estate market, it has been observed that there is a scarce number of academic publications about it. This may be due to the relevance of the subject, the recent concern of the society on the effects of global warming or the complexity of undertaking a research that encompasses geospatial, climatic, economic and non-linear parameters regarding human behaviour. Likewise, the impact of the climate crisis will vary depending on the destination under study and the type of tourism it performs. That is, areas that develop their tourism on natural environments and focus their activities on the environment as the main resources for attracting tourist demand will be more affected. On the other hand, urban regions that mainly promote cultural or business tourism will be more resilient to the impact of climate change, since their activities are mainly carried out in indoor areas and they have a greater number of infrastructures, easing the adaptation to weather inclemencies and variations on the environment. Furthermore, regions located in developing countries or small archipelagos, that are more dependent on international tourism to improve their economic prosperity, as well as, destinations that promote tourism based on nature or dependent on good climatology will be the most affected. Accordingly, there may be regions or types of tourism that won't have enough resources to adapt in time to the impact of climate change. Depending on the results of mitigation and sustainability policies, as well as the economic resources that companies and governments are willing to disburse, destinations traditionally known for their high demand for winter sports, coastal or nature-based tourism may cease to be so.

The severity of climate change stills uncertain in the medium to long term, and the consequences can be unpredictable. Mitigating climate crisis through far-reaching action to reduct and eliminate the greenhouse gas emissions is one of the most important initiatives that society must undertake to deplete the increasing global warming. Moreover, it is necessary to encourage further research on the impact of global warming on the real estate market, in order to, not only inform investors and households of the resulting corrections in the value of their real estate properties, but also to expose, well in advance, the changes in trends and variations in demand of real estate investments that will take place between certain regions. This study can therefore serve as a basis for any investor, private or institutional, when analysing any investment opportunity in the seasonal real market in order to ponder it about beyond a standard feasibility study. Any investment feasibility study should also integrate a longer-term analysis, beyond the temporality of the business plan. The inaccuracy regarding the celerity and severity that climate impact may cause to any new acquisition loss of interest as an investment, that it held thus far.

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PAPER #8.02

THE INFLUENCE OF ACOUSTIC STANDARDS IN CONSTRUCTION: A CASE STUDY OF SOCIAL HOUSING IN ARGENTINA

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ABSTRACT

Exposure to high noise levels greatly impacts human health. For this reason, it is necessary to take into account the acoustic conditioning of built interior spaces, since human beings spend a large part of their time in them. To this end, each country must regulate and promote good construction practices that guarantee the mental and physical comfort of its occupants. In the case of Argentina, there is an insufficiency in the development of laws and regulations on acoustic architecture and even more so on acoustics in homes. In this sense, this study aims to evaluate the current acoustic comfort presented by public housing in Argentina, highlighting the existing legal gaps, and enabling recommendations in this regard, taking Spain as the country of reference. This country is taken since Argentine legislation has traditionally replicated European and Spanish standards instead of American ones. To this end, a systemic review and comparison are made between the laws and architectural acoustic regulations of Argentina and Spain. The observation of the noise protection standards in closed areas of these countries will be deepened. For a better understanding of these and to meet the objective, a prototype of public housing was needed in different parts of the country through the PRO.CRE.AR plan is taken as a case study and verified according to each standard. IRAM and UNE. As a relevant result, it is shown that the houses built by the State only partially verify the admissible minimums proposed by the regulations. The lack of laws and complementary documents focused on acoustic conditioning is concluded through the case study.

KEYWORDS

Noise pollution; acoustic comfort; architectural acoustics.

1. INTRODUCTION

From the industrial revolution to the present, there is evidence of an excess of sound from technological sources as opposed to sounds of human or natural origin. Currently, technological sounds represent 68% of the total, followed by human sounds with 26%, and finally natural sounds with 6% (Schafer, 2018). In other words, the population of cities is increasingly exposed to noise generated by

sources such as vehicular traffic, construction, rail, and air traffic, among others. One of the factors of environmental degradation is sound or acoustic pollution (Maristany, 2021). The term Noise Pollution refers to the excess of sound that alters the normal conditions of the environment in a certain area (Juárez and Garzón 2020). According to data from the World Health Organization (WHO), noise is the second environmental cause of health problems, just behind air pollution -suspended particles- (European Environment Agency, 2021). (Maristany et al. 2016) .

In such a case, the countries take precautions in this regard by implementing the necessary measures for the acoustic protection of the spaces. Many of these take as a reference the set of technical regulations provided by the International Organization for Standardization (ISO) and then adapt them to their local context, including them as binding recommendations or not. However, as Maria says Machiberrena (2022), there is a lack of research and concrete actions both at the regulatory level and in environmental certifications, on the importance of protection against noise in closed spaces, being these types of spaces where human being spends 80% of their time. weather. In the environmental certifications carried out by third parties, the acoustic requirements of the buildings for their classification only have an influence of 5.9% of the total, which indicates their low consideration concerning other parameters on hygrothermal comfort, lighting, and energy efficiency, among others. The acoustic conditioning of homes is essential to preserve the physical and mental health of its inhabitants and even more so in the face of a strong trend of remote work or online education, which adds more activities and more acoustic requirements to the domestic environment (Saez, et. al., 2021). In the case of Argentina, there is an insufficiency in the development of laws and regulations on acoustic architecture and even more so on acoustic conditioning in homes.

2. OBJECTIVE

In this sense, this aims to evaluate the current acoustic comfort presented by public housing in Argentina, highlighting the legal gaps in acoustic matters, and enabling recommendations in this regard, and taking Spain as the country of reference. The choice of comparison with this country is that Argentine legislation has traditionally been taken as a model to follow and replicated the European and Spanish standards instead of the American ones.

3. METHODOLOGY

The methodology applied to achieve the objective is to make a systematic review and comparison between the laws and acoustic building regulations of Argentina and those of Spain. The observation of the noise protection standards in closed premises of each country will be deepened, being the IRAM 4044 standard in Argentina and the UNE 12354:2017 in Spain. For a better understanding of these for practical purposes, a prototype of publicly promoted housing was obtained in different parts of the country through the PRO.CRE.AR plan is taken as a case study. This presents the most traditional functional, aesthetic, and constructive typology of the country.

3.1. Bibliographic analysis of acoustic regulations

Currently, in Argentina, there is a national bill on the minimum budget for the environmental protection of acoustic quality. The main objective of this project is: To avoid or reduce the adverse effects of noise pollution on human health, other living beings, and the natural or cultural environment (Morandini, et al., 2018). In this sense, it proposes to implement an Acoustic Plan whose purpose is to design and implement measures aimed at reducing and maintaining sound and vibration levels below the guide levels of acoustic quality foreseen according to the

WHO. This acoustic plan requires the following: a) acoustic zoning based on the current or planned uses of the land, b) an evaluation of the existing acoustic situation according to the IRAM 4076 standard or its replacement. However, from the environmental and labor guidelines, the lack of technical specifications to carry out the acoustic conditioning of living spaces is evident. Within this specific field of acoustic architecture and directly related to the domestic habitat, since 2000 there has been a technical document proposed by the Ministry of the Interior called Minimum Quality Standards for social housing, last updated in 2019. This presents a section referring to acoustic comfort and refers to the corresponding regulation, IRAM series 4000, proposed by the Argentine Institute for Standardization and Certification (IRAM), a representative member of ISO and the Pan-American Commission for Technical Standards (COPANT) in Argentina. However, this document is not binding; it is simply a recommendation made by the aforementioned Minister.

At the provincial level, given the lack of sanction of the national law mentioned in previous paragraphs, the competent authorities carry out their legislation and ordinances on protection against noise, based on what is increased in article 41 of the national constitution and also in the civil code Article 2618. Where in the case of the constitution it refers to the fact that all inhabitants enjoy the right to a healthy, balanced environment, suitable for human development, and in the case of the civil code there are restrictions on the obligations as a citizen not to generate annoying noise. Only Buenos Aires, the capital of Argentina, has generated the greatest advances in acoustic matters with its provincial law no. 1,540/2004, which seeks to prevent and control noise pollution and identifies, among other things, its noise levels through noise maps, determining sensitive areas both in exterior and interior spaces and conflict areas (www.argentina.gor.ar, 2022). In the rest of the provinces, there are ordinances reformatory, annoying and excessive noise or sounds in the city (Hussl Bulgarelli 2017), however, we are sorry in these regulations it is an insignificant reference in terms of architectural acoustic conditioning. In this sense, it is up to the professional in charge and the client to apply the IRAM recommendations on protection against noise in interior spaces. In the case of low-income housing, they are subject to materializing in accordbynical specifications required by the provincial or national government, which must improve current laws and regulations. Under this scenario, the lack of binding laws at both the national and provincial levels on acoustic conditioning in interior spaces, both for new construction and for rehabilitation, is eve. It is expected that soon compliance with the IRAM Standards will be mandatory by law and it will indeed be important to analyze the recommendations they make on the subject.

In the case of Spain, the autonomous communities are obliged to comply with Law 37/2003 on Noise and determine the objectives of acoustic quality in the interior space of buildings intended for residential, hospital, educational or cultural use. Likewise, Royal Decree 1371/2007, of October 19, 2007, includes the Basic Document against Noise (DB-HR) in the Technical Building Code (Government of Spain, 2019). Its compliance guarantees the minimum requirements for protection against noise. In other words, it makes it possible to limit the risk of discomfort or illness that noise can cause to users due to the characteristics of its project, construction, and maintenance. This document takes as reference standards those provided by the Technical Standardization Committees of the Spanish Association for Standardization (UNE), a member of ISO, and the European Committee for Standardization (CEN). In 2016, the Basic Document with Comments (Dcc -DB-HR) was updated; In addition, the new Support Document DA DB HR 1 was published: "Guide for the use of magnitudes of acoustic insulation about the requirements", which expands the content of Annex H on the global assessment of the results of the insulation measures according to each type of noise. It should be noted that, in addition to the new DA DBD HR 1 Support

Document, there is a DB HR Application Guide Noise protection updated in September 2014 and also the Catalog of construction elements that allows decisions to be made in acoustic matters under the guarantee of the official values of sound insulation. Recently, the beta version of UNE 74201 (UNE, 2021) was presented, which proposes the acoustic classification of buildings; Although it is a fundamental step to improve the facilities in terms of the level of hearing they present, this standard is not yet binding.

3.2. Case study

For practical purposes, a prototype of public housing was obtained in different parts of the country through the PRO.CRE.AR plan between 2015 and 2000 is taken as a case study. As Figure 1 shows, this represents the duplex typology typical of the country, in many functional, aesthetic and, constructive aspects, being a house between dividing walls with 70 m 2 covered, resolved on 2 floors with a front and rear patio. Its location is generally in residential neighborhoods and its main source of noise is produced by the vehicular corridors that surround the neighborhood. That is, vehicular traffic noise of the aerial mobile type and vibrations in the following time slots from 7:00 a.m. to 8:00 a.m., 12:00 a.m. to 1:00 p.m. and 6:00 p.m. to 8:00 p.m. on days weekdays It should be noted that in the case of Argentina IRAM does not present noise maps; however, the acoustic quality bill mentioned in previous paragraphs characterizes residential areas as type III and recommends that sound levels do not exceed 65 dB during the day and 55 dB at night (https://www.hcdn .gob.ar/, 2022). In the case of considering the Spanish regulations, the DB HR establishes that, in the case of not knowing the external noise levels, consider between 60 and 70 dB for homes.

3.2.1. Technician report

Figure 2 shows the plan of the floors and Figure 3 shows a cross-section showing adjoining units. The envelope is materialized with different types of ceramic facings. The dividing walls of the house are double walled, hereinafter referred to as W1, formed by ceramic hollow brick (CB) 0.12 m thick, a layer of expanded polystyrene 0.025 m thick, 0.08 m thick CB, plastered on both sides, and painted. The north party wall, called W2, is resolved with a double BC wall 0.12 m thick on both sides and an EPS layer 0.025 m thick in the center and plastered on both sides. The southern dividing wall, called W3, is made up of CB 0.18 m thick, plastered on both sides. The floor, called S1, is made up of prestressed concrete beams and expanded polystyrene vaults. The windows and balcony doors open with aluminum profiles and 6 mm simple glazing without weather stripping. Its exterior doors are metallic, with 0.006 m fixed glazing. In the areas of the land where there is no building, there is a party wall of 3 m of solid ceramic brick masonry of 0.13 m plastered, called W4. The interior walls called W5 are made of CB of 0.12 m, plastered and painted on both sides. The interior doors are plywood plate doors and folded sheet metal frames.

Figure 1. PROCREAR duplex floor typology dwellings

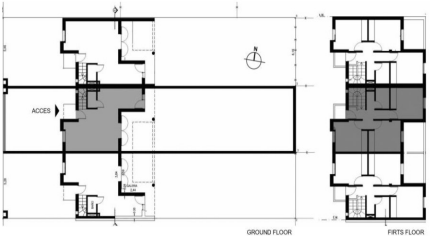

Figure 2. Plant. Own elaboration

Figure 3. Cross section of the analysis sector. Own elaboration

4. RESULTS

4.1. Review of current regulations for acoustic conditioning in Argentina and Spain

Table 1 below shows the requirements proposed by the IRAM and UNE standards for noise control in closed spaces, especially homes. For Argentina, IRAM 4044 (2015) presents the minimum permissible values of airborne and impact noise insulation to achieve acoustic conditioning in closed rooms, considering two possible scales. Scale I take the minimum values necessary to preserve people's health. Scale II establishes values that allow the occupants of different premises to achieve an adequate level for intellectual development, recreation or rest, and the protection of privacy. In the case of housing, it does not determine reverberation time, in terms of background noise values, it determines them according to

Case study :		Single-family house, duplex typology in dividing walls					
Country		Argentina			Spain		
Standard type :		IRAM 4044 standard			CTE - DB-HR		Observations
	wall type	Scale I	Scale II	Index	DB	Index	
Airborne noise	Among adjacent houses	55 dBA	56 dBA	R_w	50dB A _	$D_{mt,A}$	
	Between rooms in the same unit (no shared doors and windows)	42 dBA	48 dBA	R_w	33 dBA	AR _	They are different but comparable indices in normal reverberation conditions (0.5s)
	Between rooms in the same unit (with shared doors and windows)	35 dBA	41 dBA	R_w	33 dBA	AR _	
	facades	Scale I	Scale II				
	opaque wall	53 dBA	59 dBA	$D2\ n_{,nT,w}$	30-42dB A _	$D_{2\ m,nT,Atr}$	In Spain, these values are about external sources of 60 dBA
	Glaze wall (up to 20 %)	36 dBA	42 dBA	$D2\ n_{,nT,w}$			
Noise of Impact	between the same living place	53 dBA	46 dBA	$Ln_{,w}$	60-65 dBA	$Ln_{,w}$	
reverberation time	interiors of Accommodation	-	-	-	-	-	No recommended values are set
Noise Criteria	interiors of Accommodation	30 to 40 dBA		-	-	-	Argentina establishes a recommended value and DB HR does not

Table 1. Acoustic requirements according to IRAM and UNE standards. Own elaboration

the Noise curve Criteria. Spain requires through the CTE DB-HR similar requirements according to UNE 12354:2017, being the official version, in Spanish, of the ISO 12354:2017 Standard. It does not detect maximum levels of background noise, nor does it determine the reverberation time for single-family residences.

4.2. Verification according to regulations of each country

4.2.1 Airborne Noise

The simplified option obtained from the CTE catalog is used to determine the values of the airborne noise reduction indices of the construction elements. For the walls, the calculation of the global acoustic reduction index of the mixed construction elements of Annex G of the CTE-DB-HR (Spain 2010). In the case of the Rw of the slab, a value is taken from the simplified option of the catalog of construction elements of the CTE-DB-HR (Spain 2010) of the CTE-DB-HR. Table 2 shows the results obtained for each construction element and its verification according to IRAM and UNE standards through the CTE-DB-HR.

4.2.2. Impact noise

The concrete slab floor and its resistant structure are shared with the house that borders to the south, which means a more unfavorable context for impact noise. The impact noise value Ln is obtained using the simplified formula ISO 12354-2. Table 3 below shows the value obtained for Ln and compares it with the values established by the standards of each country. The low possibility of impact noise insulation is evident as it exceeds the acceptable pressure levels for both standards.

5. DISCUSSION

Regarding the legal instruments in force in Argentina concerning architectural acoustics, it is important to make visible that both at the national, provincial and municipal levels, this lacks laws that regulate and especially the interior space in homes. This explains that when materializing any type of housing, whether public or private, they do not verify even the minimum acceptable according to the

	Write	dBA	Index	IRAM 4044	CTE DB-HR
Walls	W1 (Enameled up to 20 %)	**21**	$D_{2m,nT,Atr}$	DOES NOT VERIFY	DOES NOT VERIFY
	W1 (Enameled up to 20 %)	**27**	$D_{2m,nT,Atr}$	DOES NOT VERIFY	DOES NOT VERIFY
	W2 – double wall	**52**	$DnT_{,A}$	CHECK Scale I	CHECK
	W3 – double wall	**52**	$DnT_{,A}$	CHECK Scale I	CHECK
	W5 - rooms in the same unit (no shared doors and windows)	**40**	AR _	DOES NOT VERIFY	**CHECK**
Slab	Beams and EPS	**45**	RW _	DOES NOT VERIFY	DOES NOT VERIFY

Table 2. Verification of Aerial Noise according to IRAM and UNE standards of the construction elements of the house. Own self elaboration

	Write	dBA	Index	IRAM 4044	CTE DB-HR
Slab	Beams and EPS	**88**	Ln	DOES NOT VERIFY	DOES NOT VERIFY

Table 3. Verification of Impact Noise according to IRAM and UNE standards of the construction elements of the house. Own elaboration

recommendations of the Standards. It should be noted that those built by the State guarantee the minimum acoustic requirements, however, according to the evaluation of the prototype, it does not meet the Minimum Quality Standards for social housing.

According to the comparison with the Spanish laws and regulations, in Argentina, it is necessary to advance and enact the environmental protection law for acoustic quality together with a series of legal instruments such as the Spanish Technical Building Code, which includes the Basic Noise Protection Document based on UNE standards and the Catalog of construction elements. The latter allows the professional in an architectural design position to choose constructive resolutions that guarantee compliance with the standard.

Regarding the recommendations based on IRAM by Argentina and UNE by Spain, there are some differences in the minimum admissible values recommended in both standards. At a general level, it is detected that the IRAM standard determines 2 possible admissible values to be reached, being those of Scale I less demanding than Scale II. Likewise, the UNE standard only starts from a reference value as the minimum acceptable. Regarding the measurement units in IRAM they use decibels (dB) and UNE uses decibels weighted to A (dBA), in addition, they take different terminology to define the unique value of the construction elements, however, the comparison is viable.

Based on this, it is observed that the values determined by the IRAM standard for airborne noise are more demanding, except for those proposed by UNE. The greatest differences are detected in the interior walls. In this sense, the IRAM standard grants different values to interior walls with windows and/or doors and interior walls without windows and/or doors. It should be noted that the values for walls without windows and doors are higher than those that do have. It is assumed that in walls with windows and doors it is more complex to achieve sealing for acoustic insulation and therefore the requirement is lower. On the other hand, the UNE standard takes the same value in both wall situations with or without openings and even presents values with differences between 2 to 15 dBA less depending on the type of wall and IRAM scale I or II. In the case of the façade wall, it is again observed that the demands are greater in Argentina, but it is necessary to carry out the following salvation. The admissible minimums considered for this type of wall in Argentina are recommended without distinguishing how many dB the external source presents. That is, it is understood that both a home near an airport or within a residential area must verify the same values.

Impact noises have more demanding requirements in the UNE standard that range from 60 – 65 dBA as opposed to 53 dBA scale I and 46 dBA scale II. Regarding the reverberation time, neither of the two standards expresses precise data for the dwelling, however, its consideration is necessary, since in many cases the dwellings have very polished wall and floor surfaces, which are counterproductive if what is wanted is Achieved is acoustic comfort in space.

The application of both regulations to the case study shows that the type of construction used to build a typical house in Argentina needs technological improvements to achieve an acoustic quality by the IRAM recommendations and the dBA values of the UNE standard for houses. urban single-family homes. In terms of airborne noise, the façade is the most unfavorable since the carpentry works due to its low performance, being made of simple glass and without adequate sealing of its joints. The impact and vibration noise pressure level in the mezzanine loss is also detected as high because it does not have any elastic insulation on both its upper and lower faces. Regarding the reverberation time, the original case presents many smooth and polished surfaces such as ceramics and slab bottoms with acrylic paint, and although none of the

standards establish admissible values for homes, it is considered important to improve it.

6. CONCLUSIONS

After completing this study, the following conclusions can be drawn:

- The minimum insulation values of the Spanish (CTE) and Argentine (IRAM) regulations are similar. The CTE requirements are comparable to scale I of the IRAM regulation
- While the CTE is mandatory in Spain, the IRAM regulations limit themselves to indicating that they will be the appropriate values. That results in non-compliant buildings and houses, especially in social housing and publicly funded construction projects as is the case in the case study.
- The house chosen as a case study does not comply with Spanish and Argentine regulations. This is due to the non-mandatory nature of the IRAM standard. In the hypothetical case that the regulations become mandatory due to the transition to the Spanish and European model, the house would have to be rehabilitated to comply with the code.
- The CTE incorporates the Catalog of Building Elements, which allows decision-making in acoustic matters under the guarantee of the official values of acoustic insulation.
- In the Spanish territory, the air insulation of the building envelope depends on noise mapping, in that direction, incorporating this into the IRAM regulations would be an added value.
- The houses built by the State do not meet the minimum standards of acoustic quality and consequently exacerbate the problems related to affordability, their sustainability, and the user's human health.

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PAPER #8.03

ARCHITECTURES OF EMERGENCY. SENTINEL OPERATIONS FOR A RAPIDLY CHANGING ENVIRONMENT

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ABSTRACT

The declaration of an emergency is given by various protocols that respond to a series of interventions driven by an environmental urgency (Anderson 2017), designed by global networks of experts that mobilize advertising modes of economic development in the face of environmental collapse (Goh 2021). This research proposes a different imaginary of the Emergency. This reflection aims to resignify the Emergency from the embodied experiences of the disruptive events we live, opening the discussion on the frictions between a normative world based on human security and the modalities of militant movements dedicated to redressing social, environmental, and economic inequalities (Whyte 2018). In this sense, we develop the idea of *sentinel modes of care* that reflect the affective scaffolding of life-related to the environment and potential catastrophe (Wright, Plahe, and Jack 2022). A state of constant alertness characterizes *sentinel care* within a more-than-human register of the relationship and potentialities of the territory. This text aims to position itself on *emergency protocols* while exploring other imaginaries and their impact on spatial practices.

KEYWORDS

Emergency; protocols; security; sentinels; architecture.

1. INTRODUCTION

In recent years we are seeing how the state of emergency is becoming the new normal. In a world increasingly interdependent and marked by planetary disruptions, emergencies are increasing and becoming a kind of "emergency condition" paced by a series of events often described as catastrophic. Perpetual risks, unpredictability, and prolonged periods of crisis extend into intersections with climate change, the density of the built environment, resource use and distribution, and political mutations. The way we perceive and the layer of meanings we attach to these events are part of the modes of representation by which society relates to and orients itself within the complexity of the environmental systems we inhabit (Centemeri, Topçu, and Burgess 2021).
On the one hand, this new order envelops us in a state of uncertainty that can slow down any action and participation of the inhabitants in moments of greatest need. On the other hand, during these moments, spaces of experimentation and social behaviors based on the practices of care emerge (Spade 2020).

From the spatial practices, we wonder how the *emergency protocols* can generate negotiations and participation of the affected communities. For this, it is necessary a resignification of emergency with the construction from the negotiation of limits, alarms, spaces, and response protocols.

1.1. The Emergency Design

The declaration of an emergency is a political and performative act that occurs when an imminent threat to human life and property is perceived, with a series of protocols that mark security limits (Collier and Lakoff 2021). When the level of alarm is catastrophic, caused mainly by political-technological setups associated with long processes of environmental degradation (Swyngedouw 2018), one enters the framework of disaster management and the political realm of catastrophes (Vázquez-Arroyo 2013). This field is applied from the perspective of human security with the modulation of risk and its regulation from new paradigms of resilience (Long and Rice 2019).

The emergency is a constituent of security. Security redefined from the *resilience paradigm* becomes a process of overcoming and coping with disturbances by absorbing the disturbance or limiting the damage from a self-organizing system (Kaufmann 2013). Thus, the state of security is never absolute but is constantly being refined. The act of redefining and generating this particular state of security is transferred to the population and to individual subjects with concrete tasks to create the conditions to restore normality. It is in this way that the *emergency protocols* constitute an apparatus defined by multiple practices of power (Agamben 2009). Protocols lead towards the (self-)conduct of other bodies that reflect the logic of *environmentality,* defined as the distribution of governance or *governmentality* (Foucault 2004; 2008) within and across environments and their technologies (Gabrys 2014). Regulatory mechanisms are formed from the conception of disturbances as moments in which to return to control and the associated state of normality. However, these same mechanisms transform normality is a perpetual crisis from their creation and reaction (Whyte 2020).

The protocols manage behaviors of society from diffuse rules allowing local self-organization to generate a complex security apparatus with strategies that are planned, carried out, and trained from a reenactment of the possible event, exercises, and drills (Collier and Lakoff 2021). These regulatory practices aim to incorporate a specific type of reaction in local communities, which are self-organized in the case of emergency but act according to common rules, from a common body established by protocols (Kaufmann 2013).

In this way, risk management comprises a series of protocols that set limits and actions that are integrated into land use laws, building codes, protective infrastructures, inspection protocols for technological systems, pollutant control regimes, toxic exposure guidelines, evacuation shelters, emergency facilities within emergency management manuals, etc.

How do these practices function architecturally? What are their limitations in a world affected by multiple and complex disruptive events? How can we conceptualize them rethinking the emergency to generate other forms of activation? How can we create practices that operate architecturally with the capacity to integrate and co-construct an infrastructure of care?

In exploring these questions, this text develops into three distinct sections that come to recompose the meanings of emergency. In a first approach, this text proposes to highlight the mechanisms that lead to spatial regulation in the management of an emergency. In a second part, the text develops the spatial operations that arise from the attention to the signs of an

imminent catastrophe, conceptualized here as *sentinel attentions*. These operations are shaped by the affective scaffolding of life-related to a rapidly changing environment. In the last part, the text will begin with the conceptualization of the *architectures of emergency,* which will allow us to move from conceptual frameworks of emergency to the spatial operationalization of protocols characterized by *sentinel care*.

2. THE SPATIAL REGULATION OF EMERGENCY: THE PROTO-TERRITORY

The emergency starts from the uncertainty of operating under exceptional laws in a "lawless" legal framework (Agamben 2008). However, this uncertainty is navigated within the previous preparation, with the anticipation and imposition of totalizing monitoring protocols with neocolonizing dyes. From Western conceptions, these operations are rewritten from the modulation of risk and the limits of security (Anderson 2010). These rules established from a series of monitoring protocols limit the impact of the possible emergency. When an emergency occurs, the alarm signal (established by the risk acceptability codes) is turned on. This signal triggers a series of cascading operations established from the hidden forces of past events or future simulations. From this continuous present with an abducted past and future, the current operationalization of the emergency in the territory reduces reality to packaged events (Hulme 2011) in a series of responses that strip them of any latent sensitivity, cultural focus, attention, or even intuition (Whyte 2020).

If we begin to look at emergency operations within a territory in a conceptualized way (Fig. 1), we can see that it is not so much the exception to the rule. The unforeseen event is planned, designed, and even commoditized. Brian Massumi, in his book *Ontopower,* conceptualizes the *proto-territory* as the place where recurring accidents occur and, at the same time, the processes of their control, defined as the *anti-accident*, are rehearsed (Massumi 2015). The *anti-accident* is the model of a territory, although more than a model it is a matrix of interconnected scenarios. In this way, preventive power is an environmental power. Marielle Kaufmann analyzes emergencies from the *resilience paradigm* and the patterns of operations that emerge within the logics of *autopoiesis* (synonymous with self-reproduction) which are networked units that are defined in the reproduction of their interconnected components. *Autopoietic systems* are engendered from their relationship to the environment because they make use of the continuous flows of energy and matter for survival in a medium. In this way, the system alters the environmental conditions of the territory through adaptive modulations (Kaufmann 2013). From these interconnections, the power of the *anti-accident* occupies the *proto-territory* in all its extensions of life, its iterative processes, and systems (Massumi 2009). The inhabitants of the *proto-territory* no longer prepare themselves for what they have experienced, but think beyond what has happened (Dekens 2007). This situation generates a total separation of meanings and approaches to the territory, turning them into colonizing forces with imposed readings of the territory. In places colonized by *emergency protocols*, local knowledge has been marginalized with the construction of large infrastructures such as the rechanneling of rivers, which is exposing communities to possible new threats. This new infrastructure is not only a technical object, but also a sense of possibilities, a language to be learned from the constitution of its materials (Larkin 2013). Moreover, climate science does not provide detailed predictions with precise causes, but modeled scenarios that allow us to work deliberately in the present, oriented towards a foreseen future.

