Influences of biological findings in the field of architectural theory and formal developments in the French landscape of the 1960's

"When we, as architects, look at the architecture of the past, we all, I believe, try to penetrate the secret. (…) We are concerned with criteria and processes: with the how, before all else. It is this, which is peculiar in our observation: we look in order to learn how it is done. The first thing we learn, often at our own expense, is that this secret does not belong to form in itself". Giorgio Grassi, 1983[1]

Giorgio Grassi, refers to search for form, where "the overcoming of practical difficulties and the definition of form are the same thing"[2]. This citation is important for us, in the sense that to understand the architecture of the French landscape and most largely, the architecture of the Team X during the 1960's, we have to understand the how, to understand what are the strategies behind, and how the knowledge and all the theories in other disciplines helped the architects of that time to rethink urbanism and architecture?

Open aesthetic

Dissatisfied by CIAM IX, CIAM as an institution and as a planning tool for the city, as "functional city",[3] George Candilis, with some others architects, organized some meetings to question the CIAM legacy. The main aim was to initiate a new methodology of practice around the question of the "habitat". These architects organized a tenth Congress : Team X.

During the different preliminary meetings, the search for a new form of urbanization, was presented by architects of the group, coming from all over the world, and most specifically, architects from the structuralist movement in the Netherlands, metabolists from Japan, brutalists, from France and England.

Candilis first presented his project for *Les Carières Centrales*, in Morocco, which was influenced by Michel Ecocahrd, chief of the Urbanism service of Morrocco. This project is a re-interpretation of the Kasbah models of aggregation. These aggregative shapes are used as a new way of urbanization by architects part of the Team X. This system is a process, which is not a composition anymore. It is an *open aesthetic*[4] as mentioned by Alison and Peter Smithson. This aesthetic is open, non-geometric'…), an aesthetic of "growth and change". Oskar Hansen will contextualize this concern in his lecture in Otterlo, in 1959, *The open form in Architecture – the Art of the great Number.* The open form is opposed to the Charte d'Athènes principles, which is a closed form, an attempt to define for once and for all[5].

1Grassi Giorgio, *Form Liberated, Never sought. On the problem of Architectural Design,* in Daidalos Vol.7, 1983, p.24

2Ibid, p.33

3

4Smithson Alison and Peter, *The Aestetics of Change »*, Architects Year Book, 8, 1957, p.14

5See Avermaete Tom, in *Team X 1953-1981, In search of a Utopia of the present,* Rotterdam, 2005, p.310

Following this theoretical principle of openness, inherent to most of the Team X architects since 1953, Alison and Peter Smithson will develop clusters projects, multifocal and aggregative structure, with the projects of Golden Lane, in 1953 and Berlin Hauptsadt, in 1957, Candilis-Woods-Josic, will define "stem" and "web" notions, with the Toulouse-le-Mitrail project. These processes are, as Lucan developed in his book, *Composition non-composition,* informals[6] and rhizomatic, following Gilles Deleuze and Felix Guattari later definition of a " system a-centered, non hierarchical (…) only defined by a circulations of state"[7]

This rhizomatic reference offers an opportunity to understand the architecture proposed by the Team X actors, in a different point of view than just focusing on the open aesthetic: the metaphor.

Alison Smithson, in an article in 1974, talking about Candilis-Woods-Josic Berlin University project, used the mat-metaphor to talk about this project[8].

Following O.M.Ungers, "metaphor as an instrument of thought serving clearness and vibrancy by avoiding the logical processes it opposes"[9] are applied by designers and architects and is uses as a generator in the design process. This is for us a way to understand architecture in the process of formation of a project and most particularly in the architecture of that time and that brings us back to Giorgio Grassi preoccupation on the how.

Metaphor as design generator

Relying on Rosario Caballero-Rodriguez, citing Jane Darke[10], metaphors in architecture are knowledge. They help architects to think a project and to translate it in a form. Metaphor plays a role of primary generator. It appeals to something that is outside the language of architecture that is an exteriority[11]. References used in architecture can be grouped following these principles : denotation-exemplification, expression and covered reference[12]. With denotation, the metaphor describes, represents, even imitates the world, but this one is re-invented by exemplification and expression. This re-interpretation, denotation-exemplification is for us what can bring together the architectural preoccupation of the TeamX. It can be translated by an open aesthetic, an open form, but also in a concept of growth and change, which refers to biological metaphor. Biological metaphors are one

6Lucan Jacques, *Composition, non-composition, Architecture et théories, XIX°-XX° siècles, PPUR, Lausanne, 2009, p.467*

7Deleuze Gilles and Guattari Felix, *Rhizome*, Paris, 1976, p.62

8Smithson Alison, *How to recognize and read Mat-Building/Mainstream as it developed towards the mat-building,* Architectural Design, 9, 1974, pp.573-590.

