# Anna Bofill's Use of Mathematics in her Architecture

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**ABSTRACT**

Mathematics is the architect's calculating tool, besides an inexhaustible source of geometric shapes, and even a way of structuring thoughts and projects, if necessary. Calculations and geometry are vital to develop an architectural project, however another option is to consider a project from a mathematical viewpoint. Combinatorial, logic, fractals, probability, etc. are mathematical concepts that can be found in the framework of architecture. Sometimes, its use is clear and seems to materialize with the construction, other times it is a source of inspiration or a modus operandi.

The work of Anna Bofill Levi, architect and composer, is an example of using mathematics to envision or conceive a project in both architecture and music. In this paper we focus on the architectural aspect and try to highlight the impact of mathematics on her work by analyzing several of her projects.

**Key-words:**

Anna Bofill, Taller de Arquitectura, design analysis, modular aggregation, isometries, Walden 7

## INTRODUCTION

Mathematics, especially in the form of arithmetic and geometry, has always had strong ties with architecture and could be said to be an important part of putting architectural designs into material form. However, proposing that math be not only a ~~vital~~ tool but could be considered as the generator of architecture is altogether another question.

Anna Bofill Levi, architect and composer, uses mathematics to create or conceive projects in both architecture and music. In this paper we focus on her architectural facet and try to show the influence of math in her work by analyzing some of her projects. We focus mainly on her early work, in which the influence of math can be clearly seen, and use as our reference her doctoral thesis, in which she explains how to use simple shapes such as cubes to generate more complex geometrical forms. As if in a game, mathematical rules and laws are used to achieve 3-dimensional figures that provide infinite possibilities to construct different structures, with isometries being mainly responsible for the diverse compositional alternatives. In her thesis, Bofill tries to open up new territory for modular aggregation and her proposals provide new ideas to expand the range of conformations in order to confer flexibility and adaptability on the structures she creates, fleeing from what she calls "*the cold rigid urban landscape of blocks".*

The body of this work is divided in two parts: In the first one we look at Anna Bofill's biography, the settings in which she moved and the society in which she lived. In the second one, we analyze the mathematical content of her thesis, whose ideas served as the basis of the design of the projects carried out by Ricardo Bofill's Taller de Arquitectura between 1964 and 1975. In the third one we consider the module and its mathematical treatment, and the fourth one deals with Anna Bofill's own reflections on her thesis and the projects related to it.

## ANNA BOFILL LEVI, ARCHITECT AND COMPOSER

When the name Bofill is mentioned in an architectural context it is not normally associated with Anna, but with her brother Ricardo. However, Anna Bofill also has an architectural background together with a strong tendency towards interdisciplinary collaboration.

Ricardo (Barcelona, 1939) and Anna Bofill (Barcelona, 1944) from their childhood lived with their father's architecture and their mother's passion for art and music. Ricardo, who decided to study architecture following in his father's footsteps, entered the Barcelona School of Architecture but was soon after expelled for his political leanings and went off to Switzerland to continue his studies there. Anna, who was passionately in love with music from her earliest years, had planned to go to Italy after leaving school, since Spain under the Franco regime was not the best place in the world to do this. However, her ambition to leave Spain was not fulfilled, as her elder brother died and since Ricardo was studying in Geneva, she stayed in Barcelona to be with her mother. It was then, in 1962, that she began to study architecture. In a later interview she once declared: "it seemed like the discipline that was most like music. Loads of different options went through my head…I was interested in so many different things and even today I am still interested in everything related to the world of science and research*"* (González and alt. 2006).

THE TALLER DE ARQUITECTURA

Between 1962 and 1963 Ricardo Bofill, after returning to Barcelona, founded the Taller de Arquitectura, which was then a new concept and was composed of a multidisciplinary group. It is with this stage of the Taller, in which Anna Bofill participated, that we deal with in the present work.

The architects Manolo Núñez, Xavier Bagué and Peter Hodgkinson, together with Ricardo Bofill, were the original pillars of the Taller, although there were other members from other disciplines, such as José Agustín Goytisolo (poet), Eduard Bonet (mathematician and husband of Anna Bofill), Serena Vergano (actress) and Salvador Clotas (politician and writer), among others (García 2013: 60). This multidisciplinary group, whose aim was to revitalize contemporary architecture, proposed new lines of action and questioned the contemporary ways of thinking and projecting, and their ideas and methods revolutionized a whole generation. Anna Bofill joined the Taller de Arquitectura in 1964, when they were commissioned to carry out the *Barrio de Reus* project, which began by looking into how urban and architectural forms were generated. The aim of the Taller was to "*Design and construct houses that would be an alternative to the housing committees and the typical rationalist apartment blocks of those times, which were based on the town planning standards of the Athens Charter produced by the CIAM convention in 1933"* (Bofill 2010) . The team of architects, mathematicians, writers, artists, sociologists and economists generated a dynamic atmosphere that, in the in search for their objectives, favored investigation and experiments with forms. Even though Anna could have approached this investigation from other directions, she opted to use math and its laws as her tools for creating forms, and the results were seen in the projects carried out by the Taller between 1964 and 1975. In her thesis entitled *A Contribution to the Study of the Generation of Architectonic and Urban Forms* (1975) (Bofill 1975) she laid down the mathematical basis (Theory of Forms) for the geometrical treatment of modules that was to be used in most of the projects. She also explained the work process and planning method involved in the theory and how it could be used to achieve the aims of the Taller. The theory promised to be a new approach to architecture and a new way of organizing spaces that would make possible new lifestyles and new social relations and structures.

