URBAN COMPLEXITY AND CONNECTIVITY: EMERGENCE OF GENERATIVE MODELS IN URBAN DESIGN

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URBAN COMPLEXITY AND CONNECTIVITY: EMERGENCE OF GENERATIVE MODELS IN URBAN DESIGN

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This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Architecture.

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Mert Ayaroğlu

ABSTRACT

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This thesis analyzes the changing design and planning strategies in the contemporary urban design area. The rapid improvements during the 20th century in complexity sciences and computer technologies have directly affected all the branches of design. In architecture, as in urban design, generative models, evolutionary design attitudes and computer based simulation tools have taken a significant role during the last few decades. In urban design, emerged in a period starting form the second half of the century, non-determinist, dynamic and self-organized design attitudes depending on naturalistic models have emerged as an alternative to determinist, static and reductionist approaches based on linear solutions.

In this study, it is aimed to define and evaluate these emerging contemporary approaches with respect to their antecedents and precedents. The study also searches for the conceptual and technical developments and background which support this process. With an analysis of case studies, the paradigm shift is examined in practice.

The study intends to clarify whether contemporary urban design approaches, especially naturalistic models could be an alternative to deterministic stances.

Keywords: Generative model, naturalistic model, evolutionary design, genetic algorithms, urban design.

ÖZ

KENTSEL KARMAŞIKLIK VE BAĞLANIRLIK: KENTSEL TASARIMDA ÜRETKEN MODELLERİN ORTAYA ÇIKIŞI

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Bu tezde çağdaş kentsel tasarım alanındaki değişen planlama ve tasarım stratejileri analiz edilmiştir. 20.yüzyıl boyunca karmaşıklık bilimlerinde ve bilgisayar teknolojisinde yaşanan hızlı ilerlemeler tasarımın her dalını da etkilemiştir. Mimarlık alanında olduğu gibi kentsel tasarım alanında da evrimsel tasarım yaklaşımları ve bilgisayar tabanlı üretken modeller özellikle son birkaç on yıldır önemli rol oynamaya başlamıştır. Kentsel tasarım alanında yüzyılın ikinci yarısından itibaren doğalcı modeller temeline dayanan, determinist olmayan, dinamik, ve kendiliğinden örgütlenen tasarım anlayışları lineer çözümlemelere dayanan determinist, statik ve indirgemeci yaklaşımlara bir alternatif olarak öne çıkmaya başlamıştır.

Bu çalışmada çağdaş eğilimlerin emsalleri ve öncülleri ile birlikte tanımlanmaları ve değerlendirilmeleri amaçlanmıştır. Ayrıca bu süreci hazırlayan kavramsal ve teknik gelişmeler ve altyapı da incelenmiştir. Örnek projeler ile de bu paradigma değişikliğinin pratik yönleri ortaya konmuştur. Çalışmadaki esas amaç, iddia edildiği gibi çağdaş kentsel tasarım anlayışlarının ve özellikle doğalcı modellerin

determinist tasarım yaklaşımına bir alternatif oluşturup oluşturamayacağının sorgulanmasıdır.

Anahtar sözcükler: Üretken model, doğalcı model, evrimsel tasarım, genetik algoritma, kentsel tasarım.

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INTRODUCTION

1.1 Shifting approaches in planning and design

The contemporary context of design and planning is seen to alter the traditional design understanding day by day. At every scale, new techniques including non-deterministic and self-organized attempts are seen to replace deterministic design approaches. In general, the design problem can be said to be evaluated more process-oriented than product-oriented. Today, within the computational environments mathematical models can be used for generating the design of evolving forms and structures in morphogenetic processes. In contemporary architecture as in urban design, the use of generative models, genetic algorithms and dynamic analysis transform the design problem into a continuous open-ended process rather than deterministic process of decision-making. In recent years architecture, engineering and urban design have been preoccupied with processes for the mathematical generation of forms in physical and computational environments.

Actually in urban design, the advent of contemporary approaches is not oriented to solving simple design problems. In order to deal with the complexity of city structures, non-linear and self-organized models far from determinism have been evaluated. Opposing the traditional view of cities as centralized and static, the new kind of city is no longer fixed and organized, but is becoming more fluid, more dynamic and much more complex. With linear, strict and deterministic models, it becomes almost impossible to explain such complex systems. The specific image of a fixed and bounded form leaves its place to dynamic, unbounded processes.

Contemporary urban form, in this instance, can not be characterized by static and isolated objects, but is conditioned by a network of flows. With different modeling techniques, the real development process of the city is tried to be reconstructed at the very outset of the process of design. By using different generative modeling methods, the nature of its growth is tried to be analyzed. Contemporary projects present many technical and conceptual differences with respect to precedent ones, but at the same time it can be noticed that most of the concepts used today, such as flexibility, self-organization, or non-reductionism have appeared in these latter projects nearly half a century ago. Therefore the study will stress the parallelism between recent approaches and their antecedents, and to this end, relate a historical background for urban design starting from the early 20th century.

The following chapter attempts to establish historical relations between recent approaches and their historical background by a selection of possible antecedents in practice and in theory, and starts with a discussion of some projects from the early 20th century that have been formed by using strict control mechanisms. In a second place, the Situationist Movement and Constant Niewenhuys' New Babylon project will be presented as a strong critique of such determinist approaches. This project is also important since it has many conceptual parallels with recent urban design projects that will be presented. On the conceptual side of the determinist design understanding, the critiques and solutions advanced by the two theorists Jane Jacobs and Christopher Alexander will be clarified. Some contemporary projects will be presented as an introduction to the reflection of recent concepts in practice.

1.2 Transformation in Control Mechanisms in Planning and Urban Design

New design policies aim to achieve a continuous, non-linear, and open-ended urban growth according to evolutionary and complexity models. Complex systems standing far from prediction, determinism and equilibrium conditions have thus

begun to take place in urban design.[1] An alternative to deterministic systems, open systems would establish a dynamic relationship between the determining forces of design and the emergent qualities of evolving systems.[2] With the improvement of digital tools, motion and time became central design parameters for the articulation of non-linearity, dynamism, and flexibility with respect to environmental variables. Instead of pre-determined final results, process oriented designs, which develop and emerge during every level, are seen to take the lead. With the techniques of computational dynamics, evolutionary and fluid models develop and oppose rather static and additive ones. Time and environment responsive models are generated in order to state flexible and dynamic systems. Computer models based on complexity theories and evolutionary biological models have started to be used to understand the formation and coherence of urban form, as well as to simulate the development of these forms. In addition to a selective historical background introduced in chapter II, chapter III evaluates the scientific and conceptual background of computational technologies and complexity sciences in order to clarify the development and improvement of generative modeling techniques.

1.3 Project Surveys and Discussion

The last chapter of the thesis will focus on some applications of contemporary urban design approaches, analyzed in two projects as case studies. The first project is Zaha Hadid Architects' winning competition entry for "Kartal Sub-Center and Kartal-Pendik Waterfront Urban Transformation Project" competition in 2006. The second project is KOL/MAC Studio's (Şulan Kolatan and William MacDonald) Project MUTEN İstanbul proposal for the Galataport Area in İstanbul, developed and presented at an exhibition at Garanti Galeri İstanbul in June 2006. Both of them have been selected because of their use of generative and

[1] Rahim, Ali (guest editor). Architectural Design: Contemporary Processes in Architecture, vol. 70, no 3, London: Wiley Academy, 2000.

[2] Hensel, Michael , Menges, Achim and Weinstock Michael (guest editors). "Emergence in Architecture", Architectural Design: Emergence: Morphogenetic Design Strategies, vol. 74, no 3, London: Wiley Academy, 2004.

naturalistic models as new tools in urban design. Another reason for their selection is that they have been proposed for very problematic regions of İstanbul, and during the last few months they have taken an important place in the Turkish architectural and planning agenda. These case studies are intended to embody the theoretical discourse about generative models in urban design. Although both of them are conceptual projects it is important to analyze them critically in order to understand and discuss the ways they propose new visions for urban design.

CHAPTER 2

A SELECTIVE OVERVIEW OF 20TH CENTURY APPROACHES TO URBAN DESING

2.1 Contemporary Approaches in Urban Design and Planning

Like in other branches of design, urban design has undergone great changes during the 20th century. Besides technological and conceptual shifts, social and economical conditions have also changed considerably during this period. Especially the rapid improvement of computer technologies in the last few decades directly effected design strategies at every scale. Different from the beginning of the century, today almost all the stages of design and planning procedures are highly complex and computer-based. Not only the way of producing (designing) has changed but also a more important transformation has taken place in the evaluation of urban problems. Dynamic, adaptable and flexible design tools and methods show their affect increasingly from day to day. But of course this paradigm shift developed within a long process. At that point it is important to explain how the urban design approaches transformed during the century and also it is important to state the similarities and differences between contemporary approaches and their precedent stages.

In contemporary design approaches, one can observe a paradigm shift from modernist planning techniques to dynamic and natural modeling techniques which show self-organized and flexible behaviour. In other words there is a shift from standard to non-standard design understanding.[1] In this paradigm shift there are numerous important changes. There is an increasing tendency for non-

[1] Mennan, Zeynep. "Des Formes Non Standard: Un 'Gestalt Switch'." (Of Non Standard Forms: A 'Gestalt Switch), Architectures Non Standard, in Migayrou, Fréderic and Zeynep Mennan, (eds.), Paris: Editions du Centre Pompidou, 2003.

determinism and naturalization in design approaches. Theoretical and conceptual changes and different ways of producing and analyzing information take place in architectural and urban design area.

The most important change in urban design is the appearance of generative approaches and non-determinist strategies. Generative models used in urban design are self-organized, adaptable and flexible systems. This process oriented design understanding is radically different than product-oriented ones. These dynamic and generative techniques turn the design problem into an ongoing continuous process. During this process with generative models, it is tried to simulate the real development of urban areas and analyze the natural process as much as possible. In all these contemporary techniques it is accepted that the city is a complex structure and it is tried to understand the environmental effects and the adaptation and transformation of the structure against these affects.[2]

As a critique within modernism it has been realized that it is impossible to deal with the problems of the city with modernist planning approaches based on static, non-flexible and determined control mechanisms, since the city is evaluated as a complex system.[3] As a result of the principle of sensitivity to initial conditions, which is one of the characteristics of chaotic systems, determinist models are almost useless in these kinds of systems.[4] As much as the system's degree of complexity increases, it becomes non-linear and dynamic. When we consider the complex structures of cities and urban areas, and the multiple and often complex effects of environmental factors and other variables, it seems clear that there will be no analytical solution for such complex systems. Instead of searching for linear solutions, it is better to control the development processes of complex and chaotic

[2] Rahim Ali. 2000.

[3] Jacobs, Jane. The Death and Life of Great American Cities. New York: Random House, 1961.

[4] Prigogine, Ilya. The End of Certanity. New York: The Free Press, 1997.

systems with the most realistic simulations of their natural behaviors: Such models can be called as "Natural Models".