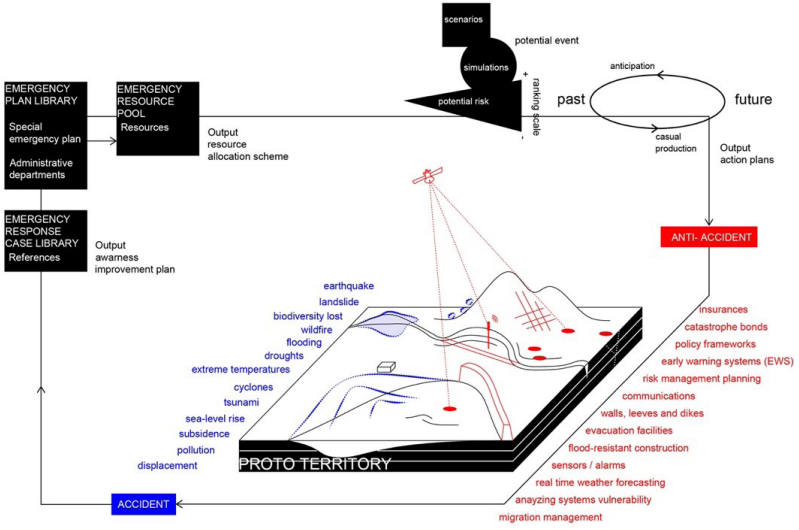


Figure 1. The spatial regulation of emergency: the proto-territory. Source: (Author 2021)

Thus, in the *proto-territory*, the emergency is designed through special plans, libraries of action plans, and banks of resources and references that make up the anti-accident and affect the formation of the accident itself. Control is not only spatial but also temporal, the present is abducted by a given set of possible events, operating to bring them into the present as potential future catastrophes that point to current vulnerabilities (Lakoff 2007). Karen Barad says that we keep designing the past and remembering the future; the present is trapped in a totalizing gaze of trying to anticipate a future of destruction affected by nuclear risk, climate change, and disruptive technologies (Barad 2018).

In this conceptual composition of the *proto-territory*, assembled from the design of *emergency protocols*, which identify security limits and generate readings for possible adaptations to possible disruptive events, modes of operation are composed that approach the sentinel body. It is from these reflections that the *Sentinel Architectures* appear. From the reading of the future emergency, these architectures oversee responding to all possible risk scenarios that may occur in an environment. Thus, as a prophetic device, we can read in them the possible events of an increasingly designed future.

3. SENTINEL ARCHITECTURES

Once we have approached the operation of the emergency protocols, we perceive that a series of pieces of evidence are necessary to activate the declaration of an emergency and thus precipitate the series of reactions necessary for its control and the illusory exit of the state of emergency. In this way, we need an alarm that incites its declaration. In addition, from precautionary principles, anticipatory action is part of the Emergency

Preparedness component (Lakoff 2007). At a time when we can anticipate possible events, but there is a degree of uncertainty due to the interconnectedness, contingency, and unpredictability of ecosystems, Early Warning Systems (EWS) have been established in recent years as surveillance methods to initiate action, even if knowledge of what is happening is incomplete (Hermans et al. 2022).

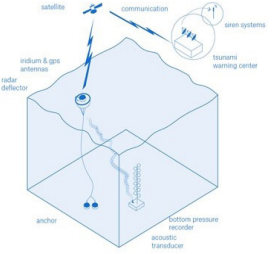
In this way, the sentinel corps is being built up in the development of continuous monitoring protocols. Sensitive or more vulnerable bodies to possible disruptive events are identified as sentinels (Keck and Lakoff 2017). The construction of these surveillance systems, modeled through EWS, is done from a continuous environmental reading. A series of reactions are expected from sensitive or vulnerable bodies to the perception of changes in an environment.

Sentinels are living beings or technical devices that provide the first signals of an impending catastrophe. In a hostile environment, we can consider them as allies for our own survival (Keck 2020). Historically, the word sentinel connotes a military function; a sentinel is a soldier. The sentinel is in charge of observing and sending signals from strategic positions on the battlefront, challenging the adversary and preventing any possible surprise attack.

Sentinel corps are in a continuous relationship with a medium and need a material thickness reading to alert them of possible changes in medium condition (Monsaingeon 2013). In their configuration, they need to know all possibilities and scenarios to forewarn the possible threat. They are configured in a state of continuous information reading security levels (Fig. 2).

But it does not remain only in the perception, the monitoring and forecasting component of the early warning system must move from forecasting the event to warning about the possible impacts of that event in terms of damage to people, infrastructure, or others (Hermans et al. 2022). The action

Matrix of tsunami siren towers, South Beach. Eirik Johnson



Deep Ocean Assesment and Reporting for Tsunamis (DART) system graph

Washington Coast. safety landscape

Figure 2. Washington Coast. Safety landscape devices. Source: The Atlas of Emergency (Author 2021)

protocols are triggered from precautionary principles on possible threats in the reading of its signals and their interpretation. Thus, sentinel architectures make visible our precarious relationship with the environment, observed as deteriorated environments, and risky spaces that need to be controlled.

From this perspective, *sentinel architectures* could be defined as architectures programmed to warn and respond to a potential event and even, to respond to all possible risk scenarios in an environment. These devices are created from the sequestration of the future in the present (Adams, Murphy, and Clarke 2009); they can read the possible events of a destiny increasingly designed from the control of accidents. The future then becomes a regime of safety and simulation that brings catastrophes into the present as if the emergency had already occurred.

However, information is not an automatic signal that can be disseminated in real-time. Data must be retrieved, collected, entered, and interpreted (Farías 2014). Therefore, a *sentinel architecture* requires the ordering and interpretation of a whole series of data in a process of continuous inquiry. One of the main mistakes that are made is the separation between the readings of the facts with the decision-making that can contradict the alarm. Thus, counter-sensing practices are necessary (Latour, 2004).

In contaminated sites impacted by hurricanes, it is easy to find many soil and sediment contaminants high enough to put the health of the residents of the area at risk. The development of community laboratories in toxic areas allows residents to identify contaminants and act accordingly. To this end, testing units, remediation practices, and inspection education should form part of the practices of ecological democracy. Community laboratories constitute a strategy that fills the gap in environmental policy and is based on principles of citizen participation (Bullard 2018) (Fig. 3).

Public lab workshop.
Public Lab website

Mississippi's changing delta. Jesse Allen / NASA Earth Observatory

Louisiana & Houston

Figure 3. Louisiana & Houston. Community Laboratories. Source: The Atlas of Emergency (Author 2021)

These groups are not experts but develop from a networked specialization of surveillance through experimentation, a sentinel must alternate between scientific conceptualization and attention to how environments are modified through localized practices. The sentinel is not an isolated individual waiting for an enemy but is a localized/distributed system that functions with attention to the distinct messages sentinels transmit and reflection of what the information means to the environment we share with them (Gramaglia 2013). A collective body, a more-than-human assemblage that expresses the tensions of life in the limit of survival.

Etymologically, the word sentinel comes from the verb *sentir, entendre, écouter* (to feel, to hear, to listen). Understanding the sentinel as a correlational figure, of the relationship and stimuli for a reaction, finding meanings in winds, rains, chemical compositions, or behaviors of diverse organisms. The sentinel body as a sensitive entity reconstructs "sensing practices" as the network of interactions between the environment and the rest of the organisms that interconnect them (Gabrys 2019). The sentinel generates

meanings, reconstructing worlds in its way of understanding space and the collective way of feeling.
In this sentinel reading, there is a relationship of actors that generates a multi-species as well as the multi-scale collective body by integrating the relationship between chemical composition readings up to large spatial scales in their deployment. Sentinel devices do not operate autonomously, but are integrated into warning and response systems, included in preparedness plans that structure the official response and decision tools that guide the intervention when an event occurs.
Moreover, as mentioned above, *emergency protocols* are built as an autopoietic or adaptive system to a specific environment. If risk management leads to the use of statistical analysis according to patterns of a historical incidence, at a time of continuous preparation and adaptation to potential hazards, surveillance takes over and with it the sentinel devices that warn of potential danger ahead.
In this way, extending the concept of *sentinel architectures*, I envision practices that pay another kind of attention - a renewed attention to the closest resources and materialities that enable negotiations between communities and the environment.

3.1. Sentinel Attention

The modes of *sentinel care* reflect the affective scaffolding of life-related to the environment and potential catastrophe. A state of constant alertness characterizes *sentinel care* within a more-than-human register of relationship, the assemblages that constitute a territory and its potentialities.

Peatland restoration blocking drainage channel.
Wetlands International

Flood marker placed near the river. Larawan mula kay Gerald Valdez

Philippines

Figure 4. The Philippines. Sentinel Codes. Source: The Atlas of Emergency (Author 2021)

From the conceptualization of *sentinel architectures*, we approach the relationship between the limits of emergency and alarms in the forms of active integration of the different inhabitants of the environment. By witnessing and mobilizing ourselves on the rapid changes we are living through, we must develop our own tools to evidence the disruptive processes in the territory, using our own bodies as instruments of evidence. From the local knowledge that is built from the experience of the local environment, the identification, and monitoring of indicators that point to a possibility of dangers, the way to confront and communicate the possible risks. Thus, it is necessary to collaboratively design objects, devices, or tools that invite observation of biophysical indicators, experimentation, and analysis to build cause-effect relationships or "worlds" about current and future conditions. Build readings to form judgments and negotiations from the independence of survival in their climate. For example, in the Philippines, the Kanungkong are instruments to warn the population when a catastrophe occurs. It is an early warning instrument made of bamboo (Molina 2016). These sentinel codes have been agreed upon with the community through consultations. In addition, the flood hazard *warning signs* have been jointly designed and are part of the community landscape. This example shows the importance of empowering local communities so that they can decide on local facts without being overridden by sometimes misleading national or international data (Farías 2014) (Fig. 4).

After this process of conceptual deployment, we can move on to the operationalization of *sentinel architectures* as evidence-generating tools. *Sentinel architectures* are in a continuous reading of influences and transformation from the surrounding environment. In continuous interaction with the earth's surface and with the different atmospheric gradients that surround them. Buildings register, accumulate and transmit in a process of aestheticization through the environment (Weizman 2017). However, *sentinel architectures* not only record their past but also generate an activation influencing the creation of futures by generating events in their relationship through other bodies. *Sentinel architecture* as a "transcorporeal stretching between the present, the future and the past" (Neimanis and Loewen Walker 2014, 1) helps to reimagine sentinel bodies as archives of events and to make other futures possible.

Its implementation from the resignification of emergency can significantly affect an architecture that reveals atmospheric conditions rather than ignores them in the expectation of the alarm signal.

4. EMERGENCY ARCHITECTURES. OPEN HOUSES AND THE EMERGENCY ARCHIVE

Once entered into the different mechanisms that engender *sentinel care*. We could reach more precise cases in the mapping and modeling of spatialities that are formed within these actions in the collective construction of the emergency and the sensibilities necessary to generate new realities from a social and political intervention.

Writing this text in another heatwave goes beyond all recorded observations (July 2022). Collectively we are experiencing the important change revealed by atmospheric conditions. It intrigues many of us. It raises questions about our habits. The city has been filled with information about places to alleviate the emergency once declared, but there are few places to discuss action plans because these plans seem to require urgency beyond debate.

However, in areas highly affected by cyclical events, for example in the more spatially marginal areas of the Ciliwung river in Indonesia, a whole network of repair communities has been emerging: the so-called Ciliwung Komunitas. These river *sentinel care communities* are responsible for monitoring river water levels, organizing the cleaning of the sewage system, and documenting and transmitting the state of the river through social networks (Miller and Douglass 2015).

These communities generate networked spatialities called *Sanggar* (open houses). These spaces can be a vacant plot, agricultural land, a pavilion, or a hut on the edges of the river that can be used for meetings, a library or prayer room and usually has basic facilities such as toilets and a pantry room (Suryantini, Permata, and Angelia 2018).

From these spaces, various activities for action and care of the territory are organized. Among the different actions, we find the organization of mobilizations, environmental defense and restoration activities, artistic and community events, forest recovery, forest rights defense, community workshops, community cleanup organization, pollutant mapping, fish species registration, garbage collection, community mapping, community gardening and composting, libraries, legal advice ... (Padawangi and Douglass 2015). In addition, this vast network of spaces becomes tools of community empowerment in times of disaster becoming a network of organization of the informal response to the emergency (Fig. 5).

It is from the development of sentinel practices based on care and resistance to the protocols of an increasingly legitimized anti-accident where we can see other *architectures of emergency.* Embracing these spaces as part of everyday life that embraces culture and economy is an alternative approach to emergency management that puts people and the whole ecology of living organisms as active members of society rather than victims. One of the best-known examples is the Sanggar Alfaz which became an open house for children to play in 2009 after the mud disaster affected the Porong subdistrict (Padawangi 2016).

These practices of evidence and care are practices that reveal multiple threats from the experience of affected communities that go beyond scientific conceptions of the record. These practices become reactive to current ecologies with resonances from the past and repercussions for the future. In this way, the spaces of recording and archiving operate to weave relationships of community care by documenting and resisting oppressions to reimagine alternatives (Caswell 2021).

Figure 5. Ciliwung River. Communities' organization. Source: The Atlas of Emergency (Author 2021)

Furthermore, communal and activist archives are open and adaptive spaces that recover individual and collective memory to reactivate social and political agency (Polletta 1999). These archive spaces as *emergency archives*, become enabling spaces for networking through sentinel readings of the medium and respond to intertwined crises from performative action.

In places like New York, Rachel Garber Cole is documenting the emotional, psychological, and sensory experiences of living in this rapidly warming time. "The Warmest Year Ever Recorded. An oral history of life on a warming planet" is an archive for a future and a practice for a present in need of experiences that alleviate these collective emotional afflictions. The spaces she has activated during the collection of experiences are the community gardens of Brooklyn, places where abrupt changes are made tangible in a reading of the plants being grown, and the more-than-human relationships of endangered common ecologies. These stories speak to our concerns as bodies sensitive to change and the need to incorporate alternative narratives and the spaces that are activated from the construction of these narratives.

This archive of experiences has evolved in connection with the Interference Archive in New York. Community archives as living archives are open, responsive, inclusive, collaborative, and generative places where the community actively constructs and archives history (Almeida and Hoyer 2019). Thus, archiving from the emergency is not only a record of the past but a political act of optimism toward a future that will need our memories to invoke struggles and crises that can give meaning to an increasingly disadvantaged present. In the end, the *emergency archive* becomes the site of cultural, political, and technological healing that emerges from the collective, networked intelligence of disruptions. Designed from the narratives and methodologies of the affected communities, it emerges as the observatory of change and a refuge to process the more-than-human trauma of the events. Thus, the *emergency architectures* are characterized as places of transcription by and for the collective

Image taken during a plant workshop.
Nora Almeida

The Warmest Years on Record. an oral history of life on a warming planet
Rachel Garber Cole

Interference Archive.
Gowanus canal. Brooklyn

Figure 6. Interference Archive, Brooklyn. Archiving the Emergency. Source: The Atlas of Emergency (Author 2021)

memory from the perspective of the future, becoming then vital spaces of transmission of all that we can save and of mourning for irreversible losses. These spaces speak of the construction and appropriation of the *architectures of emergency*. If the *architectures of emergency* are hijacked by sensitive data points of an already designed future, their operability could be reclaimed through the different sensibilities by putting in relation the production of evidence and intervention for the survival of life-generating assemblages (Fig. 6).

6. CONCLUSIONS

From these practices, the portfolio of examples from urbanism and architecture could be abundant, a new condition given should open the doors to multiple explorations (at this moment we are putting together an atlas of emergency). It is from the critical analysis of these new conditions that will lead us to swing to one side of the coin: either we accept the *emergency protocols* as they are modeled, governed by a control characteristic of the tyranny of the exception continued into a future of devastation. Or, on the other hand, we begin to construct sites of negotiation and care, for a "creative sabotage of the future" (Cooper 2006), commonplaces of redundancy assembled in worlds yet to come.
In this way, it could be from the appropriation of *sentinel architectures* that we could resist an increasingly designed future, to generate alternatives towards a future of plural and concrete possibilities "simultaneously utopian and realistic, which is built in the present from the activities of care" (Santos 2010).

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PAPER #8.04

THE ROLE OF VERNACULAR ARCHITECTURE IN THE FUTURE CITIES

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ABSTRACT

The increase in the world population and Climate Change already represent two of the most important challenges that humanity has faced throughout its history. In this sense, the human settlements of the future must find a way to solve the problems derived from these challenges while guaranteeing the development of the communities and the well-being of their inhabitants. Given the global awareness of the need to propose new forms of development, architecture and urbanism have worked on different models of change that can respond to the needs of humanity on a planet of finite resources. Vernacular architecture and its settlements have become a source of knowledge and a lesson in sustainability when facing the challenges of the future. Its ways of life and its principles emerge as teachings to incorporate into contemporary architecture in relation to the four axes of sustainability: environmental, economic, social and cultural sustainability.

KEYWORDS

Vernacular Settlements; vernacular architecture; sustainability; urban planning.

1. INTRODUCTION

In 2007, for the first time in history, the population settled in urban areas surpassed the rural population. According to the United Nations, currently 55% of the population lives in urban areas, and it is expected that this percentage will increase to 68% by 2050 (United Nations Department of Economic and Social Affairs 2018).

This urban population growth will be also reinforced by the forecasted demographic increase for the following decades. Up to 90% of this population growing will lie on the African and Asian continents, being only three countries (India, China and Nigeria) hosting the 35% of this growing (United Nations Department of Economic and Social Affairs 2018).

This circumstance poses a challenge for architecture and urbanism as the expected demographic pressure that cities will suffer forced functional and structural changes looking for a sustainable development. At present, the lack of planning is turning the informal city into the growth model for many of these cities obtaining as a result the predominance of habitats that do not guarantee the basic rights for their occupants. Faced with this option, a new vernacular architecture has emerged as an alternative model in construction against the model started in the Industrial Revolution and expanded along the 20th century, a model that creates an architecture alien of the

environment in which it is built. The new trend focuses on the values of traditional vernacular architecture as a source of forgotten knowledge and it represents an example on the three axes of sustainability: environmental, socio-cultural and socio-economic.
Here, the possibilities that vernacular architecture versus the informal city in terms of resilience and sustainability are presented. This architecture, based on accumulated experience and a sustainable exploitation of the territory and its resources could be a tool in creating a safe future. Throughout this paper, the possibilities of this architecture will be considered as an effective response to the demographic challenge and the pressing climate change.

2. THE PROBLEM WITH THE INFORMAL CITY

As seen in the introduction, the growing demographic pressure in certain countries will become one of the main problems to be solved by urban planning in the coming years. This demographic growth is also accompanied by a rural exodus to the big cities that began around the middle of the 20th century in search of a job in industry or civil construction (Tardin 2006).
One of the countries in which the greatest population growth is expected is Ethiopia, where some cities have already begun to suffer from this pressure, which is beginning to cause urban problems of different nature. The city of Addis Ababa is one of these cities, where demographic pressure has generated the proliferation of spontaneous precarious settlements that are often built without basic services.
Added to these problems of basic habitability are others of a political and administrative nature, such as the need to expropriate land and evict people to replace traditional vernacular neighborhoods with high-rise towers that make the most of construction land (Rancati 2020).It is the spontaneous settlements, however, that generate the greatest problems in cities. These settlements, which, unlike the formal city, are built outside urban and legal legislation, are characterized by self-construction and the poverty of its inhabitants.
Within the concept of *informal city*, among many others, the *villas miseria* of Buenos Aires, the *quebradas* of Caracas, the *barreadas* of Lima, the *alagados* of Salvador or the *favelas* of Brazil are collected. All these settlements share some of the characteristics defined above in addition to those detailed below in relation to urban parameters.

Illegal occupation of land

The economic availability of land that is marketed irregularly or the existence of land without defined use allows the appearance of informal settlements on the outskirts of cities. This land occupation outside urban planning legality is reinforced in many cases by the lack of public policies in urban planning that regulate the growth of these cities (Rancati 2020).

Lack of urban planning

The informal city is morphologically characterized by presenting a discontinuity with the pre-existing fabric of the urban settlement. In this way, the layouts of these settlements are distinguished from each other in the same way that they are distinguished from their surroundings by not presenting a continuity with it.
In the case of the *favelas,* for example, they present an irregular occupation that arises from some specific constructions and progressively widens in the territory. In this process, improvisation stands out both in the construction of buildings and in the planning of urban space. In this sense, public spaces are scarce and valueless, since the possibility of building more houses is prioritized economically.

Lack of infrastructures

In general, informal city settlements are also characterized by the lack of basic infrastructure. This condition not only affects the hygiene and habitability of homes, but also contributes to a biophysical degradation of the environment.

Thus, the lack of sanitation networks, for example, contributes to the contamination of the surrounding soil and water, in addition to increasing the erosion of the slopes. On the other hand, the occupation of the banks of rivers or lakes, wetlands and, sometimes, the riverbeds themselves, are the most frequent cause of floods. In these settlements, which do not have the infrastructure to deal with these disasters, these floods often cause irreparable damage (Tardin 2006).

The lack of drinking water and electricity is another of the most frequent deficiencies in this type of settlement, which greatly compromises the habitability of the dwellings. This lack of drinking water, together with the lack of public sanitation, also means the frequent appearance of diseases linked to lack of hygiene.

3. SUSTAINABILITY AS A NECESSITY IN THE FACE OF THE CHALLENGES OF A PLANET WITH FINITE RESOURCES

To this demographic crisis referenced and which is already generating some of the problems derived from the informal city, another crisis has been added for decades now, which, moreover, is the origin in part of the crises migratory and the rural exodus that do nothing but aggravate this demographic crisis. This is the ecological crisis.

The ecological crisis has become one of the main concerns and challenges of our generation and those to come. Our current model of development is assuming a depletion of the resources and natural reserves of our planet (Peiró 2010). For this reason, in 1987, the United Nations Brundtland Report firmly supported a sustainable development, defining it as that model that satisfies the needs of present generations without compromising the resources of future generations.

This concern for the environment must start from a change in mentality that reconsiders the idea of nature as a mere instrument from which to extract the necessary resources to cover our needs, that is, from the idea of nature as a mere instrument, since, as Peiró states, "... the uncontrolled exploitation of ecosystems supposes the annihilation of our source of life." (Peiró 2010, p. 14).

Given these crises that have arisen, it seems necessary to reflect on the urgency of proposing a more sustainable growth model that encompasses both economic development in global terms and the development of the cities that are the subject of this work.

At this point, it seems necessary to clarify the concept "sustainable", considering that this term is not limited to architecture but to any field of knowledge related to the development of our society. In this sense, the term "sustainable" is usually defined as "that which can be maintained for a long time without depleting resources or causing serious damage to the environment"

This meaning of the term sustainable is closely linked to the concept developed in the aforementioned Brundtland Report and the fact that it links it to two fields of knowledge such as ecology and economics is particularly important. Later, we will see how these two concepts constitute two of the dimensions to be analyzed in relation to sustainability.

Returning to the concept of sustainable development defined in the Brundtland Report, we should continue to define the concept of development, to understand how it is linked to the concept of sustainability. This concept began to be used in the field of biology in the 16th century to indicate the evolution of young individuals towards the

adult phase. However, it is from the World War II when it begins to be used in the field of economics to indicate the economic growth model of industrialized countries. In this sense, the term development is linked to countries, defining developed countries as those with a higher degree of industrialization, while less industrialized countries are classified as developing countries (Bermejo 2014).

It is precisely after the World War II when the greatest economic growth in the history of capitalism takes place based on two basic ideas. First, it is understood that peace constitutes an opportunity to achieve prolonged growth that would allow developing countries to reach the level of industrialization of developed countries. Second, the idea that the planet's resources are unlimited is advocated, thus allowing endless growth.

Already in the 1960s, the environmental problems derived from this economic growth began to be evident. It also became evident that these environmental problems had a planetary scale and resulted in Climate Change, pollution of the atmosphere and oceans, the erosion of the ozone layer and the reduction of forest mass, among many others (Bermejo 2014).

As a result of this incipient concern, the United Nations General Assembly approved the World Earth Charter in 1982, creating the World Commission on Environment and Development a year later. It was this commission that, after years of work and numerous meetings in different countries around the world, presented in 1987 the Report "Our Common Future", better known as the Brundtland Report.

The Report states that developing countries cannot copy the model of developed countries due to the scarcity of natural resources, which is especially evident in terms of energy, materials and water. For this reason, the Brundtland Report raises the need to transform the economic model because "We are unanimous in our conviction that the security, well-being, and very survival of the planet depend on such changes, now" that must occur "in the old approaches to development and environmental protection" (WCED 1987, p. 108).

As stated previously, the Brundtland Report defines sustainable development as "... development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition, as Bermejo states, has a three-dimensional interpretation, since it brings together the economic and social dimensions in the concept of development, the third being sustainability (Bermejo 2014).

Given that buildings consume 25% of the energy produced, it is of vital importance that these ideas, initiated in this Report, finds its way into the world of architecture. The search for sustainability in architecture has become a fundamental pillar of the future of our profession in recent years. This search is not only in the will of the architect to commit to a more sustainable future for construction or in a personal commitment to a planet that has progressively depleted its resources, but has been reflected in recent times in increasingly more demanding. This regulation will lead us, in the very near future, to the construction of buildings with almost zero energy consumption and, therefore, our profession must face as soon as possible this great challenge from which we will not be able to escape.

4. TRADITIONAL VERNACULAR ARCHUTECTURE AS A SUSTAINBLE RESPONSE

Over the last decades, the idea that our way of inhabiting and occupying the territory is not sustainable has been spreading. The industrialization process that has accompanied the advances in construction with the Modern Movement, has entailed

unsustainable environmental costs. The extraction, production and transport of construction materials is one of the main sources of greenhouse gas emissions directly related to the construction process based on the antagonism with the environment that surrounds us (Peiró 2010). As has been seen, numerous political and social movements have achieved a change in mentality that is key in changing the development model. Nature, in this new current, is not understood as a mere instrument with which to satisfy the needs of uncontrolled growth.

Looking to the architecture and urbanism of the past to talk about sustainability no longer represents a revolution, and, in fact, it has become a broad field of study in recent decades. During the last twenty years, a large number of publications have emerged that delve into the knowledge of vernacular architecture with the aim of extracting knowledge focused on the search for sustainability. The growing number of works related to the topic has become an important contribution focusing on the understanding of sustainability in vernacular architecture (Vellinga 2015).

The interest in sustainability in vernacular architecture arose during the first years of the eighties, coinciding with the creation of the World Commission on Environment and Development of the United Nations General Assembly and the entire consequent social awareness movement. In these early years a small number of studies focused on the environmental behavior of vernacular architecture emerged, presented at PLEA (Passive and Low Energy Architecture), a conference that took place in Bermuda in 1982.

However, this current, which coincides with the beginnings of awareness of sustainable development, was not introduced in the academic field until the last years of the 1990s, when sustainability emerged as a central theme in the politics and interest of the general public. Until then, most works focused on the relationship between vernacular architecture and the environment in general terms.

An example of this type of work is the one developed by Paul Oliver, *Encyclopedia of Vernacular Architecture of the World* (Oliver 1999), which, although part of his work focuses on how the natural environment is the starting point of vernacular architecture, it does not delve into the study of its sustainability. This trend is reversed in the early years of the 21st century where works such as those developed by Frey (2010), Weber and Yannas (2013) or Correira, Carlos and Rocha (2013) already appear. These studies delve into the sustainable capacity of vernacular architecture and study, for example, how climatic and geographical conditions lead to a particular type of housing. These are much stricter studies, in which the environment of a home is monitored in order to study the thermal behavior, humidity, solar radiation, or lighting, among others.

At this point it is necessary to establish a definition of *vernacular*, as well as to clarify the differences between this term and other related terms such as *traditional* or *popular*.

Starting from the origin of the word, it comes from Latin and means indigenous, domestic, while *verna* refers to "the slave born in the house" (Frey 2010, p. 74). This first approach already places special emphasis on the place of origin of this architecture: housing. That is, it is not something that has been produced by other people, but something that has been produced by the user himself. This idea is widely developed in the book *Architecture without architects*, by Bernard Rudofsky (1964).

This term can be closely related to what is known as traditional architecture, which, despite having aspects in common, also retains different nuances. Although vernacular architecture, which we have already talked about, stands out for its domestic character, traditional architecture also includes other types of popular

constructions, as long as it can be included within local construction traditions (Cortés 2013). The popular adjective, in relation to architecture, implies that it belongs to the people or that it is characteristic of it. This definition coincides with that of Carlos Flores who affirms that popular architecture is "the art and technique of designing, building and transforming the living environment of this social group that we have called the people, all being carried out... by individuals of the group itself" (Flores in Cortés 2013, p. 187).

In the paper "Rethinking traditional architecture for current living", Elías Ángel Peiró combines the terms *vernacular*, *traditional* and *popular* in the same definition, as he affirms that, although there are small nuances between the three terms, in the case of the architecture could be treated as synonyms. The author considers that "vernacular architecture is one that has been carried out by non-professional builders, using materials from the immediate environment and framed in the wake of a series of skills transmitted since time immemorial." (Peiró 2010, p. 15).

These definitions have the self-construction of this architecture in common, assuming this to be the main differential quality of what is known as cultured architecture, that carried out by professionals. In the aforementioned article by Juan Cortés, he considers that four main components are derived from popular architecture that condition or define this type of architecture:

1) There is a great dependence on the physical environment, derived from the poor development of pre-industrial society.
2) The use of construction techniques and traditional solutions that guarantee the effectiveness (through experience) and the durability of the response.
3) The repetition of timeless models. Architectural types.
4) The functional adaptation to the vital and productive needs of the inhabitants.

The paper goes on to link these four components to the four basic principles of sustainability. On the one hand, the total dependence on the physical environment inevitably results in an attitude of respect towards the environment. The limited technological development of traditional construction techniques is linked to the scarcity of economic resources, the repetition of models and the appearance of types leads to a cultural identity and the adapted urban model necessarily responds to a functional organization of society. The four principles of sustainability are thus established: the environmental perspective, the economic perspective, the cultural and the social (Cortes 2013).

