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THE PRESERVATION OF THE CHROMATIC IMAGE OF HISTORICAL CITIES AS A CULTURAL VALUE. THE OLD CITY OF VALENCIA, SPAIN

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Abstract

The *Study for the Recovery of Urban Spaces in Valencia Historical Center* is an interdisciplinary project of intervention in patrimonial architecture, aiming to recover the original image of spaces in the historical city center. This is a project started in 1995 and ended in 2013 which is formed by a series of activities in which both, the Polytechnic University of Valencia as a research institution and the public administrations involved in the processes of regeneration and restoration of the historic center, take part.

The aim of the project has been the start-up of a restoration dynamic of the city urban historical center and its landscape value. Joining scientific studies, tasks of awareness and sensitization of population, it aims to determine the formal and chromatic characteristics of original spaces that create the architecture of the city.

Keywords:

Historical cities, Rehabilitation, Chromatic preservation, Residential buildings.

1. Research aims

Understanding the physical and material characteristics of our historical cities is essential for the preservation of their hereditary and cultural values. Beyond the historical logic of the urban scene and its functional nature, the city is sensed through the spaces which it creates and configures. The spaces of the historical city belong to it. They represent the soul of its history and the final result of its development. Through the architectural configuration of these spaces, we can visualize the historical and vital logic that underlies the city, the heritage of the people and cultures that make it up.

In historical cities the landscape of the physical environment and the cityscape are intimately and inseparably interrelated in each particular city. This is due to the use of materials taken from the immediate environment that constitute the physical basis of the buildings, and also to the existence of a culture that, based on the human adaptation to each physical environment, generates unique and inimitable urban scenes, as a final result of a way of living, of a culture. This distinguishing specificity among cities is extrapolated within each historical city, where different districts, implemented in disparate periods and used by heterogeneous social classes, are characterized by a distinct chromatic and visual image. A rich spatial variety that reflects the history of the city and that must be preserved as a cultural value linked to the history of the city itself.

This logical articulation between architectural form, material and color is a common feature to all the Mediterranean coastal countries, in which similar material conditions coincide with an intense network of cultural and commercial exchanges, which led to a similar way of building and a similar way of understanding the city. Therefore, the set of activities developed in Valencia since 1993 is proposed as a valid methodology to be applied in the whole of coastal nations, in order to preserve a common cultural identity which is threatened by intense urbanization processes, often lacking of programs that preserve the original image of urban spaces. [1]



Fig 1. Popular housing throughout the Mediterranean arc are inked with colors arising from the surrounding oxides and lands, creating the existence of a color typical of each city: Camogli (Italy), Portofino (Italy), Saint Tropez (France) and Trastevere in Rome (Italy)

2. The Historic Center of Valencia

The aim of the project, initiated in 1995 and developed over nearly twenty years has been the start-up of a restoration dynamic of Valencia historical center, highly dilapidated since the *Turia River Flood* in 1957. Since then, a gradual abandonment and deterioration of the old town, one of the largest in Europe with 1,730.000 square meters, began. The consequences of this natural disaster were devastating to the historical city, creating a sequence that began with the depopulation due to the inability to adapt streets and old buildings to the new residential needs, a progressive loss of tertiary activities that aggravated the process of depopulation, and an ageing population structure. Finally the subsequent arrival of marginal populations, who occupied abandoned buildings, aggravated the problem. The population figures of Valencia historical city over recent decades are a clear example of the degradation process described above: [2]

RESIDENT POPULATION IN CIUTAT VELLA (VALENCIA)								
	1970	1975	1981	1985	1991	2001	2012	Var.1970/2012
TOTAL	56.391	45.252	45.252	30.125	27.010	24.167	26.368	-53,24%

Most of the resident population that remained, excluding those areas in which the Administration and a part of the financial entities settled, was increasingly aging and was economically unable of facing the maintenance tasks of the housing. Those underwent a progressive and unstoppable deterioration. Spacious mural surfaces of the historical center were characterized by a deplorable state of conservation: Walls totally faded or with the color layer so eroded that it was possible to see the previous layer existing under the current one; walls with different layers of paint, all of them chipped, that showed with clear evidence the different colorations that the building had undergone over time; chips in the chromatic finish due to the incompatibility between the paint treatment and the wall; chipped mortars with important cracks due to the age that leaved the nude brick; and bulges and flacking of waterproof paints which had been incorrectly used in subsequent remodelings. All this, added to a profound ignorance about the interaction between traditional building techniques and new materials used in the restoration process, derived in a profound deterioration of the urban image of the historical city, losing the coherence between the original urban space and the formal and chromatic characteristics of the buildings that composed it, producing the loss of the own cultural identity which the city carries



Fig. 2. Urban and architectural degradation in Valencia.