As remarked by Zeynep Mennan, the evaluation of the city as a complex system is not a new understanding.[5] It has indeed generated within the modernist discourse. However, one can note that during the 20th century, the rational comprehensive planning understanding and master plan approaches, where the city is conceived as a static, predictable and linear organization, have been common. In this planning strategy strict control mechanisms are tried to be applied according to determinist predictions about the city. According to the consideration that cities and urban areas are predictable systems, long term predictions and control mechanisms are expected to work as long as the system conditions stay stable. Although there were self critiques in the modernist period for determinist planning strategies as well as attempts to decrease strict control mechanisms, today's understanding is seen to be totally different from these initial critiques. In most of the alternative strategies against rational planning, the solution is thought to decrease the degree of control in order to create flexible and non-determinist urban systems.[6]

Similarly, the main idea behind the contemporary approaches is to evaluate the city as a non-determinist, flexible and dynamic system without decreasing the level of control. On the contrary, with improvements in complexity sciences and computer technologies, it is tried to apply more control over the system however in a non-deterministic way. With creating generative and naturalistic models it is tried to simulate the real dynamics of urban areas, and with the control over these models it is tried to achieve flexible and dynamic systems that could show

[5] Mennan, Zeynep. Doğallaştırma Süreçleri Üzerinden Bir Sergi Okuması: Project MUTEN, Kol-Mac Studio. (Naturalization Processes in Urban Design: The MUTEN Project by Kol-Mac Studio), İstanbul: Garanti Galeri, 26 June 2006.

[6] Nieuwenhuys, Constant, and Debord Guy. "The Amsterdam Declaration", Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996. p.80.

adaptability to changing environmental parameters in a non-deterministic but predictable way.[7]

These evolutionary behaviors and generative models take their bases and their main logic from the complexity of nature itself. This however is not a formal imitation of living organisms like what is understood commonly in the 'organic' tradition of design. With this model it is tried to simulate the evolutionary processes that an ecological system makes its own according to its nature. The main idea behind the generative and evolutionary models is Nature itself.[8]

Although, most contemporary approaches show several technical and conceptual differences from their precedents, many parallelisms can also be observed. Some contemporary influential concepts such as flexibility, self-organization and non-determinism have started to appear nearly a half century ago. By means of these terms, some discourses of the Situationist movement or Constant's New Babylon project situated around a similar ideology with contemporary urban design strategies. Non-reductionism for instance takes shape in the Situationist movement, where, opposing deterministic and static approaches, the city has been evaluated as a dynamic, flexible and non-deterministic system. As a continuation of the Situationist movement, Constant's *New Babylon* forms probably the most significant project displaying flexible, dynamic and non-determinist structures. Although never constructed, its complex organization depending on motion, openness and indeterminacy marks a strong reference point announcing contemporary complex, non-reductionist models.[9] Similarly, concepts such as emergence, organic growth, and incrementalism were highly expressed by the theoreticians during the 60's. As it will be explained in detail in the following

[7] Rahim, Ali. 2000.

[8] Mennan Zeynep. 2006.

[9] Wigley, Mark. "Paper, Scissors, Blur", The Activist Drawing: Retracing Situationist Architectures From Constant's New Babylon to Beyond. Cambridge, Mass.: MIT Press, 2001.

chapters, Jane Jacobs' evaluation of the city as "disorganized complex system" states a breaking point in design and planning understanding.[10] Also Christopher Alexander's theories about the holistic organic structure of cities can be argued to be an antecedent for contemporary naturalistic models.[11]

After the 1970's, parallel with improvements in computer technologies and complexity sciences, new design concepts such as generative and evolutionary models have emerged. In the beginning these contemporary tools were only thought as new ways of representation, but today there is no doubt that design and control mechanisms especially in the field of urban design have totally changed. And with an increasing tendency this paradigm shift in architectural and urban design is taking place in recent designs and realizations. But it is important to state parallelisms and differences between the contemporary approaches and their precedents. Because none of these contemporary approaches have appeared in a single day, there is a historical background behind the improvement of today's design strategies including several cross-relations between the different stages of this process. One can not think of a linear improvement: During the 20th century, according to conceptual and technological developments, design and planning understandings have also showed an evolution.

2.2 The Determinist Approaches in Urban Design and Planning

Starting from Ancient times, it was one of the biggest problems in cities to deal with a disordered city structure. During thousands of years, the problem of the uncontrolled growth of cities has kept its validity and different solutions have been offered with the tendency of keeping the city structure under control and creating ordered city plans. Miletus could be one of the well known early examples of this tendency. When it is thought that Miletus is dated to the Bronze Age, it becomes clear that the design or control problem in cities is older than

[10] Jacobs, Jane. 1961.

[11] Alexander, Christopher. A New Theory of Urban Design. New York: Oxford University Press, 1987.

3000 years.[12] Richard Sennett states that, Hippodamus of Miletus is known to be the first urban constructor to have considered the grid as an expression of his culture in the 5th Century B.C.[13] According to him; the grid expressed the logic of civilized life. In the history of western urbanism, the grid has been used when making a start in a new location or in rebuilding places that once existed but was ruined as a result of some disaster. Sennett argues that, "the fact that the grid system has been used throughout history shows that this pattern which looks rigid in form has in fact a flexible and neutral structure. In modern times, the grid has been used as a plan neutralizing the environment".[14] Spiro Kostof defines the grid as a conceptual formal order, which is non-hierarchical and neutral until it is infused with specific content where it is as well repetitive, homogeneous, and even redundant: "The grid is what you make it."[15]

It is important to stress however that the ancient and modern uses of grid geometry are different. Like all the other variables for cities, the use of grid-iron system has changed in time. Kostof argues that: "No better urban solution recommends itself as a standard scheme for disparate sites, or as a means for the equal distribution of land."[16] In Delirious New York, Rem Koolhaas evaluated the grid as a "conceptual speculation which makes the history of architecture and all previous lessons of urbanism irrelevant."[17] He adds that:

> "The Grid's two-dimensional discipline also creates undreamt-of freedom for three dimensional anarchy. The Grid defines a new balance between control and de-control in which the city can be at the same

[12] Bayhan, Susan. Priene,Miletus & Didyma. İstanbul: Keskin, 1998.

[13] Sennett, Richard. Gözün Vicdanı. Trans.: Süha Sertabiboğlu, and Can Kurultay, İstanbul: Ayrıntı Yayınları, 1999.pp. 65-66.

[14] Ibid.

[15] Kostof, Spiro. The City Shaped: Urban Patterns and Meanings Through History. London: Thames and Hudson, 1991. p.157.

[16] Ibid. p.95.

[17] Koolhaas, Rem. Delirious New York. New York: The Monacelli Press, 1994. p.20.

time ordered and fluid, a metropolis of rigid chaos."[18]

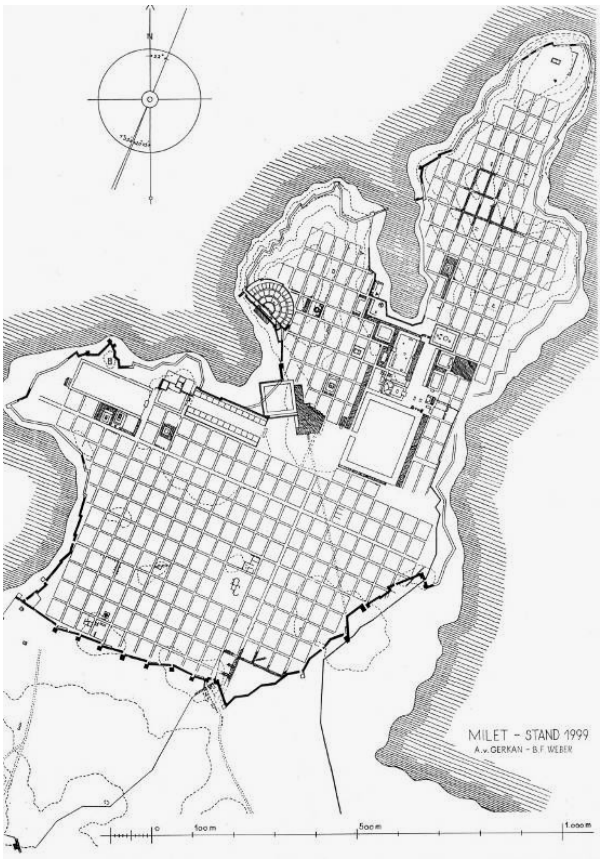

Figure 1: Grid Iron Plan of Miletus.

Poéte, Marcel. Introduzione All'Urbanistica: La Citta Antica, ed.Giulio Einaundi. Torino: 1958. fig.90.

As problem of the modern period the actual need of control over the city structures has started after the Industrial Revolution which has brought a radical transformation. It could be said that the modern urban planning approach has arisen in the 19th century, to deal with the slum areas that appeared after the Industrial Revolution, accompanied by a spontaneous and unprecedented urbanization. In order to reorganize the whole structure of cities and their

[18] Ibid.

development, strict control mechanisms have been preferred by most city planners at the end of the 19th century and during the first decades of the 20th century. They also tried to organize the cityscape according to the so-called 'blueprints' or utopian projects depending on strict geometries.[19]

2.2.1 Urban Utopias of the Early Twentieth Century

Jane Jacobs observes that that in the early 20th century, there has been a strong influence of the rational comprehensive planning idea based on determinist calculation and control mechanisms in urban planning.[20] Within this approach cities have been thought as predictable social and physical systems, and it was believed that they would show long-term repetitive behaviour and growth. At the same time most of the planners and designers have been evaluated as technical and social experts and hence their analyzes and predictions were stated as authoritative bases for designing urban areas.[21] Most of the time urban policies have been developed according to determinist rational models and planners acted as single decision makers. Static models as such, have then been tried to be developed for the cities, and predictions projected as to their future structure. Determinism and control was in maximum range and they were based on allegedly perfect calculations about urban dynamics for the future projections.[22]

Depart from the geometrical flexibilities, the grid iron plans of big American cities could be evaluated as the first reflections of such static and deterministic approach to the design of urban areas. It could be said that especially in the beginning of the 20th century, from some aspects the grid-iron system was considered as a static and rigid design tool in urban planning on the contrary of its

[19] Choay, Françoise. The modern city: Planning in the 19th Century. New York: George Braziller, 1969. p.8

[20] Jacobs, Jane. 1961.

[21] Ibid.

[22] Ibid.

flexible geometry. Strict divisions on urban areas and strong zoning policies have set the basis of planning. With the influence of Modernist idea, the functionalist approaches and zoning policies in planning increased their effect.

Figure 2: Part of the New York City Plan – Grid Iron Structure

Google earth image

Figure 3: Part of the San Francisco City Plan – Grid Iron Structure

Google earth image

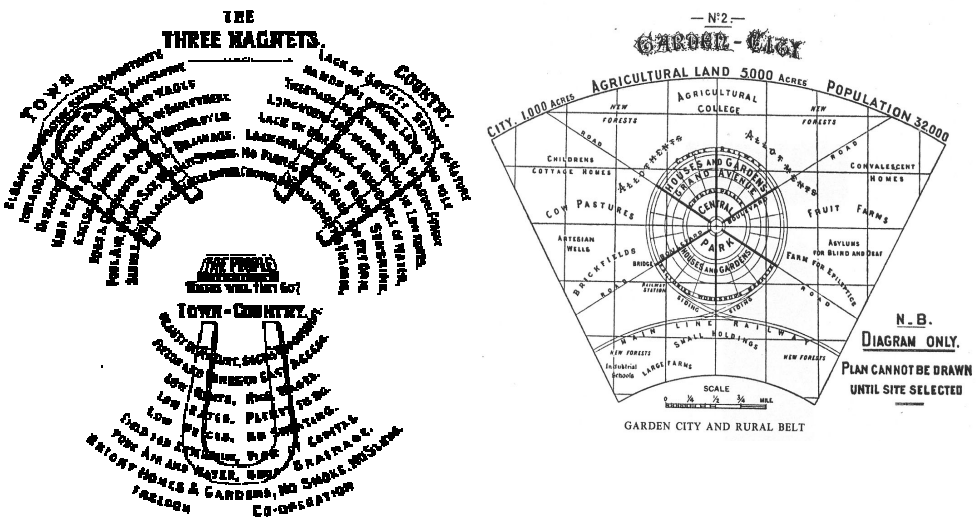

Figure 4: Ebenezer Howard's "Three Magnets" diagram and The Garden City surrounded by its agricultural belt, 1902.