According to Cortés' approaches, these four approaches, which constitute the main strengths of vernacular architecture in the face of the creation of a new architectural model, could be defined as follows:

- Environmental perspective: This approach, which frequently becomes the central axis of the so-called sustainable architecture, considers the adaptation of buildings to the environmental conditions of the surroundings, since it is directly related to the natural resources available to traditional architecture (extraction materials, water, biomass, ...). Given the difficulty of transporting these resources, the builders saw the need to exploit these resources to the maximum even without compromising their availability over time.
- Economic perspective: This perspective is based on the idea that the construction, structural and energy techniques used in popular architecture derive from the experience accumulated by successive generations that have led to solutions that lead to optimal habitability levels with the lowest possible economic cost.
- Cultural Perspective: This approach considers that popular architecture, along with *terrazgo*, constitutes the most significant element of the cultural

landscape, in addition, it is part of a valuable ethnographic heritage that also builds the identity of a territory.
- The social perspective: Building inevitably constitutes occupying the territory and the popular architecture with its occupation model that achieves great social cohesion, since it generates public spaces such as streets and squares, essential elements for the common life of the different societies.

A concept closely related to vernacular architecture and popular architecture is *resilience*. According to the definition elaborated by The Resilience Alliance (2002), resilience is the "ability of an ecosystem to tolerate disturbances without collapsing into a qualitatively different state, controlled by a different set of processes".

The Resilience Alliance is an interdisciplinary network of scientists and practitioners looking at the integrated dynamics of people and nature from a socio-ecological point of view. It has its origins in 1999 and includes a large number of member institutions such as universities, government agencies, NGOs, etc. This alliance periodically publishes the journal Ecology and Society which, over the years, has been dedicated not only to defining this term, but also to addressing numerous issues related to it. In the paper "The characteristics of resilience" published in 2002, a series of parameters that can be analyzed around the resilient capacity of a system are studied:

- The number of changes the system can undergo while retaining the same controls in the function,
- The degree to which the system is capable of self-organization,
- The ability to build and increase the capacity to learn and adapt. (The Resilience Alliance, 2002)

If we apply this term to our field of study, we observe that it becomes a strategic requirement for human settlements in the face of challenges such as Climate Change, socio-cultural change, natural disasters and economic crises that have occurred throughout history. Vernacular architecture and the vernacular settlements, demonstrate a great capacity to evolve and adapt to changing external conditions as a result of multiple cycles of global change (Ozel, B., Dipasquale, L., & Mecca, S. 2014).

In recent years, the term resilience has been used especially in the field of urban planning, understanding that this is a necessary capacity to reduce the negative impact of the changes to which cities are continually forced, as well as to generate safer cities. Resilient settlements need a dynamic architecture that can adapt to the conditions of the environment in a constant process of transformation (Ozel, B., Dipasquale, L., & Mecca, S. 2015).

5. LEARNING FROM VERNACULAR SETTLEMENTS. STRAGETIES OF SUSTAINABILITY

Throughout this paper, some of the pillars of sustainability and resilience have been established on which vernacular architecture is built and which can be a tool when building cities that reduce the negative impact on the environment of demographic pressure expected for the coming years.

Among these characteristics, we could highlight the strategies in the use of the land, the adaptation to the environment in which it is built or the ability to use renewable energy sources. These parameters are thus added to the reduction of waste and pollution to reduce the ecological footprint of settlements (Ozel, B., Dipasquale, L., & Mecca, S. 2015).

Design strategies in vernacular architecture derive from both the climate and the resources available in the environment. In this way, for example, the roofs of traditional buildings are sloped in territories with abundant rainfall, while in other drier territories flat roofs allow this water to be collected for domestic use.

Climate also affects the urban fabric of the settlements, since it changes depending on the temperatures and humidity conditions

of the construction environment. In warm climates such as the Mediterranean, compact cities are built with narrow streets that largely avoid the direct incidence of sunlight while these same streets form ventilation tunnels that generate a passive cooling system (Ozel, B., Dipasquale, L., & Mecca, S. 2015).

It is also worth highlighting the choice of the place where to establish a settlement as another strategy in the creation of sustainable settlements. In this way, the orientation of cities can play a decisive role in their sunlight and, therefore, in the need to allocate resources to heating buildings. Thus, historical settlements are often located on the southern slopes of the mountains, allowing the buildings to get sunlight throughout the day.

To understand the importance of the place and how it partly determines the urban fabric, we will use El Cabanyal, a neighborhood in València as an example. In this neighborhood on the coast of the city of València, the urban fabric is characterized by the regularity of its blocks, which run longitudinally along the coastline (Pastor, 2012). The subdivision, in this case, is the result of the parallel repetition of *barraques*, a building with a rectangular floor plan with facades on the short sides that face the public road and the interior patios.

Although the layout of these buildings was not planned, it was not random either. In its implantation there are a series of conditioning factors that rationally explain the result of this agglomeration and therefore, of the resulting tissue.

The most determining factor is the coastline that is traced in a north-south direction to the east of the neighborhood. The grouping of these *barraques* with this orientation allows these buildings to have their main facades to the east and west, allowing cross ventilation that takes advantage of the prevailing easterly winds in this area. On the other hand, in order to achieve this cross ventilation, the blocks of the urban fabric cannot be more than two plots wide, thus the length of the urban block prevails over its width, which is conditioned by the length of two plots.

In this way, the main streets of the neighborhood maintain a north-south orientation, while smaller roads open up perpendicularly, which, while facilitating communication between roads, also allow the fabric of the neighborhood to take advantage of the prevailing winds. In this case, then, the repetition of the cell and the conditioning factors of the place determine the urban fabric, creating spaces that take advantage of these initial conditions for the benefit of its inhabitants.

Mixed-use spaces and the flexibility of uses in spaces are another of the characteristics of vernacular settlements that are essential to improve their resilience and with it the sustainability of cities. Maximizing activities in spaces and land, as well as combining the uses of urban spaces, contributes to improving the functionality of economic, social and cultural activities with low energy consumption compared to single-use spaces (Ozel, B., Dipasquale, L., & Mecca, S. 2015). These concepts, on the other hand, are closely related to the implementation of collective housing and shared urban facilities to the extent that these spaces for coexistence also contribute to improving the social relations of the communities.

Returning again to El Cabanyal, it is worth noting how the use of the public thoroughfare in this neighborhood allows it to be interpreted as an extension of the dwelling in such a way that the public space is resignified, housing public uses and private uses in such a way that life itself of its inhabitants allows to guarantee the care of the streets, as well as the safety of the people who transit them. In these streets it is not difficult to find groups of neighbors eating in front of their houses at improvised tables or doing domestic chores while the public space also becomes a stage for processions or celebrations.

The use of suitable materials is another of the characteristics that are framed within

different pillars of sustainability, both environmental and economic, since the use of little transformed materials and the use of little machinery to obtain them considerably reduces the environmental pollution derived from the building. This same precept is linked to the use of local materials as a basis for the construction of vernacular buildings in such a way that it contributes to their resilience by having the materials necessary for the repairs that these buildings may require nearby (Rosaleny-Gamón, M., 2021).

The ability to promote the economy and local crafts is Also noteworthy in relation with the promotion of sustainability in vernacular architecture. This facilitates the maintenance of buildings during the useful life of the buildings, while contributing, on the one hand, to the transmission of constructive cultures, and on the other, to the creation of a unique cultural landscape for each territory.

In relation to the resilience of vernacular settlements, it is also worth noting the capacity of traditional architecture to promote autonomy and self-sufficiency through mechanisms such as the integration of housing and production spaces, coexistence with private gardens to supply food and domestic livestock and the use in the home of spaces for the storage and preservation of food.

As a whole, the way of life of the vernacular settlements, together with the intrinsic pillars of sustainability in their way of understanding and exploiting the territory, constitute a case study to improve the understanding and appreciation of the principles of sustainability that can be applied to the construction of new settlements, as well as the growth model of existing cities (Ozel, B., Dipasquale, L., & Mecca, S. 2015).

6. CONCLUSIONS

In the introduction of this work, a problem has been presented that already affects numerous countries, mainly in Africa, Asia and South America. The demographic pressure currently suffered by some countries such as Ethiopia will increase in the coming decades due to the population growth in some of these territories. Architects and urban planners of the 21st century will have to face the problems caused by this demographic challenge. This forces us to rethink the consumption models of contemporary societies, as well as to rethink construction and urban planning systems to guarantee that large urban areas can satisfy the basic needs of its inhabitants.

As has been seen, it was in the 1980s when the social pressure derived from the already evident environmental problems of growth based on a deficient economic system forced United Nations to create the World Commission on the Environment and Development. The aforementioned "Brundtland Report" emerged from this commission, which highlighted the need to change the growth model of the so-called developing countries.

While buildings consume up to 25% of the energy generated worldwide, many architects already considered in that decade the need to renew the trends in construction and urban planning that were still inherited from the Modern Movement and the Industrial Revolution. A model that ignored the environment in which it is built, understanding nature as a mere store of resources.

Some of these architects found in traditional vernacular architecture a source of knowledge about sustainability to apply in contemporary architecture. This model made it possible to establish a system that, far from breaking with the knowledge accumulated over generations and generations, was nourished by it and allowed a return to growth based on a sustainable way of exploiting the territory and its resources.

Throughout the paper, the strength of vernacular architecture has been highlighted as a solution to the need for growth in a world of finite resources. It is therefore an architecture that guarantees sustainable growth, which contemplates the four pillars of sustainability, the environmental perspective,

the economic perspective, the cultural perspective and the social perspective.

In this way, traditional vernacular architecture constitutes an example of sustainable construction, based on the analysis of the territory in which it is built and the resources available. These lessons offered by vernacular settlements become essential when facing the demographic and urban challenges foreseen for the coming decades and which may represent an alternative to informal settlements incapable of guaranteeing a decent life for the citizens who occupy them.

This work does not suppose more than an approximation to a field of study that is gaining strength in recent decades, however, the current bibliography focuses fundamentally on the capacity of vernacular architecture as a cell of the city. The challenges of the future, however, force us to become aware of the importance of urban planning, that is, of the urban scale. This is the field in which professionals in this sector should focus their efforts. The case of El Cabanyal, which has been used to exemplify some of the benefits of vernacular settlements, may serve in the future for the urban planning of the city of Valencia, analyzing the reason underlying each decision of the urban fabric with the objective of achieving more sustainable cities that respond to the demographic, climatic and energy challenges of the next generations.

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PAPER #8.05

TIMBER BUILDINGS: A SUSTAINABLE CONSTRUCTION ALTERNATIVE

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ABSTRACT

The construction and building environment is one of the largest contributors to climate change, greenhouse gas emissions, depletion of natural resources and damage to ecological integrity. Therefore, the use of more sustainable materials in construction is currently of great interest. Structural wood is considered as a versatile renewable material, having an optimal strength-to-weight ratio, insulating properties, low carbon emissions in the operational life cycle and a great abundance in nature. Furthermore, unlike other materials, wood is the only one that stores carbon in its production. The purpose of this project is to evaluate, through the Life Cycle Analysis methodology, the environmental impact of the construction of buildings made of timber compared to reinforced concrete buildings, understanding the environmental benefits and disadvantages of each technology. The results obtained from the comparison of a timber building with its concrete counterpart confirm the feasible benefit of wood in the reduction of carbon emissions and non-renewable energy consumption, as well as other positive aspects such as the reduction of other emissions. By highlighting the benefits and opportunities of wood it is intended to promote the material in construction and the development of more efficient buildings.

KEYWORDS

Timber buildings; life cycle analysis; engineered wood products; environmental impact; sustainable construction.

1. INTRODUCTION

Due to rapid population growth, it is estimated that every year between 2019 and 2025, around two billion square meters of land will be needed for new construction, mainly housing (Arup 2019). Associated with this, in 2020, the construction sector accounted for 37% of carbon dioxide (CO2) emissions, with 10% caused by the manufacture of materials and products such as steel, concrete and glass (United Nations Environment Programme 2021). The report of the United Nations Department of Economic and Social Affairs (2021) states that, in order to meet the Sustainable Development Goals, a process of sustainable urbanization will be required to accommodate the increase in population.
"Sustainable construction" consists of the proper management, use and reuse of energy, natural resources and materials throughout the life cycle of a building. The "Committee on Climate Change" of the United Kingdom affirms that the implementation of wood in the construction of buildings is a sustainable response to reduce greenhouse gas emissions in relation to growing urban demand (Spear, et al. 2019). In this sense, the publication:

"Communication on opportunities for the efficient use of resources in the construction sector" (European Commission 2014) stated that in order to reduce the environmental impact, it is necessary to improve the design and planning of construction, taking into account its full life cycle, as well as a greater use of materials with potential for recycling or reuse.

Wood emerges in construction as a sustainable structural material due to it being a renewable, biodegradable, reusable, recyclable resource and carbon sink, in addition to reducing the total construction time. When performing a life cycle analysis (LCA) of building materials, wood generally has a lower environmental footprint and lower energy consumption in its extraction and manufacturing, compared to conventional materials (Sathre 2007) (Hill and Zimmer 2018) (van Wijnen 2020).

Wood is the only material that retains carbon in its generation of approximately 1 ton of CO_2 per cubic meter (Beyer, et al. 2011), offsetting the emissions generated during its processing. In addition, forest residues, obtained in processing, can be used as biomass for the factory's own power generation (van Wijnen 2020). Therefore, the production, construction and use of buildings with wood structures require less energy consumption and lower emission of pollutants than buildings with concrete or steel structures (Canadian Wood Council 2004).

To combat climate change, architectural projects are being developed using engineered wood products (EWP) as an alternative with less environmental impact compared to construction with other traditional materials. EWP have a lower global warming potential (GWP), at the product stage, compared to reinforced concrete, even when carbon sequestration from wood is excluded (van Wijnen 2020). If the carbon sink effect is included, wood stands out as a highly sustainable material both in production and throughout the material's life cycle. Consequently, the use of EWP as a construction material has been promoted due to its results and benefits discovered in sustainability evaluations, among which LCA stands out.

In this study, the environmental impacts of a mass timber building (MTB) are evaluated and compared using the LCA, with respect to a similar reinforced concrete building (RCB). The LCA constitutes an important tool and guide in the selection of construction materials and systems according to their specific environmental impacts throughout the life cycle of the building (from the extraction of materials to final disposal).The evaluation will make it possible to assess the environmental benefits of wood compared to other structural materials and its potential for sustainability in buildings.

2. MATERIALS AND METHODS

2.1. Buildings design

As a point of reference for the development of the LCA, we have selected the 12-story prototypes in the report "The Case for Tall Wood Buildings: Second Edition" (2018), designed by Michael Green Architecture and Equilibrium Consulting. The structural system of the RCB is a combination of a frame and a rigid reinforced concrete core. The proposed concrete building model is a concrete frame structure "The typical floor and roof structures are suspended slabs supported on concrete columns and beams" (Michael Green Architecture 2018, 189). The structure of the MTB is made up of cross-laminated timber (CLT) core walls, glued laminated timber columns and steel and glued laminated timber beams. Floor and roof structure is of CLT. Also, two layers of 5/8" Fire-Rated Type X Gypsum Board on the exposed surfaces of the EWP elements have been added as an important fire protection aspect of the system. Both buildings are supported by typical footing foundations with a concrete slab on grade.

2.2. Goal and scope

The objective of this study is to evaluate the environmental impact of a MTB in comparison with a counterpart RCB, determining which construction system provides an environmentally preferable structural option. Comparative analysis is performed using the fast-track LCA method which identifies differences as well as the relative contribution of structural assembly groups and building materials to the total environmental impact of each type of building.

For a fair comparison, both buildings were designed to be functional equivalents. Since the research focuses mainly on the comparison of the structural framework of buildings, the LCA includes the core, load-bearing walls, columns, beams, floors, fire protection and foundations. Partitions, envelope, installations, insulation, ceiling finishes and other construction elements not mentioned in the previous list are excluded. The functional unit is described as a residential building with 12 stories, located on a theoretical site in Vancouver. The reference study period is 60 years.

The analysis is performed "cradle-to-grave" according to the EN 15804 standard. This includes the product stage (A1–A3), the construction stage (A4–A5), and the end-of-life stage (C1–C4). The use stage (B) is excluded from the comparative LCA, due to the assumption that the structural system does not need any type of maintenance during the period of time considered. On the other hand, an expansion of the system is applied to take into account the permanent biogenic carbon sequestration of stage D, which considers the benefits and loads beyond the useful life of the building. Stage D data is reported separately due to the high degree of forecast uncertainty. Table 1 reflects the boundary of the analysis system with differentiation of the stages included and excluded.

2.3. Life cycle inventory and impacts

The inventory of each structural option is organized in three sections: (1) compilation of the general information (location of the building, type of building, area, height and useful life); (2) identification of the materials of the assembly groups; and (3) building model development.

SYSTEM BOUNDARY																EXPANSION
Product Stage (A1-A3)			Construction Stage (A4-A5)		Use Stage (B)							End-of-Life Stage (C)				Potential Benefits and Loads (D)
INCLUDED			INCLUDED		EXCLUDED							INCLUDED				INCLUDED
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Installed product in use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction Demolition	Transport	Waste Processing	Disposal	Recovery Reuse Recycling Potential

Table 1. Boundary of the evaluation system. Source: Authors based on EN15978

The amounts of steel and concrete required in the foundations are calculated directly by the Athena Impact Estimator for Building LCA tool by entering the dimensions of the elements. The construction quantities of the rest of the assembly groups of both buildings are calculated and assumed from the structural plans published in the report by Michael Green Architecture (2018). Numerical data handling and processing is done in Microsoft Excel®.

The Athena Impact Estimator for Building tool is free Canadian software that applies the "Tool for Reduction and Assessment of Chemical and Other Environmental Impacts" methodology to perform the life cycle impact assessment. The environmental impact for some stages, such as transportation and demolition, are automatically estimated by the software. The environmental data of construction materials and processes come from the Athena® life cycle inventory database, with regional sensitivity and with a data age of less than 10 years, generally complying with ISO 14040/44 standards (Athena Sustainable Materials Institute 2016). Once the quantities of construction materials have been entered, the data for the rest of the stages is calculated in the background by the software, in accordance with the EN 15804 standard. The midpoint life cycle impacts assessed by Athena Impact Estimator for Building, in accordance with ISO 21930/31, are indicated in table 2.

3. RESULTS AND DISCUSSION

3.1. Life-cycle assessment comparison for environmental impacts of the two buildings

As shown in figure 1, the life cycle impact assessment illustrates that the MTB, from cradle-to-grave, had a lower environmental impact than the RCB, in all nine environmental impact categories. Additionally, if stage D is added, it is estimated that the wooden structure reduces GWP by 125%. While in the rest of the categories, except for the ozone depletion potential, stage D increases the difference in the attenuation of the impacts, meaning a reduction of 91% in favour of the MTB.

At the cradle-to-grave boundary, the difference between both buildings is an emission reduction of 23%, 33%, 48%, 65% and 80% in categories of smog potential, acidification potential, eutrophication potential, human health particulate and ozone depletion potential, respectively, in favour of the timber building. Adding stage D means an increase of no more than 3% in the aforementioned differences. Regarding the GWP, in the cradle-to-grave boundary, the result for the MTB is 64% lower than the RCB. Also, if stage D is included, the wooden building has 126% lower greenhouse gas emissions. For total primary energy

Abbreviation	Impact Category	Unit
GWP	Global Warming Potential	kg CO_2 eq.
AP	Acidification (Air) Potential	kg SO_2 eq.
HHP	Human Health Particulate	kg PM2.5 eq.
EP	Eutrophication (air & water) Potential	kg N eq.
ODP	Ozone Depletion (air) Potential	kg CFC -11 eq.
SP	Smog (air) Potential	kg O_3 eq.
TPE	Total Primary Energy Consumption	MJ
NRE	Non-Renewable Energy Consumption	MJ
FFC	Fossil Fuel Consumption	MJ

Table 2. Impact categories studied. Source: Authors based on (Athena Sustainable Materials Institute 2016)

consumption (TPE), non-renewable energy consumption and fossil fuel consumption, the MTB has a lower impact than the conventional structure. In the TPE, the difference between both buildings is relatively smaller in both boundaries: 4% from stages A to C and 7% from stages A to D. While in the non-renewable energy consumption, the difference between both buildings is significantly higher at both boundaries: 40% (from stages A to C) and 42% (from stages A to D). Regarding the fossil fuel consumption, the difference is 38% (from stages A to C) and 44% (from stages A to D).

Figure 2 graphically shows the proportion of environmental impacts for the evaluated life cycle. It is observed that for both buildings the contribution of the product stage (especially extraction and manufacturing sub-stages) is dominant in all impact categories. For the RCB, end-of-life stage (especially of demolition [C1], waste processing [C3] and energy use of disposal equipment [C4] sub-stages) has the second largest impact in almost all categories, with the exception of human health particulate and ozone depletion potential, where second place is occupied by the stage construction stage (especially the construction and installation sub-stage). In the case of adding

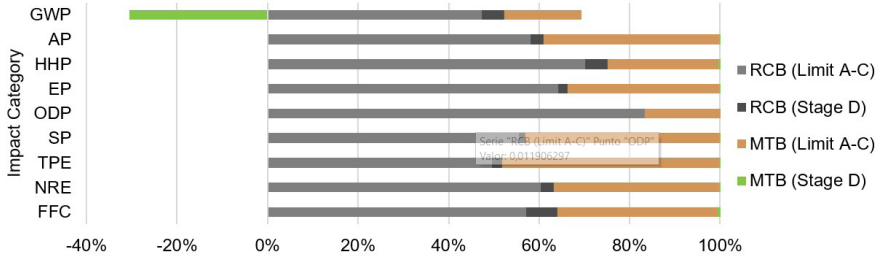

Figure 1. Comparison of the total impacts of the life cycle, excluding stage B, of the buildings evaluated

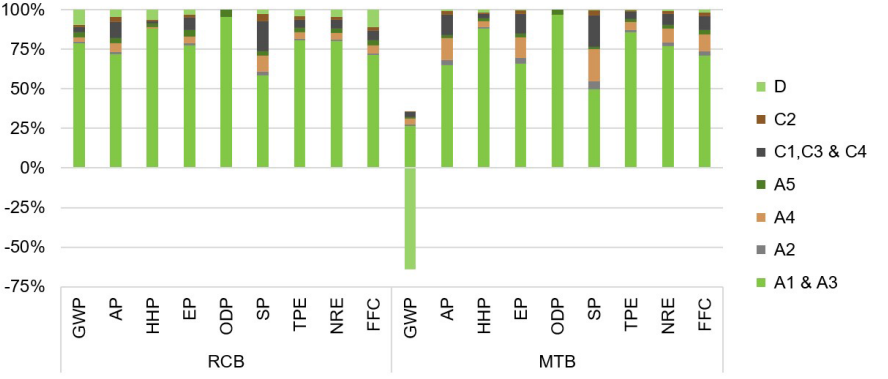

Figure 2. Environmental impacts, in percentage, of each stage of the life cycle for each building evaluated

stage D, the stage with the second largest impact in the GWP, human health particulate and fossil fuel consumption categories would be the added stage. Meanwhile, for the MTB, construction stage (especially the transport) has the second largest impact in all categories, with the exception of smog potential , where second place is occupied by end-of-life stage. In the ozone depletion potential, the second largest impact occurs in the construction and installation sub-stage. The extension of stage D assumes a significant reduction in GWP emissions. The importance of the impact of the rest of the categories is maintained.

In the extraction and manufacturing sub-stages within the system boundary, the MTB reduces emissions by 36%, 42%, 57%, 67%, 69% and 80% for smog potential, acidification potential, eutrophication potential, human health particulate, GWP and ozone depletion potential, compared to the RCB. In the TPE, the MTB only reduces 2% of emissions; however, the non-renewable energy consumption and fossil fuel consumption is 1.8 times higher for the RCB. The impacts generated by the transportation in either the product or the construction stage are greater for the MTB; however, the difference is not substantial enough to have an effect in favour of the RCB in the total impact. On the contrary, in the transport of the end-of-life stage, the MTB offers a reduction of 46% compared to its counterpart, in all impacts. In the construction and installation sub-stage, the reduction that the MTB represents over the RCB is between 43 and 88%. While for the total of C1, C3 and C4 sub-stages, the reduction is between 20% and 46%. In the case of stage D, the MTB has a 91% lower impact than the RCB in seven of the nine categories. In relation to the GWP, the MTB has a 712% reduction in greenhouse gas emissions in the stage D. For its part, the ozone depletion potential does not account for impacts.

3.2. Comparison of global warming impacts and total primary energy consumption by building assembly groups

Figure 3 shows the GWP and TPE of the building assembly groups. For the RCB, greenhouse gas emissions came mainly from floors and walls, representing, from cradle-to-grave, 42% (629,103 kg CO2 eq.) and 23% (341,242 kg CO2 eq.) of its total emissions, respectively. The addition of D to the analysis does not result in a big change to the overall results. For the MTB, floors accounted for 42% (232,629 kg CO2 eq.) and walls 9% (50,182 kg CO2 eq.) of its total cradle-to-grave carbon emissions. By adding stage D, the elements represented a reduction in total carbon emissions of 110% (-472,032 kg CO2 eq.) and 20% (-83,925 kg CO2 eq.), respectively.

From cradle-to-grave, compared to the RCB, the MTB assembly groups significantly reduced greenhouse gas emissions by

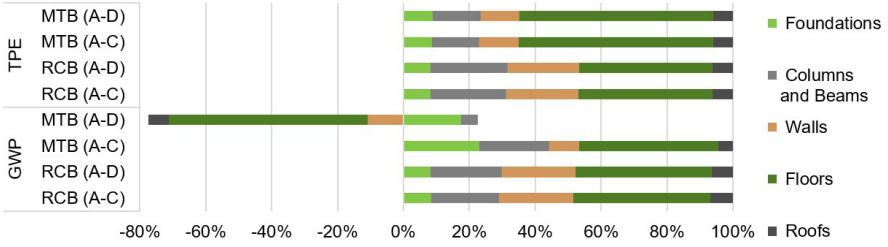

Figure 3. Comparison of the impact of global warming potential and total primary energy consumption by assembly groups of each building

85% (walls), 63% (floors and "columns and beams") and 77% (roofs). With the expansion of the boundary, the MTB assembly groups compared to the RCB, drastically reduced greenhouse gas emissions by 168% (floors), 144% (roofs), 123% (walls) and 89% (columns and beams).

Regarding the TPE category, for the RCB the consumption comes mainly from the floors and the columns and beams, representing, from the cradle to the grave, 41% (6,578,822 MJ) and 23% (3,700,147 MJ) of the total use, respectively. For the MTB, floors accounted for 59% (9,185,033 MJ) and columns and beams 15% (2,259,189 MJ) of the total cradle-to-grave consumption. The addition of stage D does not cause a change in the results for both buildings for these assembly groups. From cradle-to-grave, compared to the RCB the assembly groups of the MTB, with the exception of the floors, have a lower consumption of 48% (walls), 39% (columns and beams) and 5% (roof); the floors have a consumption greater than 40%. From stages A to D, the high consumption of the MTB floors drops to 34% with respect to the RCB, while the comparative consumption of the other assembly groups also changes to 50% (walls), 42% (columns and beams) and 8% (roofs).

3.3. Building material comparison

Figure 4 shows the total mass of each assembly group with respect to the materials used. Floors made up the largest share (by mass) of materials among all assembly groups, followed by walls. The total mass of the materials for the MTB was 2,357 tonnes, while the RCB was 7,378 tonnes, that is, about 3 times heavier. For the RCB, more than 95% of the material mass is concrete, followed by steel. Meanwhile, for the MTB, the most used material by mass was wood, followed by concrete (foundation) and gypsum board. It should be noted that the RCB uses 8.8 more concrete than the MTB.

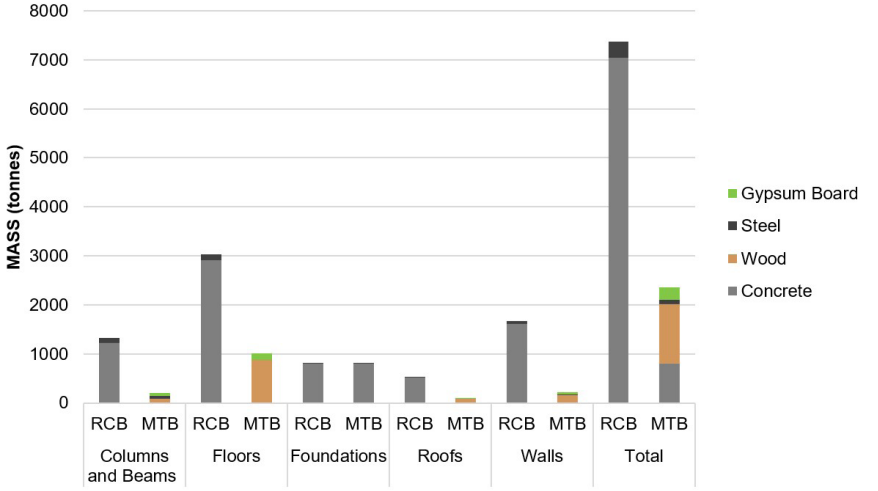

Figure 4. Mass comparison of materials used in mass timber buildings (MTB) and reinforced concrete buildings (RCB)

3.4. Discussion

3.4.1. Environmental impacts

The results reveal that the RCB, compared to the MTB, produces a greater negative impact in all the categories considered, with the product stage being the one with the highest emission and consumption. It follows that these facts are associated with the material used, demonstrating the benefits of wood compared to concrete, such as, for example, the reduction of liquid waste in bodies of water, which harms aquatic biodiversity. The increased toxicity associated with the RCB may also be associated with the high release of various contaminants in cement kilns (Soberón 2017).