The Taller's versatility in generating forms was approached mainly by the modular aggregation method. Influenced by Rafael Leoz and Louis I. Kahn, among others, the projects they carried out between 1964 and 1975 were based on simple modules that became complex spatial compositions by means of the laws of aggregation. Together with

Eduard Bonet and José Agustín Goytisolo, Anna's work consisted of establishing the mathematical models or algorithms that would explain the laws of aggregation for the generation of forms.

A number of modular-based buildings were carried out by the Taller between the first modular experience in 1963, with the El Sargazo Apartments (Castelldelfels, Barcelona), until Walden 7 (San Just Desvern, Barcelona) in 1975, including: The *Barrio Gaudí* (1964, Reus, Tarragona), the *Castell de Sitges* (1965, Sant Pere de Ribes, Barcelona), the *Xanadú* Building (1966, Calpe, Alicante) and the *Muralla Roja* (1968, Calpe, Alicante), La *Ciudad en el Espacio* (1970, Madrid) and the *Petite Cathedrale* (1971, Cergy-Pontoise, París). With each project, the modular aggregation process and its laws of composition became more refined, the modules more simple (Figure 1) (García 2013: 83) and the proposals more systematized.

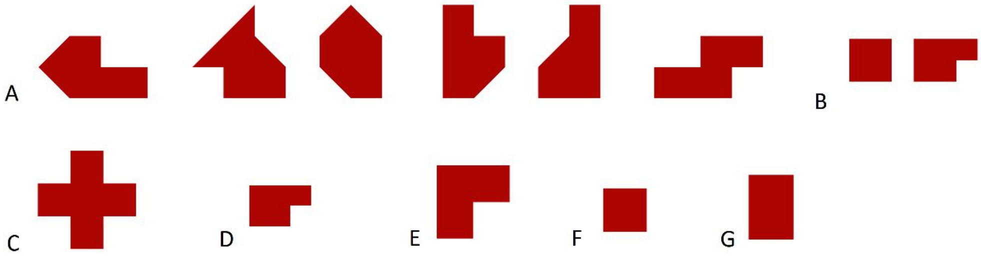


Figure 1. The modules used in the different projects: A) Barrio Gaudí, B) Xanadú, C) Muralla Roja, D) Castell de Sitges, E) Ciudad en el Espacio, F) Walden 7 and G) Petite Cathedrale.

In *Walden 7*, which was perhaps the culmination of the Taller's achievements during this period, a cube was used as the basis of the structure, the apartments were composed of repetitions on this theme, and the different isometries of the module generate spaces between the apartments. The novelty of Walden 7 lay in the fact that the cubes could be placed in juxtaposition with each other in order to generate external concave or convex spaces. Not all the apartments were composed of the same number of cubes, nor were they at the same level, which gave the building a certain labyrinthine appearance, even though the conceptual rigidity of its geometry, curiously enough, makes the structure seem flexible and haphazard. This project was one of the Taller's most emblematic projects and marked a turning-point in Spanish architecture.

Walden 7 was completed in 1975, 10 years after Anna Bofill began research on the Theory of Forms, and marked the end of an era. It was in this year also that Anna read her doctoral thesis at Universitat Politècnica de Barcelona.

HER OWN WORKSHOP, GENERIC URBAN PLANNING AND MUSIC

Between 1981 and 1982 Anna Bofill left the Taller de Arquitectura and thus stopped working with her brother Ricardo. At this time she also became divorced from her husband. These two great changes marked the start of the second phase of her career. However, she did not abandon the most classical facet of her profession, the construction of buildings, but now her interest was in generic urban planning (or the feminine vision of the city and its architecture). Today she is an undisputed leader of feminism in architecture and has carried out many projects incorporating the generic perspective, for example, her *White Book: Women and the City* (Bofill and alt. 1998), or *Guide to Urban Planning Including Generic Criteria* (Bofill 2008).

Even though she had decided to study architecture and had given up the idea of studying music in Italy, she did not abandon music altogether. The creative process she used in her musical compositions was practically the same as that used in her architectural and urban compositions (Martín 2002: 63). In 1971, when she was immersed in the Walden 7 project, she composed her first piece of music, *Esclat,* in the first and fifth part of which she used the same geometric approach used for Walden 7, based on isometries and algorithms. Not only that, the relationship between tones and rhythmic groups follows the Theory of Probability and the Monte Carlo Method. In 2009 she explained the mathematical basis of her musical compositions in a paper read before the Second Schelling Conference on Art and the Humanities in Munich(Bofill 2010).

## THE THEORY OF FORMS

Anna Bofill assimilates architectural space to geometric space in order to be able to manipulate the surroundings systematically and rationally so as to find mathematical and geometric laws able to generate volumetric structures from basic elements, which she defines as *minimum cells*. As if it were a building game, at first, in an attempt to systematize the development process, she lays down the rules for grouping the pieces that will form the structure and then chooses the piece or pieces to be manipulated according to certain rules. Modules or units thus become bodies or developments of a certain size. We shall use the same method to try to give an insight into the Theory of Forms described in her thesis.

MINIMUM CELLS. APPLICATION OF ISOMETRIES. EXPERIMENTAL PHASE.

The generative geometric laws used to create volumes are those that regulate *rigid motions* or *isometries*, i.e. movements carried out on an object that do not alter its form or its size but only its position in a space, so that its dimensions (perimeter, area and volume) do not change. This process can be suitably adapted to the building requirements of the time and the available prefabrication methods. The isometric transformations include the following: translations, rotations, and reflections or symmetries.