Howard, Ebenezer Sir. Garden Cities of Tomorrow. ed. with a pref. by F.J. Osborn, with an introductory essay by Lewis Mumford, London: Faber and Faber, 1965.

Actually, The Garden City movement which has taken place at the end of the 19th century in England could be seen as another precedent to the determinist urban design understanding with its strict geometrical structure. Sir Ebenezer Howard was the founder of this movement. In his book "Garden Cities of Tomorrow" he proposed a model for lower density suburban development surrounded with agricultural lands as permanent green belts.[23] His proposal, summed up in the diagram of "Three Magnets", could be evaluated as one of the first applications of the zoning principle.[24] He argued that industrial areas should be separated from residential areas and such a zoning approach was new for that time.[25]Ebenezer Howard's contribution was "the Garden City", a plan for moderate decentralization and cooperative socialism. Robert Fishman evaluates the

[23] Howard, Ebenezer Sir. Garden Cities of Tomorrow. ed. with a pref. by F.J. Osborn, with an introductory essay by Lewis Mumford, London: Faber and Faber, 1965.

[24] Ibid.

[25] Ibid.

symmetry of the Garden City as the symbol and product of cooperation, the sign of a harmonious society. [26]

Following Howard's Garden City proposal, an important urban planning started to take shape with the Modernist movement in the early 20th century. The idea of modernism in architecture and in urban planning has been strongly defined with the series of International Congresses of Modern Architecture (CIAM). The first congress had taken place at La Sarraz in 1928, and the functionalistic view of urbanism has first been declared there. In the final declaration it has been written that: "Urbanism can no longer submit exclusively to the rules of a gratuitous aestheticism. It is functional by its very nature and the three primary functions that urbanism must fulfill are, dwelling, working and recreation."[27] In the third congress in Frankfurt, 1930 CIAM members criticized garden cities as being incapable of meeting the requirements for a rational healthy and fruitful life: They claimed that garden city solution leads to a scattering of dwellings and to the complete alienation of certain inhabited areas.[28] Instead, they suggested high rise housing blocks for more functional dwellings.

And at the fourth International Congress of Modern Architecture in 1933 which had been assembled with the theme of "The Functional City", functionalism and zoning principles have been set with the declaration of the "Athens Charter".[29] The charter directly suggested rigid functional cities with high, widely-spaced apartment blocs and green belts which would separate each functional zone of the city and these apartment blocks.[30] Four functions for the city –dwelling, work,

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[26] Fishman, Robert. Urban Utopias in the Twentieth Century: Ebenezer Howard, Frank Lloyd Wright, Le Corbusier. Cambridge, Massachusetts: The MIT Press, 1982. p.8.

[27] Le Corbusier, The Athens Charter: IV International Congress for Modern Architecture. Trans. from the French by Anthony Eardley, New York: Grossman Publishers, 1973. p.7.

[28] Ibid. p.20.

[29] Ibid.

[30] Ibid.

recreation, transportation- were evaluated as four keys to urban planning.[31] As one of the pioneers of the modernist movement, Le Corbusier had an important position in the process of the Athens Charter. Most of the main arguments of the Charter have also constituted the basis for Le Corbusier's urban design projects.

Figure 5: Le Corbusier's "Ville Contemporaine" (The Contemporary City), 1922.

Last accessed in November 2006.
<http://commons.wikimedia.org/wiki/Image:Citt%C3%A0_per_tre_milioni_di_abitanti.jpg>

"Ville Contemporaine" (The Contemporary City) was one of his early urban proposals which projected to house three million inhabitants in 1922.[32] The main part of this project was formed by sixty-storeyed cruciform skyscrapers which were a combination of glass and steel. They were set in within large, rectangular park-like green spaces. At the very centre was a huge transportation center that on different levels included depots for buses and trains, as well as highway intersections and at the top, an airport. The main transportation vehicle had been thought as automobiles.[33] Fishman claims that, For Le Corbusier's urban goal,

[31] Ibid.

[32] Le Corbusier. L'Ouvre Complète. vol.1-8, Basel, Boston: Birkhäuser, 1999.

[33] Le Corbusier. L'Ouvre Complète. vol.1-8, Basel, Boston: Birkhäuser, 1999.

"putting the world in order", is expressed here by pure forms. The Contemporary City is a perfectly symmetrical grid of streets where the right angle reigns supreme.[34]

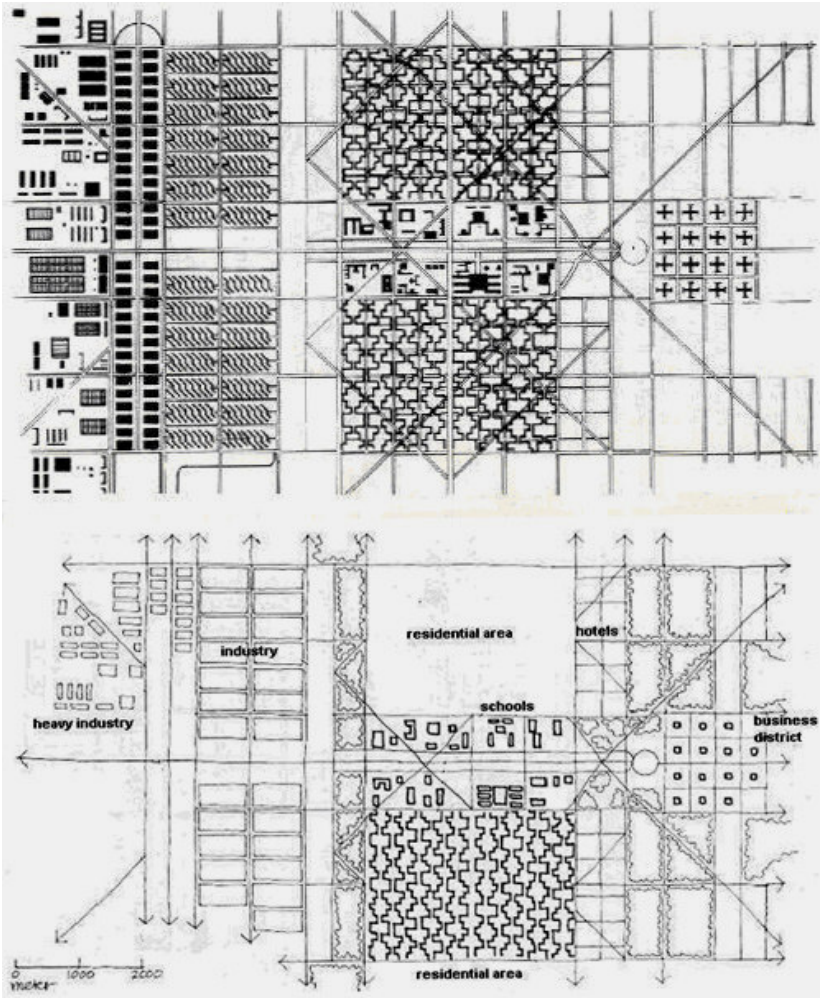

Figure 6: Le Corbusier's Ville Radieuse, 1935.

Last Accessed in November 2006
<http://home.worldonline.dk/jgkjelds/radieuse2.jpg>

[34] Fishman, Robert. 1982. p.190.

Figure 7: A scale model of the Le Corbusier's Plan Voisin for Paris, 1925. The Seine and Ile-de-la-Cité are the lower right.

Fishman, Robert. Urban Utopias in the Twentieth Century: Ebenezer Howard, Frank Lloyd Wright, Le Corbusier. Cambridge, Massachusetts: The MIT Press, 1982.

Figure 8: Le Corbusier's Plan for Anvers, 1933.

Hamburg University, last accessed in November 2006
http://www.tu-harburg.de/b/kuehn/lec2.html

Le Corbusier had some other important urban proposals such as the Plan Voisin for Paris-1925, Project for Anvers-1933 and Ville Radieuse-1935. Similarly in these proposals, his main functionalistic idea and strictly ordered way of design could easily been seen. Fishman states that for Le Corbusier the design of cities was too important to be left to the citizens. Le Corbusier argues that: "The organic city, the city that emerged slowly as the result of many individual decisions, was a thing of the age when carpenters built their own houses and artisans created their own handicrafts." And in the Machine Age, strict designs and applications are needed for the efficiency and beauty.[35]

Simon Sadler defines the "rigid functionalism" of modernist planning approach in these sentences:

> "Modernism's extension through town planning to the larger urban realm was like a diagrammatic representation of the forces of functional separation –housing, work, recreation and traffic, to use CIAM's (Congres Internationaux d'Architecture Moderne) famous 'four functions' of 1933- a Cartesian fixation that outlawed space for any nonprogrammed activity, while accelerating the circulation of labor and commodities into a circle of productivism."[36]

These pioneer planners in the beginning of the century saw the problems of society and of the economy in mostly physical terms, suggesting a physical or spatial solution in terms of a particular arrangement of pure forms and structures.[37] But there have been different attempts. Another important figure in urban planning theory, Patrick Geddes's (1854-1932) contribution to planning was to ground it firmly on a realistic study, a close analysis of settlement patterns

[35] Ibid. p.190.

[36] Sadler, Simon. "The Indeterminate Utopia", Architectural Design: New Babylonians, vol. 71, no 3, London: Wiley Academy, 2001. p.89.

[37] Hall, Peter. Urban and regional planning, New York: Routledge, 2002. p.53.

and local economic environment. Geddes evolved the method of urban survey at the beginning of the twentieth century. His working method was characteristically based on the survey of the region, followed by an analysis of the survey, and only then by the actual plan. Peter Hall notes that Geddes, more than anyone, has given planning a logical structure.[38]

But none of these projects during the early 20th century could bring effective solutions to urban problems. The major problem was that most of the planners and urban theorists had formulated urban systems as simple and static problems. Actually starting from the early 30's, critiques started to be directed against the Modernist urban planning which was formulated with determinist and strict design strategies which are not time-vised flexible.[39] Alternatives and new urban design models have then been discussed. More importantly, cities started not to be considered as just simple systems.

2.3 Critical Approaches in Urban Design and Planning in the Second Half of the Twentieth Century

It could be said that the fourth CIAM congress where the Athens Charter had been declared, was the peak of functionalism and determinism. After that point it became obvious that urban systems were not simple enough to be taken into consideration in terms of static and simple functions. So starting from the 40's, critiques and new alternatives were begun to be developed.[40] In the 1950's, strong critiques through Modernist architecture and urban planning have appeared. It was argued that the modernist idea had ignored human needs and the psychological function of the environment. In 1954, one of the declarations of The Lettrist

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[38] Ibid. p.43

[39] Sadler, Simon. 2001.