In this context, since 1995, a series of scientific activities were initiated and developed aimed to determine the original chromaticism of each one of the neighborhoods that make up the historical city. The culmination has been the development of a *Color Shade Card* for each one and a *Color Shade Card* general for the whole city, which has acquired the character of binding regulations in restoration processes [3]. A study aimed to determine the material-constructive features of plasters or mortar renderings in facades has been developed, in order to ensure the structural sustainability of interventions [4]. And it has been implemented in a number of pilot interventions with the aim of both, evaluating the viability of the chromatic and structural proposal, and implementing a number of focal points distributed throughout the whole historical center which act as dissemination and awareness elements for the population and the technicians involved in the processes of restoration, such as architects, developers and builders.

As a result of all the above described, there has been a gradual recovery of the original city chromaticism, initially generated from government, but gradually spread to the private sphere, that begins to bear fruit in the historical center, in which all scales interventions have gradually been adapted to the scientific guidelines, producing a progressive recovery of the urban image and its patrimonial values

3. Scientific studies: Description of works

The set of studies has focused on the analysis and developing performance determinations in small-scale residential buildings. The issue here is not a program of interventions aimed at the recovery of the great patrimonial architecture, but we are moving in the field of restoration of urban scene itself, giving preference to small-scale residential architectures, those buildings that form the urban scheme itself.

3.1. Color analysis and preparation of Color Plans: Applied methodology.

A total of approximately 1.200 samples for subsequent analysis have been extracted in the whole of Valencia's historical center, sorted by type, age of construction and belonging to the wall background or ornamentation.

In the first phase, the colour of the superficial coats of paint was studied *in-situ* and 'colour chromatic' maps were made from instrument readings. These maps identified qualities of light as: HUE, VALUE, and CHROMA. The instruments used were: an adapted contact colour meter (measuring mode: absolute and differential) and a spectrophotometer (Colour systems: XYZ, Yxy, L*a*b*, L*C*h°, from CIE ; Hunter Lab and Munsell. Absolute values and increments. Total colour difference). In a second phase, the study has been broadened with laboratory chemical analysis to determine the exact composition of the original materials – construction materials and mortars, as well as the pigments used in the pastes and the resulting colours. This process of analysis and classification of the samples leads to a third phase of the study. The pigmentation samples were prepared for an optical photographic study with a binocular magnifier for a physical/chemical analysis and determination of components. The analytical instruments and techniques used were: a *scanning electron microscope (for the morphological study of the samples)*, and *X-ray diffraction*, or Scanning Electron Microscope/Energy Dispersive Using X-Ray (SEM/EDX) for the mineralogical analysis of samples.



Fig. 3. Sample extraction and analysis to find out the original construction techniques and pigments

The result of the developed studies [7] allows describing the basic construction technology, common to all analyzed historical buildings, with minor variations. In this way we can conclude that in masonry from before the middle of the 19th century, they mostly used air hardening mortars (lime mortar and gypsum plaster) and hydraulic mortars (pozzolanic and hydraulic lime mortars). Relative to repairing mortars, the use of lime, gypsum and hydraulic mortars was usual. The set of developed analysis about the historical center of Valencia give us the following relative values about the predominance of one or another construction technique in historical buildings: [5]

Major component	Statistical predominance
Calcite	19%
Gypsum	56%
Lime y gypsum	25%

In all cases, the predominant aggregate was the siliceous, existing limestone and dolomite aggregates in smaller quantities, and being characterized the gypsum plaster by a higher binder/aggregate ratio than the lime mortars [6]. Such constructive solution, common to the material traditions of all cultures of the Mediterranean arc [7], is characterized by a high adaptability to the environment, and what interests us most here, by the close connection with the territory proposing a color treatment technology based on the use of oxides as natural inking mechanism for mortars. So that in a significant majority of Mediterranean historical centers, the use of colored mortar has a major importance in the final color image of the urban space, both in terms of structural materiality and with regard to the compositional use of materials and color to define the final image, regardless of the specific cultural values of the different Mediterranean coastal countries.