The basic elements able to generate the urban tissue by means of isometries are based on different criteria: use, relation to surroundings, the supporting infrastructure network, possibilities for growth of the volumetric elements generated, etc. This latter condition necessarily requires the existence of a vertical direction and horizontal planes (by the law of gravity, the minimum displacement effort requires horizontality). Under these conditions, the best elements are evidently parallelepipeds.

After choosing the basic elements and the geometric laws, experiments are carried out with repeated applications of these laws to obtain a description of any the more complex structures that can be systematically obtained. As a particular case of the parallelepiped, the cube is often resorted to in this experimental phase. With the aid of the *Mathematica* software, following the mathematical expressions that define these movements, we replicated some of the movements described by Anna Bofill in her thesis (Bofill 1975). We used blue to identify the original basic elements and yellow for the transformations.

- Translation

In Figure 2 various schemes are shown that include translations. Figures 2A, 2B and 2C are those of *Unit L, Cross Unit*, and an extract from *Unit U* in her thesis.

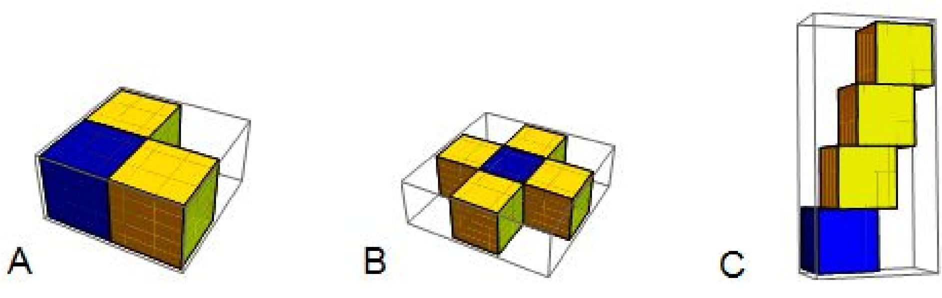


Figure 2. Examples of translations applied to a cube: A*) Unit L*, B) *Cross Unit*, C) *Unit U*.

- Rotation

Figure 3 shows the result obtained from *Unit U* after applying a 90º counter-clockwise rotation to it around the *OZ* axis on the *XY* plane.

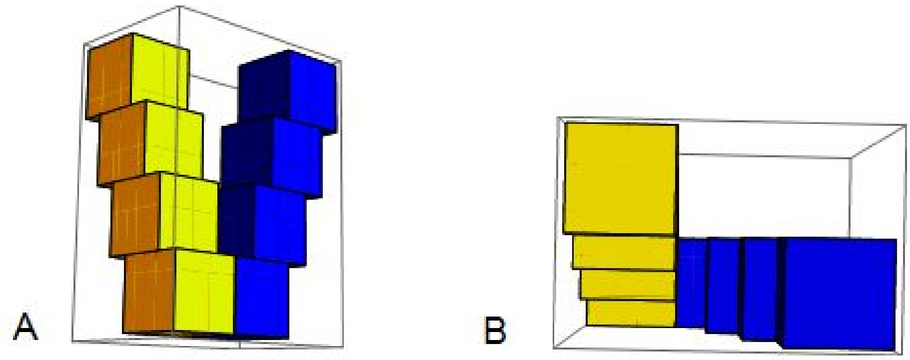


Figure 3. Example of a rotation applied to *Unit U*. A) Perspective, B) Plan.

- Helical motion

Figure 4 contains an example of the repeated application of helical movement around axis *OZ* of a parallelepiped with a square base and height equal to half of the edge.

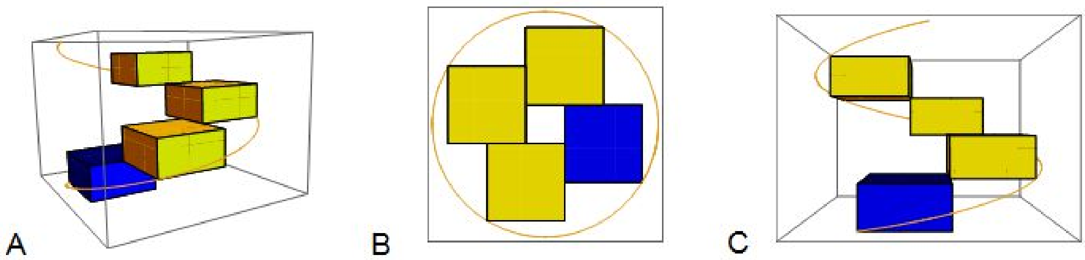


Figure 4. (A) Perspective, (B) plan and (C) elevation of an example of helical motion applied to a parallelepiped. The helix described by the motion is shown in orange.

- Symmetry with respect to a plane

Figure 5 shows the *Unit L* shown in Figure 2A and the symmetry with respect to the *YZ* plane.

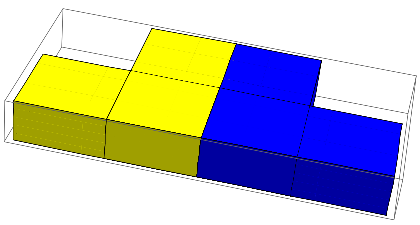

Figure 5. Example of symmetry with respect to an axis applied to *Unit L*. The original is shown in blue and the transformed in yellow.

## UNITS FORMED FROM CUBES

As we have seen above, applying isometries to minimum cells generates a series of conformations. In this phase there are many possibilities but only a few are chosen to make up units (or modules) such as those shown in Figure 2. When a configuration is called a unit it means that it has the potential to become a module in the development of a more complex structure.