[40] Andreotti, Libero, and Costa Xavier (Eds.). Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996.

International asked "what does Mr. Le Corbusier know about human needs?"[41] Starting with this Situationist critique, during the second half of the 20th century, architects and urban theoreticians worked on the elaboration of non-deterministic and generative models of architecture and urban design.

2.3.1 Situationist Movement

Strict and determinist control mechanisms for the city have been questioned also during the 1950's. As a critique of modernist thought, the "unplanned city" tendency was introduced. Especially with the Situationist movement, these oppositions strongly affected architecture and city planning. The Situationist International was founded by Guy Debord, Constant Nieuwenhuys and Gil Wolman in 1956. They structured all their ideology over the concept of "Unitary Urbanism" which had been defined as "the theory of the combined use of arts and techniques for the integral construction of a milieu in dynamic relation with the experiments in behaviour."[42] Situationists argued that, the functionalists had ignored the psychological function of the environment.[43] So they created psychogeographical maps and worked with these maps on existing city structures. Situationists define psychogeography as "the study of the specific effects of the geographical environment, consciously organized or not, on the emotions and behavior of individuals."[44]

Sadler argues that "Classic Modernism had assumed that architectural revelation would be achieved by contemplation of the fixed and ideal architectural object, but situationism promoted architecture as an event and situation which could only

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[41] The Lettrist International. "Skyscrapers by the Roots", Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996. p.44.

[42] Unsigned. "Definitions", Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996. p.70.

[43] Jorn, Asger. "On the Current Value of the Functionalist Idea", Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996. p.34.

[44] Unsigned. 1996. p.69.

be realized by the active involvement of the subject."[45] It could be said that the main principle of the situationist city was unitary urbanism. It was a "city constituted of grand situations, between which the inhabitants would drift, endlessly".[46] At 1958, in the third Situationist International Conference, the "Amsterdam Declaration" has been written by Guy Debord and Constant Nieuwenhuys, which consisted of eleven points setting out a minimum definition of Situationist action; according to that declaration unitary urbanism was defined as "the complex, ongoing activity which consciously recreates man's environment according to the most advanced conception in every domain."[47]

Situationists defined their position against static and non-flexible urban scapes in these sentences:

> "We believe that all static, unchanging elements must be avoided and that the variable or changing character of architectural elements is the precondition for a flexible relationship with the events that will take place within them."[48]

Mark Wigley states that this new way of urbanism exists in time, and differently from static urban parts as it was used to before, it is the activation of the temporary, the emergent and the transitory, the changeable, the variable, the immediately fulfilling and satisfying.[49] As Sadler argues, "Unitary Urbanism rejected the idealistic quest for fixed forms and permanent solutions that had been

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[45] Sadler Simon. 2001. p.89.

[46] Sadler, Simon. The Situationist City, Cambridge, Mass.: MIT Press, 1998. p.117.

[47] Nieuwenhuys, Constant, and Debord Guy. "The Amsterdam Declaration", Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996. p.80.

[48] Nieuwenhuys, Constant. "The Great Game to Come", Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996. p.63.

[49] Wigley, Mark. "The Great Urbanism Game", Architectural Design: New Babylonians, vol. 71, no 3, London: Wiley Academy, 2001. p.9.

the basis of traditional town planning."[50] According to him, situationist architects projected a city based not on functional order but on purposeful disorder, while the precedent unitary cities had tended to be idealizing, classicizing, and rationalizing.[51] He also claims that Le Corbusier's "Ville Contemporaine" could be thought as one of these precedents.[52]

As one of the founders of the Situationist movement, Constant Nieuwenhuys defines their conception of urbanism as social. He states that; "We are opposed to the conception of a 'ville verte', a 'greened town' where well-spaced and isolated skyscrapers must necessarily reduce the direct relations and common action of men".[53] This social sensibility is important since in none of today's pioneer design approaches there seems to be such kind of social or political tendencies; rather they are exclusively based on computational theories. Situationist movement did not only propose new formal and planning solutions, but it also had a strong commitment to social issues that directly related with the way of living and the social conditions. In the city this social aspect would become more important in Constant's New Babylon.[54] However, although the situationists had strong theories about the city, these could never be realized and stayed as proposals. There was also another problem related with the fact that the situationist idea of non-planned city was standing closer to urban chaos than urban freedom.

2.3.2 Constant Nieuwenhuys and the New Babylon

A follower of the Situationist movement, Constant Nieuwenhuys developed the "New Babylon" project at the very beginning of the 60's, a utopian model that has

[50] Sadler Simon. 1998. p.120.

[51] Ibid. p.120.

[52] Ibid. p.120.

[53] Nieuwenhuys, Constant. "Another City for Another Life", Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996. p.94.

[54] Ibid.

been designed as an alternative to the modernist city structure.[55] Constant had been one of the founders of the Situationist International Movement with Guy Debord.[56] But later he quit the SI in order to work on a utopian city project: the "New Babylon". Although he developed this project separately from the situationists, the idea of situationism has also stated the basis for New Babylon. At 1958, he exhibited the first drawings and models.[57] "New Babylon" was the first project that used concepts such as openness, flexibility, indeterminacy, and heterogeneity in urban design and opened new visions in this era.[58] And in many respects it can be evaluated as a precedent of contemporary urban design projects since there are similarities such as the importance given to flexibility, self-organization and adaptability. Like the Situationists' maps, New Babylon covers the city and the earth's surface, suspended high above the ground on huge columns. All transportation including automobile traffic is isolated on the ground, beneath which trains and fully automated factories are buried. Also, the ground remains free for agriculture, wild nature and historical monuments. Enormous multilevel structures, 5 to 10 hectares in area, are strung together in a chain that spreads across the landscape.[59] The system consists of continuously interconnected "sectors" which are the main living spaces of the project. As Simon Sadler noted, New Babylon sectors could be imagined as "abstractions" of the ambiance discovered by psychogeographers in existing cities.[60]

The basic elements of the network, the "Sectors" are autonomous units of construction and the sector network creates a continuous space. Since it covers all

[55] Andreotti, Libero. 1996.

[56] Ibid.

[57] Sadler, Simon. 1998. p.127.

[58] Zegher, Catherine and Wigley, Mark (Eds.). The Activist Drawing: Retracing Situationist Architectures From Constant's New Babylon to Beyond. Cambridge, Mass., MIT Press : 2001.

[59] Nieuwenhuys, Constant. "New Babylon: An Urbanism of the Future", Architectural Design: New Babylonians, vol. 71, no 3, London: Wiley Academy, 2001. p.14.

[60] Sadler, Simon. 1998. p.139.

earth's surface and there are no more boundaries for national economies, New Babylon has a flexible structure that can grow endlessly.[61] Wigley explains how, the spaces are interlinked in a labyrinthine network that spreads itself across the earth's surface as one immense building. Although this specific form of play, any randomness in the project is removed. "All the drawings are controlled images of an uncontrolled space."[62]

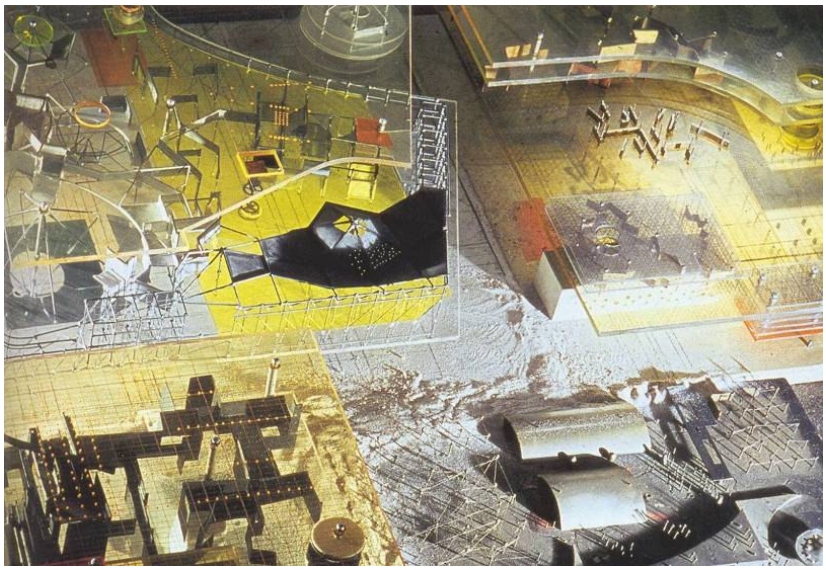

Figure 9: Constant Nieuwenhuys' New Babylon, Combination of Sectors, 1971

Zegher, Catherin. "Introduction", The Activist Drawing: Retracing Situationist Architectures From Constant's New Babylon to Beyond. Cambridge, Mass.: MIT Press, 2001. 113.

Constant Nieuwenhuys was sharply critical of modernist planning schemes influenced by earlier utopian proposals of Ebenezer Howard, CIAM or especially the works of Le Corbusier.[63] Opposing rectangular grids, formal master plans or

[61] Nieuwenhuys, Constant. "New Babylon", Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996. p.158.

[62] Wigley, Mark. "Paper, Scissors, Blur", The Activist Drawing: Retracing Situationist Architectures From Constant's New Babylon to Beyond. Cambridge, Mass.: MIT Press, 2001. pp.29-31.

[63] Ibid.

blueprints, he proposed a highly complex system without any strict geometry but claiming refined control systems that permit symbiotic, ever-evolving relationships between people and architecture.[64] Colin Fournier states that, in Constant's approach master plans and Euclidean geometry were totally rejected and that there would be no rectilinear grid.[65] The utopianism of New Babylon is therefore not directed towards presenting an ordered vision of the city. It does not present a formal plan or blueprint to be realized in the future, nor a vision based on a harmonious arrangement of space and society.[66] The freedom which Constant had in his models and drawings made it easier to create the real freedom which had to be developed in New Babylon.[67]

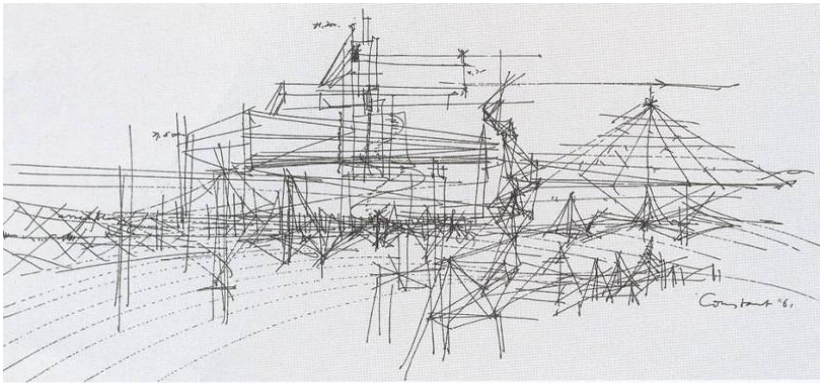

Figure 10: Constant Nieuwenhuys' New Babylon, Untitled, 1961-1962.

Zegher, Catherin. "Introduction", The Activist Drawing: Retracing Situationist Architectures From Constant's New Babylon to Beyond. Cambridge, Mass.: MIT Press, 2001. 64.

[64] Pinder, David. "Utopian Transfiguration: The Other Spaces of New Babylon", Architectural Design: New Babylonians, vol. 71, no 3, London: Wiley Academy, 2001.