9Ungers O.M., *Morphologie : City metaphors,*Köln, Verlag der Buchhandlung Waler König, 1982, p.10

10See Caballero-Rodriguez Rodriguo in Gerber Andri, Patterson Brent, *Metaphors in architecture and urbanism,* transcript Verlag, Bielefeld, 2013, p.91

11Eisenman Peter, *Diagram Diaries,* Thames and Hudson, London, 1999, *pp.168-209*

12See younès Chris in Gerber Andri, Patterson Brent, *Metaphors in architecture and urbanism,* transcript Verlag, Bielefeld, 2013, p.268

category of metaphors used by architects. They appeal to life analogies[13].Relying Caballero-Rodriguez again; metaphors can also come from design textiles, mechanics, linguistic and/or music[14].

Clusters developed by Alison and Peter Smithson and the Candilis-Woods-Josic stem are indubitably organic principles of infinite growth and appeal to biological metaphors. This principle of growth is also a preoccupation of architects in Japan, crystallized in the Metabolist movement. Arata Isozaki for example, developed a cellular project under a form of cluster, in his project, *Clusters in the air in 1962.*This idea of a growing organism composed of cells aggregate emphasizes the metabolists conception of society performing as a biological system. The growing aspect inherent to a biological system are contained in the projects developed by the Metabolists[15] and also by the Team X architects. The growing principle has been developed earlier by Kenzo Tange, with his Tokyo Plan project. This one has been presented to Team X and influenced them in the idea of an open aesthetic, capable of growing. For Tokyo Plan, Tange used biological analogy: the brain nervous system[16]. The different connections of the nervous system are translated in multi-level city, composed like a web, a complex circulation system. These circulations form connections reminding Aldo Van Eyck- Candilis and Jaap Bakema's obsession.

The Metabolists biological interest is also showed visible in the work of Kurokawa. He participated to a Team X meeting in Royaumont in 1962. He presented a direct DNA-shape like project, *Helix city,* referring to the early discovery of the DNA by Avery. This direct interpretation refers to the concept of denotation described by Chris Younès.

Furthermore, Kurokawa in his "capsule declaration" [17]expands on the idea of spatial units and cellsthat he had worked with since 1959. This particular approach on cell is also present in Aldo Van Eyck's work. In the Amsterdam orphanage project, Van Eyck developed a project as a "cellular dynamic". This approach takes the form of a grid, but illustrates perfectly the structuralist movement developed in the Netherlands and the definition given by Deleuze. For Deleuze "elements of a structure have neither extrinsic designation nor intrinsic significance[18]. What matters is their position in ' a space truly structural, topological", knowing that "the scientific ambition of structuralism is not quantitative but topological and relational"[19].

This focus on cells, connections and relationships corresponds to a structuralist concern[20].

13Chupin Jean-Pierre, *Analogies et théorie en architecture,* Infoli*o,* Gollion, 2010, pp.46-71

14See Caballero-Rodriguez Rodriguo in Gerber Andri, Patterson Brent, *Metaphors in architecture and urbanism,* transcript Verlag, Bielefeld, 2013, p.93

15See Gow Marcelyn in Gerber Andri, Patterson Brent, *Metaphors in architecture and urbanism,* transcript Verlag, Bielefeld, 2013, p.204

16Ibid, p.206

17Kurokawa Kisho, *Capsule declaration*, in Kurokawa, 1977, p.84, originally published in Space design, March 1969

18Deleuze Gilles, *A quoi reconnait-on le structuralisme ?, in l'île déserte et autres textes, Textes et entretiens, 1953-1974*, Paris, 2002

19Ibidem

In biology this structuralist understanding knows an enthusiasm as well. In 1965 François Jacob, Nobel Prize of medicine, published his research in a book, *La logique du vivant.* His concern with the development of a living organism introduced the notion of *program*[21]. The genetic program is constituted by the essentially invariable combinatory of elements. The program contains also all the operations that transform a living species during his growth.