If conditions are applied to minimum cells and isometrics other *units* can be obtained, e.g. if the basic and transformed elements share a common surface (or part of a common surface), edge or vertex. With this restriction, and taking a cube as the basic element, we can obtain new units by applying different isometries, such as those shown in Figure 6.

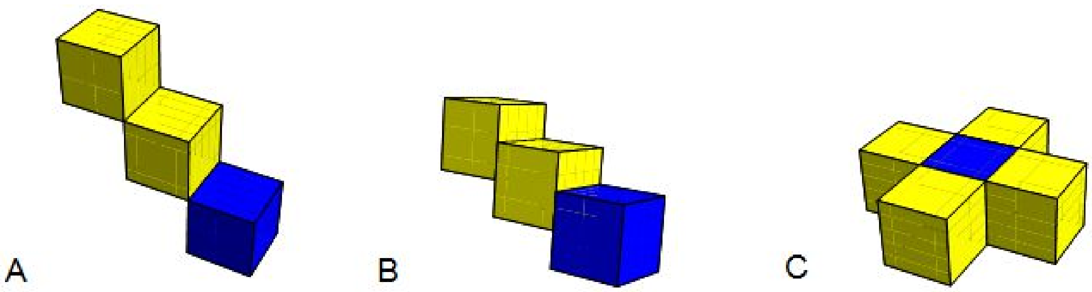


Figure 6. Units with various cubes formed by translation of a cube. A)Translation according to vector $(a,0,a)$, $a$ being the value of the cube edge. B) Translation according to vector $(a,0,a/2)$. C) Translation according to vectors $(\pm a,0,0)$, $(0,\pm a,0)$ (*Cross Unit*).

Not all the units have the same interest, as the architectural vision of the desired objective and the particular conditions of the project will determine the suitability of one arrangement over another.

## FORMING BODIES

Applying rigid motion to units, other more complex structures can be obtained, identified as *bodies* by Bofill in her thesis. The range of configurations is quite large and it is important to emphasize the existence of relationships among the bodies and the use they will be put to. Some examples are as follows:

- *Bodies* formed from the *Cross Unit*.

In Figure 7 various examples can be seen of bodies formed from the *Cross Unit*. In Figure 7A linear translation was applied four times of vector *(a,a,a)*, a being the cube edge. This inclined linear development is suitable for urban projects on sloping terrain. Applying together the translations of vectors *a(1,1,1), a(1,-1,1), a(-1,-1,1),a(-1,1,1)* the body shown in Figure 7B. In 7C another example can be seen of a body for forming more complex structures known as *nuclei* (see below). The central empty spaces generated by this body can be used as patios or small courtyards in more complex developments.

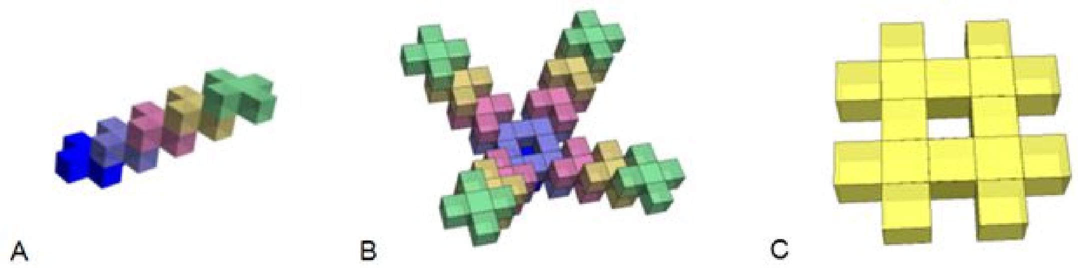


Figure 7. Examples of bodies obtained from *Cross Unit*. A) By means of translation of vector *(a,a,a), a* being the cube edge. B) By translating vectors *a(1,1,1), a(1,-1,1), a(-1,-1,1),a(-1,1,1)*. C) Body used to form *Nuclei*.

- *Bodies* formed from the *Unit L*.

Figure 8A shows an example of a body formed from the *Unit L*. To form the pseudo-unit *double L* we first consider the *Unit L* and its horizontal translation according to vector *(-2,1,0)*, and then perform a repeated translation of vector *(1,1,-0.5)* on the pseudo-unit. Nesting various of the bodies obtained, we now have low-density urban tissues that can be adapted to inclined sites or used as holiday flats.

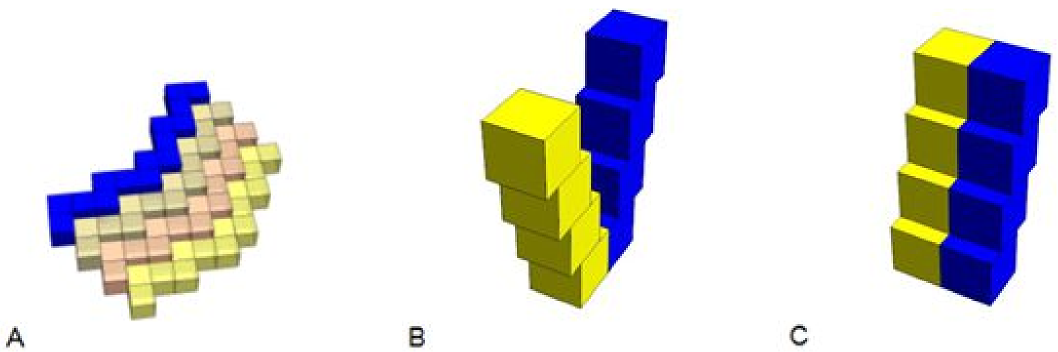


Figure 8. Examples of bodies formed from A) *Unit L, and B) and C) Unit U*.