Fig. 4. Chromatic and material study of a facade of the historical center through stratigraphic analysis of plaster samples.

The colored lime mortar used natural pigments, soil and oxides which were extracted from the hinterland close to the city and they linked the images of the city and the territory. This is the origin of the fact of identifying certain colors to particular cities: the ocher of Sienna or the yellow of Naples were created from the natural conditions of the site, generating a two-way relationship that came to assimilate city and territory in the collective imaginary. [8]. It is precisely the loss of this close interrelation between the material from the immediate surroundings and the traditional structural solutions which has generated both, the progressive material deterioration of the Mediterranean historical centers, and the loss of identity and the chromatic and visual artificial uniformity that derive from the indiscriminate use of modern materials. The present study stresses this aspect, proposing not only the recovery of the traditional material characteristics through the use of contemporary structural techniques, but also the link between these material characteristics with the chromatic variables of architectural form and the establishment of implementation criteria aimed to preserve the historical spatial differences of the different areas of the historical city.

3.2. Typological analysis

To the material and structural progressive deterioration derived from the abandonment of traditional techniques and the gradual incompatibility between the original walls and the finishing contemporary treatments, we should add the indiscriminate application of unitary and undifferentiated color solutions, disassociated from the chromatic logic that links the original structural techniques with the compositional criteria for applying the color typical of each period and architectural typology.

One of the main contributions of the developed works has been the elaboration of an implementation strategy for the scientific results based on the relationship established between color and architectural typology, allowing a differential application of the Color Chart in each

intervention area and therefore the preservation of a different color image in the distinct urban areas of the city [9]. To avoid this distortion, one of the starting points of the work has been to prevent at all times the development of general application guidelines, that are undifferentiated for each and every typology of the historical center. The preservation of the cultural identity of the city necessarily involves the development of specific guidelines for each type of architecture, with the aim of preserving the chromatic characteristics of each space. Therefore, we have proceeded to make the typological classification of each and every existing patrimonial building in the historical center of Valencia, classifying them in the Typology Plan of each district, and afterwards assigning specific intervention guidelines which are appropriate to each style, time of construction and material-construction characteristics. All this information has been graphically systematized in the typological plans of each district, which is a basic tool for applying the results of the study.