The combinatory of elements appears also further in Jacob's book: "To the general astonishing, a protein molecule, architecture of a rare complexity in three dimensions, is reduced to a structure of a particular simplicity in one dimension. (…) The complexity in the space is given by folding of the chain on itself(…). What confers to the molecule its specific form, it's the length of the chain, a hundred to a thousand units, et the sequence in which are contained these units. The diversity and the complexity are once again obtained by the simplicity of a combinatory"[22].

This combinatory process with a main concern for aggregative structures developed in Team X projects focusing on 3D complexity, connections influenced some other young brutalist architects in France : l'Atelier de Montrouge.

The advances in sciences especially in biology influenced this group of architects. They were aware of François Jacob [23]understanding of combinatory and 3D shapes in reading an article published in *Les Lettres françaises*[24]*.* This postulate, relied by Catherine Blain in her Phd thesis on the Atelier de Montrouge, brings us back to the influence of the biological findings in the field of architectural and formal development of the 1960's. Metaphor is used as a design generator in the design process to imagine new way of urbanization, interconnected and able to grow. This way of re-interpretating biological findings refers to denotation-exmplification and expression as mentionned.

Atelier de Montrouge

The theories conveyed by the Team X knew an enthusiasm with the young architects generation. This was made possible through working connection. The founders of the Atelier de Montrouge were in relation with George Candilis in Morocco for the project of les Carrières centrales. At that time they were interns for Michel Ecochard. Jean Renaudie joined Riboulet, Thurnauer and Véret later.

The team X concerns on dwellings containing the ability to stimulate some new human being relationships within the house, the village, the city, the metropolis and the region, engendered an interest in combinatory in the work of Atelier de Montrouge. Associations systems having the

---

20Lucan Jacques, *Composition, non-composition, Architecture et théories, XIX°-XX° siècles, PPUR, Lausanne, 2009, p.479*

21Jacob François, *La logique du vivant, une histoire de l'hérédité,* Gallimard, Paris, 1970, pp.11-17

22Ibid, pp.277-278

23Blain Catherine, *L'atelier de Montrouge (1958-1981), prolégomènes à une autre modernité, Université de Paris VIII, Phd, 2001, p.296*

24*Vivre et parler : un débat entre François Jacob, Roman Jacobson,, Claude-Lévy Strauss et Philippe L'Héritier, in Les lettres françaises, 14 février 1968, pp.3-7*

potential to create differentiated forms and places were explored in a first project: the CECA competition[25].

This competition was an answer to the exploration by the Atelier de Montrouge of Open form and progressive urbanism [26] emphasized by team X. This approach, relying Riboulet focused on the creation of forms that are able to engender themselves and to grow[27].

Following this idea of combining cells reminding Aldo Van Eyck's interest in cellular dynamic, this informal process of designing architecture is pursued through the Cap Camarat project. This project went further into the idea developed by Fançois Jacob that the simplicity of combinatory offers "architecture of a rare complexity in three dimensions". Indeed, the project explored with a dwelling program facing the sea, an aggregate of forms respecting the site topography. The third dimension – the slope, was a determinant parameter in the design process, reminding that the *program* contains all the operations needed for an organism (the project) to grow.

Going further in the combinatory process the Atelier de Montrouge was commissioned to design a library for childhood in Clamart. The circular shape was chosen and was assembled like an aggregate of cells. This is the first time that this circular shape appears in the work of the team. This system of aggregates offered an opportunity for the library to expand itself after ten years. Actually a ninth cell was added, reinforcing the conceptual approach of open form and designing a project that is able to grow like a living being.[28]

Those principles of exploring a system which is in the meantime open, flexible, progressive are again used to design the Gigaro project. The design also explored the assembly of circular cells. This project is particularly important in the development of the office because it marked a progressive detachment of Jean Renaudie who was in charge of the two former projects. His formal concerns of combinatory of cells explored in these projects were crystallized in his proposition for le Vaudreuil.

Le Vaudreuil

For this project the Atelier made three propositions. The first two ones met the preoccupation of unit combinatory assembly connected through a network. These connections are omnipresent and a multi-level city is created. Those designs remind the mat-metaphor presented by Alison Smithson and the Tokyo plan 1960 proposition by Kenzo Tange.