For both buildings the GWP category shows a large impact in terms of CO2 release. The structural wood for the MTB potentially reduces its carbon footprint. The greenhouse gas emissions from the transport of the construction stage are higher for the MTB due to the greater distance between the CLT manufacturer and the construction site. The CO2 sequestration of the EWP, in stage D, decreases the GWP emitted for the MTB by a factor of almost two.

The results of the TPE should be analysed from a different perspective. Although the difference in consumption between the RCB and the MTB is marginal, the real difference lies in the type of energy consumed. It is observed that 95% of the energy consumed for the RCB is non-renewable, while for the MTB it is only 60%. Wood offers the possibility of using the residues of its extraction and processing as biomass, counteracting the effects of energy consumption. In contrast, the higher consumption in either the product or the construction stage may be linked to the greater distance travelled to supply the material and the final product, so that the transport trucks consume more fossil fuels in the product stage. On the contrary, in the construction and installation sub-stage, the 43% reduction for the MTB emissions with respect to the RCB is consistent with the greater total mass of the materials for the RCB (specifically, more than three times that of the MTB materials), so more heavy machinery is required.

3.4.2. Life-cycle stage analysis

All the indicators have shown the largest impacts during the product stage, specifically in extraction and manufacturing sub-stages. From stages A to C, the aforementioned sub-stages had an impact in the categories between 60%-95% for the RCB and between 50%-97% for the MTB. The difference in sub-stage impacts between structures is due to embodied emissions from the construction material used, indicating that structural wood products, and thus the MTB, embody less impact than concrete.

On the contrary, the transport of product stage and the transport of end-of-life stage, as well as the construction-installation sub-stage, have shown the least contribution to the environmental impact of the evaluated structures, with a maximum total of 5% for the buildings. In the construction and installation sub-stage, the RCB has a greater negative impact in all categories than the EWP counterpart because the former naturally has a higher total material weight and consequently requires more energy for construction and installation activities.

After the product sub-stages, the next most impactful sub-stages for the MTB are: firstly, the transport of the construction stage and secondly, the total of C1, C3 and C4. As regards the RCB, following the product sub-stage, the total of C1, C3 and C4 is the most significant.

In comparison, the greater relevance of the transport of the construction stage for the MTB, compared to the RCB, is due to the greater distance between the structural wood factories and the construction site. As far as concrete is concerned, being a common structural material, suppliers are usually within 50 km of the construction site. In North

America, construction with CLT is not yet a common practice (Pei, et al. 2016) so its commercial production in Canada is relatively recent (Karacabeyli 2010). This implies a limited CLT industry in the area and, therefore, longer transportation distances, which generates greater impacts in the transport of the construction stage for the MTB, such as the greater consumption of fossil fuel. The increase in structural wood factories would reduce these transportation distances, resulting in a lower impact for the MTB.

The relevance of the end-of-life and D stages for the RCB is due to the problems linked to construction and demolition waste management operations, which include the difficulty in the separation and recycling of the components since the concrete waste is voluminous, difficult to compact and takes up considerable space (Badraddin, et al. 2021). In contrast, the wooden elements offer the possibility of dry construction, which facilitates the disassembly, classification and storage of the construction elements. This reduces the amount of waste and allows recyclable or reusable materials to be reinserted into the production cycle, favouring the circular economy. Additionally, the carbon sequestration by the EWP used in the MTB offsets the GWP generated during the other stages and results in a drastic reduction compared to the RCB.

3.4.3. Building assembly groups

The results indicate that the floors represent the highest percentage of greenhouse gas emissions and TPE consumption in both buildings. In the GWP category, the assembly group with the second largest impact for the RCB is walls (23%), while in the case of the MTB this assembly group only represents 9%. The impact of the RCB walls is 6.8 times higher than the MTB walls. According to the results, the reduction in greenhouse gas emissions from the floors and walls of the MTB, compared to the RCB, is due to the large amount of CLT that replaces the concrete and steel of the assembly groups.

The benefit of wood in floors and walls becomes evident by adding stage D to the GWP category. Carbon sequestration in both assembly groups counteracts the damaging effects of the structure throughout the building's life cycle. Therefore, in the construction of buildings, the substitution of concrete and steel for structural wood results in environmental benefits.

Regarding the TPE of the MTB, the high consumption of both the floors and walls, as well as the columns and beams, is related to the use of the EWP, which requires a greater amount of energy in its production than concrete. However, the distinction must be made that almost half of this comes from bioenergy used in the sawmill processes.

Given that floors and walls make up the majority of the total building mass, and as more levels increase the total mass of assembly groups, designers should consider selecting materials that have less environmental impact , while also meeting the structural requirements.

3.4.4. Building material

Firstly, it is shown that cast-in-place concrete, compared to other products, is the material that produces the most damaging environmental impact in eight of the nine categories. In the TPE category, larger impacts are due to the use of EWP; however, as indicated in section 3.4.1, a large part of this consumption comes from renewable sources. On the other hand, the carbon footprint of concrete is highly significant compared to EWP, which is demonstrated by the higher greenhouse gas emissions for the RCB, compared to the MTB. Additionally, construction with EWP results in carbon being stored throughout the life of the product. This means that choosing a structural material with low emissions, such as CLT or glued laminated timber, substantially reduces the environmental impact of buildings.

Secondly, it is shown that both floors and walls make up a substantial part of the environmental impacts studied. Both assembly groups are mainly composed of concrete and CLT in the RCB and the MTB, respectively. Subsequently, the environmental impact of the assembly groups is directly linked to these materials.

In essence, building with wood consumes approximately one third the amount of fossil fuel compared to building with reinforced concrete. Likewise, wood offers a substantial greenhouse gas emissions reduction benefit even when CO2 storage is not considered. Additionally, the lighter weight of CLT, while offering essentially the same structural strength, leads to lower greenhouse gas emissions during the MTB frame construction compared to the RCB.

4. CONCLUSIONS

This study conducted a comparative LCA of two functionally equivalent buildings in Vancouver, Canada, using the Athena Impact Estimator for Building. The results illustrate that using wood instead of reinforced concrete in the structural framework produces notable reductions in almost all the environmental impacts of a 12-story building. In the TPE category, the difference between the MTB and the RCB is minimal; however, this impact does not take into account how much energy comes from renewable sources. If the energy obtained from wood residues as biomass is taken into account, the impact of the MTB is substantially lower compared to the RCB.

Regarding the stages of the life cycle, the results show that for the two materials, the larger contamination is generated in extraction and manufacturing sub-stages, which is significantly greater for reinforced concrete structures. The sub-stage with the second largest impact on the MTB is the transport of the construction stage due to the lower commercial production of wood as a structural element. The impact of transportation distances can be reduced if structural wood trade and industries increase. In the case of the RCB, the sub-stage with the second largest impact is the construction and installation sub-stage, while for the MTB its impact is relatively minor, which is be related to the lightness and ease of handling of the EWP that allow reducing the amount of heavy machinery required, the associated emissions and the times and costs of the construction stage.

Regarding the efficiency of material resources, the RCB uses three times more mass than the MTB. Additionally, it is shown that the use of CLT in the assembly groups is a significantly more sustainable option than concrete. Its use in the walls and floors would imply a great reduction in the total impact of the structure.

From this quantitative research, it is shown that the construction of the MTB is a more environmentally friendly selection (as long as the wood comes from sustainable forests) than the RCB and, in addition, reduces the carbon footprint of the buildings considerably. However, the large-scale potential is limited by its management and commercial production.

Overall, the study reinforces the growing global recognition of the need for a comprehensive LCA to understand the various environmental impacts of different building designs. Based on environmental performance, as well as structural advantages (strength, ductility, and durability), hybrid wood structures may lead to increased use of wood in building construction, fostering the development of more sustainable and efficient buildings. The results obtained herein clearly demonstrate significant environmental benefits in the selection of EWP for the construction of buildings.

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PAPER #8.06

DESIGN FOR DISASSEMBLY IN HOUSING: THE NEED TO ADAPT LCA TO SHEARING LAYERS

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ABSTRACT

The current lack of sustainable and affordable housing is a global issue which has reached a crisis point. Traditional construction approaches used to solve sustainability issues in housing are often in tension with affordability, where the achieving one of these two aims is often to the detriment to the other. The application of Design for Disassembly (DfD) in combination with Industrialised Construction (IC) can simultaneously provide environmentally and economically sustainable solutions to these ongoing housing challenges. However, the application of DfD and the planning of varying lifespans for different building components raises issues with the conventional Whole Building Life Cycle Assessment (LCA) methodology, which is used to quantify environmental impacts of the construction.
This paper covers three theoretical objectives: (1) to provide an overview of DfD and IC and how these can be combined to provide resource efficient, affordable housing (2) examine how the Shearing Layers concept can extend the building lifespan and better ensure a sustainable End-of-Life, and (3) a preliminary outline proposal as to how the Whole Building LCA methodology, based on existing standards, can be adapted to align with the Shearing Layers. These objectives will be achieved through a literature review, covering the theoretical principles of DfD and the key ISO standards related to LCA. Based on the literature and applied theory, a preliminary aggregated LCA methodology is proposed that will be further developed and tested using case studies in future investigations by the author.
The result of the discussion reveals potential conflict between construction in practice and applying Shearing Layers and the adapted Whole Building LCA and the need for further investigation to establish the number of years assumed for each layer of the LCA. Whilst inventory data for materials and processes follow conventional practices, it is the proposed organisation of information into layers illustrates to designers the need to design housing for disassembly to remove and replace building components.

KEYWORDS

Sustainable housing; Design for Disassembly (DfD); Life Cycle Assessment (LCA); Circular Economy (CE); shearing layers.

1. INTRODUCTION

A key issue to address the challenges of the climate and housing crises is resource inefficiency, construction not only accounts for nearly 40% of global energy-related CO2 emissions (UN 2017); over a third of all EU

waste is generated by construction and demolition (European Commission 2020a). Additionally, advancements in energy efficiency have exposed the urgent need to reduce the extraction of raw materials and embodied carbon to achieve net zero by 2050 (European Commission 2020b; LETI 2020; Gervasio and Dimova 2018). In tandem, there is not only a lack of social and affordable housing, 'affordable housing' is becoming increasingly unaffordable (Housing Europe 2021).

To address these challenges, the industry must move away from the linear "take-make-waste" model that has underpinned development to a Circular Economy (CE) approach, decoupling growth from the consumption of finite resources (The Ellen Macarthur Foundation 2015). Circular housing systems can potentially improve affordability whilst simultaneously improving environmental sustainability.

These circular goals can be achieved through DfD in combination with Industrialised Construction (IC), also known as Modern Methods of Construction (MMC). IC is a broad term encompassing the systematic and controlled production of buildings. It is increasingly associated with industry 4.0 and merging with ICTs such as BIM to support an integrated project team and document information for all building life-cycle stages. Both IC and CE principles consider buildings as a product rather than a one-off prototype. These two schools of thought intersect in practice through DfD where demountable standardised elements are easily adapted, reused, repaired, recycled, or relocated. Long-term cost savings are possible through circularity and the closing of material loops, with the added benefit of sheltering businesses from resource price fluctuations (European Commission 2020b). Although designing for circularity through DfD requires an increase in initial capital investment, this can be overcompensated with a reduction in future costs over the whole building lifecycle (Braakman, Bhochhibhoya, and de Graaf 2021).

Life Cycle Assessment (LCA) is a methodology and decision-supporting tool commonly used by industry professionals and scholars to measure and compare the environmental impacts of buildings. It is important to use a reliable Whole Building LCA methodology that is aligned with sustainable construction practices such as DfD, not only to appropriately measure and reduce the environmental impact of housing, but crucially to be able to define sustainability targets at the policy level. Therefore, the aim of this paper is to propose the first steps towards adapting and improving the conventional Whole Building LCA methodology, for application to housing built using DfD.

2. DESIGN FOR DISASSEMBLY IN HOUSING

2.1.Design for Disassembly (DfD)

In the Architecture Engineering and Construction (AEC) industry, Design for Disassembly - also referred to as Design for Deconstruction – is the design and planning of the future disassembly (or deconstruction) of a building, in addition to its assembly (Cruz Rios and Grau 2019). DfD can reduce embodied carbon across the building stages and is considered the "ultimate cradle-to-cradle cycle strategy" (Smith, 2010, p.222). Economic value can be maximised whilst simultaneously minimising environmental impacts in line with CE principles. This is achieved through the recovery of building materials based on the 3Rs principle (reduce, reuse, recycle). Benefits also include increased flexibility and adaptability, optimised maintenance, retention of heritage, and the possibility to easily relocate an entire building (Rios, Chong, and Grau 2015).

Although significant research in applying DfD to construction and housing began in the early 2000s (Smith 2010) the concept is

not new, it has been used by nomadic groups throughout history and well-known structures include the Native American Tipi (Fig.1), Mongolian Yurt (Fig.2), and Bedouin tents or "Buryuut Hajar" (Fig.3). Disassembly is also integral to exhibition pavilions, entertainment structures, military facilities and refugee shelters assembled for rapid deployment and temporary use (Guy and Ciarimboli 2008). Such examples provide valuable knowledge for the application of DfD to permanent housing; notable Research and Development (R&D) projects include Cellophane House by KieranTimberlake (2008) and European project Buildings as Material Banks (BAMB 2020).

DfD is dependent on design principles including standardised and interchangeable components and connections, dry construction methods with mechanical connections as opposed to chemical bonding, designing with safety and accessibility in mind, and documentation of materials and methods for disassembly (Guy and Ciarimboli 2008; Crowther 2005; Morgan, Architects, and Stevenson 2005). The deconstruction plan is key to this process and should be developed during the design phase (Tingley 2012; Jensen and Sommer 2019). Designing for disassembly goes against construction conventions and requires the collaboration of multiple stakeholders, such as a deconstruction manager after the use stage (Charef and Lu 2021).

2.2. DfD in combination with IC: A kit-of-parts

DfD in housing can be implemented on a small scale using conventional construction techniques, the use of human-scale components or 'sub-assemblies' are ideal in application to modest self-build projects such as the open source WikiHouse project (TED Talks 2013). However, the benefits of DfD can be scaled-up when paired with Industrialised Construction (IC). Through economies of scale DfD in combination with IC can provide social and affordable housing on a mass-scale: reducing construction time, improving build quality, and reducing costs. Production of industrialised housing can take place in factories either off-site or in temporary on-site hubs. It is expected that a significant proportion of housing in the coming decades across Europe will be built in such factories, and sustainable homes will be mass-customised from range of prefabricated standard elements (McKinsey 2020).

This form of housing production can provide user-oriented housing through a 'kit-of-parts' or catalogue of large standard prefabricated elements such as the roof, structure, and wall panels to name a few (Fig.4). A first step in applying DfD to industrially produced housing would be to ensure each element from the kit-of-parts is designed to be assembled as well as disassembled, with the possibility of re-assembly.

Figure 1. [left] Native American Tipi. Source: https://hearthworks.co.uk/history-of-traditional-tipis
Figure 2. [centre] Mongolian Yurt. Source: http://loc.gov/pictures/resource/ppmsca.14742/
Figure 3. [right] Bedouin Buryuut Hajar. Source: https://www.loc.gov/resource/cph.3b22258/

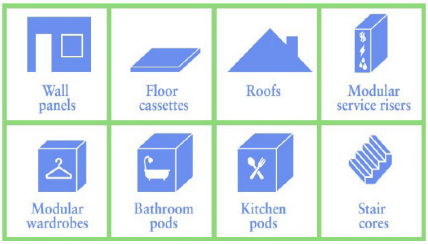

Figure 4. Industrialising housing with a kit-of-parts: Source: Author's own image

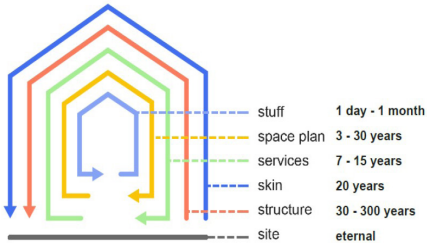

Figure 5. Shearing Layers diagram adapted by author. Source: Author's own image based on Brand (1994)

2.3. Shearing Layers and the Six S's

DfD principles aim to extend the building lifespan for as long as possible to increase material longevity, as advocated by the Ellen McArthur Foundation (2015). Therefore, resource efficiency of residential buildings should be maximised through dismantling and recycling housing at the end of the service life, in addition to maintaining, repairing, and replacing components during the use phase. A building comprises of different components with varying lifespans that should be accounted for, to extend the lifespan of an entire house or apartment block.

In the book How Buildings Learn: What Happens After They're Built, Brand (1994) organised these varying lifespans into six categories with the Shearing Layers concept. The concept built upon the work of Duffy (1992), who Brand quoted to substantiate the theory which views buildings as "a set of components that evolve in different timescales". The six S's include the 'site', 'skin' (façade), 'structure', 'services', 'space plan' (internal layout) and 'stuff' (furniture and appliances) (Fig. 5).

Breaking down the building concept into separate layers facilitates planning for the replacement of parts to close material loops whilst the building is inhabited, in addition to the planned reuse and recycling of building elements at the end of the building lifetime. The structure is shown as the longest lasting built element (potentially up to 300 years according to Brand) and hence more permanent, in contrast to the space-plan which is subject to adapt with lifestyle changes, such as adult children leaving the family home or the need to work from home. How these six layers are connected to each other is crucial to enable the removal of building elements, "[o]therwise the slow systems block the flow of the quick ones, and the quick ones tear up the slow ones with their constant change" (Brand 1994).

R&D projects piloting DfD in housing increasingly incorporate Brand's Shearing Layers model to account for their varying lifespans (Acharya, Boyd, and Finch 2020; Crowther 2005). The application of Shearing Layers to a kit-of-parts for housing should consider the varying lifespans of each component, categorising these into the separate building layers. Potential difficulties lie in elements that combine the structure with the skin, which could include both roof and external walls when using a panelised system (highlighted in red in figure.6). To ensure the Shearing Layers are adhered to, independent load bearing structures such as portal frames would mitigate the issue of separating the outer layer, or the thermal envelope.

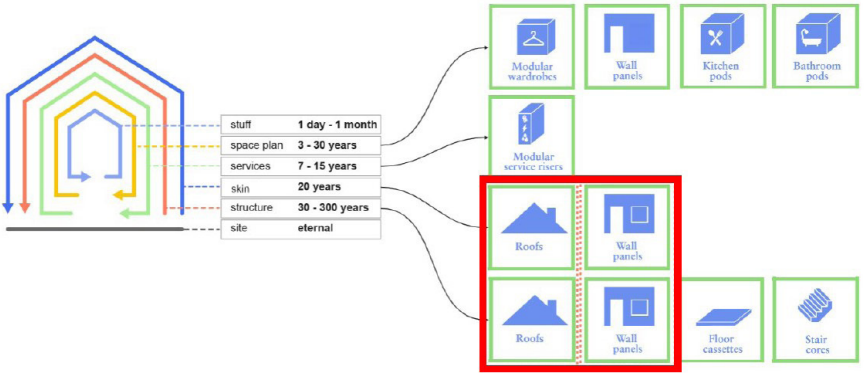

Figure 6. Shearing Layers applied to a kit-of-parts. Source: Author's own image

3. LIFE CYCLE ASSESSMENT (LCA)

3.1. An overview of LCA

Life Cycle Assessment (LCA) is a standardised method to comprehensively quantify all emissions and resources involved in the production of goods and services, providing information on the environmental and health impacts, in addition to resource depletion (European Commission 2010). LCA serves as an analytical tool that can be used to compare products, accounting for all input and output flows related to the entire life cycle, from raw material acquisition, manufacture, use and maintenance (whilst the home is occupied), to the deconstruction and beyond EoL phase (T. Sartori et al. 2021).

LCA was originally used to assess small scale products as opposed to buildings; according to Guinée et al. (2011) one of the first studies was carried out by the Midwest Research Institute (MRI) for The Coca Cola Company in 1969 to compare different beverage containers. The LCA methodology was applied to buildings decades later in the 1990s and is also referred to as a Whole Building LCA (BRE 2018).

A Whole Building LCA is an increasingly core component of Green Building assessments such as carried out by BREEAM, which incorporated LCA into their credit system following demand for transparency from the construction industry (T. Sartori et al. 2021). The inclusion of quantitative methods such as LCA supports the move towards a performance-based rather than descriptive approach to measuring sustainability. This is promoted by leading Green Building certification body BREEAM, who in reference to LCA state "you can't manage it if you don't measure it" (BREEAM, 2018).

3.2. Key standard ISO 14040:2006

The ISO 14040 series provides a standardised global framework for practitioners and scholars alike to conduct a Whole Building LCA. The series provides the basic outline for an LCA methodology with four distinct analytical phases:

1. the goal and scope definition phase,
2. the inventory analysis phase to estimate quantities of materials, products, and processes,
3. the impact assessment phase, and
4. the interpretation phase.

The first phase 'goal and scope definition' sets the depth and breadth of the LCA, phase two involves a Life Cycle Inventory (LCI) that encompasses the input/output data, phase three is the Life Cycle Impact Assessment (LCIA) whereby additional information is used to assess the LCI results, and the last phase is interpretation of the LCI and/or LCIA results which are then summarised and discussed (ISO 2006).

3.3. Key standard EN 15978:2011

An important addition to the international standards was the publication of EN 15978 under CEN/TC 350, which supports the decision-making process and provides more specific guidance for the calculation methods. This should include all building related construction products, processes, and services used over the life cycle of the building (CEN 2011). The standard provides a framework which breaks down the life cycle into four main phases (A-D): 'A' Product and Construction stages, 'B' In-use stage, 'C' EoL, and 'D' Beyond building life cycle. Within each phase are several numbered sub-phases or 'modules'.

The inclusion, or exclusion, of these stages delineate what is known as the system boundaries of the assessment. A summary of the building stages and their associated system boundaries can be understood as the following: cradle-to-gate (modules A1-A3), cradle-to-site (modules A1-A5), cradle-to-grave (modules A1-C4), or cradle-to-cradle (modules A1-D). A cradle-to-cradle Whole Building LCA supports a circular approach to housing and is increasingly incorporated into Green Building assessments (BREEAM 2022; USGBC 2022). This is crucial when designing a circular building system as the reuse, recovery, and recycling potential must be pre-planned to better safeguard the sustainable EoL, which would take place beyond the lifetime of the original project team. A cradle-to-cradle Whole Building LCA could therefore be used to promote circular economy principles in housing through DfD practices.

Product phase			Construction phase		Use phase							End-of-Life phase				Benefits & Loads
A1 - A3			A4 - A5		B1 - B7							C1 - C4				D
A1 - Raw material supply	A2 - Transport to manufacturing plant	A3 - Manufacturing & fabrication	A4 - Transport to project site	A5 - Construction & installation process	B1 - Use	B2 - Maintenance	B3 - Repair	B4 - Replacement	B5 - Refurbishment	B6 - Operational energy use	B7 - Operational water use	C1 - Deconstruction/demolition	C2 - Transport to disposal facility	C3 - Waste processing for reuse, recovery or recycling	C4 - Disposal	D - Re-use, recovery, recycling potential

Figure 7. Building life cycle phases and modules. Source: Author's own image based on EN 15978

3.4. LCA and life span consideration

LCAs assume a service life span for buildings of different uses, including residential buildings; within academia and industry the number of years considered to conduct a Whole building LCA are not consistent (Grant, Ries, and Kibert 2014). A study by Sartori et al. (2008) reviewed 60 case studies from nine countries, revealing common practice was to assume a 30 to 50-year life span to perform a Whole Building LCA. More recently, another academic study by Hossain and Ng (2018) confirms this may still be an accepted norm; within a sample of 36 LCA studies the majority assumed a 41–50-year life span and only 4% assumed a life span greater than 80-years.

There are several ISO standards related to service life planning, such as ISO 15686-5:2017(en) (ISO 2017), however there is no prescriptive number of years detailed. Within Europe, Eurocode EN 1990:2002+A1 specifies a 50-year life span for the structural system of a building. This period has been used by the Joint Research Centre (JRC) of the European Commission as the predicted life span for Whole Building LCAs (Gervasio and Dimova 2018).

Similarly, there is a lack of consensus amongst industry professionals for the length of a building's life span. Whole Building LCAs by BREEAM use a default calculation period of 60-years (BREEAM 2018); the 'Green Guide' by BRE (the parent company of BREEAM) loosely bases the 60-year period on ISO 15686 in addition to guidelines by BPG (1999), BLP (2000), and CIBSE (2000) amongst others.

Another issue – and a source of major conflict with DfD principles and CE goals – is the conventional Whole Building LCA assumes one length of time to assess the impacts of the entire building.

In practice, building lifetimes vary considerably from case to case, even amongst residential buildings; the seemingly arbitrary 50- or 60-year life span is markedly low as the vast majority of housing remains in use over multiple generations.

4. ADPAPTING THE LCA METHODOLOGY

4.1. Proposed aggregated methodology

The issue of an inconsistent predicted building life span becomes redundant when applying LCA to analyse the environmental impacts of housing designed for disassembly. To incorporate CE and the benefits of DfD, the conventional Whole Building LCA presents major shortcomings which must be addressed by adapting the widely accepted methodology. Whilst the incompatibility of DfD with a Whole Building LCA remains unresolved, an increasing number of scholars are contributing to this issue (Joensuu et al. 2022; de Wolf, Hoxha, and Fivet 2020).

This study proposes the application of the Shearing Layers concept to the Whole Building LCA through the aggregation of six separate LCAs, these could comprise of large building components that adhere to the separate Shearing Layers. The methodology would align with the key ISO standards discussed (ISO 14040 and ISO 15978) amongst others, whilst incorporating building information related to kit-of-parts elements commonly used by industrialised house builders. For each layer, the aggregated methodology would assume a life span equal to the upper-range value provided by the Shearing Layers concept. For example, the structure, which according to Brand has a potential lifespan of 30-300 years, would assume a 300-year lifespan. Once the LCAs have been aggregated, the lifespan for the Whole Building LCA would assume the same lifespan as the structure, as once this fails, the whole building would need to be disassembled.

One could argue that separating a residential building into six layers is rather general, in the context of this study and in anticipation of application to future studies, a more granular approach would be too time-consuming and may not yield significantly improved

results. Furthermore, the broader aim of the study is to impact the Whole Building LCA methodology adopted in industry, which would be more difficult to achieve with a high level of complexity and more time-consuming process.

4.2. Supporting analytical tools

Analysis of materials and processes will be performed using the ecoinvent Life Cycle Inventory (LCI) database, a mature database integrated into the SimaPro application. Ecoinvent is a globally recognised LCI data source provided by a Swiss not-for-profit association and therefore contains data specific to the Swiss construction industry. The proposed methodology will account for this through adapting input data to a general European origin (rather than Swiss-specific), to support the comparison of future case studies from different European countries.

4.3. Applying Shearing Layers to case studies

The following section provides some detail as to how Brand's six Shearing Layers will relate to built elements in the future case studies. The 'site' layer will be considered eternal, though remediation practices (excavation and landfilling) will be calculated. The 'structure' layer will encompass the foundation and load-bearing elements (including columns, beams, and floor slabs and stair cores) and will assume a 300-year life span. The 'skin' layer (external façade including windows and doors) will consider a 20-year life span. The 'services' layer (modular risers containing HVAC, plumbing, lifts, fire sprinkler systems, and communication and electrical wiring) will assume a 15-year life span. The 'space plan' layer (interior walls, ceilings, floors, and doors) will be calculated with a 30-year life span. Lastly, the 'stuff' layer (furniture such as chairs, desks, and appliances) will not be included in the Whole Building LCA as these are not fixed building elements and are subject to a considerable amount of change. The proposed methodology assumes the upper limit of the time provided by Brand for the expected life span of each layer as previously shown in figure.5. However, it should be noted there is a lack of qualitative data to substantiate the exact number of years that should be adopted for each layer. Therefore, the proposed length of time for each layer for the proposed methodology will be reassessed and further developed.

5. CONCLUSIONS

This paper provided the background to DfD in housing and how in combination with industrialised construction methods can be used to provide sustainable social and affordable housing. Although these building methods and strategies are not common practice, there is growing research and several pilot projects, suggesting this may be used more widely to provide sustainable housing solutions.

It was argued that the current Whole Building LCA methodology does not provide designers and policymakers with a true reflection of the building performance of DfD buildings, on which to base housing-related decisions; this unsuitably assumes the same life span for the whole building. This should instead consider the impacts of separate components and their associated lifespans, aligned to Brand's Shearing Layers concept.

The first steps towards adapting the conventional Whole Building LCA were outlined, to be based on existing standards and that would comprise of aggregated LCAs of prefabricated components from a kit-of-parts. Lastly, this paper anticipates the potential conflicts that may arise in applying the adapted LCA to existing projects due to difficulties in separating layers, particularly where panelised systems are used. This research will be further developed and applied to case studies in future work by the author.

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PAPER #8.07

THE GAP BETWEEN NEAR ZERO EMISSIONS BUILDINGS AND THE SPANISH BUILDING REGULATION

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ABSTRACT

Due to the effects of climate change, energy has become one of the most relevant topics nowadays. Because of the increasing amount of electronic devices, the dependency to energy consumption is increasing every year. At the same time, in order to avoid the devastating effects of global warming, it is crucial to find ways to lower the energy consumption in buildings. In recent decades, the building regulations have been updated several times to account for this changing reality. However, is the local Spanish energy regulation restrictive enough to reach Near Zero Energy Buildings (NZEB)?
This study aims to answer this question through a case study. A single-family house built in Valencia in 2013 has been analyzed by comparing the current state and how it would have been constructed under the updated legislation. The work is conducted through energy simulation and Life Cycle Assessment (LCA). The energy simulation is performed with OpenStudio, which uses the calculation engine EnergyPlus. The LCA was carried out using SimaPro and the Ecoinvent database. By analyzing the results obtained in both cases, it is possible to analyze the effectiveness of the CTE DB HE 2019 compared to the applicable norm in 2013 in terms of reducing energy consumption and the CO2 equivalent emissions. It can be concluded that although the current legislation is a significant improvement over previous ones, it is not enough to reach NZEB.