[65] Fournier, Colin. "Webbed Babylon", Architectural Design: New Babylonians, vol. 71, no 3, London: Wiley Academy, 2001. p.76.

[66] Pinder, David. 2001. p.19.

[67] Wigley, Mark. 2001. p.29.

Constant was not only proposing a new architectural or urban structure but also organizing a new kind of urban life. According to David Pinder, space for Constant is understood in social and political terms.[68] So New Babylon could not be evaluated as separate from its social and political claims. Beside its spatial qualities, this proposal projected a new way of living. As a result of its physical and social aspects, New Babylon could be evaluated differently from other utopias. Pinder explains about this by stating that, "Utopian dreams about cities are often dismissed for being necessarily authoritarian with their fixed plans and proposals for spatial forms.[69]

It is interesting to note the similarities between the social and physical network of New Babylon and today's World Wide Web system. Catherine de Zegher states that Constant conceived of an urban model that literally envisaged the World Wide Web.[70] Constant also defined the culture of the utopic city of New Babylon, as based on a lifestyle grounded in the notion of freedom He stated that this culture resulted from the global activity of the whole world population and that every human being had a dynamic relation with his surroundings.[71] Sadler notes that: "Constant created New Babylon at something of binding the cities of the world together; it would literally have been the global village."[72] Actually what Sadler called as "global village" has been created with the improvement of the "world wide web" where all boundaries and distances have been destroyed. The whole world now acts as a global village in the virtual space.

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[68] Pinder, David. 2001. p.19.

[69] Ibid.

[70] Zegher, Catherine. "Introduction", The Activist Drawing: Retracing Situationist Architectures From Constant's New Babylon to Beyond. Cambridge, Mass.: MIT Press, 2001. p.10.

[71] Nieuwenhuys, Constant. "New Babylon", Theory of the Derive and Other Situationist Writings on the City. Barcelona: Museu d'Art Contemporani de Barcelona, 1996. p.157.

[72] Sadler, Simon. 1998. p.147.

One other thing which is very important in the contemporary realm is that Constant had developed his project with hundreds of drawings, models, and photographs. But there was no differentiation of sketches, draft copies, or working models. Drawings were not a transitional stage in the production process; they were the entire project itself. Drawing is not a transitional stage in the production process, nor does it imply come at the very end. There are no final renderings of a completed scheme, no presentation drawings.[73] Why is it that important? Because with the shift into digital design techniques which are far from determinism and predictability, in most of the projects the "process" has become more important than the "product". All the design stages have become process oriented. This process oriented approaches could be easily seen already in the New Babylon, so with this aspect it was again very far from the other examples of its period. Similarly Sadler argues that Constant's dynamic labyrinth could be thought as anticipation through real architecture of the possibilities which computerized cyberspace offered us a few decades later.[74] Constant defined that:

> "New Babylon is one immeasurable labyrinth. Every space is temporary, nothing is recognizable, everything is discovery, everything changes, and nothing can serve as a landmark. Thus psychologically a space is created which is many times larger than the actual space."[75]

Nothing was static and deterministic in New Babylon; both the physical and social life had an exact freedom and flexibility. As it is said, Constant did not only propose a new approach to urban design, but he also proposed a new social system, a new way of living, easily seen in the effects of Constant's Marxist ideology.[76]

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[73] Ibid. p.32.

[74] Ibid. p.147.

[75] Ibid. p.143.

[76] Ibid.

Constant had worked on his project almost ten years but it could never be realized. Even, sometimes it had been criticized as being nothing more than Le Corbusier's "pilotis, his open plans, and his inclination to lie waste".[77] But it is obvious that New Babylon opened a new perspective in urban design with its revolutionary physical and social aspects. Although it stayed just as a "paper project", with the new ideas it has brought such as flexibility, openness, adaptability, New Babylon became an important antecedent to contemporary examples.

2.3.3 Jane Jacobs

Peter Hall claims that by the end of the 1960s there has been an increasing volume of protest at the inhumanity of the new high blocks especially questioning the whole philosophy of massive urban renewal which was essential to the realization of Le Corbusier's ideas.[78] The urban theorist Jane Jacobs was one of the sharp opponents of determinist approaches in urban planning. In her first book "The Death and Life of Great American Cities", she has severely criticized the 1920's and 1930's city planning theory by self-positioning against the orthodox city planning theory, evaluating cities as 'organized complex organisms'.[79] Since she believed that the city is a living organism, an eco-system which has a complex structure, it could not be seen as either a simple or a disorganized complex system as most modernists believed. She argued that city processes in real life are too complex to be routine.[80] And she suggested that over time, buildings, streets and neighborhoods function as dynamic organisms, changing in response to how

[77] McDonough, Thomas. "Fluid Spaces: Constant and the Situationist Critique of Architecture", The Activist Drawing: Retracing Situationist Architectures From Constant's New Babylon to Beyond. Cambridge, Mass.: MIT Press, 2001. p.99.

[78] Hall, Peter. Urban and regional planning, New York: Routledge, 2002. p.52.

[79] Jacobs, Jane. The Death and Life of Great American Cities. New York, Random House: 1961: 431-432.

[80] Ibid. pp.431-441.

people interact with them.[81] Hence, Jacobs was strongly against the static and deterministic city planning approach of the early 20th century. Similarly she was sharply criticizing Ebenezer Howard's Garden City theory which had been influential in the early 20th century. She was complaining that Howard had formulated the city as a problem with two variables; the quantity of housing and the number of jobs and also the town and greenbelt relationship. She claims that, successful large urban elements possess a rich internal complexity and an enormous number of links to adjoining urban elements.[82] She argued that such an idea of two-variable relationship could never be applicable for big cities. Within this respect, Jacobs considers also Le Corbusier's Radiant City vision, as a vertical and more centralized version of the two-variable Garden City.[83] About tendency in planning theory for predictability, Jacobs claims that:

> "Beginning in the late 1920's in Europe and in the 1930 in America, the city planning theory began to assimilate the new ideas on probability theory developed by physical sciences. Planners began to apply the probability theory in physical science as if cities were understandable purely by statistical analysis, predictable by the application of probability mathematics, manageable by conversion into groups of averages."[84]

Jacobs argues that the city cannot be thought in terms of 'simplicity' or of 'disorganized complexity' that is complete randomness. The city is defined as organized complexity, as an "organism that is replete with unexamined, but obviously intricately interconnected, and surely understandable relationships."[85] And from her point, a city is fundamentally a living organism which contains the

[81] Ibid.

[82] Ibid.

[83] Ibid. pp.435-436.

[84] Ibid. p.436.

[85] Ibid. pp.435-439.

organization of many different functions with complete interlinkages and exhibiting a holistic behaviour. She argues that all problems related with natural organisms are certainly complex problems but not problems of disorganized complexity. These are problems which involve dealing with a sizable number of factors which are interrelated into an organic whole so according to progresses in life sciences they are evaluated as problems of organized complexity. As far as she argues that cities have many variables interrelated into an organic whole they can be seen as organized complex systems.[86]

Similarly, Charles Jencks states that a city is not particularly a question of functional zoning, or dividing areas up into "five functions" –living, circulating, recreating, governing- or "simplicity". [87] Michael Mehaffy has a similar point of view since he argues that, it was clear even then that the problems of the human environment were in many respects emergent problems of "organised complexity".[88]

2.3.4 Christopher Alexander

Christopher Alexander was one of the theoreticians who worked on the concepts of natural/organic growth phenomena, incrementalism, and the concept of the 'growing whole'. Starting from the 1970's, he began to question the complexity and the wholeness of city, especially in his book "A New Theory of Urban Design". [89] He argues that the city shows an organic and ongoing growth and he was one of the first to express such concepts as incrementalism, unpredictability and emergence that are quite influential in contemporary approaches. Zeynep

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[86] Ibid. pp.432-433.

[87] Jencks, Charles. The Architecture of the Jumping Universe: A Polemic: How Complexity Science is Changing Architecture and Culture. London: Academy Editions, 1995. p.26.

[88] Mehaffy, Michael. "Codes and the Architecture of Life", Katarxis No3, last accessed in February 2006
<http://www.katarxis3.com/Mehaffy_Codes.htm>

[89] Alexander, Christopher. A New Theory of Urban Design. New York: Oxford University Press, 1987.

Mennan and Emel Aközer argue that Alexander's piecemeal approach may well be regarded as an alternative to utopian, blueprint and rational comprehensive plannings.[90] He evaluated the city as an unpredictable whole which shows piecemeal growth and where parts are strongly interconnected.[91] Parallel to developments in complexity sciences, Alexander also developed and updated his holistic and incrementalist theory of urban design in his latest book "The Nature of Order", where holism is seen to relate directly to emergence. [92] He believes that, "every increment of construction in the growing city must be designed to preserve wholeness at all levels, from the largest level of public space, to the intermediate wholes at the scale of individual buildings, to the smallest wholes that occur in the building details".[93] He states that "every new act of construction has just one basic obligation: it must create a continuous structure of wholes around itself".[94] In order to state the wholeness for the process of growth he argues about the necessity of the following seven rules:

1. Piecemeal growth
2. The growth of larger wholes
3. Visions
4. The basic rule of positive urban space
5. Layout of large buildings
6. Construction
7. Formation of centers[95]

But still his arguments are seen to remain visual analyses between city structures or some other architectural objects and natural formations, rather than statements for organic or complex model proposals. In addition, some of his arguments are

[90] Aközer, Emel, and Mennan Zeynep. "Urban Design as a Learning Process", Stüdyolar, Ankara: ODTÜ Mimarlık Basım İşliği, 1995. 20-29.

[91] Alexander, Christopher. 1987.p.14.

[92] Alexander, Christopher. The Nature of Order: An Essay on the Art of Building and the Nature of the Universe. Berkeley, California: Center for the Environmental Structure, 2002.

[93] Alexander, Christopher. 1987.p.29.

[94] Ibid. p.22.

[95] Ibid. p.30.

not so relevant with today's situation or the concepts that this thesis focuses on. Firstly he argues that: "The whole is unpredictable. When this piecemeal growth starts coming into being, it is not yet clear how it will continue, or where it will end, because only the interaction of the growth, with the whole's own laws, can suggest its continuation and its end."[96] The concept of wholeness still keeps its currency but not as being unpredictable. So at that point Alexander's model of wholeness is different from today's understanding of wholeness which is defined as self-organized bodies controllable with naturalistic models. While he was defining the whole as an unpredictable process with its own growth, contemporary projects are trying to predict this ongoing process with naturalistic models. Genetic algorithms and naturalistic models are used to state the development of systems. So it is tried to make it possible to get the necessary information about this growing process. What Alexander calls "organic" is somehow unpredictable, self-growth. But all the unpredictability and randomness are tried to be eliminated in today's approaches. What is tried to be achieved today is to create natural development models of urban systems in order to simulate and control urban growth. On the other hand, Alexander specifically focuses on the importance of the "whole" in urban areas. According to Alexander the whole is coherent, not fragmented, and its parts are also whole.[97] Actually his approach to city structure as a whole system is somehow similar with Jacobs's approach. This approach to see the city as a whole still keeps its importance for today's urban design and planning understanding.