- Bodies formed from the *Unit U.*

Figure 8 shows examples of bodies formed from the *Unit U* after performing symmetrical motions with respect to a vertical plane (Figure 8B) and horizontal plane (Figure 8C). The symmetry with slip is equivalent to adding a translation to the three previous symmetries.

FORMATION OF NUCLEI, LINEAR DEVELOPMENTS AND URBAN TISSUES

Increasing the complexity of the structures, in this section we give some examples considered in Anna Bofill's thesis of how to form possible urban nuclei, their linear development, and urban tissues.

If we think in terms of urban development and consider growth in relation to surface areas, we prefer the horizontal direction, so that the useful rigid motions are reduced to translations on a horizontal plane and symmetries with respect to vertical planes.

Figure 9 shows the nucleus obtained from the *body* formed by two *Cross Units* by a series of symmetries (Figure 9A). Combining this nucleus different horizontal developments are obtained (Figure 9B). If vertical development is also considered we can obtain nuclei like that shown in Figure 9C, obtained from a helical motion with a 90º rotation in each step and vertial translation of the vector with the cube edge module. This, in turn, can connect with analogs following the linear development seen in Figure 9B to obtain the urban network shown in 9D.

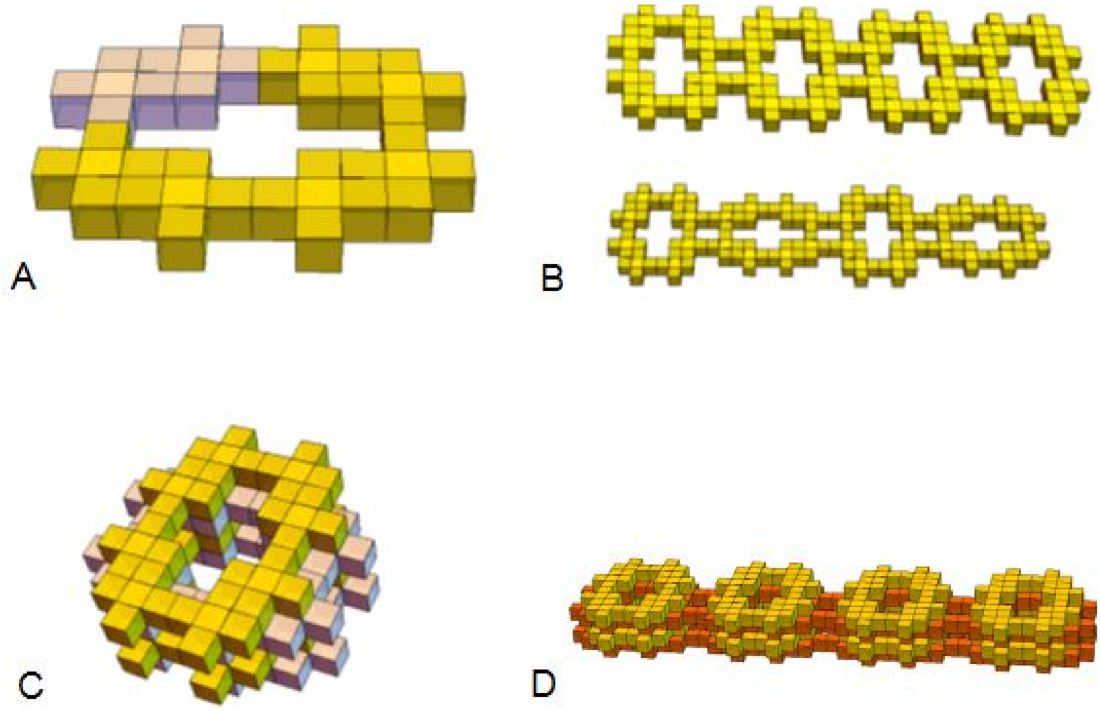


Figure 9. A) *Nucleus* obtained from a series of symmetries of the *body* formed by two *Cross Units*. B) Horizontal developments obtained from the *nucleus* in Figure 9A. C) Vertical developments obtained from the nucleus in 9A. D) Urban mesh formed following the lineal developments of Figures 9B and 9C.

Using the movement of the chess knight, units, bodies and nuclei can be developed as shown in Figure 10.

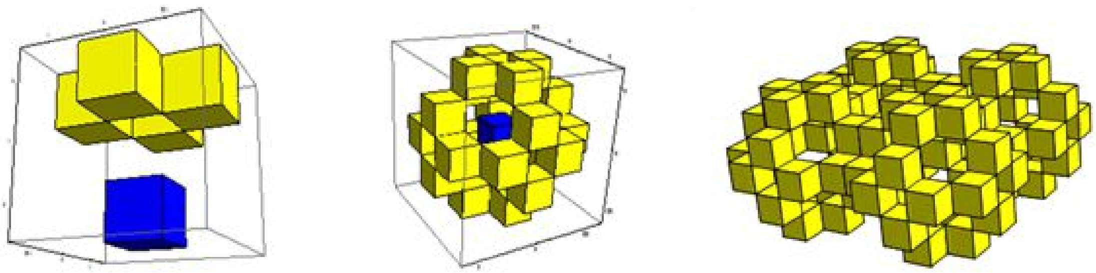

Figure 10. *Body* (center) and *nucleus* (R) generated from translation motion shown in the figure on the left.