KEYWORDS

NZEB; carbon footprint; Life Cycle Assessment; thermal simulation.

1. INTRODUCTION

The building sector has a dramatic influence on the environment. Buildings not only need a huge amount of resources for their construction, but also host most human activities, which commonly entail a massive consumption of energy. Therefore, buildings not designed adequately to reduce the need for energy consumption can be hugely detrimental to the environment. Many architects and industry professionals have been aware of the determinant relation between buildings and their environment. A great example of that is Solar architecture, which started as a trend in the 30s in the United States. Solar architecture involved taking advantage of orientation and glass surfaces to provide sufficient light and heat to interior rooms. The anxiety about the possible lack of sufficient energy supply after the Second World War gave a boost to solar architecture. Some remarkable examples are the Sloan House (1939) and the Duncan House (1941), both by Fred Keck, the MIT solar house

(1939), and the Dover House by Maria Telkes and Eleanor Raymond (1948). However, the increase in the use of oil and natural gas, as well as the fascination for the possibilities of nuclear power, undercut these innovative solar designs in the fifties (Barber 2016). Along those years, other pioneers in bioclimatic architecture started making their mark. Victor Olgyay published his book *Design With Climate*, published in 1963 (Victor Olgyay 1963). Baruch Givoni was also a pioneer in the field. He became well known for his book *Man, Climate and Architecture*, where he presented his famous bioclimatic diagram (Givoni 1969). In the 70s, due to the oil embargo, energy optimization was in the limelight again. Counter-cultural movements led to another wave of interest in designing with the sun (Denzer and Gardzelewski 2019). They felt attracted not only to the positive effect those houses had on the environment but also to the revolutionary shapes and designs they had. The work of those early adopters was instrumental to the development of our current standards for efficient and sustainable construction, such as Passivhaus (Santy et al. 2017).

Due to the need to mitigating climate change, reducing the energy consumption of buildings is now more important than ever before. As with every industry, the building sector needs to reinvent itself to meet the new sustainability standards. Terms such as Nearly Zero Emissions Buildings have gained relevance in the last decades (Hermelink et al. 2013). One of the key aspects in the mitigation of energy consumption is to construct highly insulating building envelopes. An adequate building envelope minimizes the thermal losses avoiding the need to increase or lower the indoor temperature through HVAC systems. Building regulations play a huge role in fostering thermally insulated building skins.

The first building regulation in Spain, NBE-AT-79 (Basic Building regulation), was passed in 1979. This regulation defined the amount of thermal insulation required in buildings for the first time. However, it was not a comprehensive code that regulated every significant aspect of buildings in Spain. After almost 30 years, in 2007, the Spanish Ministry of Development passed the Spanish technical building code (CTE) (Ministerio de Fomento. Gobierno de España 2007). The Energy Efficiency Document of the CTE (CTE DB-HE) divides the country into different zones to account for the significant climatic variation in the country. The different areas are characterized by a code composed of a letter and a digit. The letter refers to the severity of winters, on a scale from A to E, and the digit to the severity of summers, on a scale from 1 to 4. In late 2019, there was an update in the CTE DB-HE. For the first time, it introduces the concept of Near Zero Energy Buildings (NZEB). Its states that all Spanish buildings constructed under the current regulation must be NZEB (Ministerio de Fomento. Gobierno de España 2020).

However, there is not an accurate definition of what an NZEB actually is. This paper deals with the comparison between the energy consumption in a single-family house constructed under the 2007 regulation and the same hour if it had been built under the current legislation, factoring in the amount of thermal insulation that it would have needed.

1.1. Objectives

This research has two main objectives. First, to assess the influence that building regulations have over the energy consumption in buildings. Secondly, to evaluate how that energy consumption translates into environmental impacts, especially the carbon footprint.

2. METHODOLOGY

This paper has been structured as a case study. The Spanish Building Code's impact on the energy consumption of buildings has been studied through the analysis of a single-family house in Aldaia (Valencia). It is a three-floor row house with 229.23m2 of usable area. Its main façade faces north. The first

floor is mainly used as a garage; the second floor has a kitchen, a living room, a bathroom and a bedroom. The third floor has two bedrooms, a bathroom, and a small studio. The Last floor serves as the entrance to the terrace. Figures 1 and 2 depict an extract of the building plans.

The façade of the building is formed by a cavity wall composed of the following elements: 11.5 cm exposed bricks, a 3cm air chamber, 3 cm of polyurethane foam, a 2cm cement mortar layer, 10 cm hollow bricks, and a 1 cm layer of gypsum plasterboard. The flat roof is composed of a layer of bitumen seal, 4 cm of polystyrene foam, a 3 cm cement mortar layer, and finished with ceramic tiles.

As this building was built in 2013, the main idea of the study is to compare the energy consumption at the current state of the house with the energy consumption that the house would have if it had been built under the 2019 version of the CTE DB-HE, the document that regulates the energy efficiency requirements of buildings in Spain. For the purpose of this study, the current state of the house will be named Case 1, and Case 2 will represent the house built under the 2019 regulation. To adapt the house to the current standard, the main change has been to increase the amount

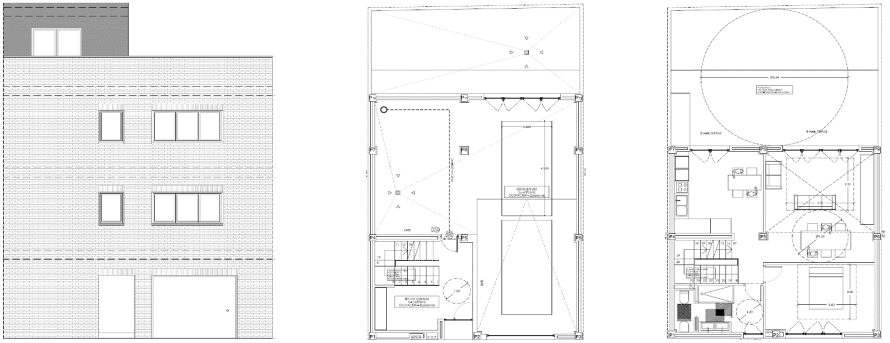

Figure 1. Plans of the house part 1: entry elevation and first and second floor section. Source: Own source

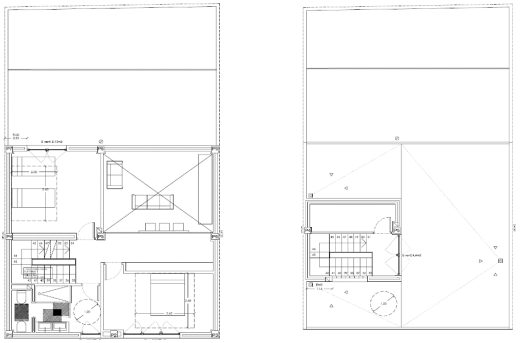

Figure 2. Plans of the house part 2: Third and fourth floor section. Source: Own source

of thermal insulation in the roof and in the façade. The façade maintains all its original layers mentioned in the previous paragraph but the polyurethane. The thickness of the polyurethane layer increases from 3cm to 10 cm. The roof also maintains all its layers but increases the thickness of the polystyrene slab from 4 to 13cm.
The aspects of energy consumption studied are heating, cooling, and DHW (domestic hot water). The HVAC systems used all use electricity. An air-to-air heat pump is used to cover both the heating and cooling demand. The efficiency ratios for heating and cooling, respectively, are 3.48 (SCOP) and 2.44 (SEER) (Table 1). The air distribution is done through ducts. The DHW demand is covered by a combined system of a solar domestic hot water system and a water boiler. The solar panel cover 60% of the total energy demand for hot water, which is the minimum required by the building regulations.

	Efficiency		
	SERR	**SCOP**	**$SCOP_{DHW}$**
Case 1	2.44	3.48	1.00
Case 2	2.44	3.48	1.00

Table 1. Energy efficiency of the HVAC systems

As explained in the two following subsections, the comparison of the two cases is conducted both from purely the point of view of the energy consumption and the effect it has on the environment. A comparison between the 2013 and the 2019 version of the DB-HE can be seen in Table 2.

2.1. Energy simulation

The simulation process employed aims to determine the building's primary energy consumption and the percentage of renewable and non-renewable energy. The software used is OpenStudy, an open-source software that uses EnergyPlus v9.1 as its calculation engine. The software performs an annual simulation at hourly intervals. Therefore, the software estimates the distribution of the energy demand every hour to maintain the defined operational conditions in every zone.

2.2. Life Cycle Assessment

The analysis of the environmental impacts produced by the house's energy consumption on the environment is performed through a comparative Life Cycle Assessment (LCA). LCA is a methodology used to account for the effect that every process involved in any human activity has on the environment. The ISO 14040 covers the process necessary to adequately conduct an LCA. The data used to model the electricity mix comes from the Ecoinvent database v3.6. The data has been handled using the software Simapro v9. The calculation method used to assess the impacts is the Environmental Footprint v3. This calculation method was developed by the European Commission and can be considered the most adequate for assessing the environmental impacts of products within the context of the European Union.

3. RESULTS AND DISCUSSION

This section deals with the energy simulation and LCA results.

3.1. Energy simulation results

The energy simulation results show a significant reduction of the energy demand, especially in the case of heating, in which the demand is reduced by almost 80% (Table 3). The reduction in the refrigeration demand is 20.5%. While it might seem like a small reduction when compared with heating, it is a significant difference in the time in which the use of air conditioning would be needed

			CTE HE 2017	CTE HE 2019
			kWh/m²·year	*kWh/m²·yea*
HE0		Non-renewable primary energy consumption	49.00	28.00
		Total primary energy consumption	-	56.00
HE1		Heating demand	15.00	-
	Thermal transmittance of the building envelope	*Unit*	*W/m²·K*	*W/m²·K*
		Walls in contact with the exterior	1.00	0.56
		Floors in contact with the exterior	0.65	0.56
		Roof	0.65	0.44
		Elements in contract with the exterior	1.00	0.75
		Dividing walls	1.00	0.75
		Windows and openings	4.2	2.3
		Doors	-	5.7
	Global heat transmission coefficient	*Unit*	*W/m²·K*	*W/m²·K*
		Compactness V/A ≤ 1	-	0.58
		Compactness V/A > 4	-	0.77
	Solar control	*Unit*	*kWh/m²·mes*	*kWh/m²·mes*
		Solar radiation in July $q_{solo;jul;lim}$	-	2.00
	Building envelope permeability	*Unit*	*m³/h·m²*	*m³/h·m²*
		Air renewal rate of change in a 100 Pa overpressure	-	27.00
		Unit	*n50 h⁻¹*	*n50 h⁻¹*
		Air renewal rate of change in a 50 Pa pressure V/A ≤ 2	-	6.00
		Air renewal rate of change in a 50 Pa pressure V/A > 4	-	3.00
	Imbalance limitation	*Unit*	*W/m²·K*	*W/m²·K*
		Inner partition floor in the same house unit	1.55	1.55
		Inner partition wall in the same house unit	1.20	1.20
		Inner partition floor in a different house unit	1.10	1.10

Table 2. Comparison between the current and the former Basic Document on Energy savings of the CTE regulation

in the house. The energy for DHW does not change, as the insulation does not affect the demand for hot water.

Table 4 shows the results of energy consumption. Unlike energy demand, energy consumption takes into account the energy efficiency of the HVAC systems employed in the house. The efficiency coefficients employed are shown in Table 2. After factoring in those coefficients, it becomes apparent that in case 1, the energy consumption is the highest in the case of heating, followed by the Domestic Hot Water and the refrigeration. However, after improving the thermal insulation of the building envelope, the biggest energy consumption becomes the DHW. The amount of energy needed for heating decreases significantly, almost to the point of evening out with the refrigeration consumption.

	Energy demand (kWh/m^2·year)		
	Refrigeration	Heating	DHW
Case 1	3.47	29.17	5.85
Case 2	2.68	6.24	5.85

Table 3. Energy demand of case 1 and 2 obtained through the thermal simulation

3.2. Life Cycle Assessment results

Table 5 shows the LCA characterization results obtained through the Environmental Footprint methodology. The climate change category shows that by applying the 2019 version of the DB-HE, the house emits 65 tons of CO2e less than with the previous regulation. In general, as the energy savings are around 45%, the total environmental impacts of every category are reduced at the same rate. That was something to be expected due to the fact that the electricity mix is the same in both cases. The environmental Footprint methodology offers the possibility of normalizing and weighting the results. This allows a direct comparison between the relative importance of each one of the categories to the total environmental impact. Figure 3 shows the weighted results. The two categories with a higher environmental impact are Climate Change and Resource use. This result responds to the high content of energy generated from fossil fuels that there still is in the Spanish electricity mix. This result would probably be different in the near future as more percentage of renewable energy is incorporated into the electricity mix.

	Energy consumption (kWh/m2·año)			Annual energy consumption (kWh)			Total consumption (kWh)
	Ref.	Heating	DHW	Ref.	Heating	DHW	
CASO 1	1.42	8.38	5.85	376.82	2221.42	1551.11	4149.36
CASO 2	1.10	1.79	5.85	291.44	474.94	1551.11	2317.49

Table 4. Energy consumption of case 1 and 2 obtained by using the efficiency coefficients

Impact category	Unit	Energy case 1 (100 años)	Energy Case 2 (100 años)
Climate change	kg CO_2 eq	135827.33	75861.852
Climate change - Fossil	kg CO_2 eq	134483.97	75111.57
Climate change - Biogenic	kg CO_2 eq	254.46	142.12
Climate change - Land use and LU change	kg CO_2 eq	1088.90	608.17
Ozone depletion	kg CFC11 eq	8.81E-03	0.00492038
Ionising radiation	kBq U-235 eq	33572.21	18750.65
Photochemical ozone formation	kg NMVOC eq	526.76	294.20
Particulate matter	disease inc.	3.14E-03	1.75E-03
Human toxicity, non-cancer	CTUh	2.14E-03	1.20E-03
Human toxicity, non-cancer - organics	CTUh	5.15E-05	2.88E-05
Human toxicity, non-cancer - inorganics	CTUh	1.26E-04	7.05E-05
Human toxicity, non-cancer - metals	CTUh	1.98E-03	1.10E-03
Human toxicity, cancer	CTUh	7.60E-05	4.25E-05
Human toxicity, cancer - organics	CTUh	2.13E-05	1.19E-05
Human toxicity, cancer - inorganics	CTUh	3.46E-13	1.93E-13
Human toxicity, cancer - metals	CTUh	5.47E-05	3.05E-05
Acidification	mol H+ eq	1208.27	674.84
Eutrophication, freshwater	kg P eq	6.18	3.45
Eutrophication, marine	kg N eq	174.04	97.20
Eutrophication, terrestrial	mol N eq	1948.37	1088.20
Ecotoxicity, freshwater	CTUe	2559062.20	1429279.40
Ecotoxicity, freshwater - organics	CTUe	20466.86	11431.08
Ecotoxicity, freshwater - inorganics	CTUe	147913.27	82612.05
Ecotoxicity, freshwater - metals	CTUe	2390682.10	1335236.20
Land use	Pt	548530.54	306363.55
Water use	m^3 depriv.	90777.89	50700.98
Resource use, fossils	MJ	3195034.80	1784480.80
Resource use, minerals and metals	kg Sb eq	1.47	0.82

Table 5. Environmental Footprint Characterization of the energy consumption of case 1 and case 2 over 100 years

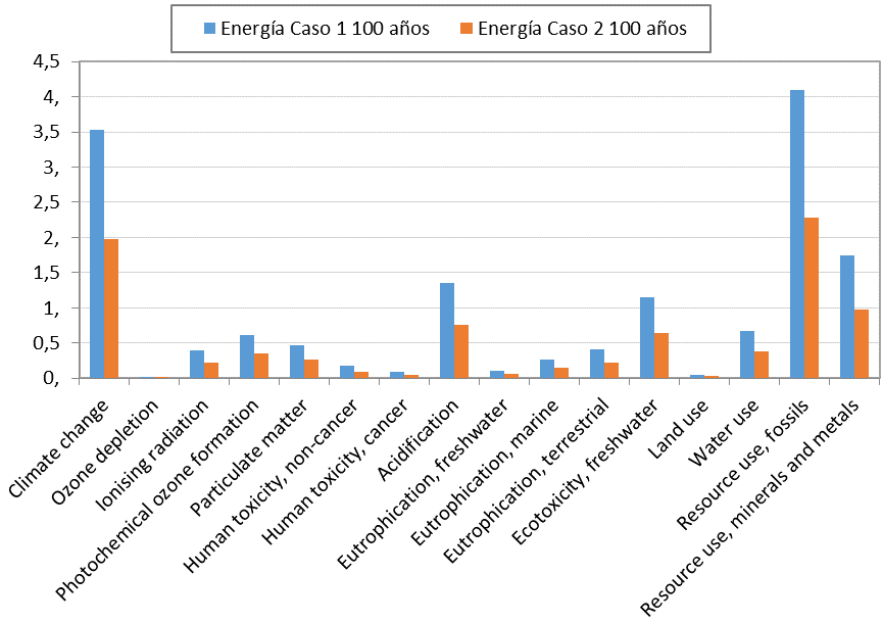

Figure 3. Weighting and single score Environmental Footprint result

4. CONCLUSIONS

After finishing this study, several conclusions can be drawn:

- While the first version of the CTE DB-HE was a step in the right direction, it was still not restrictive enough to provide a sufficient level of energy efficiency, and it was far from the standards of other European countries.
- The 2019 version of the DB-HE is a cornerstone in the evolution of sustainable and energy-efficient buildings in Spain. In the case of the case study house analyzed, the energy consumption of the building is reduced by 45%. In terms of carbon dioxide equivalent emissions, which entails a reduction of 65 tons of CO2e over 100 years.
- Despite the improvement of the DB-HE 2019, the results obtained don't get near the idea of a Near Zero Energy Building (NZEB). Although the definition of NZEB is somewhat loose, the energy consumption of the house is still too high to be considered nearly zero.
- As the buildings transition more and more to consuming renewable energy, the focus should not be to talk about Nearly Zero Energy buildings, but to talk about Nearly Zero Emissions Buildings, or Nearly Zero Impact Buildings.

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PAPER #8.08

COMPARATIVE EVALUATION OF PASSIVE CONDITIONING STRATEGIES FOR THE IMPROVEMENT OF COURTYARD THERMAL PERFORMANCE

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ABSTRACT

The alarming increase in global average temperatures and the adaptive capacity of humans in relation to air quality and temperature are becoming increasingly relevant. Scientific resources have focused on the thermal adaptation of building users, but little research has been done on thermal comfort in outdoor and semi-outdoor spaces in the city. This study focuses on the analysis and comparison of different passive strategies implemented in courtyards. The present investigation quantifies the comfort improvement brought by shading and misting elements in courtyards. For this purpose, a set of intrinsic and extrinsic variables that intervene in the thermodynamic behavior of the courtyard will be taken into account. The relevance of the study lies not only in the need to design energy-efficient buildings with adequate thermal comfort patterns but also in more resilient urban environments in the current climate change scenario. The main objective of the research is to quantify the implementation of other passive strategies and the results of different combinations of these. The results identified a thermal delta in the courtyard of up to 10°C cooler than the outdoor temperature, which varies depending on the different strategies implemented and the time of day.

KEYWORDS

Courtyard; architecture; comfort; climate change.

1. INTRODUCTION

The issue and effects of climate change are a concern that today's society must take into account in order to mitigate them. Thermal forecasts for the end of the century indicate an increase of several degrees in average temperatures in cities (Santamouris et al. 2001). The latest studies carried out by the Intergovernmental Panel on Climate Change (IPCC) show that the data for southern Spain are not very encouraging. Moreover, CO2 emissions are one of the most relevant causes of climate change to be taken into account, and buildings cause 40% of CO2 emissions in Europe (Matthews et al. 2009). The measures needed to face this problem are becoming highly restrictive, so contributions from any discipline are essential for nations to comply with new requirements. One of the main objectives to mitigate climate change regarding architecture is the design of Nearly Zero Energy Buildings (NEZB). Reducing the energy demand of buildings is possible

thanks to different passive strategies in the architectural design of cities and their morphology (Bitan 1988). Courtyards have gained importance in cities mainly affected by global warming, such as Seville, acting as highly efficient passive cooling systems, used in vernacular architecture in hot areas. Depending on their construction and design characteristics, they help remarkably as thermal regulators of buildings' and cities' temperatures, mitigating the urban heat island effect (UHI) (Carnielo and Zinzi 2013). The so-called UHI effect occurs mainly in large cities, due to the built mass, producing an overheating of urban areas. During summer heat waves, some cities have reached more than a 10°C difference between the rural periphery and the urban area temperatures.

The tempering potential of courtyards is a value to be taken into account in cities with warm climates. This has been assessed and demonstrated for less extreme climate zones (Nasrollahi et al. 2017; Taleghani et al. 2014). The thermal gap achieved with the outside is the main parameter to take into account when assessing this temperate potential. The effectiveness of courtyards depends on the intrinsic and extrinsic characteristics of each courtyard. Some internal ones, such as geometry, aspect ratio (AR), orientation (Oktay 2002), the presence of vegetation or water, degree of exposure to wind (Safarzadeh and Bahadori 2005), constructive finishes (albedo) (Taleghani 2018), shade elements (Cindel et al. 2018), stand out, but it is the external environment that determines the tempering capacity to a greater or lesser extent.

The microclimate of the courtyard contributes to the energy savings of the building by tempering adjacent rooms. It also allows the users of these spaces to be thermally comfortable most of the day in the warm season (Diz-Mellado, Galán-Marín, and Rivera-Gómez 2020).

The implementation of passive strategies in courtyards can improve their indoor microclimate in a controlled way. The inclusion of vegetation (Diz-Mellado et al. 2020), albedo variations, the presence of water sheets (Pearlmutter and Berliner 2017; Hweij et al. 2017), or nebulizers (Ulpiani et al. 2019; Ulpiani, di Perna, and Zinzi 2019) or the placement of shading elements (Shashua-Bar, Pearlmutter, and Erell 2009) are some of those that have been tested so far (Soflaei et al. 2017). Some of them are inexpensive and easily available bioclimatic strategies.

A new line of research that has not been addressed so far is the comparison of different passive strategies and their combination such as the effect of a common shading element (an awning) on the partial or total surface of the courtyards, during 24-hour cycles or only in the daytime period, and the presence of nebulizers. This research, therefore, aims to test the tempering potential of courtyards in extreme summer temperatures, and the effect of passive shading strategies and misters. The study focuses on a case study in the city of Seville, which is a city characterized by the presence of many of these spaces. The assessment of the courtyard microclimate is analyzed, first without any strategy, then with a 24-hour shading element, then with a shading element during daylight hours, and finally a combination of a daytime shading element and foggers. This is a comparative analysis with very similar outdoor climatic conditions. The ease and speed of assembly as well as the cost-effectiveness of these strategies make the results of the research a fundamental aspect against climate change.

2. MATERIAL AND METHODS

2.1. Location and climate description

In this section, the local climate of Seville (Seville, Spain, 3722058" N 558023" W, 16 m a.s.l.), in Southern Spain, is analyzed

in detail and a case study is selected for investigation.

Seville is the capital of Andalusia, an autonomous community of Spain with an area of approximately 14,036 km2. Seville covers 140.8 km2 and has an average height above sea level of approximately 7m. The city of Seville is located on the fertile plain of the Guadalquivir, a river that goes through the city from north to south. It has 688.711 inhabitants, making it a medium-sized city in Spain and the most populated city in Andalusia. Seville is one of the warmest cities in Spain. It has a Mediterranean climate and is very warm in the summer months.

In the research, parameters such as the Diurnal Thermal Range DTR (Equation 2) are used (Lee et al. 2018; Lim, Hong, and Kim 2012). DTR is the difference between the minimum and maximum temperature values captured in a given observation time, usually a 24-hour cycle (Qu, Wan, and Hao 2014; Braganza, Karoly, and Arblaster 2004).

$$T_{max} - T_{min} = DTR\ (°C) \qquad (2)$$

Between the summer and winter months, there is a great variation in temperatures, but there are also large variations in DTR, reaching 12-13 ºC in winter and 16-17 ºC in summer. Winters are generally mild, with few days registering 0ºC and little rainfall. In summer, temperatures can occasionally exceed 40 ºC in the hottest months. Due to climate change, as we mentioned earlier, it has been recorded that summer is lengthening in time, as the heat starts earlier in the year and leaves later, so the climate in Seville works as two seasons, winter and summer, with a short period with a mild climate such as spring and autumn.

According to IPCC projections for the coming decades (IPCC 2018), heat waves are becoming more frequent in the city of Seville, and will increase considerably. Summer temperatures are regularly high in this southern and inland area of Spain. The Spanish Código Técnico de la Edificación (CTE), the building standard (Documento Básico 2017), classifies Seville's climate as B4, which indicates mild winters and high summer temperatures. According to the Köppen classification, it is classified as category Csa, characterized by hot, dry summers with low rainfall.

Seville is a city in which most days are sunny, so there is special importance in protecting oneself against solar radiation, and that is why the use of shading elements is a fundamental part of this city.

2.2. Case study

The object of study of this research is an educational building built in 1959, located in a consolidated urban environment. It consists of a basement, ground floor (gf), gf + 1, gf + 2, and upper floor. It is a building composed of 3 volumes of different heights (Fig. 1). The courtyard under study serves offices and classes?, and its characteristics are specified in the Table 1.

The influence of the geometry on the thermodynamic behavior of the courtyards is of great importance according to previous research (Rivera-Gómez et al. 2019) and is defined as the ratio between the height (H) and the width (W) of the courtyard, known as the aspect ratio (AR) (Equation 1). In the case study, two ARs (I and II) are considered, one for each side of the courtyard considering them as simplified parallelepipeds.

$$AR = H/W \qquad (1)$$

Courtyard	Surface	Dimensions		Height (m)	AR I	AR II
CS1	81,0	5,9	8,5	11,7	2,00	1,40

Table 1. Geometric data of the case study

Figure 1. Case study courtyard

2.3. Field monitoring campaign

A plan of field monitoring campaigns is designed to measure the temperature in the case study courtyard.
The thermal evaluation using temperature and humidity sensors is carried out at different heights to be able to appreciate and analyze the thermal stratification with greater precision, as in previous campaigns considerable thermal differences have been observed at the different levels of the courtyard. The thermal stratification is influenced by internal parameters of the courtyard such as its orientation, geometry, or construction characteristics, as well as by external factors such as the season of the year and the climatic zone.
The monitoring plan is carried out for July 2021, with outdoor temperatures typical of the warm season. The monitoring campaigns are divided into four parts: courtyard monitoring without implementation of passive strategies (A); implementation of shading elements during 24h (B); implementation of shading elements (Fig. 2b) during daylight hours (8.00 am - 9.00 pm) (C); implementation of nebulizers (6s/min) (Fig. 2c) in combination with shading elements during daylight hours (D). The planning of the monitoring campaigns is in Table 2.

Monitoring Campaign	Passive Strategy	Date	Time frame
A	-	12/07 – 15/07	24 h
B	Shade Element	16/07 – 19/07	24 h
C	Shade Element	20/07 – 23/07	8.00 am – 9.00 pm
D	Shade Element + Nebulizers	24/07 – 27/07	8.00 am – 9.00 pm + 6 seg/min 24 h

Table 2. Planning of the monitoring campaigns

A weather station model PCE-FWS20 is located on the roof of the building to monitor outdoor data related to temperature, humidity, wind speed and direction, and precipitation (Fig. 2a). All these data were recorded in a control center located inside a nearby office inside the building. Simultaneously, three temperature and humidity sensors were placed on a string at different heights to capture the thermal stratification of the air. The sensors were protected from direct solar radiation with a ventilated shield, according to previous research. In the case study, the sensors were placed at the base of the string at a height of 3.0 m, 5.0 m, and 7.0 m above the courtyard floor, model TESTO174H temperature recorders. With the measurements outside and inside the courtyard, the Thermal Delta (TD) between the courtyard and the outside can be determined (Rivera-Gómez et al. 2019).

$$TD(°C) = OT - CT \quad (3)$$

TD is a factor consisting of the difference between the outdoor temperature on the roof of the building and the temperature in the courtyard measured by a sensor placed at a certain height above the ground for a certain time. It is a very useful factor for assessing the tempering potential of the courtyard.

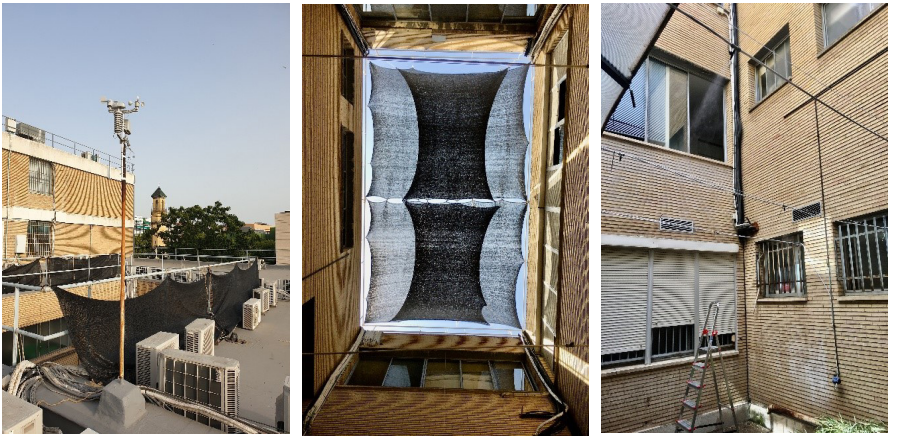

Figure 2. Location of the measurement instruments. a) weather station PCE-FWS 20, b) data loggers TESTO 174H, c) nebulizers at 2.00 m (6 seg/min)

3. RESULTS AND DISCUSSION

This section shows the results of the different monitoring campaigns (A-D) carried out inside the courtyard. Two selected days from each type of campaign are shown in figure 3. The days have been selected according to the outdoor temperature, choosing the days with the most similar outdoor temperature for future comparison of the implemented passive strategies. The results shown in Figure 3 are divided into four blocks (A, B, C, and D), representing the four monitoring campaigns carried out. In dark color, the monitored outdoor temperature on the roof of the building, and in other colors the temperature and humidity of the sensors placed inside the courtyard.