Alexander also pays attention to what he calls the 'organicness' of city structures but his understanding is very different from the concept of "organic" in today's architecture and urban planning. He states that, "when we look at the most beautiful towns and cities of the past, we are always impressed by a feeling that

[96] Ibid. p.14.

[97] Ibid.

they are somehow organic."[98] Because of the geometrical properties and of the zoning principles especially enforced with the Athens Charter, he evaluates the artificial cities as problematic. Alexander claims that: "When compared with ancient cities that have acquired the patina of life, our modern attempts to create cities artificially are, from a human point of view, entirely unsuccessful."[99] It could be claimed that his organic approach is more related with the organicity of ancient or medieval city patterns. Alexander explains his idea of organic as:

> "This feeling of "organicness" is not a vague feeling of relationship with biological forms. It is not an analogy. It is instead, an accurate vision of a specific structural quality which these old towns had… and have. Namely: each of these towns grew as a whole, under its own laws of wholeness… and we can feel this wholeness, not only at the largest scale, but in every detail."[100]

Alexander's organic idea stays largely formal in his establishment of similarities or relations between natural forms and city structures, and is not totally convincing in the contemporary era where the evolutionary characteristics derived from nature are considered more important than the direct formal similarities. It is however important that he introduced more than twenty years ago these concepts and problems intensively dealt with in present discussions.

2.4 Contemporary Solutions for Urban Design: Lars Spuybroek-NOX and Ali Rahim-CAP

After the explanations about the critiques of determinist approach before going into detail of the conceptual and technical improvements, it is important to briefly see the contemporary situation of urban design with some examples. In order to

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[98] Ibid. p.2.

[99] Alexander Christopher. ""A City is not a Tree", Design After Modernism: Beyond the Object, Thackara, J. (ed.), London: Thames and Hudson, 1988. pp.67-84.

[100] Ibid.

clarify today's approaches, some projects, which are directly related with the concepts appeared in the critiques of determinism, will be analyzed briefly. Both Alexander and Jacobs developed strong theories as an alternative to determinist planning but these theories could not always find practical application. The proposals of the Situationists and Constant's New Babylon, were standing against strict control mechanisms and suggested that these control mechanisms be decreased: The city structure should act its own development. But within the contemporary situation, the relation between urban design and control mechanisms is being evaluated differently. It could be said that there is a tendency to increase the control over the designed model, which does not amount to increase determinism and prediction. On the contrary, it is tried to state that the city's organization would show a sustainable development by its own by reacting to necessary adaptations and flexibilities following environmental factors and other parameters. Differently from some decades ago, today environmental parameters are directly processed in generative models in order to understand the complex behavior of the city and prepare for self-organized, adaptable, flexible and dynamic urban design projects. Most of the recent projects aim to generate complex environments that continue to evolve through adaptation. Achim Menges defines this process as "adaptiogenesis".[101] Adaptation is based on evolutionary and generative modifications and is the process of the continuous adjustment of a system to environmental factors. Contemporary generative models or approaches based on the 'emergence' concept are based on the principle of more control but less determinism and prediction. Modeled after nature but in a different way, evolutionary models are organized for different processes. This scientific discourse will be discussed in detail in the following chapter. But it seems useful to review briefly in a first place, some projects as an introduction to the techniques and approaches used in contemporary practice.

[101] Menges, Achim. "Morpho-Ecologies: Approaching Complex Environments", Architectural Design: Emergence: Morphogenetic Design Strategies, vol.74, No.3, London: Wiley Academy, 2004. p.83.

In the realm of contemporary production, NOX-Lars Spuybroek and Contemporary Architecture Practice (CAP)-Ali Rahim, are just two of the architectural teams working in this lead, developing projects using complex computational tools. *Offtheroad-5speed* and *Paris Brain* projects of NOX and *Main Street-Houston* and *Confluence of Commerce* projects of CAP are significant works that use generative modeling techniques and computational tools in order to design dynamic urban spaces.

Lars Spuybroek's (NOX) works are inspired from Frei Otto's early experiments in form finding. In the early 1990's Frei Otto and his group studied what they called "optimized path systems".[102] Actually these were similar to the experimentations of Gaudi's chain modeling techniques.[103] According to Otto, "analogue computing" techniques create a machine which finds a form.[104] It is important that, while analogue computing techniques have certain flexibility, a certain amount of freedom to act, this freedom is at the same time limited to a certain degree by the structure of the machine itself.[105] Spuybroek uses Frei Otto's wool threads model in order to calculate the shape of two-dimensional city patterns, arguing that in this system there is no randomness but only variation.[106]

One other important subject both Otto and Spuybroek deal with are "Wet Grid" and "Dry Grid" Systems. Spuybroek defines the classical Greek Grid (which he calls as a "Dry Grid") as a system which separates infrastructural movement from material structure.[107] This means that the structure is solid while the movement is liquid. On the other hand, Frei Otto's "Wet Grid" is one in which movement is

[102] Spuybroek, Lars. "The Structure of Vaugness", NOX, Machining Architecture, New York: Thames & Hudson, 2004. p.352.

[103] Ibid. p.352.

[104] Ibid. p.352.

[105] Ibid. p.352.

[106] Ibid. p.354.

[107] Ibid. p.354.

structurally absorbed by the system. Spuybroek works on Wet Grid systems in order to create dynamic spatial relations that would show adaptable behaviour to environmental parameters.

Off-the-road-5speed is one of NOX's non-standard prefabricated housing projects in Eindhoven with an integrated approach to the design of large-scale urbanist structures and the small scale of the house and its interior within one continuum of five interrelated levels, like machines.[108] Here dynamic diagramming appears as a determinant method for organizing the whole housing scheme based on mass-customization. In every scale, from the biggest to the smallest, all "speeds" which are taken as a major variable of the project, are absorbed by interactive, variable, responsive systems. These dynamic systems never reach to equilibrium since all movement on the moment of freezing is passed on to the next stage like a changing of gear. The 5 levels –urbanism, typology, program, manufacturing, living- are thought of as 5 gears and as a result of this dynamic, generative process, mass customized housing settlement has been developed.[109] The social aspects of the project could be evaluated as remarkable. A flexible urban system contributes to the improvement of the quality of daily life.

Paris Brain is an another NOX research study of open and flexible urbanization programs with total unpredictability developed after Frei Otto's "wet grid" system. [110] For the 2001 exhibition "Experiences d'urbanisme: Visions des Pays-Bas" at the Institut Néeerlandais in Paris, NOX has set up an installation that used intensive techniques in an experimental way. [111] Using Frei Otto's "wool thread" system NOX tried to map the collective movements of the people in the area on

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[108] Spuybroek, Lars. "OfftheRoad_5Speed", Architectural Design: Architecture + Animation, vol.71, No.3, London: Wiley Academy, 2001. p.57

[109] Spuybroek, Lars. NOX, Machining Architecture, New York: Thames & Hudson, 2004. p.114.

[110] Brayer, Marie-Ange and Miyagrou, Frédéric (Eds.). ArchiLab: Radical Experiments in Global Architecture. New York: Thames&Hudson, 2001. p.180.

[111] Spuybroek, Lars. 2004. p.352.

the western part of La Défense in Paris.[112] NOX takes the movement as a variable for the model. In order to define the vectors that affect the whole system, hundreds of interviews are made with people around this area. This flexible and non-deterministic system makes it possible to model the unstable and living organism of the city which reorganizes and rearranges itself continuously. With the use of Wet Grid systems NOX tries to create constantly evolving and adapting design models.

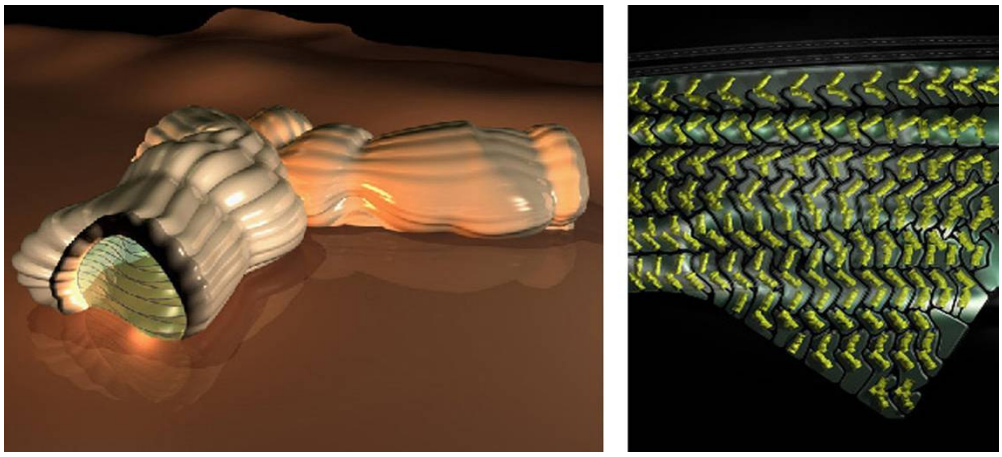

Figure 11: Lars Spuybroek-NOX's "Off the Road 5 Speed", 1999-2000.

Spuybroek, Lars. NOX, Machining Architecture, New York: Thames & Hudson, 2004. p.127.

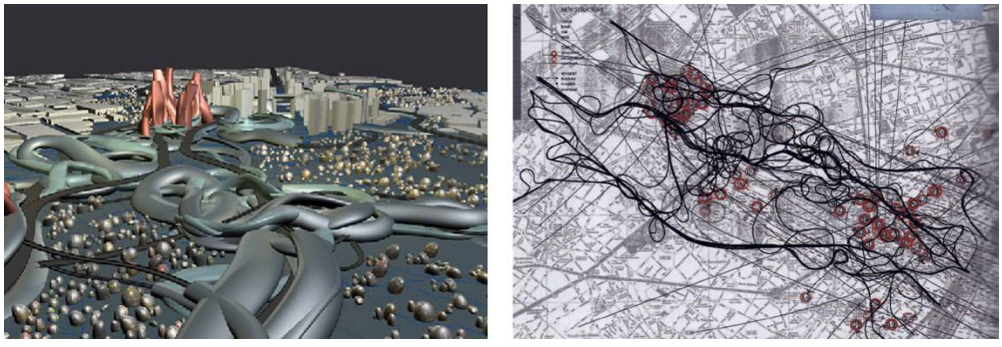

Figure 12: Lars Spuybroek-NOX's "Paris Brain", 2001.

Spuybroek, Lars. NOX, Machining Architecture, New York: Thames & Hudson, 2004. p.259.

[112] Spuybroek, Lars. 2004. p.354.

Another important architectural team working on digital design techniques in urban design is the New York based Contemporary Architecture Practice (CAP). *Main Street-Houston* is an invited competition masterplan project including twelve miles of re-design, where Ali Rahim and his colleagues diverged from the conventional rules of 'master planning' in order to dissolve the bounded limits of the city creating dynamic and adaptive models. A new urban landscape of fluid transformations and interconnected networks were developed.[113] Rahim mentions that, current technological developments in transportation and communication have led to changes in culture and lifestyles that call into question the limits of the city. This limitless city calls for new techniques of exploration.[114] Rahim uses computational dynamics, which can grow models that are evolutionary and fluid as opposed to static and additive. Dynamic systems can respond to the changing spatiality and complexity of the limitless city brought to the fore by new techniques of connectivity. Rahim argues architects and planners need to develop these techniques, distancing themselves from utopian proposals reflecting nostalgia for the past.[115]

Confluence of Commerce is another CAP project using animation techniques, and where the generative potentials of time-based parameters are investigated. Here, Ali Rahim specifically works on the concept of time and by using various animation techniques he tries to control the unpredictable, irreversible and qualitative character of time.[116] He questions the Newtonion approaches where time is qualitative and irreversible, and consists of linear duration.[117]

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[113] Rahim, Ali. "City: From the Definitive to the Unbounded", Architectural Design: Contemporary Processes in Architecture, vol. 70, no 3, London: Wiley Academy, 2000. p.19.