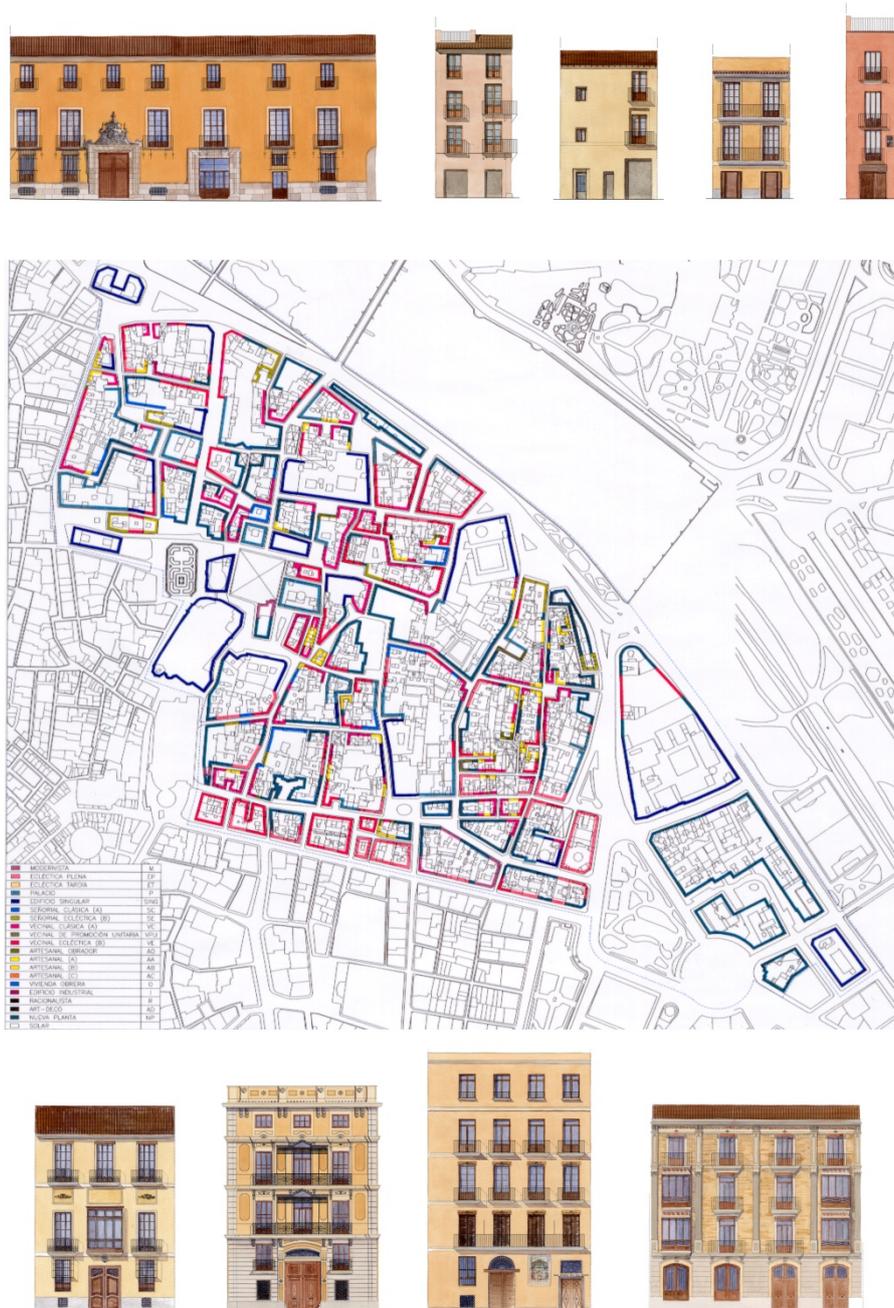


Fig. 5. Typological classification of the buildings in the historical center of Valencia

4. Results

4.1. Color and typology

A series of individualized guidelines for each building typology has been developed, which identifies the background ranges and the ornamentation, as well as the possible chromatic interactions between both and the combination criteria. In the case of facade backgrounds, the dominant ranges in the historical city, sorted by types, are the following ones:

CHROMATIC RANGES	ARTISAN		CLASSICISM		INTR. ECLECTICISM		PALACES		TOTAL	
	units	%	units	%	units	%	units	%	units	%
STONE		0,00%		0,00%		0,00%	2	9,52%	2	0,63%
STUCCO		0,00%		0,00%		0,00%	1	4,76%	1	0,31%
BRICK		0,00%		0,00%	2	2,99%	2	9,52%	4	1,25%
2.5Y	7	5,60%	13	12,15%	7	10,45%	1	4,76%	28	8,75%
2.5YR	5	4,00%		0,00%		0,00%		0,00%	5	1,56%
5YR	29	23,20%	14	13,08%	6	8,96%		0,00%	49	15,31%
7.5YR	31	24,80%	23	21,50%	17	25,37%	4	19,05%	75	23,44%
10YR	45	36,00%	45	42,06%	29	43,28%	11	52,38%	130	40,63%
5R	0	0,00%		0,00%		0,00%		0,00%	0	0,00%
10R	8	6,40%	2	1,87%		0,00%		0,00%	10	3,13%
5GY		0,00%	10	9,35%	6	8,96%		0,00%	16	5,00%