In Figure 11 we show the result that would be obtained after successive development phases of the body shown in Figure 10 applying symmetry with respect to the planes tangential to the surfaces.

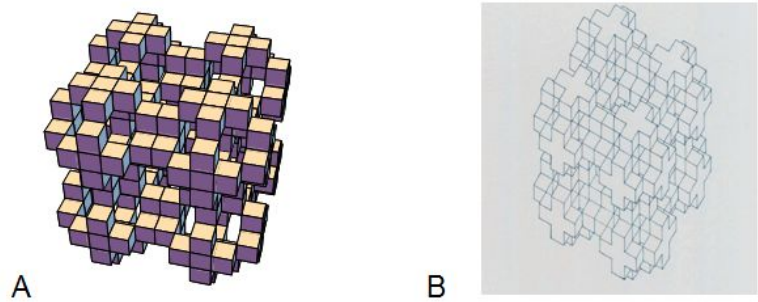

Figure 11. Result of successive developments that could be obtained from the body in Figure 10. A) Graph made on Mathematica. B) Drawing from Bofill's thesis (Bofill 1975: 88).

From the stepped unit obtained from a cube according to vector *(a,0,a/2)* in Bofill's thesis (Bofill 1975: 180 et seq.), linear developments are considered with the aim of configuring a semi-covered, and covered gallery and to convert a covered to a semi-covered gallery (Figure 12). The motions that define these developments are the translation of the stepped unit (translation in a straight and oblique line) and the symmetry with respect to a vertical plane. Figure 12 again shows (L) the graphs made on Mathematica and (R) the drawings from A. Bofill's thesis (Bofill 1975: 181-182).

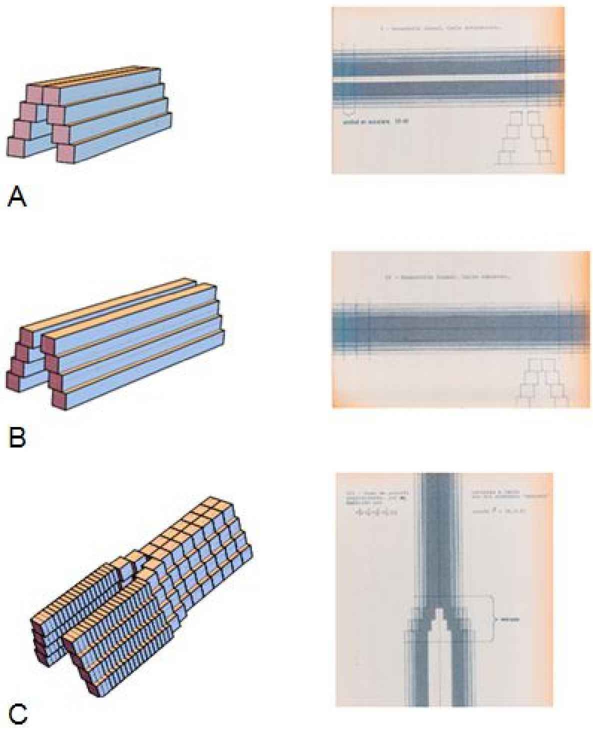

Figure 12. Various linear developments obtained from a stepped unit. A) Development to configure a semi-covered gallery. B) Development to configure a covered gallery. C) Development to convert a covered to a semi-covered gallery.

EXTRAPOLATION OF THE THEORY OF FORMS TO THE TALLER PROJECTS

Here we shall concentrate on a study of Walden 7 as the typical example of the Taller de Arquitectura's working method in the period studied. Walden 7 could be described as a type of vertical maze with seven interior patios interconnected vertically and horizontally. The structure is similar to a city district, which has both a horizontal and vertical extension, with 16 floors (including the roof terrace) and a surface area of 31.140 m$^2$, 446 apartments and 1.000 residents.

From the mathematical standpoint it is an example of a *nucleus* formed of *units* and *stepped bodies* formed by four successive translations of a cube. Translations, horizontal and vertical plane symmetry are applied to the nuclei to configure the modules of which the structure is composed.

The following scheme (Figure 13) shows the drawings of the aggregation system in A. Bofill's thesis (Bofill 1975: 137-138), on which Walden 7 was based.