[114] Ibid. p.20.

[115] Ibid. p.25

[116] Rahim, Ali. "Irreducible Time: Machining Possibilities", Architectural Design: Architecture + Animation, vol.71, No.3, London: Wiley Academy, 2001. pp.28-35.

[117] Ibid. p.30.

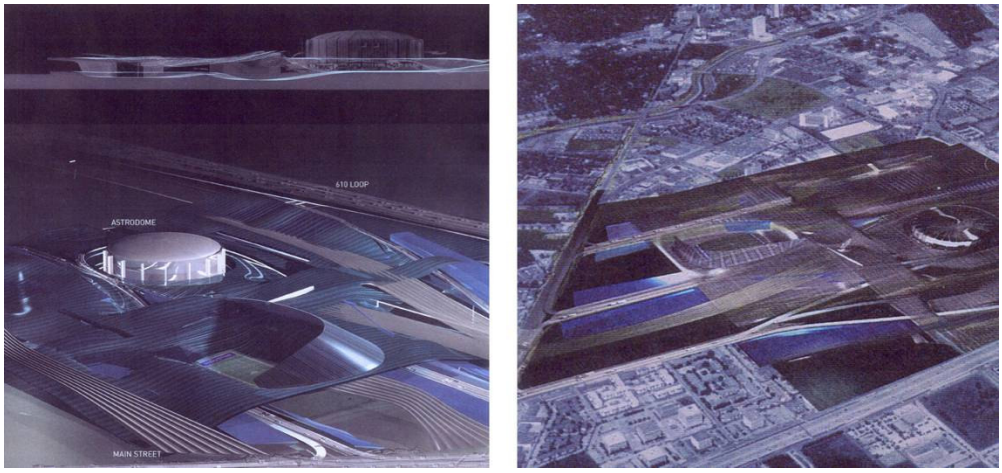

Figure 13: Ali Rahim-CAP's "Main Street" Project.

Rahim, Ali. "City: From the Definitive to the Unbounded", Architectural Design. vol.70, No.3, 2000. pp. 23-24.

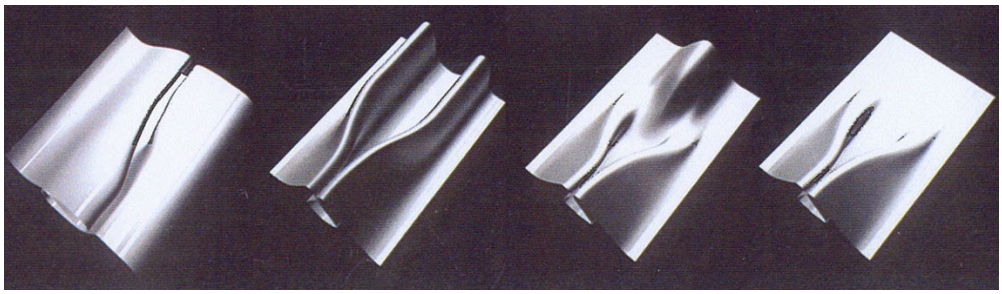

Figure 14: Ali Rahim-CAP's "Confluence of Commerce" Project.

Rahim, Ali. "Irreducible Time: Machining Possibilities", Architectural Design. vol.71, No.2, 2001. pp. 28-29.

Instead of strict urban analyses or determinist formal processes, in this project time- based animation techniques play the major role for urban analyses and design. Ali Rahim argues that the determinate materialism of time as a number needs to shift to the notion of a non-determinate, non-reversible temporality, and he also states that, "the qualitative duration between past and future maximizes generative potentials within the framework of non-linear, bottom-up animation techniques, and meets the objective world as actual machined forms of

architecture that are innovative, flexible in use yet precise."[118] This qualitative duration inhabits itself in the matrices of high-end animation software between the conceptualization of the initial idea and its material form. Non-linear, endogenic and bottom-up animations are no longer proportional to their causes but are unpredictable and emergent.[119] So these, time-based techniques make the whole project more process-oriented than product-oriented. Rahim explains about animations techniques and how the process became important: "Animations operate with spontaneity and develop traits simultaneously with the nonreversible directionality of temporality where the present and the past are simultaneous. The future is undecided but is bound by its past and makes present the process of having been.[120]

Both the *Paris Brain* and *Main Street* projects show a similarity in their use of economical parameters for the creation of generative models. As a result of their flexible and non-linear characteristics based on the concepts of motion, time, continuity, and information, these projects are compelling recent cases referring to the problematic of complexity theories at the urban scale. But it is hard to state whether they support the needs of urban areas or not since most of them could not yet be realized. Although they stay as "paper projects", it is obvious that they are bringing new perspectives to urban design. NOX and CAP's approaches to urban problems and the contemporary techniques they use state important reference points for the concepts and the case studies that will be explained further.

Besides these conceptual parallelisms, one can also observe a technological gap between contemporary projects and their precedents. But more importantly, the social content of different period's projects show significant differences. The utopian models of the Modernist project, and even most of the non-deterministic

[118] Ibid. p.35.

[119] Ibid. p.33.

[120] Ibid. p.33.

ones in the 1950's and 60's have had a strong political and social aspect. Besides their technical characteristics, they have also made social and political statements. Most of the non-reductionist models of the last few decades seem devoid of such social or political content. Instead, their technological/physical characteristics have become more articulate and pronounced. Contemporary design grounds on technological and theoretical developments that seem independent from social and political content. Mostly economical, information related or market-based variables are evaluated during generative modeling processes. As Ali Rahim argues, the dynamism of the city offers a rich potential for contemporary forms of urban development, relying on market economics to provide its emergent logic.[121]

[121] Rahim, Ali. 2000. p.20.

CHAPTER 3

THE DISCOURSE OF COMPLEXITY AND THE EMERGENCE OF GENERATIVE MODELS

3.1 Theoretical Discourse of Uncertainty

The naturalistic models and most of the other generative concepts that are used in contemporary architecture and urban planning are directly related with the shift from standard to non-standard approaches in design understanding.[1] Parallel with the developments in mathematics and physics, the appearance of the concept of "non-standard" has also effected the design era. This shift signifies above all a fundamental change in understanding and managing complexity, both in theory and practice. Manuel De Landa mentions that today's design process will be quite different from the traditional design understanding which operates within metric spaces."[2] About non-standard approaches, KOL/MAC Studio argues that: "while the former approach uses a reductive logic with regard to systems and their constituent elements, the latter recognizes that the emergent-adaptive behavior of complex systems is more than the sum of its parts, and thus has to be examined as a whole."[3]

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[1] The concept has been introduced to the field at the the International exhibition *"Architectures Non Standard"* at the Centre Georges Pompidou, Musée National d'Art Contemporain, Centre de Création Industrielle, December 10th, 2003-March 1st, 2004, Curators: Migayrou, Fréderic and Zeynep Mennan. For a conceptual elaborationof the non standard see the essays in Migayrou, Fréderic and Zeynep Mennan, eds. *Architectures Non Standard*. Paris: Editions du Centre Pompidou, 2003.

[2] De Landa, Manuel. "Deleuze and the Use of Genetic Algorithm in Architecture", Architectural Design: Contemporary Techniques in Architecture, vol.72, No.1, London: Wiley Academy, 2002. p.12.

[3] Kolatan, Şulan and MacDonald William (Kol/Mac Studio). "MUTuelle Environnementalite" ("MUTualistic ENvironmentality"), Architectures Non Standard, Migayrou, Frederic and Zeynep Mennan, (eds.), Paris: Editions du Centre Pompidou, 2003.

Starting from the beginning of the 20th century, the dominant techniques in urban planning and design assume a hard deterministic control over a limited selection of data that informs the design process. Michael Hensel and Johan Bettum argue about this deterministic control that, "the process moves more or less linearly from a preconceived idea of urban organization towards its pre-determined implementation."[4] They also believe that, "in this way, the process is closed to changes in the reference data or new information that can emerge in the process of the work, including transformed conditions, generated with the design process itself."[5]

But today it is a common point that the contemporary city has a very dynamic structure depending on flexibility, adaptability and mobility. So, it is understood that determinist control mechanisms fail dealing with such kind of a system. Instead, control mechanisms based on generative models within the naturalistic approach became dominant especially in urban design. [6] Related with the issue of unpredictability approach De Landa argues that:

> Our world is governed not only by nonlinear dynamics, which makes detailed prediction and control impossible, but also by nonlinear combinatorics, which implies that the number of possible mixtures of meshwork hierarchy, of command and market, of centralization and decentralization, are immense and that we simply cannot predict what the emergent properties of these myriad combinations will be.[7]

[4] Bettum, Johan, and Hensel Michael. "Channeling Systems: Dynamic Processes and Digital Time-Based Methods in Urban Design", Architectural Design: Contemporary Processes in Architecture, vol. 70, no 3, London: Wiley Academy, 2000. p.38.

[5] Ibid. p.38.

[6] Mennan, Zeynep. Doğallaştırma Süreçleri Üzerinden Bir Sergi Okuması: Project MUTEN, Kol-Mac Studio. (Naturalization Processes in Urban Design: The MUTEN Project by Kol-Mac Studio), İstanbul: Garanti Galeri, 26 June 2006.

[7] De Landa, Manuel. A Thousand Years of Nonlinear History. New York: Zone Books, 1997. p.273.

3.1.1 Complexity Sciences

In addition to new theories about contemporary approaches, developments and new inventions in complexity sciences again accelerate these attempts. Scientific improvements in chaos theory, fractal theory, evolutionary biology and generative models made it possible to create realistic modeling and simulations about urban areas, based on complex systems. According to Stacey's definition:

> "Complex systems, whether physical, chemical, biological or social, are creative –able to "learn" in complex ways and shift to new structures- only when they operate at the edge of system disintegration, in a kind a phase transition between a stable zone of operation and an unstable zone of disordered regime, referred to as chaos."[8]

As a result of chaos, neither the creative process itself, nor the outcome, can be planned or predicted. The links between antecedent conditions are not controllable or predictable.[9] Complex systems are non-linear but ordered systems. They can be chaotic or not.[10] Stacey also argues that, "the consequent effects are not necessarily random and chaotic because of an inherent order that emerges at the edge of chaos. This order does not occur according to a "blueprint" or prior determination; instead it is created out of the chaotic conditions themselves."[11]

At that point, it may be useful to explain briefly some concepts in complexity sciences since they also affect chaotic conditions. Actually, most of the time complexity sciences are dependent on chaos theory. For chaos it could be said that

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[8] Stacey, D. Ralph. Complexity and Creativity in Organizations. San Francisco: Berret-Koehler Publishers, 1996. p.60.

[9] Ibid. p.60.

[10] Çambel, Ali Bülent. Applied Chaos Theory: A Paradigm for Complexity. Boston: Academic Press, 1993. p.14.