In the above table the absolute predominance of ochre and reds in the historical center of Valencia can be appreciated. The chromatic families with the greatest global occurrence are 5YR, 7.5YR and 10YR. The predominance of these colors is due not only to formal factors or 'taste', but also it is often caused by the use of oxides as natural dyes for mortar [10]. This predominance was constant throughout the 19th century, although we must now make two specific exceptions: a tendency to lighten the chromatic intensity is noted in the buildings belonging to the late 18th and early 19th centuries (artisan) and in those of the middle and late 20th century (residential); and the existence of a progressive chromatic enrichment and polychromy as the result of the progressive implantation of formal Eclectic tendencies. The reason for this variation stems in both, cultural and stylistic aspects, and in the technical evolution suffered by the structural techniques in the period between 1730 and 1900, with the gradual abandonment of traditional techniques based on the use of oxides from the immediate environment as pigment material, and the replacing by industrial pigments which significantly expanded the available color ranges and altered the technical capabilities of the resulting compounds.

The existence of a '*chromatic continuum*' is thus established, formed by small residential buildings that create a chromatic background for the city in shades of ochre and red, mostly belonging to the 5YR, 7.5YR and 10YR families, and to a lesser extent to those of 2.5Y, 2.5YR and 10R. Within these families, the chromatic intensity varies from area to area: greater intensity in areas where older buildings predominate (*18th century artisan and aristocratic*) and lighter where the predominance is composed of '*middle class*' buildings belonging to the mid and late 19th century (*Classic residential and Eclectic and 19th century aristocratic*).



Fig. 6. *Trinquete de Caballeros Street: An example of predominantly Aristocratic Buildings*

Outside this chromatic continuum, there are '*chromatic exceptions*' that characterize specific spaces. Firstly, the special buildings and palaces that use not only colored mortar belonging more or less to the major chromatic families, but also other expensive materials that make them unique and convert them into visual landmarks within the chromatic scheme of the city, such as stone and stucco.

4.2. *The chromatic characterization of the urban areas.*

This set of decisive factors profoundly affects to the total urban image, since the distribution of the different architectural typologies throughout the city space is not constant. The historical Mediterranean cities were structures characterized by a functional and social strong zoning. Different social classes settled in diverse districts, and the predominance of building typologies typical of each one created an urban image generating, despite the application of similar structural techniques and the existence of color ranges limited by the use of natural pigments typical of the immediate environment, a "chromatic zoning" of the historical city. Thus, the composition of a Color Chart can not be expected as unitary for the whole set of urban centers, but we must generate implementation strategies that have the aim of a differential application, which is linked to the specific architectural typology and result in a heterogeneous visual zoning once applied. This zoning is ultimately a picture of the city history itself.

The implementation methodology proposed in the research about the historical center of Valencia, by means of linking architectural typologies and specific criteria of the various color ranges that make up the total Color Chart, has enabled preserving this spacial wealth, which is evident in the comparison of the implementation results between two clearly distinct spaces: Lope de Vega square, urban area built mostly between 1800 and 1850 where such singular buildings as Santa Catalina Church coexist with artisan buildings; and La Paz Street, urban environment of bourgeois origin, erected in the late 19th century and characterized by the predominance of Eclectic and Modernist residential buildings belonged to the enriched industrial bourgeoisie.

Lope de Vega Square responds to what we might call "*spaces with artisan predominance*". Such spaces, majority in the historical center, are configured from the fragmented medieval parcels and they are mostly built by small constructions of artisan use which coexist with larger buildings, whether stately buildings or singular buildings. They are characterized by a high

degree of visual and chromatic fragmentation, juxtaposing the facade colors in a fast and strongly vertical sequence, since each narrow building adopts a chromatically independent solution. However, this visual fragmentation is joined to some color uniformity due to the use of a limited number of color ranges, which were basically derived from the use of pigments based on natural oxides (5YR, 7.5YR, 10YR and 10R), more economical and readily accessible. So they were appropriate to modest buildings and those with an especially practical nature.