For the third proposition Renaudie developed another idea: a city on a hill. To achieve his goal he used the guidelines he explored in Gigaro and Clamart: the circular cells and the three dimensions assembly. On the competition panels Renaudie cited Claude Lévy-Strauss and the idea of structure with rings of variable dimensions to propose an "idea of a whole volume" was presented. The drawings illustrated the idea of the text by trying to construct complex organisms that announce the

25Blain Catherine, *L'atelier de Montrouge (1958-1981), prolégomènes à une autre modernité, Université de Paris VIII, Phd, 2001, p.107*

26Candilis Georges, *Le fond du problème,* AA n°130 « habitat », février-mars 1967

27Blain Catherine, *L'atelier de Montrouge (1958-1981), prolégomènes à une autre modernité, Université de Paris VIII, Phd, 2001, p.209*

28Ibid, p.218

new forms of the city. Renaudie's proposal seemed to be a transfiguration of the organic logic[29]. The plan resembled more and aggregate of cells federated by a whole organization than a building plan. The drawing is inspired by the cellular metaphor contained in the text and is translated in architecture through the process of denotation. The design generator borrowed from biology was metaphorically interpreted through the design process to produce an alternative order. Bénédicte Chaljub makes the hypothesis that Renaudie reached the "organic order" described by Wright where the part is integrated to give the impression of the whole.

According to her, Renaudie revived the architecture of the eighteenth century which was an art of imitation of the nature. Nevertheless Renaudie went further in his interpretation thanks to François Jacob understandings of living beings. Indeed the contemporary scientific thought of that time allowed Renaudie to think architecture as an organizational principle, a combinatory extracted from the microscopic scale. This way of thinking architecture relates the influence of scientific findings in the field of architecture in form shaping. They are used as metaphors to organize social life in new form of urbanization and is emphasized in Renaudie's work in this article, but were omnipresent in Metabolists, Structuralists and Brutalists architects fromTeam X.

This proposition for le Vaudreuil and May 68 events marked Renaudie's departure and he founded his own office.

Atelier Jean Renaudie

Following Chaljub in her thesis and Irenée Scalbert[30] we can see that Renaudie pursued his work through the explorations of the cellular combinatory in three dimensions. The spatial grammar is given and depends on the scale of the project: circular for urban scale and triangles for domestic scale. Vitrolles and Ivry-sur-Seine are an exemplification of that concern. Vitrolles explored once again the circular geometry and the biological principles developed for Le Vaudreuil. According to Chaljub[31] the design process does not invoke a vegetal growth like in Wright's projects, but is more an assembly of constructions in cascade obtained thanks to spatial connections. For Ivry-sur-Seine, Renaudie needed another metaphor to artificially create a geographical topography: the hill. This landscape metaphor is introduced to produce connections between the people and to explore one again aggregation with a simple spatial grammar that is omnipresent during the design process but express a complex organization in three dimensions, like François Jacob focused in his presentation of the protein molecule.

Conclusion

Through this article we tried to explore our hypothesis that biological findings influenced the field of architectural theory and formal developments in the French landscape of the 1960's. The development of our postulate connected the members of the Team X and their concerns with new form of urbanization. The structuralist approach in different domains allowed these architects to get

29Chaljub Bénédicte, *Les œuvres des architectes Jean Renaudie et Renée Gailhoustet 1958-1998*, Université Paris VIII, Phd, 2007, p.78-79

30Scalbert Irenee, *A right to difference : the architecture of Jean Renaudie,* AA Publications, London,2004

31Chaljub Bénédicte, *Les œuvres des architectes Jean Renaudie et Renée Gailhoustet 1958-1998*, Université Paris VIII, Phd, 2007, p.156

hold new way of thinking by theorizing their practice. In the case of Renaudie, François Jacob was his main inspiration. We also defined this way of thinking as an open aesthetic or as an informal process to cite Jacques Lucan. This non-compositionnal design method also refers to the use of metaphor as a design generator. The metaphor is omnipresent in the design process and allows architects to think a building and translates the preliminary ideas into drawn form. The metaphor generates creative, unexpected options lending the design process important and necessary intermediary momentum[32] and allows us to understand better the question of the how evocated by Giorgio Grassi, focusing our attention not on the form in itself, but on the processes of how architecture is thought and how it acquires meaning.

32See Schurk Holger in Gerber Andri, Patterson Brent, *Metaphors in architecture and urbanism,* transcript Verlag, Bielefeld, 2013, p.230