Figure 3 shows considerable thermal stratification between the TESTO174H sensors. The thermal stratification between sensors varies between 1-2 ºC in consecutive sensors separated by 2.00 meters. This thermal stratification is different in campaign D, where the temperature of the lowest sensor is significantly different from the one at 5.00 meters. As for the relative humidity, the trend is the same in campaigns A, B and C, increasing considerably with the implementation of the foggers in campaign D, especially during the day. The temperature at the lowest sensor is similar, with a noticeable increase in temperature at higher elevations. Figure 4 shows the average results of temperature and humidity inside the courtyard.

Figure 4 shows that the tempering potential of the courtyard increases when a shading element is implemented, being similar in campaigns B, C, and D. In terms of DTR, the average outdoor thermal variation is 18 °C, while in the courtyard it varies between 8 and 4 °C. To assess the microclimatic potential generated by each passive strategy implemented, one day has been selected from each of them. Figure 5 shows the TD achieved in each campaign with respect to the average yard temperature.

The hourly TD is shown in Figure 5a, and in Figure 5b, the maximum TD achieved during the day is expressed as positive, and the maximum TD during the night, when the courtyard is warmer than outside, as negative. The TD achieved in campaign A is 5.5°C during the day and -2.4°C during the night. By implementing a shading element for 24 hours in campaign B, the TD is 9.5°C, improving by 4°C due to the presence

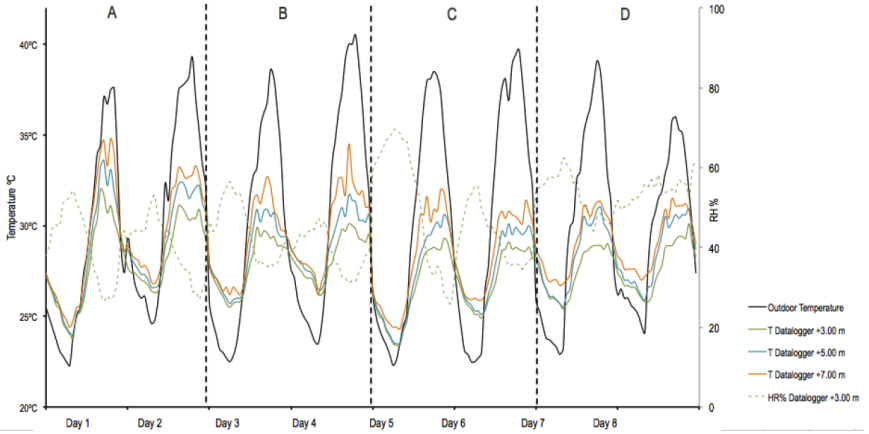

Figure 3. Results of selected days in monitoring campaigns

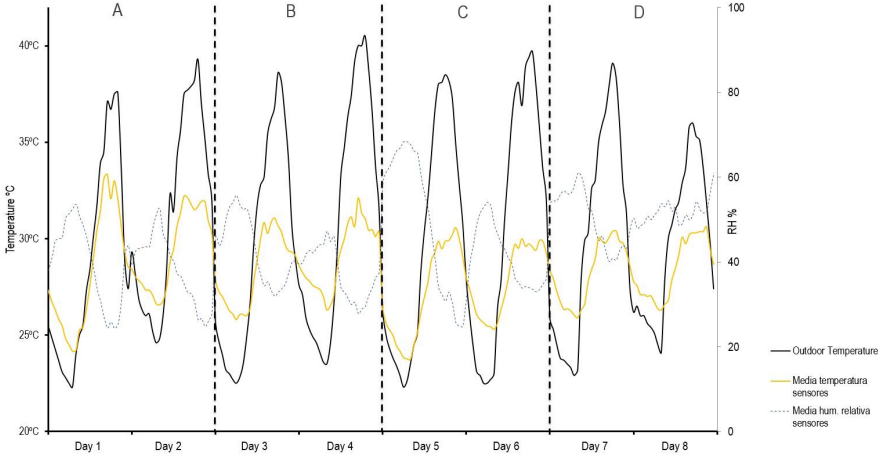

Figure 4. Results of average temperature and humidity in the courtyard

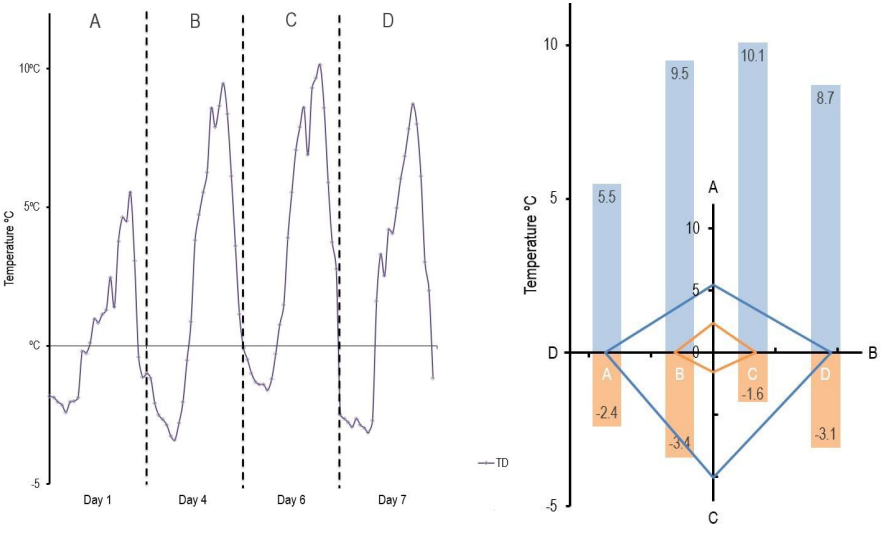

Figure 5. TD results for four selected days a) overall TD 20, b) diurnal and nocturnal TD

of the shading element. However, during the night, the TD is -3.4 ºC, significantly affecting the courtyard temperature during the night period. In campaign C, the TD is 10.1ºC, significantly higher than in the previous case. During the night period, when the shading element is removed, the courtyard manages to cool down, almost balancing with the outside temperature. The presence of foggers in campaign D has not produced any improvement in combination with the shading element in the daytime period. During the night, the courtyard does not cool down, with the foggers producing a similar hot air pocket as the shading element in campaign B.

4. CONCLUSIONS

The thermal tempering achieved in buildings by the influence of the microclimate generated in the courtyard is a real fact of scientific interest. Vernacular architecture in the Mediterranean climate has been characterized by the presence of these spaces as the spatial core of buildings.

The implementation of different passive strategies applicable to these spaces is important due to the improvement achieved in the temperate potential of the courtyards. In this research, the implementation of shading elements and misters has been tested during several monitoring campaigns.

The selected case study manages to temper the temperature in this space by more than 5ºC during daylight hours. However, the implementation of a shading element provides up to an additional 5ºC, achieving a TD of more than 10ºC. However, foggers have not brought significant improvements.

During the night, these passive strategies were also compared, achieving space cooling in the campaigns with the removal of the shading element during the night hours.

This research aimed to compare different passive strategies applicable to the courtyard. Ultimately, the implementation of shading elements during the day plus night-time removal is the most suitable passive strategy for this case study. The limitations of this research have been the lack of a new campaign in which only misters are implemented to test their effect on their own. In future lines of research, it will be possible to carry out this comparison in courtyards with different geometries and climatic zones to detect which passive strategy is more suitable for each type of courtyard in each climate.

ACKNOWLEDGEMENTS

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PAPER #8.09

SOCIAL HOUSING IN THE DOMINICAN REPUBLIC, A STUDY ON THERMAL COMFORT

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ABSTRACT

The accelerated growth of cities entails challenges in all sectors, and specifically, it has a close relationship with the construction sector. The Dominican Republic is a country where urban growth is increasing considerably, representing a problem of great magnitude in terms of the construction of social housing to reduce the housing deficit. In the social housing projects in Santo Domingo, the energy conditions are non-existent. There are no previous studies on the thermal comfort of those buildings. For this reason, this study seeks to analyze thermal comfort and energy efficiency in these types of housing through an energy simulation.
The energy simulation is carried out through OpenStudio, which uses the Energy Plus calculation engine. A type of model was analyzed for the determination of temperatures and ranges of thermal comfort to evaluate its behavior for 24 hours in different months. The calculations obtained from the energy consumption due mainly to the variation of the comfort temperature indicate that the temperature variation is very similar in the selected months, with a maximum temperature of 27.3ºC in the hottest month and a minimum temperature of 26 .8ºC in the coldest month. Finally, due to the warm climate that prevails in the area, a high comfort temperature is recorded in these types of dwellings. To improve the comfort conditions in this type of dwelling, it is necessary to add thermal insulation and control the solar gains effectively.

KEYWORDS

Thermal comfort; energy simulation; natural ventilation; thermal analysis; OpenStudio.

1. INTRODUCTION

In developing countries, especially in the countries located in Latin America, the rapid growth of urban areas has caused in recent decades complex social problems that significantly affect the city and the environment. This urban growth is directly driven by the population growth due to the increasingly high natality rates and, therefore, by the higher housing demand. In modern society, most human activities take place inside buildings, both homes, and offices. Homes need to provide a safe and livable environment to ensure the well-being of its inhabitants (Observatorio de Políticas Sociales y Desarrollo 2017). However, new buildings have consequences beyond the environmental impact of their construction process. The energy consumption during the use phase of the building is probably the most impacting process that buildings entail. Researchers claim that buildings consume between 30 and 40% of the total primary energy worldwide and between 40 and 50% of the greenhouse gases worldwide (Ramesh, Prakash, and Shukla 2010).
Several strategies have been used to reach higher indoor comfort levels over the years. The climate

conditions in most parts of the world require the dwellers to use high quantities of energy, either highering or lowering the temperature through HVAC systems. The incipient effects of climate change are already altering the weather conditions and causing a higher energy demand for refrigeration in some locations.

Social housing policies in Latin America and the Caribbean have focused on tackling the housing shortage while not paying enough attention to the deficiencies in quality that lead to lower comfort levels and higher carbon emissions ("El Problema de Vivienda de Los 'Con Techo'" 2004). According to a study published by the Office for National Statistics (ONE), 71.4% of the housing stock in the Dominican Republic lacks adequate infrastructure and quality materials. The National Housing Institute (INVI) is currently working on offsetting this deficiency. either highering

In countries with areas with warm and humid climatology, as is the case of the Dominican Republic, the effects of overheating and moisture accumulation directly affect the comfort inside the dwellings. Furthermore, the Dominican Republic is not only located in a seismic epicenter but also has seasons with a permanent incidence of hurricanes and tropical storms. Due to those climate conditions, it is necessary to bear in mind that the structure and the other building elements should be designed to resist those phenomena.

1.1. Goal

This study focuses on analyzing the thermal comfort conditions and the energy efficiency while trying the reach the levels required by international standards without using mechanical ventilation. A social house prototype located in Santo Domingo city is used as a case study.The main objective of this study is to analyze the existing problems related to ventilation in the case study, which directly affect thermal comfort. The purpose is to estimate the difference between the current state of the building and the ideal comfort temperature range and propose solutions to improve this and other similar buildings without using HVAC systems.

2. METHODOLOGY

This work is structured as a case study. The thermal performance of an apartment building constructed in the context of a national social housing program in the 80s was studied.

2.1. Case study

A residential building located in the Invivienda sector, East Santo Domingo province, was chosen as the object of this case study. This building was constructed as a part of a national housing program in the 80s. Figure 1 shows the ground plant of the building and its different architectonic spaces. Figure 2 shows the plant of one of its housing units. The building has four floors. Each one of the floors has four housing units. Each of the sixteen housing units has a living room, three bedrooms, a bathroom, and a laundry room, accounting for 75 square meters. Each apartment has only one access door, one auxiliary door, and eight windows, each made of the same materials.

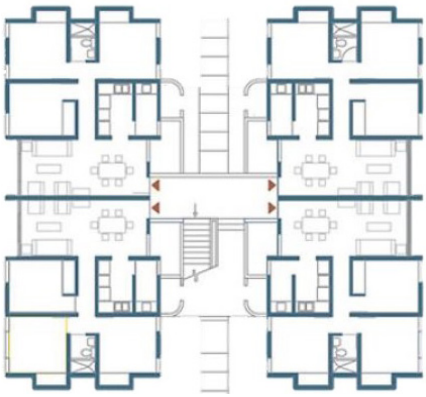

Figure 1. Architectural plan of the building

Figure 2. Architectural plan of the building

The Santo Domingo province is located at 18°29'08"N latitude 69°52'24"O longitude. It has a humid tropical climate with an average annual temperature of 25ºC. Due to the oceanic current and breeze, the average temperature is around 1.5ºC lower than its latitude suggests. The highest average temperature is about 34 ºC, registered in July and August, and the lowest is around 19ºC in January and February. Intertropical locations such as Santo Doming city have high average temperatures, with low variation between night and day temperatures. There is also a relatively low seasonal variation. The high relative humidity, typical of tropical climates, makes it hard to reach adequate indoor comfort levels.

The average precipitation levels reach 1446mm. The highest rainfall incidence takes place in May and November. Santo Domingo city is in the trajectory of the northwest trade winds. The annual average wind velocity is 10.1 km/h. Near the shore, the wind direction changes direction due to the temperature differential between the land and water masses, which causes the winds to flow from the sea to the land during the day (SE), and from the land to the sea during the night (NE). That phenomenon helps mitigate the constant hot and humid conditions over the year.

Because of the proximity to the equator, the hours of daylight variate between 11 and 13. It can be stated that Santo Domingo Receives an average of 215 hours of sunlight each month with a maximum sunshine time of 62%. The solar radiation potential in the Santo Domingo Island (average solar radiation on a horizontal surface) variates between 5.25 and 5.5 kWh/m2 per day on the western side.

2.2. Simulation process

Several thermal simulations were conducted to analyze the performance of the case study building to determine the comfort temperature range. To obtain it, the period of the year with the higher temperatures and the period with the coolest temperatures were considered in a span of 24 hours. The day zone and the night zone, and one of the floor levels were also analyzed in the same period. SketchUp Pro-2021 was used for 3D modeling, one of the best computer programs for creating architectural 3D models. The thermal simulation was performed using the software OpenStudy, an open-source program that uses the Energy Plus calculation engine (United States Department of Energy 2019).

The simulation was run in two different conditions, the first one being its current state and the second one and the second one after conducting refurbishment measures.

2.3. Materials

According to the data from the National Survey of Multi-Purpose Households carried out by the National Statistics Office ((ONE) 2019), the primary materials used in the country are concrete blocks, both for external walls and partitions, zinc and concrete for the ceiling and aluminum for the windows. Table 1 shows the most typical construction materials in the Dominican Republic.

Figure 3. Simulation of the building in OpenStudio

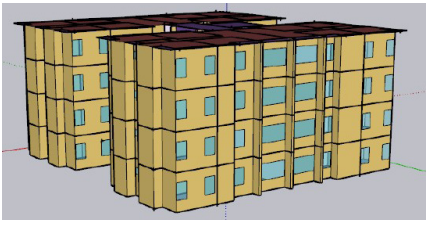

Figure 4. Simulation of the building in OpenStudio

The materials employed and the different apartments have been emulated in the thermal simulation. The building has a flat roof with a 12 cm reinforced concrete slab. Its outer face has a mortar covering and a waterproofing layer. The exterior walls and partitions are constructed with 20 cm thick concrete blocks covered with a cement mortar layer on both sides. The floor is composed of a slab of reinforced concrete and horizontal aluminum sheets distributed over all the surfaces with a ten-centimeter separation. The entrance door is made of pine wood, and the interior walls are made of plywood.

Table 2 describes the composition and the thermal properties of the materials that compose the façade, and Table 3 the layer composition of the roof.

Building elements	Thermal resistance (m² -˚K/W)	Thermal conductivity (W/m ˚K)	U-Value (W/m² ˚K)
Cement mortar	0.017	1.30	5.39
Concrete block façade	0.13	1.18	3.37
Concrete roof	0.13	1.65	3.30
Aluminum windows	/	230	5.84
Wood doors	250	0.16	0.37

Table 1. Thermal properties construction materials in the Dominican Republic

Layer	Material	Thickness (m)	Thermal Resistance (m² -˚K/W)	U-Value (W/m² ˚K)
1	Rubbed mortar	5mm		
2	Rustic mortar	15mm		
3	Façade concrete block	200mm	0.29	3.48
4	Rustic mortar	15mm		
5	Rubbed mortar	5mm		

Table 2. Elements of the façade construction materials in the Dominican Republic

Layer	Material	Thickness (m)	Thermal Resistance (m² -˚K/W)	U-Value (W/m² ˚K)
1	Waterproofing	3mm		
2	Rustic mortar	50mm		
3	Reinforced concrete	120mm	0.27	3.71
4	Rustic mortar	20mm		
5	Rubbed mortar	5mm		

Table 3. Roof elements construction materials of the Dominican Republic

PARAMETER HOT DAY	
Occupant by Zone	4 PEOPLE
People Activity	80%
Time of Occupation	168 Hours per Week
Simulation Day	August 15th

PARAMETER FRESH DAY	
Occupant by Zone	4 PEOPLE
People Activity	80%
Time of Occupation	168 Hours per Week
Simulation Day	January 16th

Table 4. Parameters for openstudio simulation

3. RESULTS AND DISCUSSION

Once the simulation is complete, the results are shown by the OpenStudio viewer, which summarizes the results using tables and graphs. The simulation parameters are displayed in Table 4.

As was previously explained, two simulations were conducted. In the case of the first scenario, initial temperatures on a hot and cold day were obtained to determine the comfort range of the building. The 15th of August was chosen as the hot day and the 16th of January as the cold one. The second scenario was performed with the same parameters but added a passive natural ventilation solution to compare the temperature and comfort range.

Figure 5 depicts the exterior temperature in those periods. The maximum temperature on a hot day is 30.5ºC, and the maximum on a cold day is 29.1ºC. Figure 6 shows the average radiating temperature in those periods. In this case, the maximum temperature on a hot and cold day are 31 and 30.1ºC, respectively. The relative humidity on a hot day varies between 75 and 88%, with the average hourly being approximately 80%. For a colder day, the results oscillate between 66 and 72%, with an average of 69%.

In scenario 1, the calculations did not account for the influence of natural ventilation. Figure 7 shows that the indoor temperature reaches a maximum of 29.3ºC during the hot season and a maximum of 28.6% during the cold season. In both cases, the temperatures are outside of what would be considered comfortable.

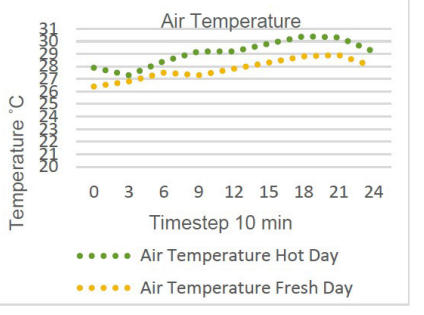

Figure 5. Air Temperature scenario 1. Own source

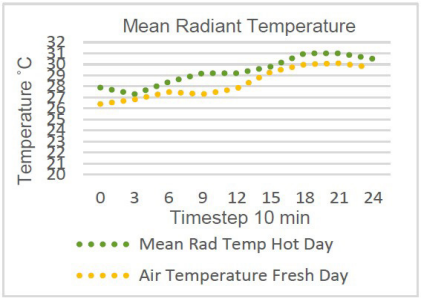

Figure 6. Mean Radiant Temperature scenario 1. Own source

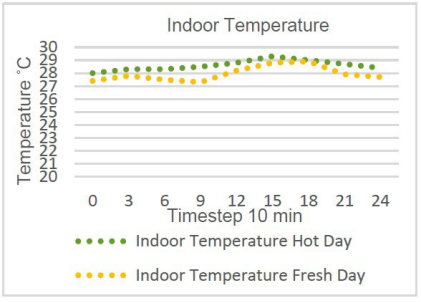

Figure 7. Indoor Temperature scenario 1. Own source

PMV	Thermal Sensation
3	Much hot
2	Warm
1	Slightly warm
0	Neutral
-1	Slightly cold
-2	Cold
-3	Very cold

Table 5. Thermal Sensation. Source (ISO 2005)

Afterward, the temperature is evaluated using the Fanger methodology, which assesses the Predicted Mean Vote (PMV) on the thermal sensation scale of a group of people exposed to a particular environment (Diego-Mas 2015). This method derives from heat transfer physics combined with an empiric adaptation to account for the subjective human sensation. PMV establishes a thermal tension based on thermal transmittance in the stationary state between the body and the environment and assigns a vote of comfort according to that tension. PMV is measured on a scale from three (much hot) to minus three (Very Cold) (Table 5). From that, it is possible to obtain the Percentage of People Dissatisfied (PPD) for each PMV. The PPD increases as the PMV moves from the neutral position (zero) to either positive or negative values. Table 6 shows the temperatures required to perform the thermal comfort calculations. The values were obtained through the simulation with OpenStudio.

The thermal comfort was assessed using Design Building, which calculates the PMV and PPD by introducing the data in table 7. Figure 8 shows the thermal comfort on a hot day with the natural ventilation turned on. The figure shows that the operative temperature registered is 30.5ºC. The thermal sensation is 2.20, which is considered warm according to Table 5. The PPD indicates a value of 84.81% of satisfaction due to the high temperatures. Figure 9 shows the thermal comfort of a cold day. It indicates that the operative temperature is 29.4 and the thermal sensation is 1.83, which indicates that the comfort level is slightly warm, according to Table 8. The PPD is 68.38%, which is still due to the high temperatures.

Day	Air Temperature	Mean Radiant Temperature	Relative Humidity
Average Daily Max. Hot Day	30˚C	31˚C	69%
Average Daily Max. Fresh Day	28,8˚C	30,1˚C	65%

Table 6. Mean Temperatures for calculate thermal comfort scenario 1. Own source

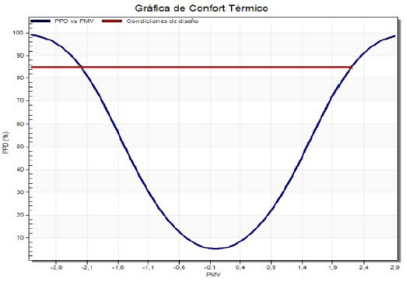

Figure 8. Thermal comfort hot dayscenario 1. Own source

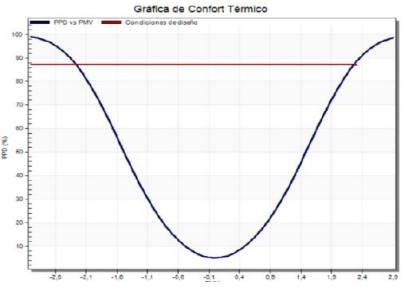

Figure 9. Air Thermal comfort fresh day scenario 1. Own source

Results	
Operating temperature ˚C	30,5˚C
PMV	2,2
PPD (%)	84,81%

Table 7. Results thermal comfort scenario 1. Own source

Results	
Operating temperature ˚C	29,4˚C
PMV	1,83
PPD (%)	68,38%

Table 8. Results thermal comfort scenario 1. Own source

The second proposed scenario takes into account the effect of natural ventilation. The simulation is configured to control the parameters of opening and closing windows according to the relation between internal and external temperature. The windows in these kinds of buildings do not have glass. The window frame only has shutters to control the airflow and light inside the house. Table 9 shows the temperature and humidity for scenario 2. Figures 6 and 7 depict the exterior temperature in those periods. The maximum temperature is 28.8ºC on a hot day, and the maximum temperature on a cold day is 27.3ºC.

Figure 10 shows a maximum average radiating temperature of 25.4ºC on a hot day and a maximum radiating temperature average of 24ºC on a cold day. The relative humidity on the hot day oscillates between 96% and 85%, the hourly average being 90%. The cold day has a relative humidity between 57% and 70%, averaging 63%. The interior temperature reaches a maximum of 26ºC in the hot season and 25ºC in the cold season. The PMV and PPD were again obtained using the data from Table 9. Figure 11 shows the thermal comfort result in a hot day with natural ventilation, showing an operative temperature of 27.1ºC. The PMV is 1.08, slightly warm according to the values in Table 10. The PPD indicates a value of 29.72%.

Day	Air Temperature	Mean Radiant Temperature	Relative Humidity
Average Daily Max. Hot Day	28,8˚C	25,5˚C	90%
Average Daily Max. Fresh Day	27,3˚C	24˚C	63%

Table 9. Mean Temperatures for calculate thermal comfort scenario 2. Own source

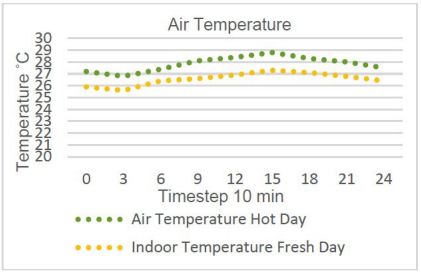

Figure 10. Air Temperature scenario 2. Own source

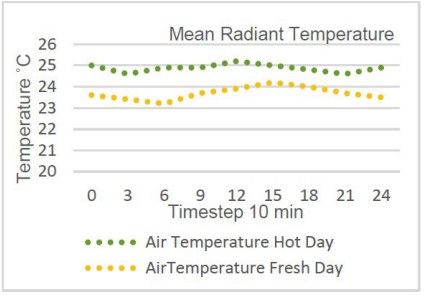

Figure 11. Mean radiant Temperature scenario 2. Own source

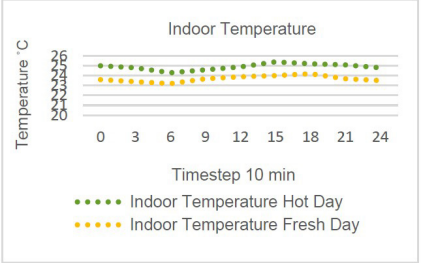

Figure 12. Indoor Temperature scenario 2. Own source

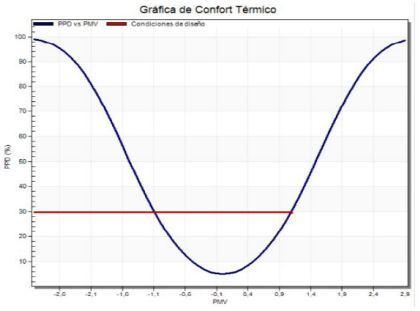

Figure 13. Thermal comfort hot day scenario 2. Own source

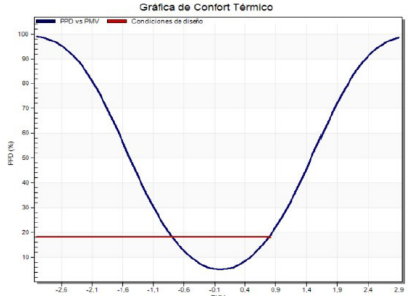

Figure 14. Thermal comfort fresh day scenario 2. Own source

Results	
Operating temperature ˚C	27,1˚C
PMV	1,08
PPD (%)	29,72%

Table 10. Results thermal comfort scenario 2. Own source

Results	
Operating temperature ˚C	25,6˚C
PMV	0,79
PPD (%)	18,13%

Table 11. Results thermal comfort scenario 2. Own source

Figure 14 shows the thermal comfort values accounting for the natural ventilation on a cold day. It shows an operative temperature of 25.6ºC and a PMV of 0.79, which can be considered neutral according to Table 5. The PPD is 18.3%.

As seen in scenario one, the results show that the high temperatures directly affect the thermal sensation when the space is not adequately ventilated. For that reason, the PMV is 2.2, which negatively affects the thermal comfort and the PPD, 84.81%. However, when the parameters of natural ventilation are correctly configured, in scenario 2, the temperature drops, and although the thermal sensation keeps being high, a PMV of 1.08 is obtained. This PMV is slightly warm. The PPD also drop the 29.72%. Both scenarios were calculated for August 15th.

On January 16th, the results of scenario 1 show lower temperatures. However, the thermal sensation keeps rising, with a PMV of 1.83 and a PPD of 68.38%. In scenario 2, the PMV is 0.79, considered neutral, and a PPD of 18.13%.

According to the Fanger method, for the value to be considered adequate, the PMV must be within -0.5 and +0.5. The comfort temperature should also be between 20ºC and 24ºC in the cold season and 23 and 26 in the hot season.

5. CONCLUSIONS

The study's primary purpose was to analyze the thermal comfort in a social housing project in the Dominican Republic and propose measures to improve it through passive measures. Natural ventilation, orientation, and shading are critical factors in the design strategies toward passively obtaining better thermally behaving buildings. This study allowed to evaluate the thermal comfort conditions of the building in two scenarios, one with natural ventilation and one without it. The results in neither scenario reached the minimum requirements for thermal comfort. The best obtained PMV was January 16th, in which the PMV is 0.76 with an operative temperature of 25.6ºC and a PPD of 18.13%, where the acceptable values are between -0.5 and +0.5 with an operative temperature from 24 to 26ºC. A possible solution to this problem would be to improve the thermal insulation of the building envelope. Also, it would be advisable to include glass in the windows beside the shutters. Opening the shutters at night would also help in lowering the temperature. These solutions might be a starting point for future studies and research on these building typologies.