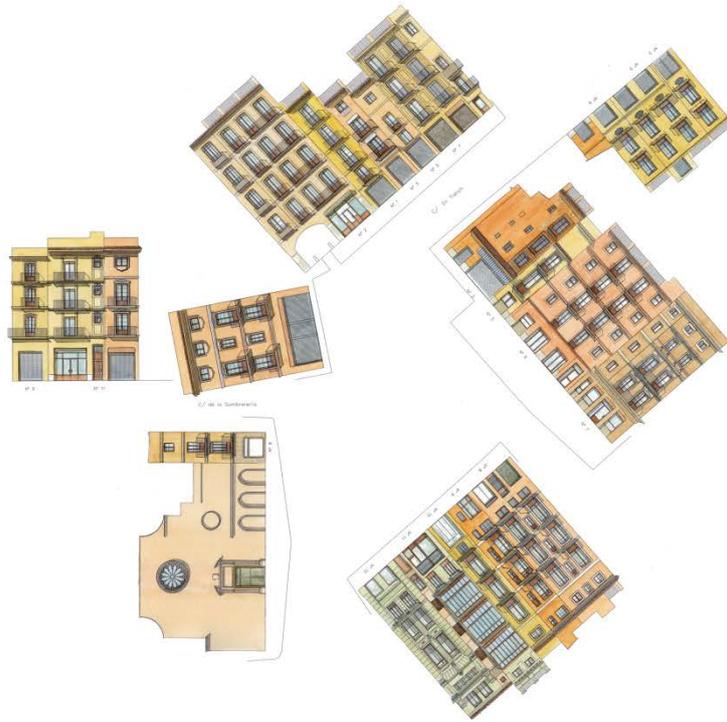


Fig. 7. *Lope de Vega square.* : An example of urban space with predominantly *Artisan Buildings*.

On the other hand, La Paz Street belongs to those areas where Eclecticism and Modernism have been established; the new areas erected by and for the wealthy bourgeoisie of the late 19th century through processes of urban renewal. They are buildings which are characterized by both a larger size and a greater ornamental wealth, resulting in a higher chromatic complexity. New materials are introduced and the color ranges are extended, now they are not only strictly limited to the land pigments themselves. All this things lead to a scene that is characterized by both, broader background planes, which increase the visual weight of the colors used on the walls, and a chromatic profusion in the ornamental elements derived from both, the major formal complexity typical of these styles and the use of pottery and other innovative construction techniques.

The visual and color differences between both urban areas are the result of a differential application of similar color ranges. From the technical point of view the material differences between the plasters used in both cases are minimal, almost nonexistent. One thing that is shown in the performed analyzes, besides the incorporation of different materials, is a tendency to smooth the chromatic intensity (ranges 2'5Y, 5Y, 10GY, 5YR, in the case of the Eclectic and Modernist buildings of the late 19th century), a propensity to the visual fragmentation due to the ornamental enrichment and to the conscious search of the polychromy incorporating materials, such as the carpentry, locks and ceramic panels, to the chromatic game. What is noteworthy is that, simultaneously to the increase of the ornamental complexity, there is an increase of the needs for harmonization among levels, so that, to the traditional chromatic harmonization between background and compositional elements, we can add the need to harmonize the background color with the balconies and locks, and to harmonize these last two together.