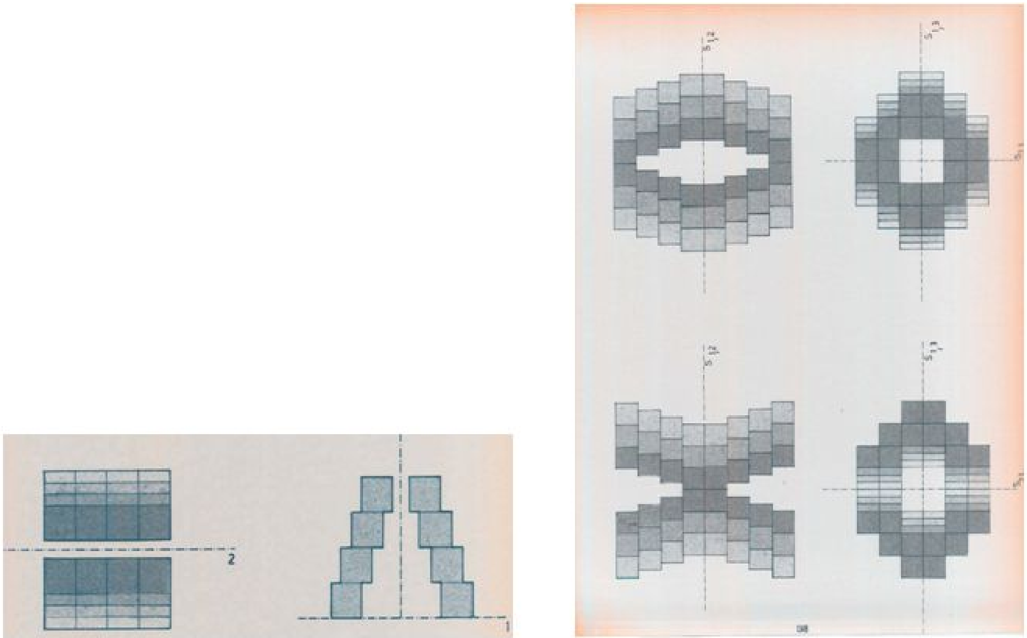

Figure 13. Schemes from A. Bofill's thesis for Walden 7.

Below (Figure 14) we show the drawings made on Mathematica of the modular groups considered in the construction of Walden 7.

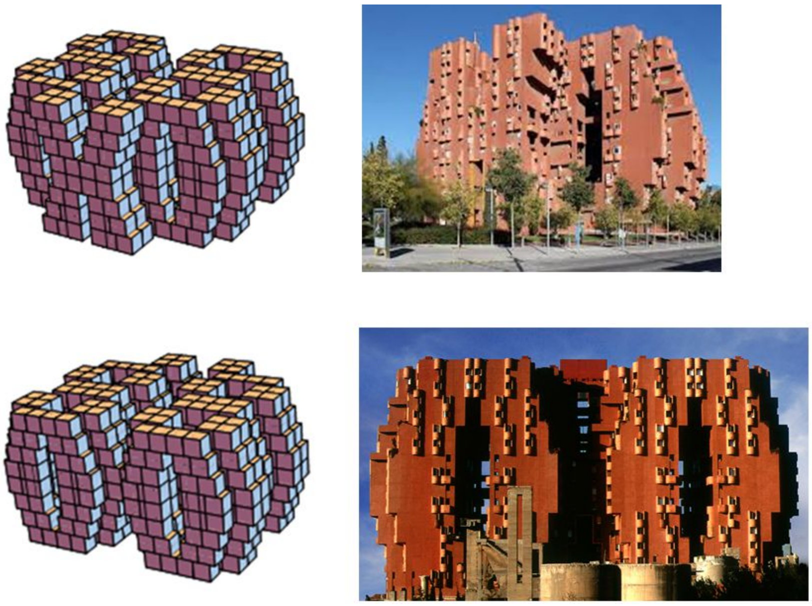

Figure 14. (L) Model of front (above) and back (below) of Walden 7 created on Mathematica. On the right photos of Walden 7.

## THE BINOMIAL OF MATH AND ARCHITECTURE

### THE REASON FOR THE THEORY OF FORMS

In order to understand the reasons that led Anna Bofill to create her Theory of Forms and the Taller to undertake the projects they carried out between 1963 and 1975 we have to go back even further in time.

The Modernist Movement in urban planning began after the founding of the CIAM, and especially after its fourth congress in 1933, which gave rise to the Athens Charter, which was taken as the model for the new conception of town planning. This new perspective included *zoning*, or the idea that every activity should take place in an area specially set out for the purpose to avoid interference and problems in the community. Even before this time there had been other theories that pointed out the complexity of urban problems: e.g. Geddes (1854-1932) highlighted the importance of geography and history as differentiating elements far removed from narrow and uniform types. Within the modernist movement, Lewis Mumford (1895-1990) had always maintained that many activities had been left out of the Athen's Charter's definition of a city, including its culture, its citizens and its social relations. In fact Mumford refused to write an introduction to J.L. Sert's book (Sert 1942) precisely because Sert (1902-1983) was in favor of using the criteria of the Charter for solving the problems of modern cities.

A great deal of material has been published on this subject and our intention here is not to give a critical evaluation of this situation. However, we must at least recognize the value of the collective consideration of cities as key elements in the new culture; more than half the world's population, and almost three quarters of the European, now live in towns and cities. However, we must be aware of this background in order to understand that the Taller was looking for a form of construction other than what Anna Bofill described as *cold, rigid apartment blocks*, repeated over and over again in the suburbs of all the cities in Europe in the form of identical, homogenized urban sprawls, and with absolutely no regard for their previous identities, their climates or histories.

In addition to these *people's buildings* that the Taller wanted to design, there was at the same time a desire to discover a mathematical theory of forms, or a type of obsession with creating an automatic process for generating urban landscapes from mathematical models. *Grouping* (perhaps as a compact model) appeared as a system of collective housing that could respond to the urgent need for houses (the basic right of having somewhere to live) and to systematizing the solutions. Grouping, as compared to isolation, highlights the apparent contradiction of living together but in liberty (social but independent). People wanted to live together in cities while at the same time preserving their identity and privacy, and the Theory of Forms proposed a number of different ways for them to achieve this.

## MODULATION AND PROPORTION

If isometries provide a way of systematizing the process, we must also mention another element of the Theory of Forms of great importance for architecture and urban planning: the module.

Modules can be seen as a system that allows the group to be identified by using one of its parts as a measure. Basically, it involves a way of providing or describing the scale of each element, i.e. showing whether it is large or small. The Japanese *tatami* can be considered an example of this for the way it converts a recognizable everyday object into a unit of measure, in Japanese culture, and facilitates the comprehension of an abstract concept such as proportion or size.

Both Leonardo da Vinci and Le Corbusier used the human body as the reference for measure and proportion.