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PAPER #8.10

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT: FROM OBLIGATION TO NECESSITY. NEW TRENDS AND SOME TOOLS FOCUSED ON ARCHITECTURAL PROJECTS

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ABSTRACT

The construction of a building is an activity that generates a considerable use of materials and diverse resources. Likewise, new materials and supplies are used to maintain or renovate buildings, some of which are historically reused, partially or entirely. These processes generate a series of residues or waste materials C&DW, especially at the end of the building's useful life with its demolition. These elements are becoming increasingly important from the point of view of new approaches to the circular economy. Therefore, these elements previously discarded are now considered valuable resources. The agents involved in the building process are becoming increasingly aware of these issues. There is an evolution from the obligation imposed by the regulations toward new perspectives and trends. For that purpose, current tools will be discussed and compared, helping to understand the additional challenges and possibilities for architecture.

KEYWORDS

C&D Waste management; building reused materials; recycling in architecture.

1. INTRODUCTION

In recent years, sustainable development objectives have analyzed several resources in different areas. Particularly in architecture, the construction, maintenance and, finally, dismantling or demolition of the buildings. The focus has been placed on materials used in building activity: Construction and Demolition Waste (C&DW).
In 2018, this accounted for about 36% of the volume of waste generated in the EU (Eurostat 2021). This situation is a significant problem due to waste management, storage, reuse, treatment, and rejection or disposal. Therefore, a change in approach and priorities is essential, based on reducing and reusing this waste in different areas, starting with the construction itself. From the initial design to the final stages, it should be possible to evaluate its impact and introduce measures to achieve these goals.
This paper is organized into four sections, summarizing and updating the different approaches regarding the reuse and management of C&DW. These approaches go from the general EU framework to the recent Spanish regulations. The primary documents and the successive contributions are briefly cited, synthesizing the consecutive changes they have entailed. This paper presents the general overview

and perspective of C&DW regulations and a forecast of future approaches and trends in light of the current circumstances.

2. THE REUSE OF MATERIALS IN ARCHITECTURE

2.1. A brief historical overview of the current situation

In ancient buildings, it is common to see partially or entirely reused elements that have remained up to the present day. The structure of these buildings was mainly made up of walls and columns: the masonry work used on them came from different locally accessed materials. The reuse of elements or materials from previous constructions was frequent. Some building components, such as ashlars or capitals, were sometimes reused just as they were in another place (Fig. 1). Notwithstanding, they were sometimes "reused" to produce filler concrete, union mortars or coatings.

Construction technology has dramatically evolved, especially since the 19th century, due to industrialization and the development of new materials. These products acquired more convenient features during the 20th century, whereas fuel consumption, especially non-renewable energies, grew in manufacture, transport, installation, and subsequent demolition. The 21st c. challenge is to maintain or even improve quality and comfort standards while reducing C&DW and the energy involved in different processes.

Until the end of the 20th c., most building construction materials were obtained or manufactured from new raw materials. Gradually, traditional and "reused" elements were replaced by the latest materials due to their economic performance. This approach followed the "linear economy": produce, use and discard.

However, since the 1980s, the "circular economy" and "life cycle analysis" have introduced different architectural strategies for reusing construction elements, components or materials. (Fig. 2) Over time, this idea has become a beneficial possibility aligned with sustainable development goals. Nevertheless, it has become necessary to return to the reuse of materials not only for environmental reasons but also as a response to the raw materials, import-export crisis, and high energy prices.

Figure 1. Benavites Tower (Valencia) 14-16th c. South corner detail with reused materials. Source: VLM

2.2. Key aspects to consider in C&DW reuse, advantages and drawbacks

The possibilities for reusing in architecture are considerable, from directly reusable parts that require some modification, to auxiliary components or support and to those elements that need mechanical or physical-chemical transformations. The advantage of these actions is preservation of the environment by keeping the old elements in the useful life cycle, allowing the conservation of embodied energy (Akanbi et al. 2019).

Proper disassembly planning is essential for reuse (Sanchez and Haas 2018). Depending on the project and the new use, the transformation or adaptation of the pieces will be more or less significant. To evaluate reusability, it will be necessary to correctly identify the different features, such as the shape and dimensions, components and origin (Kozminska 2019).

In the case of transformation, the materials' identification, composition, and characterization are critical to ensure compliance with statutes and benefits established by the different regulations. Compared to the usual or recognized design, a new system or material that totally or partially reuses the previous ones requires preliminary analyses, controls, and some experience (Kozminska 2019).

For this reason, in areas such as civil engineering, some materials are becoming more usual, those whose characteristics are well known. These materials can be used in large areas such as landfills, pavements and roads, installations and urban furniture. Similar behaviour or improvement of some features allows the replacement of the previously used components in large volume or quantity.

Nevertheless, some buildings' elements become diverse and specific, providing solutions for different features. From the structure, and the envelope, to the interior finishes and furniture, they are made up of multiple materials, which can interact in different ways. This situation implies more significant complexity when considering and analyzing their identification and reuse possibilities.

At the same time, it is also an advantage to provide opportunities for the application of recovered or recycled elements or materials in these different areas. Therefore, we need the effective separation and preparation of multiple construction elements and materials. A proper dismantling management process in order to classify everything (as far as possible) is key to retrieving or producing new materials.

2.3. The reuse of materials in new projects and constructions

Faced with this favorable though emerging situation, identifying or locating constructions with the prevalence of reused materials is still challenging. It is also tricky to find buildings with components obtainable to reuse once the construction's useful life has ended. As a result, many of these projects and works are considered "experimental", temporary or provisional (Fig. 3)

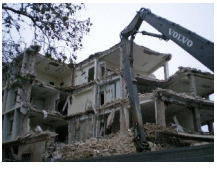

Figure 2. Non-selective demolition works, Pl. America, Valencia (2010), a container with different materials mixed and a recycling plant, where C&DW is sorted and classified. Source VLM

Figure 3. Constructions with ship containers. Source: https://casascontenedores.es/

Figures 4 and 5. Container restaurant. Source: Murad Garcia architects

These works are published in journals, technical papers, or websites as prototypes or models to follow (Fig. 4 & 5) Accordingly, they require verification or studies that involve an initial investment, generally from their promoters and "self-builders", research on their behavior in the medium and long term. These constructions are scattered over many private and public countries, mainly in homes and small collective facilities.

Hence, a primary classification according to their shared characteristics can be established. Firstly, those projects made from elements with little transformation and which took advantage of maritime containers, ships, planes, and vehicles; secondly, those built with pieces and parts of these elements. Finally, more "conventional" constructions using recycled or transformed materials.

Fortunately, different companies and manufacturers are investing and, progressively, offering more products that can be used in projects, individually or as a complete system. In product catalogues or exhibitions, it is common to find those alternative recycled products from construction materials or other industrial sectors. Many coatings, installations, partitions, and even structural concrete admit a percentage of recycled aggregate with certain limitations.

2.4. Construction EU regulations: obstacles with the reuse of C&DW and new proposals

Up until recent decades, regulations relating to building construction in some European countries, such as Spain, had changed from prescriptive to performance-based. Nowadays, codes do not specify using a limited number of constructive solutions or materials. They are centered on the achievement of certain behavior regarding basic requirements: reaction to fire, thermal and acoustic insulation, or health standards. This possibility opens the door to innovation and improvement of construction systems

and materials. However, this evolution is slow, and the previous standard solutions are maintained with some adaptations.
Furthermore, the new proposals require documents that certify the European Technical Assessment (ETA), a favourable technical evaluation of a product's suitability for assigned uses. European Regulations on Construction Products such as EU 305/2011, amendments EU 568/2014 and 578/2014 must be compulsorily followed on performance evaluation of construction products. Specialized institutions carry out this assessment by way of technical means and adequate funding. Likewise, there are Commission Delegated Regulations, which establish conditions for a large number of products and materials. A series of harmonized CEN-EN standards are published in the European Official Journal to complement them.
This situation makes implementing reused or recycled materials challenging, as they require one or more evaluation processes. This lack of specific standards for C&D recycling materials has led to compliance with the essential requirements and use in low-quality applications or "downcycling" (Allwood 2014), recycled aggregates for road base and infill. Therefore, alternative solutions for recycling higher-quality C&DW are urgently needed (Di Maria, Eyckmans, and Van Acker 2020). For this reason, the European Commission has recently approved the proposal COM (2022)144-*Harmonized conditions for the marketing of construction products* (European Commission 2022) to develop standards including outcomes with a significant impact on the environment and CO2 capture.
In this sense, the Platform on Sustainable Finance, an advisory body subject to the Commission's rules for expert groups, has recently presented a report about this matter. The annexe establishes proposals on technical screening criteria to determine how the activities of the construction sector contribute to the circular economy. The Commission will need to analyze the document in order to elaborate on new directives since they propose new measures. Among its goals, two aspects affect architecture projects:

- The proposal concerning construction designs and techniques must support circularity criteria and demonstrate that they are more resource efficient, adaptable, flexible, and easy to dismantle, enabling reuse and recycling. It must be verifiable according to indicators following ISO 20887:2020 (ISO 2020), EN 15643 (CEN 2021), and EN 16309 (CEN 2014).
- In new and refurbished buildings, at least 50% of their elements (either by weight or surface) must be made of reused or recycled materials, including facades, roofs, and internal walls and floors. Of that 50%, at least 15% must be reused components, another 15% recycled content, and the remaining 20% reused, recycled, or from responsible sources or renewable materials.

There is a recent European Construction Industry Federation (FIEC) reaction (FIEC 2022), with some comments and proposals for amending the Platform report. Therefore, these new proposals are under debate and will establish the following architectural trends.

3. THE EU AND SPANISH FRAMEWORK ON C&DW MANAGEMENT

3.1. EU and Spanish C&DW management framework: common guidelines

Since the Mid-1970s, a series of documents and directives in the EU, such as 75/442/CEE (The Council of European Communities 1975), established the legal framework for treating waste. They were considered in order

to protect the environment and human health and progressively improved and itemized the conditions. Proper management, recovery techniques, and waste recycling are necessary for construction and demolition to reduce resource pressure and improve their subsequent use.

Directive 91/156/EEC (European Council 1991) established shared definitions and first measures in this area. Later, Decision 2000/532/EC (Commission of the European Communities 2000) set up the harmonized *List of Waste* that allows waste identification with six-digit codes, also assigned to C&DW. Waste Framework Directive 2008/98/CE (European Parliament 2008) unified and modified previous regulations, establishing the "waste hierarchy," five key points in waste policy: prevention, preparing for reuse, recycling, energy recovery and the final disposal. About C&DW introduced the 70% recycling and recovery objective to be achieved by 2020. The subsequent decision, 2014/955/EU (European Commission 2014), updated and adapted the previous list of waste to this regulation.

The following Directives EU 2018/850 (European Parliament 2018a) regarding waste disposal and EU 2018/851 (European Parliament 2018b) support sustainable production and consumption models aligned with circular economy principles. This regulation aims to promote the design, manufacture, and efficient products, which are durable, repairable, reusable, and upgradeable. The ones containing "Critical raw materials" (CRMs) were considered a key objective to prevent them from becoming waste. It also promoted the availability of spare parts, technical information, and product repair, maintaining quality and safety. This matter affects many goods and devices, including those employed in buildings, especially installation components.

Another essential document in EU construction and demolition waste management was the reference protocol entitled *Guidelines for the waste audits before demolition and renovation of buildings* (GROW.DDG1.C.4 2018). It is a non-binding guideline but establishes the general processes and steps that should be considered before demolition and renovation work in buildings.

The idea was to help the different actors or parts involved: practitioners, public authorities, certification agencies and recycled materials clients to properly handle the waste stream. It promotes the management of CDW aligned with the "waste hierarchy"; therefore, it contributes to resource efficiency. The Protocol is intended to raise awareness about legal requirements.

3.2. Spanish regulations background and recent updates

Spanish environmental regulations were developed 30 years ago. They started with hazardous waste RD 833/1988 (Ministerio de Obras Públicas y Urbanismo 1988), which includes codes and activities related to construction materials. However, the RD 105/2008 (Ministerio de la Presidencia 2008) was the main change, binding C&DW Studies and Plans with Projects. The client or "producer" should provide them, but generally, they are drafted by practitioners, estimating the C&DW and providing measures to minimize it. The Project's Budget includes an economic study, which is required to constitute the deposit and Planning Permission.

This regulation established the role of the different agents involved in the C&DW management: the producer, identified with the owner of the property to be built or demolished, the waste holder who executes the work, and the waste manager who is responsible for the waste documentation. Subsequently, other agents involved in the processes were determined, such as transport, storage, treatment or recovery, etc.

Figure 6. Current general waste management scheme in projects and works Source: VLM

The subsequent regulations, such as L 22/2011 (Jefatura del Estado 2011), follow the EU Directives. It systematized the agents' obligations involved in the C&DW management simplifying the administrative tasks. It focused on preparation for reuse and recycling, setting objectives for implementing the collection of different materials. It also replaced the pre-administrative control with a final check to avoid slowing down economic activities. This approach has changed, requiring previous administrative compliance. In the Spanish housing rehabilitation plans RD 853/2021 (Ministerio de Transportes y Movilidad Urbana 2021), projects must follow the adaptability and deconstruction criteria (ISO, UNE) and the 70% reuse of C&DW.

Finally, the new L 7/2022 (Jefatura del Estado 2022) concerning Waste and Circular Economy has introduced the mentioned criteria in a mandatory manner. It adds new definitions and relationships between the agents involved in C&DW management waste (Fig. 6).

The significant changes are:

- A minimum amount of 70% of non-hazardous construction (excluding uncontaminated land reuse onsite) and demolition waste must be prepared for reuse, recycling and recovery, including landfills. This was already established by the EU Directive of 2008, but new goals point to 90%.
- The classification of non-hazardous C&DW into the following fractions: wood, mineral fragments (concrete, bricks, ceramics and stone), metals, glass, plastic and plaster. Also, elements, such as tiles, toilets or structural parts will be classified as reusable (mandatory from July 2022).
- Preferential onsite waste classification, including previous mandatory hazardous waste separate collection. The demolitions will preferably be performed by selecting materials to be removed (mandatory from early 2024).
- The use of materials "digital books" records in new construction, following the EU regulations on the circular economy. Therefore, the development of new specifications will implement "eco-design" requirements.

In this last issue, there is still a long way to go in the monitoring and traceability of all processes. Generally, the administrative control is under the auspices and final guardianship of the municipalities, but they have to carry this out with unequal and non-unified means and resources.

3.3. The requirements accomplishment: software apps and future objectives

The processes related to the management of CDWs represent a significant challenge, especially as regards their assessment. Many methodologies exist in different countries (Wu et al. 2014). Still, adapting to EU regulations requires recognizing particular data (Llatas 2011), adapting calculation methodologies and implementing new software, and obtaining indicators, quantities, and the annexes of project documents.

Some architects' professional associations, public entities such as the IVE (Fig. 7), IHOBE or ITEC, or commercial companies such as CYPE Engineers, Graitec-Arktec, or Urbicad, have developed helpful software for Waste Management Studies. Nowadays, the estimation of the amount of waste generated uses three different methodologies:

- The first is based on "statistical data" from waste plants and different studies research. It is a quick process, requiring the input of little data. The Guide with the "ratios" of C&DW in Spain (CSCAE-CGATE, 2020) allows calculation according to climatic zones and construction typology (Fig. 8).
- The following is based on the project's measurements and budget, drafted with different software and associated with a particular database. It means that each construction system and material have an individual evaluation. Therefore, the design project data must define detailed construction characteristics and measurements.
- The third way, related to the previous, although more complex, would involve getting the C&DW studies from the BIM data models and complementary applications (Mercader-Moyano et al. 2017). In this case, it will be necessary to establish how far into the detail it is necessary to go in the architectural models.

These options are viable in new construction but require a complex audit in rehabilitation, dismantling or demolition cases, where all the construction components are not precisely known. All these possibilities allow recent decisions based on the results but require weighing up the resources used.

The more complex the input, the more information will be obtained. Similarly, along with the rating of sustainability, energy certification and evaluation of improvement measures would be desirable. The more knowledge and experience available, the better the assessment and comparison of methodologies. Following these procedures and considering new requirements, material selection or even the whole construction system can change; therefore, it is necessary to consider this matter right from the start of the project in order to improve C&DW.

Figure 7. IVE online C&DW assessment. Source: www.five.es

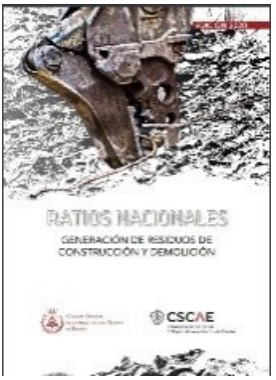


Figure 8. C&D Ratios report, areas and related data. Source: www.cscae.com

4. THE PRICE OF CONSTRUCTION MATERIALS AND ENERGY: AN UNCERTAIN FUTURE

According to reports and statistics recently published by the INE (Fig. 9), raw materials prices have suffered hyperinflation since the end of 2021, with increases of around 20% and "stock breaks". The increase in the price of supply chains is due to the interruption of supply channels caused by Covid-19 and recent restrictions on export-import due to the military conflict and the subsequent rise of energy and transport.

This situation is especially pronounced in energy, with increases of 110%. Materials such as copper, steel and aluminium have suffered increases of more than 30%. On the other hand, these materials are among the most recyclable or reusable, so their necessary recovery is unquestionable, more as a necessity than as a legislative imposition or an opportunity to benefit from subsidies.

Accordingly, global problems are already being transferred directly to projects and constructions differently. These approaches to the correct use of waste can evolve from purely an environmental issue to an opportunity to dispose of resources and save energy in their production and transformation. This situation raises new perspectives in construction and architecture for the future.

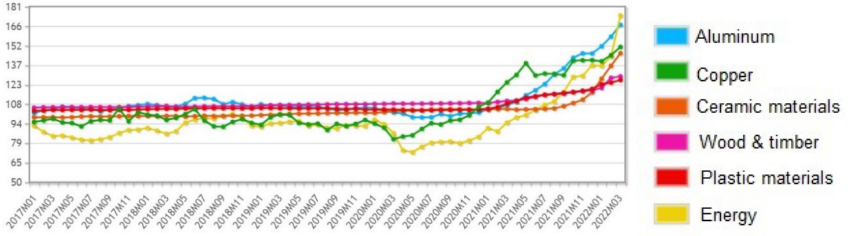

Figure 9. Evolution of materials & energy price index 2017-2022. Source: INE 2022

5. CONCLUSIONS

In view of the study, the following conclusions may be drawn:

1. The current general and theoretical approaches to reduction, reuse and recycling preparation follow a more detailed and improved process as regards the objectives established some decades ago.
2. The progressive evolution of criteria and regulatory framework regarding C&DW management in the EU can be currently recognized through local legislation, particularly in Spain.
3. Despite some delay, the requirements of the Directives are being introduced in different countries in two ways: legislation or mandatory regulation and promotion or incentives
4. The challenge now is to address the barriers in the single market for reused construction products and contribute to the European Green Deal and the Circular Economy action plans.
5. The role of public administration is essential to promote shared objectives and develop new sources: guidelines, best practices, software, etc. to support the different agents involved.
6. Considering how the new changes affect the building sector is crucial, particularly for new construction or rehabilitation projects, where construction systems and materials selection need to be taken into consideration.
7. All these new trends should change the perspective towards a future architecture that involves sustainability goals. This must be considered in upcoming projects from the very beginning.

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9

HEALTH AND PANDEMICS

PAPER #9.01

REDEFINING THE ROLE OF ARCHITECTURE DURING THE PANDEMIC CRISIS

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ABSTRACT

This paper focuses on the two-way relationship between a pandemic and architecture. Architecture serves human needs, adapts to them and evolves because of them. This study aims to investigate the issues and challenges that arose in modern housing during the spread of the COVID-19 pandemic. A historical review of the pandemics which have plagued humanity is briefly described. Pandemics, as global emergencies, affect human life, the places where the individual is active, and, consequently, the architectural structures. For this reason, the main tool of the study was a questionnaire that was developed and distributed to young people aged between 18 to 35, living in European cities with a population of more than one million. In this way, an initial study was conducted to find out about ways of living during the pandemic and to question how modern architecture will be affected by the current pandemic. In a big part, World War II has formed the current complex housing structures in the modern world. Today, due to the COVID-19 pandemic, the current transitional era has brought changes to peoples' lifestyles. The paper continues with the presentation and analysis of the questionnaire's answers and records the houses' current issues due to this crisis. The study concludes with certain themes of potential design and environmental strategies for sustainable housing, to improve the individuals' quality of life.

KEYWORDS

Architecture; pandemic; COVID-19; housing structures; sustainable housing.

1. INTRODUCTION

This paper is an open-ended study analyzing the relationship between the pandemic and architecture. The term pandemic expresses the rapid spread of infectious diseases in large areas of the Earth or on a global scale. The word is composed of the Greek terms "πας + δήμος", which mean "all" the "population". The emergence of pandemics is not something new for humanity. Since ancient times people have managed to deal with and stop pandemics. The discovery of antibiotics in the 20th century, for example, has helped the Bubonic Plague and other bacterial diseases become much less deadly. It is well known that the best way to defeat a virus is immunity. Immunity can come either naturally, by getting sick and developing antibodies or technically through the administration of a vaccine (Paul Fine, Ken Eames, David L. Heymann, 2011). So, the most effective way to deal with the COVID-19 pandemic was to develop as quickly as possible. However, since the virus was spreading and millions of people were losing their lives, the only solution to slow down the transmission of the virus, while developing the corresponding vaccines, was to follow

an older method. In fact, this method was invented seven centuries ago for the treatment of the black death: quarantine, or in its more contemporary version: confinement and social distancing, which is avoidance of overcrowding and close contact to reduce the transmission of the virus.

Pandemics have been milestones in human history that have overturned the conditions of human life–as these existed before their appearance- and have created radical changes in the field of architecture. As a pandemic affects everyday life, it would not be possible to leave architecture unaffected.

Architecture, in turn, is shaped through social and individual needs but at the same time it may shape new tendencies. Modernism in the early twentieth century emerged from a time when the concept of therapy was still associated with superstitions and prejudices, while the application of scientific methods was still at an early stage. However, modern functional lifestyles had already begun to emphasize cleanliness, hygiene, fresh air and sunlight. Epidemics from the recent past can teach us how architecture can help combat the spread of infectious disease, especially if the main ways of their transmission are considered and taken into account: air, surfaces and water (Michael Murphy, 2020). In the 1920s, as it was inevitable, the architecture of leading modernists, such as Le Corbusier, Aalto, and Duiker, was affected by the pandemic of the time. The tuberculosis disease established a clean, white, luminous, well-ventilated modern architecture with open-air spaces. Villa Savoye and sanatoriums in Paimio and Zonnestraal set some of the principles of modernism: flat roofs, terraces, specially designed interiors and furniture with precision (Med Hist, 2005).

Paimio Sanatorium by architect Alvar Aalto was a prime example of modern sanatoriums. Built at the highest point of a pine forest, it provided its patients with unlimited access to fresh air and light. Aalto chose colors that could have a positive impact on patients. The walls were light in color, while the ceilings were dark, in an attempt to make the general tone calmer from the perspective of a patient lying on a bed.

On the top floor, the architect designed a terrace throughout the south-facing wing, where patients lay down for hours as part of their treatment. Moreover, furniture and lighting fixtures -which were designed for the sanatorium by Alvar Aalto together with his wife Aino- have become notable elements of design, such as the armchair model 41, which was designed to help patients breathe better, inclined individual washbasins, designed so that each patient could avoid accidental wetting from water and disturbance of the other patients etc (Diana Anderson, 2010).

Zonnestraal Sanatorium by Jan Duiker was an ornament of the modern movement designed of concrete and glass. Zonnestraal was built as a tuberculosis sanatorium in the 1920s and 1930s. The main concern was the provision of open spaces and exposure to fresh air. The entire floor plan of the building used a 3mx3m grid, following the principles of the modular architecture of Le Corbusier. The enclosure had a great amount of transparency, using materials that allowed as much light as possible to enter the patients' rooms. Duiker aimed to make his buildings light and airy. He also tried to illuminate the interiors by painting them with light blue and cream colors. (Med Hist. 2005).

If tuberculosis contributed greatly to the definition of modern architecture, we may assume respectively that COVID-19, combined with confinement at home, will affect contemporary architecture in the near future. In contrast to the airy, pristine, minimal space of modernism, the area which was required to protect us from COVID-19 has been isolated, with dividing partitions between people and with a minimum social distance of 1.5 meters. Widely open-air spaces seem to have been preferred, whereas closed spaces have been in need of remodelling.

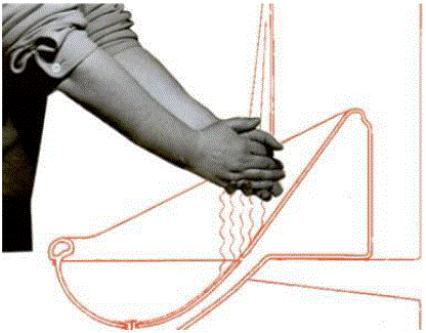

Figure 1. Noiseless wash basin with 45 degrees inclination. Source: Alvar Aalto Museum [edited by author]

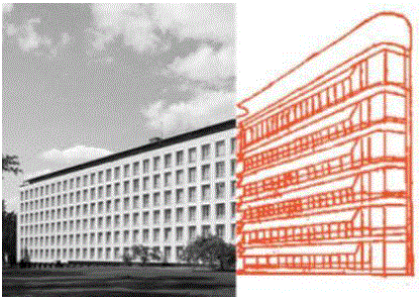

Figure 2. Paimio Sanatorium facade. Source: Maija Holma, Alvar Aalto Museum [edited by author]

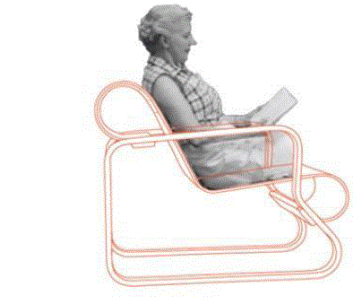

Figure 3. chair model 41, Pikku Source: Suvi Kesäläinen, [edited by author]

For the vast majority of people, our house is the most important building in our lives, but we rarely have a say in its original design (Nicola Gillen, Pippa Nissen, Julia Park, Adam Scott, Sumita Singha, Helen Taylor, Ian Taylor, Sarah Featherstone, 2021). COVID-19 has brought to the surface the already existing problems and has revealed new weaknesses in many aspects of our lives. Housing has been among the most obvious cases, especially during the quarantine period, while our home has never been more important in dealing with a pandemic (Kyle Chayka, 2020).

In 2020 people worldwide have spent more time inside their homes than in any previous year and certain things, such as high internet connection speeds or ergonomically designed chairs have been high on wishlists. Being confined at home undoubtedly requires imagination and innovation, ergonomic design, and the use of advanced technological means in our habitable space. Fundamental architectural principles, such as access to an outdoor area, pleasant views, adequate natural lighting, ventilation, and controlled interior temperature have proven to be not mere advantages, but essential features of ahome. Similar to previous moments in history when health and social crises led to changes in architecture, the pandemic offers an opportunity to re-evaluate design and space standards (Goode 2021). Pandemics changed the usual living conditions of humans, as the aim was to stop the spread of specific microorganisms. Thus, the tactic of forced confinement has often been adopted to achieve social distancing and reduce the rate of transmissibility. In the recent case of COVID-19, this practice resulted in individuals modifying their daily life, so that all their activities could take place in their residence, by using all available technological means. This study aims to review the new conditions which were formed due to the spread of the COVID-19 pandemic.

2. METHODOLOGY

This paper is part of a research thesis, conducted during the lockdown period. Due to the fact that the current pandemic is still active, this is an initial study which aims to examine the changes that have brought new challenges in the way of living during the pandemic and to investigate the potential impact of Covid-19 on contemporary architecture, in the hope of becoming a starting point for further research. The main tool chosen was an online survey, which focused on European urban centers. The method of the questionnaire was chosen for the collection of data which was completed in two phases. The first one was conducted between May and June 2021 and included 42 structured questions which reflected
on general information about the participants, their residential environment, their home use and user satisfaction with dwelling space. Later on, the questionnaire was repeated in September 2022 reaching an extended target group and it was enriched by 46 questions in regard to relationships between spatial environment, housing design and wellbeing.
Certain criteria that would maximize the challenges confronted during the pandemic defined the structure of the online survey. The questionnaire referred to the specific period between March 2020 and June 2021; a period of time when design failures in dwellings were easier to perceive, since the house became the place for various activities, in order to avoid the transmission of the virus. The majority of people were obliged to work remotely at their home while educational institutions offered their services through online learning systems.
The questionnaire was aimed at young people aged between 18 and 35, an age range familiar with the main author, which could ensure easy access to the audience, facilitate the online collection and the further reflection of data. Moreover, younger people spent lockdown with less space than those in older age groups. According to Judge and Rahman [2020], older households aged 65+ have almost twice as much usable space than younger households (16-34) who are also twice as likely to lack access to a private garden than those 65 and over.
The questionnaire was addressed only to residents of Europe, in cities with more than one million inhabitants. The COVID-19 pandemic challenges during lockdowns were inevitably bigger in highly populated cities, where the virus was spread at a very fast pace. Moreover, after the end of World War II, cities in Europe began mass reconstruction and the creation of urban centers. (Nicholas Bullock, 2002). Mass reconstruction could have evolved into a good practice if there had been architectural criteria and implementation of contemporary urban planning strategies. Rapid post-war development and the densification of centers, traffic congestion and lack of open spaces created severe problems in the urban fabric and consequently in the citizens' wellbeing. The increasing development of apartment buildings based on private funds, combined with a motive for direct profit, unclear aesthetic rules and untargeted design, combined with the inadequacy of the legislation frame and building permit procedure, have inevitably led to a specific character of the city image with identical high-rise concrete blocks of flats, limited provision for viable public space, dense habitation with problematic neighboring relationships, environmental degradation and finally alienation of people. (Selana Vronti, 2015). This framework was further challenged by the current pandemic and was decided as the preferred setting for the online survey.
A total of 146 people took part in the first survey which was reopened to include another 70 people, reaching a total of 216 respondents. The study was conducted through google forms the first one, and typeform the additional one. The results were edited with google sheets.