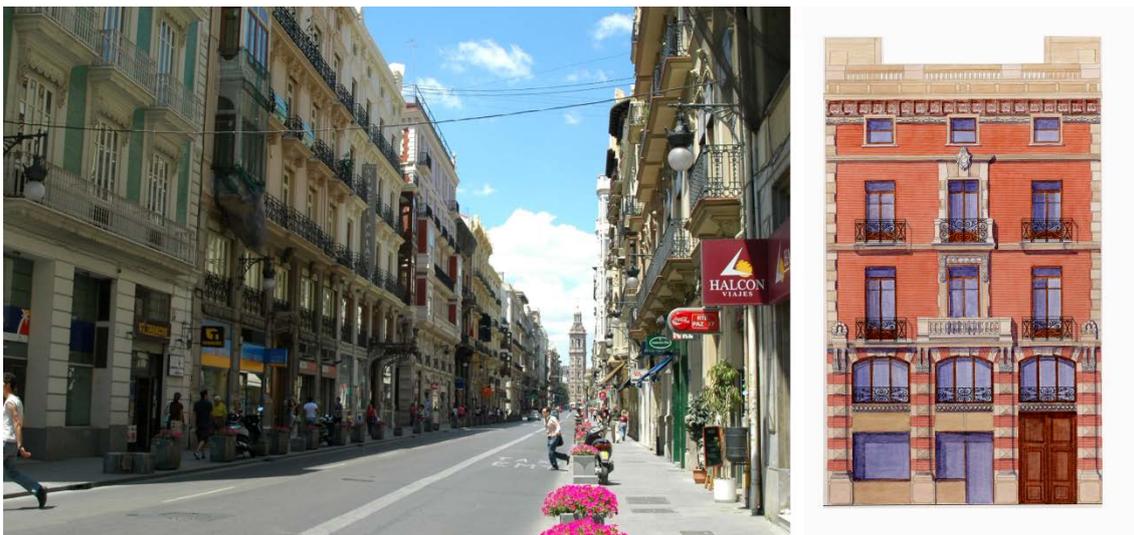


Fig. 8. *La Paz Street*, and sample of Eclectic building restoration project (XIX-XX)

In both cases there is a marked material-structural continuity. However, in opposition to the color uniformity of the wall backgrounds and the visual fragmentation of Classicist buildings, derived from the smaller size of the plots, Modernism and Eclecticism propose an urban scene characterized by large planes materialized with colored plasters similar to earlier times, but softening the color intensity and proposing an ornamental profusion that breaks up the form, creating a rich and polychrome visual image.

As result there is a chromatically complex urban center, multi-polar and structured by districts. A color wealthy that reflects the different distribution of typologies and which is the result of a differential settlement of the various social classes throughout history. [11]

3. CONCLUSIONS AND RESULTS

The *Study for the Chromatic Recovery of the Historical Center of Valencia* is presented as a proposal for intervention in the historical city, which is characterized by combining the scientific study with the active participation of society living in the city. It is based on the conviction that the starting points of any urban rehabilitation process and of any intervention in the historical city, must necessarily be respectful with the logic aesthetic of the buildings on which they act and with the complex urban spaces in which they are located.

The set of developed works has tried to recover one of the levels of this complex formal structure that supports the logic of the traditional urban scene: the color. And it does so with the understanding that color is an unavoidable part of the formal logic of architecture itself; that color is, like proportion, scale, ornament, and all other aspects that refer to the aesthetic dimension of architectural form, a part of the set of variables that make it a logical and articulated whole. Each period handles the color in a different way, either by the use of certain building techniques, by the limitations of the available technology, or by the logic of the dominant aesthetic trends themselves; and the respect for the historical architectural form necessarily entails the respect for the chromatic logic of the period in which the work was built. Especially in cities, like most Mediterranean cities, where the color value has the origin in the surrounding lands, from which the mineral pigments that characterize traditional building techniques are extracted; a relationship between urban image and land material that turns into an anthropological relationship of a great cultural value.

One of the conclusions that emerge from the set of studies is the relationship that link a specific architectural type and the color ranges used in it. Each typology, which is ultimately a product dedicated to a particular social class at a particular time, is characterized by formal and chromatic solutions used in its resolution. And this typological variety ultimately drift towards an urban variety. If we can relate each typology with some specific color ranges, it is possible to establish color identification areas in the city, in direct correspondence with the predominance therein of one or another typology. So, the aesthetic and chromatic differences among neighborhoods where there are predominantly artisan building typologies, characterized by ornamental nudity and construction simplicity, and those other areas of the city with a predominance of bourgeois residential buildings of the late 19th century, constructed according to the principles of Eclecticism and characterized by the use of different materials and the polychrome derived from them, are evident. Preserving this chromatic logic is preserving the logic of urban form itself.

But the study is based on the belief that the city interventions must necessarily be carried out through the direct involvement of the people living there. It is not only a practical matter, derived from carrying out an intervention of this magnitude without the direct participation of private capital, but it is based on the belief that the image of the city is something experienced by people living there. The city carries two levels of values: the historical and the social.

At the end of the process, the *Study for the Chromatic Recovery of the Historical Center of Valencia* has aimed to generate a restoration dynamics that, having concern for the past, project into the future, as well as it rebuild and ensure the preservation of the architectural and urban values that gave us the successive generations which lived there and created it, while it involves current generations in regenerating the city to subsequently leave it to future generations.

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