In the Theory of Forms, the module is the basic element that allows the required systematization and also provides advantages for the building process. It may seem a contradiction that the method or the modulation involve structures that are *adaptable* to many different lifestyles, but we only have to look at the use of the Theory of Forms in architecture and urban planning to see that in fact no contradiction is involved.

PUBLIC SPACES

At the time when Anna Bofill belonged to the Taller, they were also interested in another important factor of urban planning considered to be a vital part of modern culture: public spaces. These are understood as something that increases in value as they change because they are responsible for catering for different types of people and activities under diverse conditions. Private individuals can make changes to their own space as they see fit (although making changes to a house may involve problems, which makes renting a flexible solution against buying as a rigid solution), but public spaces have to respond to many different needs and so cannot afford to specialize (e.g. children's playgrounds and areas for the elderly) as their basic function is to serve the needs of the entire poulation.

Jordi Borja (1941) has said that any element that carries out more than one function in a public space (and so makes it possible for people to meet and mix) is worth more than one that is aimed at one specific type of citizen. The possibilities offered by the Theory of Forms therefore are not limited to private interests but are also open to public spaces. They are not only interested on what goes on behind closed doors but also in what happens outdoors. These designs have both positive and negative sides, and both are of interest.

This is where the concept of the compact city appears as an alternative to the diffuse model of the Athens Charter; it favors proximity instead of specialization and could be thought of as a mixture of the casbah (as an architectural unit) and the kibbutz (as a self-sufficient functional unit). And here the module, as a mathematical-architectural element comes into its own as a generator of open spaces for collective activities.

Therefore, the module, the compact city, proportion, multifunctionality and social relationships can be seen as the basis that questions urban reality and joins together urban planning, architecture and mathematics.

**CONCLUSIONS**

Mathematics can be seen as objective truth and is therefore removed from the social situation and the surroundings. We may or may not like certain statistics, another aspect of math, and they may be right or wrong, but they reflect reality, represent proven facts and do not make moral judgments. However, how we interpret them is another question, as is how we are supposed to react to them.

With these elementary facts we enter in the world of mixed disciplines, which can only be a source of wealth, progress and advancing knowledge.

In Anna Bofill's Theory of Forms and its application to the projects carried out by the Taller de Arquitectura when she was a part of it we can see a clear example of how mathematics and its internal laws can be used as an intellectual game that tries to avoid the fortuitous (discretional) and keeps to the methodic in an attempt to point urban progress in the right direction.

**POST-SCRIPT: INTERVIEW WITH ANNA BOFILL**

Below we give some of Anna Bofill's reflections on her projects in the form of extracts from an interview kindly conceded to the authors in the summer of 2016.

*"In those ten years the Taller de Arquitectura was working on a number of alternatives to solve the housing problem in Spain. These alternatives were inherited from the 1933 Athens Congress and the CIAM, which proposed apartment blocks and towers for cheap housing along the lines of the model of a city in Le Corbusier's Ville Radieuse. This type of model was used for the buildings put up in the working-class districts of many cities after the Second World War. However, we rejected it out of hand at that time because it was an international solution that created the same impersonal surroundings wherever it was used and took absolutely no acount of the lives of the residents or of the "genius loci" (a term used by Professor Christian Norberg-Schultz in the title of his book, which also had an influence on our way of thinking). This thinking is expressed synthetically in "El Manifiesto del Diablo" and was the origin of our research on large-scale social housing and the models that could be used for designing districts and even whole cities (which I call residential units and urban settlements)."*

*"In ten years you can produce a lot of ideas, proposals, formal models, written theories and poetical writings, as well as films and musical works. I remember that the poet José Agustín Goytisolo wrote a whole book of poems entitled "Taller de Arquitectura" (published by Lumen, Barcelona, in 1977), which I recommend reading in order to better understand the essence of the ideas that we proposed, debated and agreed on as a group. Ours was by no means cold and functional work in response to commissions, but mostly projects we took on ourselves, with daily sessions of passionate debate in which we analyzed what we liked*

*about the architecture and urban planning of the time. We would think of possible solutions and ways of tackling the problems and then share the work out according to each one's capacities and knowledge."*

*"As for the forms themselves, which is the subject of your work, they were especially the result of the research done by Manuel Nuñez Yanowsky and me. We approached the subject from two different angles; he used intuition and trial and error, manipulation of volumes, cubes and parallelepipeds and others, while I tried to find a logical/mathematical/geometric sense to it all by finding out all that was taking place (in the 60s and 70s) in modular architecture and other disciplines like mathematical logic, linguistics (structuralism was then in vogue) and listening to Gabriel Ferrater explain generative grammar, interviewing Noam Chomsky in Boston, studying sociology, psychology (Skinner, among others), human geography (Henry Lefebvre, for example, and others), mathematics (Hermann Weyl, Eduard Bonet,etc.) and a long list of other topics."*

*"And now what? The door is still open, of course. I think this information is vital and so is the use of holistics in architecture and town planning, but I have the impression that no attention is paid to these areas in Spanish schools of architecture. I always insist on this: how can we influence or transform the places we live in without detailed knowledge of the characteristics they are composed of? How can you offer people somewhere to live if you know absolutely nothing about them? I think that this is the reason for the failure of the districts that have been built in our cities since the sixties, or of the cités of Paris, to give another clear example of how the surroundings have a negative influence on the people that live there.*

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**Acknowledgemts**

This work has been partially supported by the Department of Applied Mathematics of Universitat Politècnica de València (PID-DMA 2014 y PID-DMA-2016).