3. FINDINGS

3.1. General information about the participants

The general profile of the participants and the countries which participated are presented in the diagrams that follow. Most respondents came from Greece, whereas a significant number participated from Belgium, Bulgaria, Croatia, Czech Republic, France, Germany, Italy, The Netherlands, North Macedonia, Poland, Portugal, Romania, Spain, Sweden, Turkey and the United Kingdom.

Table 1. Participating countries

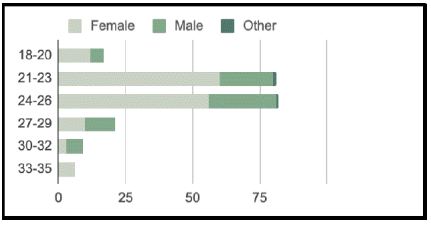

Table 2. Gender and age of the participants

One of the main questions asked was regarding the mode of working and studying. It is worth noting that, during the pandemic, 53.8% of teleworking took place in the field of work, whereas 90.6% of academic courses were completed via tele-education. Both percentages, however, indicated that the majority of young people carried out their activities online.

If you are an employee, what working model did you use most during the pandemic?	
Work in person 30.8%	Work from home 53.8%
Suspension of work 9.2%	Other 6.2%

Table 3. Work situation

If you are a student, how did your courses mostly take place during the academic period?	
University classes 4.7%	Online classes 90.6%
Both of the above 4.7%	

Table 4. Studies situation

3.2. Information about the residential environment

Following the delineation of the participants, basic information on their residential environment was gathered to better understand the context of confinement. One of the most interesting observations was that the majority of young people tend to stay in spacious houses, usually between 80 and 120 square meters [which does not align with the aforementioned study of Judge and Rahman [2020]. This finding is attributed to the fact that they live together with other people, as will be mentioned later.

In the aforementioned question, it is evident that despite the spacious surface of the houses, their largest percentage (57.9%) has only one bathroom. In general, it seems that it is necessary to have at least two toilets in one residence so that one is mainly used by the residents and the second one acts as an auxiliary bathroom for visitors and patients. (Rousakou Elpida, 2015).

What is worth noting -in the previous table and the one that follows- is that although 78.2% of the residencies do not have a garden, a probable consequence of habitation in a big city, a large percentage of them have semi-open or outdoor spaces. Moreover, despite the doubts and challenges brought by COVID-19, the participants seem to have adequate lighting and ventilation in their homes, which was a positive finding.

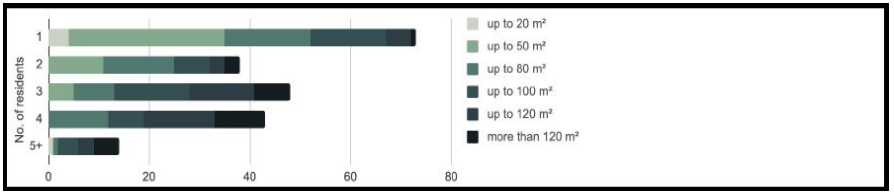

Table 5. Houses square meters comparing to the residents of it

How many bedrooms does your house have?			
1	2	3	4+
25.0%	24.1%	33.3%	17.6%

Table 6

How many bathrooms does your house have?			
1	2	3	4+
57.9%	31.5%	6.5%	4.2%

Table 7

What would be the ideal number of bedrooms?					
1	2	3	4	5	6+
10.1%	29.0%	34.8%	15.9%	7.2%	2.9%

Table 8. out of 70 answers

What would be the ideal number of bathrooms?					
1	2	3	4	5	6+
24.6%	53.6%	13.0%	5.8%	0.0%	2.9%

Table 9. out of 70 answers

How many autonomous common areas (living room, kitchen, dining room, etc.) does your house have?	
1	2
28.2%	44.9%
3	4+
19.0%	7.9%

Table 10

Approximately how many square meters are the semi-outdoor, balconies, and outdoor spaces in total?		
0sqm	up to 5sqm	up to 10sqm
14.4%	21.8%	28.2%
up to 15sqm	up to 20sqm	above 20sqm
15.3%	13.4%	6.9%

Table 11

Does your house have a garden?	
Yes	No
21.8%	78.2%

Table 12

Does your house have adequate window lighting?	
Yes	No
83.8%	16.2%

Table 13

Does your house have adequate ventilation?	
Yes	No
85.6%	14.4%

Table 14

3.3. General Information about the life at home during the pandemic

This chapter presents data on life in the residential dwelling and especially on the people who lived together during the quarantine period. As it is indicated below in the respective tables, 79.2% share their home and most young people live with their families.

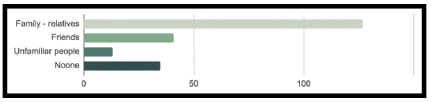

Table 15. Who did you live mostly with?

If they do not share their residence:

Did confinement at your own house affect you psychologically during the pandemic?	
Yes	*No*
77.1%	22.9%

Table 16

Would you rather have roommates during the pandemic?	
Yes	*No*
74.3%	25.7%

Table 17

In case the participant lived on their own, a 77.1% recorded percentage was affected psychologically due to their confinement. Recent research has shown that depression rates during the period of confinement tripled (Andreas Zachariadis, 2021). In case of depression, it is recommended to invest time with family and friends. This may also justify the increased number of people who, in a similar case, declared their preference for living together. (Nirmita Panchal, 2021).

If they do share their residence:

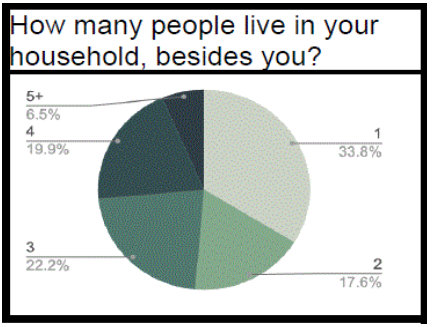

Table 18

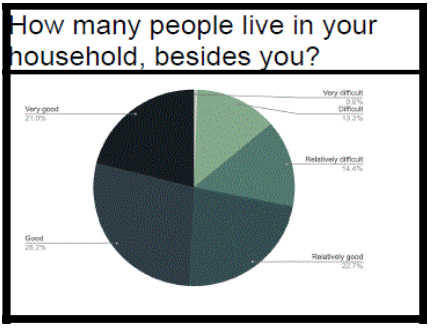

Table 19

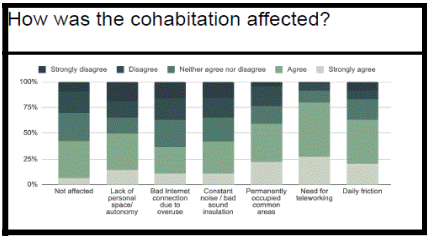

Table 20

As mentioned earlier, the largest percentage of participants [58.8%] live with their families. Usually, the number of people living together in the same house ranges from 1 to 3 people, without taking the participant into account, i.e. a total of 2 to 4 people. Finally, the conditions of cohabitation are positive for the majority of the participants, since 21.0% responded that they have *"very good"* relations with their roommates and 28.2% of them described them as *"good"*.

Almost 1 in 3 participants claimed that they felt a violation of their personal space. In the accompanying qualitative question *"If so, how was it sidelined?"* several stated that there was inevitable augmented daily friction among the flatmates and often -due to the different daily simultaneous activities- tension was created. Still, others said that since the whole family had to spend all hours of the day inside the house, common areas were constantly crowded, while their house was converted into an office, a sleeping area, a relaxation area, or a gym at the same time.

3.4. Information about the habits that the participants developed during the pandemic

Diagrams 21 and 22 show different activities that the participants were asked to engage with in their bedroom and the common areas of their house, respectively. Most of them seem to have performed reading/studying and working out secluded, in their bedroom, as it is a more private space of their house. On the other hand, the living room or the common areas, in general, were used for food preparation and consumption, which is expected since having a meal is a more social practice.

In the following questions, it seems that most participants were neutral as to the need to renew and remodel their house, with a very slight inclination towards change. Specifically, only 18.0% responded that they felt the need to remodel the house *"rarely"* or *"very rarely"*, compared to 38.4% who answered *"often"* or *"very often"*. However, it seems that 57.4% of the participants did make some alterations to their home environment and this helped them improve their overall psychology, as is reflected in the corresponding percentage of 86.9%. Finally, the modifications that occurred were mainly minor changes, such as the addition of paintings, indoor plants or other decorative elements, changing the colors of walls and other surfaces, etc; that is modifications in general that helped in the renewal of space, aiming to create a more hospitable and aesthetically pleasing living environment.

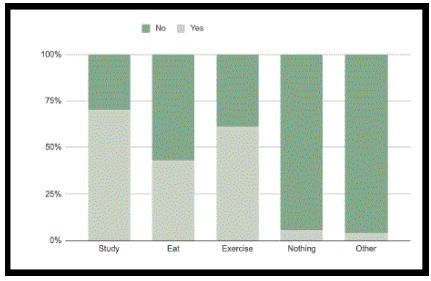

Table 21. What activities were you invited to do in your bedroom during the pandemic?

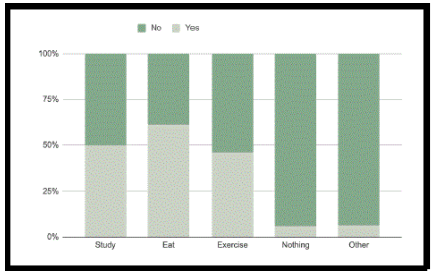

Table 22. What activities were you invited to do in your living room or other common areas during the pandemic?

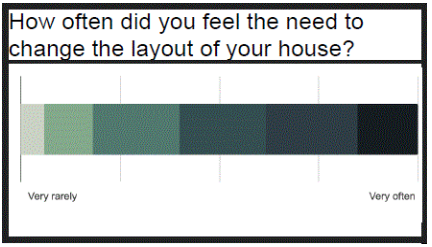

Table 23

Did you make any changes to your house during the pandemic?	
Yes	*No*
57.4%	42.6%

Table 24

If yes, did it help you improve your mental health?	
Yes	*No*
78.3%	21.7%

Table 25

Regarding the performance of technology and the internet, more than half of them seem to have faced technology problems (59.7%),with the majority of them mentioning low internet speeds and the lack of an adequate number of computers to meet the needs of all house members.

Was the technology/internet performance at your place of residence adequate during the pandemic?	
Yes	*No*
59.7%	40.3%

Table 26

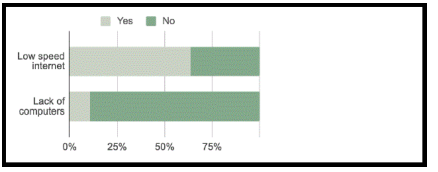

Table 27. What were the problems they faced, out of the 59.7% that said yes.

Most of the participants seem to have spent the majority of the day inside their bedrooms, where almost everyday activities took place and a higher level of privacy could be achieved.

Participants were then asked what they considered to be the biggest advantage and disadvantage of their home, respectively, during the pandemic. It has been observed that there was a consensus of views on what constitutes a positive and a negative feature of a dwelling. The key features highlighted in both questions were:

Positive:

- Balconies or terraces which offered contact with the outdoor environment, Luminosity and sound insulation, Adequacy of rooms/ spaces to meet the needs of all residents,

Negative:

- Insufficient number of sanitary facilities and finally, the inadequacy of an independent workplace or study area, such as an office space.

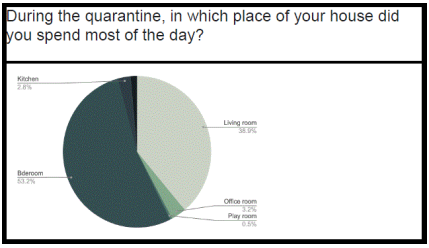

Table 28

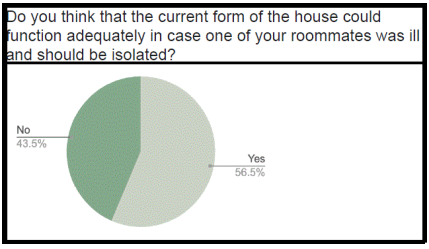

Table 29

Furthermore, the participants were questioned about their lifestyle and the changes that occurred to it during the pandemic, but also about whether they maintained these newly adopted habits until today.

The vast majority seem to have followed a healthier lifestyle with better nutrition and new hobbies, such as sports; habits that many tried to maintain after the end of their mandatory confinement. On the other hand, some reported their lack of mood and their performance in harmful habits for health, such as smoking and alcohol or the consumption of unhealthy snacks.

Finally, very little divergence was observed in the question of whether the form of one's residence could function adequately if one of the roommates became ill and had to be isolated. A percentage of 54.4% responded positively while 45.6% answered negatively, arguing that if such an issue would arise then they would not be able to deal with it, mostly because of the lack of a second toilet or an additional room, necessary for the seclusion of the patient.

4. DISCUSSION AND CONCLUSIONS

The present paper studied the role of housing during the critical periods of the pandemic and emphasized on the current situation as it was shaped by COVID-19. The role that architecture plays in developing a healthy and sustainable environment is important in addressing the challenges associated with rapidly transmitting diseases such as COVID-19. The idea that a disease can reshape and define the architecture of each period is a fact that has troubled the respective community in recent times. The aim is always to develop solutions to limit and control the transmission of the disease. These last years have led the world to face the challenges of the pandemic. As a consequence, we have witnessed inevitable changes in all aspects of human life, the need for new different scenarios of using our living space, but also the development of interactions between the users of the home. People were forced to shape their place of habitation by adapting it to their own living and working requirements (Zecca et al, 2020).

As the answers to the questionnaire demonstrate, the respondents spent a significant amount of time at home, thus inevitably the space, size and design of their home had a serious impact on their daily living experience. Due to this increase in time engaged at their dwellings, the respondents became aware of the positive and negative features of their homes. They also realized that existing dwelling spaces had to be re-organized to host multi-functional areas and simultaneous activities.

As it was aforementioned, targeted housing design is an important solution in dealing with a pandemic, both to limit the disease and to ensure the physical and mental health of the people who live in it. Understanding

and analyzing the critical housing issues that arose after the spread of COVID-19 and worsened during the quarantine is a first step toward highlighting the need for targeted housing design. We should learn from the previous pandemics that humans need to live in high-quality sustainable spaces, which may offer adequate comfort conditions [luminosity, temperature, ventilation, humidity] and help them come into contact with nature. In cases, such as confinement, where this contact was not possible these past two years, there was an effort to create 'green' spaces in the residences by placing plants both outdoors and indoors. Moreover, it is concluded from this present study that housing units should embrace flexibility, creating the possibility to accommodate different functions that occur simultaneously, consider the possibility of a potential division of area to offer undisturbed personal space, and allow the harmonic and functional cohabitation of several humans in one residence, even in the case of an illness, by the provision of an autonomous room and hygiene area for a patient. Apart from privacy, one major theme that came out was the need for direct access to an open space. Although most participants' houses lack gardens, the key feature highlighted in a house was the contact with the outdoor environment. Looking back in the previous pandemics paradigms, exposure to sunlight, nature and fresh air have been considered essential for people's physical and mental health. Probably, during the threat of the pandemic, for most people, home becomes the safe place for protection and survival. However, responses reveal that for a big part of participants, this safe space was reduced to the limited area of their bedroom. Moreover, the variety of activities, including housing habits and remote working, which were happening simultaneously in one space, blurred the boundaries between work space and personal space. This is why most respondents wished for the presence of more individual spaces for privacy and concentration. It should be noted though that if the house is transformed into a permanent workspace, the notion of dwelling and intimacy may be completely redefined.

The current pandemic underlines the vulnerability of housing design and urges for spatial resilience and optimization of certain standards. Re-defining spatial and behavioral changes in our homes may shape future needs and dwelling usability. Potential design and environmental strategies for sustainable housing, to improve the individuals' quality of life may include:

- obligatory direct access to private outdoor spaces
- flexibility in the layout of floor area, allowing its alternative division to minimum spaced autonomous rooms
- obligatory increase in the number of bathrooms depending on the number of inhabitants of a house
- optimization of standards [i.g. soundproof insulations in dividing walls] to improve environmental comfort
- optimization of technological infrastructure
- provision of funding for home renovation and adaptation

EPILOGUE

Some of the questions and challenges that have arisen and are worth mentioning, concern the following three pillars:

New normality

The ever-changing conditions in emergencies, such as pandemics, have led many people to recognize new needs and problems due to their new living conditions. This is made apparent initially by the creation of new habits and alternative ways of living, working, educating and entertaining. In addition, it has been necessary to convert the functions of certain places or units into completely new

uses to sufficiently serve the new needs of their users. All these facts raise the question of a new normality, as it has been experienced recently.

What will everyday life look like in the post-pandemic period? Which measures that were implemented during this period will become institutional in the subsequent normality? What impact will the pandemic cause in the urban space and the built environment in general? How will housing units and cities operate in the near future?

Pandemic reality

Previous pandemics, such as cholera, tuberculosis and Ebola, brought about similar changes and raised the question of the relationship between the pandemic and architecture, creating the conceptual framework of pandemic architecture. During the 19th century, design mechanisms were developed that had as their ultimate goal the development of treatment, health and cleanliness spaces. The current period concerns the transformation of housing and urban spaces to adapt them to the new pandemic reality. The directions are as follows:

a. examination of housing scenarios with the possibility of isolating potential patients who do not need intensive care
b. improving public health in the community and
c. finding solutions to maintain the normal functioning of the city and the daily life of its residents.

Social distancing

The spatial experience of people as individuals and as communities are understood through broader concepts, which come from the field of social and psychological considerations of space and architecture. The main challenge that arose was the review of fair distance based on the criteria of spatial distancing and maintaining social solidarity, as well as the harmonization of spatial and social relations. The urban fabric, as it is related to the understanding and recognition of the zones of habitation, work, education, etc., is an important source of information on the socio-spatial relations and experiences of people. On these bases, questions that emerged about the new interpersonal relationships and the relationship of humans with space have dealt with anthropometric and ergonomic issues as a core.

The fear of infection by disease had a decisive role in architecture and design during the period of modernism, when diseases such as tuberculosis, plague, etc. dominated throughout Europe. In the past months, a new conjuncture forming a two-way relationship between disease and architecture has emerged once more, where the fear of infection controls again what kind of spaces we want to live in. Just as tuberculosis shaped modernism, COVID-19 is going to affect contemporary architecture and create a turning point in the way architects will design buildings (Kyle Chayka, 2020).

There is a need to start a discussion in order to raise the new concerns that have emerged through the crisis of the COVID-19 pandemic. Instead of an epilogue, certain questions are asked with a view to reflection and further investigation, since the theme negotiated in this study is still open. These questions are: *how can planning and more specifically architectural design contribute to improving the quality of life of people in their homes? What data should be considered during the design and construction process of a structure? How will we achieve the adoption of more sustainable and 'green' practices? Finally, if we adopt the above practices, will we be able to deal effectively with a new pandemic in the future?*

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CONCLUSIONS

ON THE SOUNDNESS OF THEORETICAL FOUNDATIONS AND THE ADAPTABILITY OF PRACTICAL APPLICATION IN ARCHITECTURE

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Architecture has only quite recently become aware of its research potential compared to other disciplines with a much longer historical tradition. In the specific case of Europe, few institutions dedicated significant economic and human resources to it and production, in general terms, was rather modest. Good evidence of this is the fact that the European Association for Architectural Education would not elaborate its well-known "EAAE Charter on Architectural Research" until 2012. Despite being a relatively recent document, it is responsible for delimiting the meanings of "architectural research" and "research by design", a dichotomy that, until clearly defined, had been the subject of fierce academic discussions. The term "architectural research" was then applied to scientific research capable of generating knowledge, insights and understanding with a methodology and tools like those employed in other disciplines with a much longer tradition such as medicine. Simultaneously, the term "research by design" was applied to define the design process inherent to the architectural exercise, which, after analyzing the needs, resources and means, and the boundary conditions of the commission understood as an open-ended question, offers the best possible answer based on the knowledge and skills of the designer. The adequacy and appropriateness of this response will be determined by subsequent analyses, objective or purely subjective, immediate -and therefore offering the capacity to reconsider decisions- or long term and then, hopefully, with benign conclusions. Thus, "research by design" is as old and as frequent as architecture itself.
However and as previously mentioned, pure "architectural research" has mostly only recently become widespread. The adjective pure is employed since it is worth mentioning that, paradoxically, the EAAE's own and recent update of its Charter on Architectural Research, again blurred the boundaries between the two types of research. The new version intentionally breaks down the boundaries between the two previous categories, consequently assigning the role of researcher to any architect, promoting hybrid research practices in which architectural designs in assimilable situations lead to useful conclusions for the entire professional collective, and, above all, promotes collective, inclusive, and transdisciplinary dynamics. Research experts in the discipline of architecture such as the late Dutch architect Susanne Komossa (fig. 1) advocated these diffuse boundaries enthusiastically.

Figure 1. Dutch architect Susanne Komossa (1956-2020)

The updated definitions of the EAAE Charter on Architectural Research presuppose architects as a group perfectly familiar with research and capable of applying it to the changing needs to which their designs must respond. And those members of this group who find themselves in an environment as propitious for research as universities are, therefore, in the best conditions to produce good results.

The Higher Technical School of Architecture of the Polytechnic University of Valencia is perfectly aware of this circumstance and of its responsibility towards society to carry it out in a satisfactory and fruitful manner. It was within this conceptual framework that the first edition of the Valencia International Biennial of Research in Architecture, VIBRArch, was held on October 18-19, 2018, with a focus on "Proactive-Reactive Architecture". Two years later, the second edition of the biennial would be held along with what is probably the world's most important event in the field of general architecture research. The "EAAE-ARCC International Conference and 2nd Valencia International Biennial of Research in Architecture" was held on November 11-14, 2020, in an online format triggered by the outbreak of the COVID health crisis then focusing on "The Architect and the City". Despite the postponement of dates initially planned for the end of spring and the inevitable disappointment of only seeing colleagues and speakers through the screens, the conference was a great success and expanded the potential audience for both events in their future editions when they would recover their own individual path. And the optimism of the closing ceremony led to the necessary conviction to start designing what would be the third edition of the Valencian biennial.

The call for papers of the third edition of the Valencia International Biennial of Research in Architecture was launched on February 16, 2022, on this occasion with a focus on "Changing Priorities". On the deadline for abstracts submission, finally extended to April 11, 2022, a total amount of one hundred and two proposals had been submitted. A Scientific Committee composed by two hundred and six academics and experts on architectural research from Albania, Australia, Austria, Belgium, Bosnia and Herzegovina, Canada, Croatia, Cyprus, France, Germany, Greece, Ireland, Italy, Mexico, the Netherlands, Norway, Paraguay, Poland, Portugal, Romania, Singapore, Slovenia, Spain, Switzerland, Turkey, Ukraine, the United Arab Emirates, the United Kingdom, and the United States of America, and with a remarkable 60,19% percentage of women, reviewed thoroughly all the proposals. Authors were accordingly informed subsequently. Accepted abstracts came back as full papers and the Scientific Committee members performed their double-blind peer reviews once more and authors were conveniently notified congratulating them, requesting them to introduce some improvements or invited to withdraw their manuscripts. At the very end of the process, fifty-eight papers made their way through and were accepted for presentation during the up to four parallel sessions. These are the works which have been included in these proceedings distributed in the frequently mentioned nine thematic areas.

The conference was once more hosted by Higher Technical School of Architecture of the Polytechnic University of Valencia on November 9-11, 2022. The opening ceremony was chaired by UPV Vice Rector Débora Domingo Calabuig with the interventions of Francisco Javier Martín Ramiro, General Manager for Housing and Land of the Spanish Government, Marta Vall-Llosera Ferran, President of the Higher Council of Spanish Chambers of Architects, and Luis Sendra Mengual, Dean of the Official Chamber of Architects of the Valencian Community (fig. 2).

Figure 2. Presidential table during the opening ceremony of the 3rd VIBRArch on November 9, 2022

Those attending the event were able to enjoy up to three keynote lectures offered by prestigious professionals. During the evening of November 9, Daniel Ibáñez (fig. 3), Director of the Institute for Advanced Architecture of Catalonia (IAAC), spoke about the building industry carbon footprint and the chance that introducing massively timber in the construction sector might represent.
At noon of November 10, Jenny Russell (fig. 4), Director of Education and Learning at the Royal Institute of British Architects, focused on the importance of mental wellbeing in architecture, meaning students, docents, and practitioners.
Finally, at noon of November 11, Inés Sánchez de Madariaga (fig. 5), UNESCO Chair on Gender in Science, Technology and Innovation, Professor of Urban Planning at Universidad Politécnica de Madrid, and Chair of AGGI the Advisory Group on Gender Issues to the Executive Director of UN-Habitat, offered an amazing overview of the most relevant gender studies of our recent history.

Figure 3. Daniel Ibáñez

Figure 4. Jenny Russell

Figure 5. Inés Sánchez de Madariaga

This third edition of the biennial introduced a novelty compared to previous editions. We refer to the open debate on architectural research in Spain that participated by the Directors of relevant Spanish schools of architecture. Interesting reflections were heard from Manuel Blanco Lage, Director of the Higher Technical School of Architecture of the Polytechnic University of Madrid and President of the Spanish Conference of Schools of Architecture, Félix Solaguren-Beascoa de Corral, Director of the Higher Technical School of Architecture of Barcelona, Ramon Pico Valimañan, Director of the Higher Technical School of Architecture of Seville, Plácido Lizancos Mora, Director of the Higher Technical School of Architecture of the University of Coruña, and who writes this words as Director of the host school (fig. 6).

Figure 6. Open debate on architectural research in Spain by the Directors of the schools of (from left to right) Coruña, Barcelona, Madrid, Seville and Valencia

These intense program was completed by the aforementioned four parallel sessions of paper presentations arranged in three face-to-face rooms and one online room during each session, the presentation of the results of the "Architecture's Afterlife" Erasmus+ Project, and a meaningfully successful workshop on "Writing for architectural journals" conducted by Professor Juan Serra Lluch, Deputy Director for Research of the Higher Technical School of Architecture of the Polytechnic University of Valencia.

The closing ceremony was chaired once again by UPV Vice Dean Débora Domingo Calabuig and counted with the interventions of Oya Atalay Franck, President of the European Association for Architectural Education and Laura Soto Francés, Regional Secretary of Bioclimatic Architecture and Energy Sustainability (fig. 7).

Figure 7. Presidential table during the closing ceremony of the 3rd VIBRArch on November 9, 2022

The specific conclusions of the varied topics addressed in the different papers can be perfectly described in the previous pages of these proceedings. But having attended the event, some general conclusions can be drawn from the different sessions, interesting lectures, and fruitful debates:

- The richness of matters attended is perhaps the first and most obvious conclusion. Architecture has become a huge discipline

encompassing many specialist areas and fields of practice which resist being detached from the central core. As stated in the conclusions of the previous edition, this diversity is understood in our case as richness and not as a problem.

- Transversality has arrived to stay in architectural research. Almost any paper had addressed its topic from different perspectives making that most of the manuscripts could have been fitted in more than one thematic area.
- The topic of the conference was constantly celebrated by all attendees arguing that the specific moment in history that we were going through was really testing architecture's capacity to change its priorities.
- The health crisis caused by COVID-19 and the necessary confinement to which citizens were forced during the first months have led to the need to revisit the relationship between architecture and health, an issue that had been relegated to a smaller percentage of research in architecture despite its paramount importance in certain historical periods and which now takes on an leading role since prestigious voices warn that climate change could lead to new pandemics.
- These same issues renew the importance of architecture in society. Architecture and medicine are, most likely, the two disciplines that have contributed the most to increasing human life expectancy, also improving its quality.
- The well-being of people appears as a research topic with increasing frequency. Not only physical well-being, but also emotional. Not only well-being of the individual but that of the collective understood as much more than the sum of the above.
- The concept of care extends beyond people and takes on a global character, meaning the planet. There is a clear awareness that the most negative effects of the pandemic caused by COVID-19 have already been controlled and that we must redirect a large part of our capacities and efforts to mitigate the effects of the imminent climate crisis and to remedy or reverse those in which that we still have some maneuverability.
- Respect and empathy emerge as issues with great prominence, constituting a special way of dealing with traditional issues but also others of more recent prominence such as gender, migratory phenomena, social inequalities, the progressive aging of the population and greater life expectancy, and others.

Finally, its is always necessary to place value on the curiosity, proactiveness, optimism, resourcefulness, culture, and excellence of architects. Our commitment to whatever that we undertake is always the best warranty of a successful result. Undoubtedly, our transversal, multidisciplinary and research-based training has perfectly prepared us to respond satisfactorily to a wide variety of changing priorities.

In loving memory of Susanne Komossa.