[11] Stacey, D. Ralph. 1996. p.60.

whereas it is a situation, "chaos theory is the amalgam of methods useful to scrutinize non-linear, dissipative, deterministic problems that have randomness embedded in them."[12] Simply, the unpredictable dynamic systems or their behaviors are evaluated as chaos. One other important factor is that, chaotic or highly complex systems are far from prediction. Timur Karaçay states three reasons that prevent prediction for most of nonlinear dynamic systems. First of all, there is no analytical solution to the system and second any of the beginning conditions can not be absolutely specified. And this concept of undefined beginning conditions is called as "Uncertainty of Measurements".[13] Small changes in the beginning situations could cause greater differences during the process. Similarly, physicians define the concept of chaos as sensitive dependence on initial conditions. Henri Poincaré was the first one who established the negative effects of this concept over determinism.[14]

Classical Mechanics (Newton Mechanics) states the basis of determinism. Modern science is totally dependent on determinism and linearity as a result of Isaac Newton's three main laws of movement. About the effects of linearity in Modern sciences, De Landa claims that:

> When we think that the majority of equations used in science are linear and that a linear conception of causality dominated Western thought for over two millennia, we may be inclined to think that our lack of familiarity with questions of self-organized heterogeneity and our tendency to think about complexity in terms of homogeneous hierarchies derive from the way we represent the world to ourselves.[15]

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[12] Çambel, Ali Bülent. 1993 p. 194.

[13] Karaçay, Timur. Determinizm ve Kaos, Mantık, Matematik ve Felsefe II.Ulusal Sempozyumu, *Tema: Kaos,* Assos, 21-24 Eylül 2004:
<http://www.baskent.edu.tr/~tkaracay/agora/teblig/kaos.htm>

[14] Ibid.

[15] De Landa, Manuel. 1997. p.273.

Karaçay defines that according to determinism, the current situation of a physical system is the result of a previous one.[16] So it looks that, it is possible to determine every fact and movement beforehand as it was thought during the Modernist period. But as it has been explained before, in order to state determinism an analytical solution to the system as well as well defined initial conditions are needed, which looks impossible in the case of complex systems. Although it looks so easy, it is almost impossible for most of the systems in reality. This impossibility and all the unpredictabilities about complex systems create the phenomena of chaos.

Multivariability and the degree of complexity of systems are important in order to reach exact solutions. Karaçay defines that, when the physical systems get more complex, the number of variables in the differential equation which represent the system increase and as a result the system becomes multivariable. Also the system becomes non-linear since the degree of variables gets higher. Usually it is almost impossible to solve such complex systems. He argues that, this concept is the main reason why phenomena called as chaos can not be explained with conventional mathematic formulas.[17] Similarly, De Landa states the insufficiency of analytical tools for solving the non-linear equations. Unlike linear ones, as a part of complexity, there is a demand of computer to solve non-linear systems.[18] As a continuation of this situation, De Landa argues that:

> "This limitation of the analytical tools for the study of nonlinear dynamics becomes even more constraining in the case of nonlinear combinatorics. In this case, certain combinations will display emergent properties, that is, properties of the combination as a whole which are more than the sum of its individual parts."[19]

[16] Karaçay, Timur. 2004.

[17] Ibid.

[18] De Landa, Manuel. 1997. p.17.

[19] Ibid. p.17.

Henri Poincaré again was the first who used the term "chaos" to denote this unpredictable situation.[20] In 1900, he proved that the solution of the equation, which determines the movement of the solar system, is highly sensitive to initial conditions. In addition he also proved that, it is impossible to state whether the solar system is stabilized (determined) or not, since it is not possible to set the initial conditions perfectly.[21] So his arguments are so important for chaos theory and non-standard approaches.

Another important concept in chaos theory is "Self-Organization". Peter M. Allen defines that self-organization in physics or chemistry means stating "the equilibrium condition of the system according to the changes in external environment."[22] Related with this definition, self-organizing systems could be defined as flexible, dynamic urban structures, free from symmetry. There are multiple equilibriums in these systems, which can develop adaptations to environmental fluctuations.[23] In the case of urban planning Manuel De Landa formulates the difference between self-organized and planned cities not only as a formal difference but the difference between the decision making processes behind the genesis and subsequent development of that form. He states that: "The crucial distinction is between centralized and decentralized decision making in urban development."[24]

In the contemporary approaches to urban and regional planning, flexibility and adaptability of these complex systems take an important place. While urban and

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[20] Ibid.

[21] Ibid.

[22] Allen, Peter M. Cities and Regions as Self-Organizing Systems: Models of Complexity. Amsterdam: Gordon and Breach Science Publishers, 1997. p.16.

[23] Ibid. pp.16-20.

[24] De Landa, Manuel. 1997. p.30.

regional models (naturalized models) are derived from self-organizing systems in physics and chemistry, the key events in these models are the existence of spatial instabilities.[25] It is tried to create urban models that could show adaptability and long term stability against economical and populational instabilities. So the whole complex system should change and transform in favor of equilibrium.

Although they are evaluated most of the time on the formal basis, fractals are also important concepts in complexity sciences since they state a strong relationship between formal properties and mathematics. Fractals are tenuous spatial objects whose geometric characteristics include irregularity, scale-independence, and self-similarity.[26] Fractals can also be determined as geometrical figures that consist of an identical motif repeating themselves on an ever-reducing scale. It is a common argument that most of the large and complex urban areas show fractal growth during their developing processes in time. Nikos Salingaros quotes from Makse and Havlin that: "Urban evolution is a connective process on all scales; opposite of what a random process would be. And the geometry of built form as revealed by the natural uncontrolled growth of cities is fractal and not random."[27] Hans Lauwerier argues that, "the fractal structure of urban form becomes more apparent when the urbanized areas of a city, metropolis, or urban system are viewed as a whole."[28] The fractal dimension (degree) of urbanized areas can also be thought of as an indicator of the complexity or dispersion of urban form. According to Shen, the higher the value of a city's fractal dimension, the more complex or

[25] Ibid.

[26] Shen, Guoqiang. "Fractal Dimension and Fractal Growth of Urbanized Areas", International Journal of Information Science, vol.16, no.5. Taylor&Francis Group: 2002: 1.

[27] Salingaros, Nikos A. "Complexity and Urban Coherence", Journal of Urban Design, vol.5, no.3, Carfax Publishing, 2000.

[28] Lauwerier, Hans. Fractals: Images of Chaos, Toronto: Penguin Canada Inc., 2001. p.104.

disperse the city becomes.[29] Carl Bovill argues that traditional urban geometry is characterized by fractal interfaces.[30]

The development of fractal geometry is directly related with the improvements in computer technologies since fractal geometries have such complex structures that it is almost impossible to deal with them manually. Parallel with the development of mathematical chaos theory in the 1960's and 1970's, Benoit B. Mandelbrot developed the new fractal geometry during his works at IBM research laboratories.[31] For Ferdig, fractal geometry describes the complexity of the irregular shapes in the natural world through a set of simple equations that combine to form infinite diversity: He explains that the most important property of fractal shapes is that their characteristic patterns are found repeatedly at descending scales of subsystems throughout a complex system; so, parts of fractal shapes, at any scale, are similar in shape to the whole.[32]

Mandelbrot defines the fractal as follows:

> "Fractals are geometric shapes that are equally complex in their details as in their overall form. That is, if a piece of a fractal is suitably magnified to become of the same size as the whole, it should look like the whole, either, or perhaps only after a slight limited deformation."[33]

[29] Shen, Guoqiang. 2002. p.10.

[30] Carl Bovill, Fractal Geometry in Architecture and Design, Boston, Birkhauser. 1996

[31] Benoit B. Mandelbrot, The Fractal Geometry of Nature, New York: W.H. Freeman and Company, 1982.

[32] Mary A. Ferdig, Complexity theories: perspectives for the social construction of organizational transformation, p.6

[33] Benoit B. Mandelbrot, "Fractals and an Art for the Sake of Science", The Visual Mind: Art and Mathematics, Cambridge, MA: MIT Press, 1993. p.12.

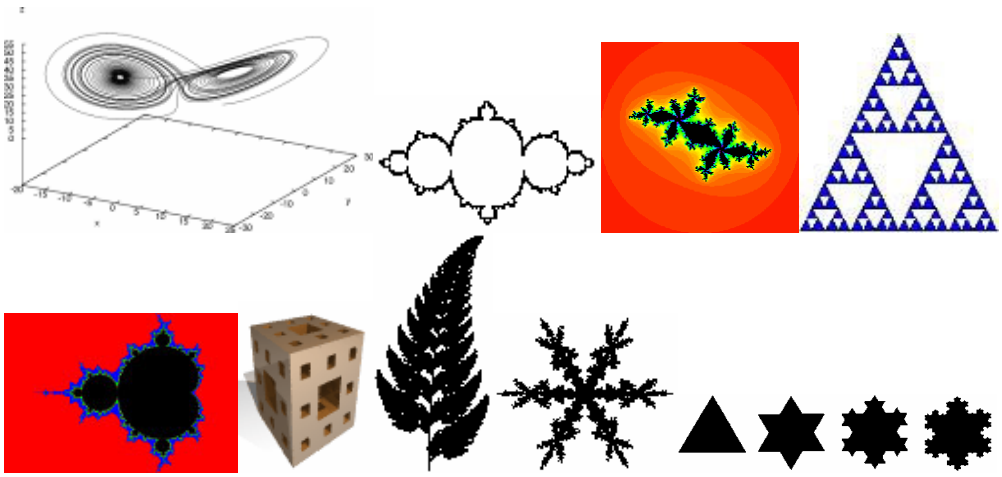

Figure 15: Fractal Images, From left to right: Lorenz Set, Julia Set (San Marco Dragon), Julia Set, Sierpinski Triangle, Mandelbrot Set, Menger Set, Fern, Snow Particle, Koch curve

Karacay, Timur. Determinizm ve Kaos, Mantık, Matematik ve Felsefe II.Ulusal Sempozyumu, *Tema: Kaos,* Assos, 21-24 Eylül 2004: [http://www.baskent.edu.tr/~tkaracay/agora/teblig/kaos.htm]

In his article, "Fractals and an Art for the Sake of Science", he argues that fractal geometry is directly dependent on computers. He claims that before the seventies, when the necessary hardware and software were developed, it was impossible to create such fractal shapes.[34]

Genetic and evolutionary algorithms have been developed in order to simulate natural models, and to create dynamic, non-determined generative design models. Genetic algorithms which are used to state adaptive processes initiate and maintain a population of computational individuals, depending on genotypes and phenotypes.[35] For each different project, new algorithms are constituted for successfully simulating the realistic generative model. Generative models are also very similar to self-organizing systems but in addition, they can show greater adaptability and flexibility since they are open-ended and unpredictable systems.

[34] Ibid. p.11.

[35] Weinstock, Michael. "Morphogenesis and the Mathematics of Emergence", Architectural Design: Emergence: Morphogenetic Design Strategies, vol.74, No.3, London: Wiley Academy, 2004. p.16.

Specifically evolutionary models are proposed as the generative force for urban and architectural form: These models have the potential for optimizing solutions with their environmentally responsive and adaptive nature.[36]

Manuel De Landa's theories about genetic algorithms provide acceleration on the conceptual side of the shift from determinist understanding to non-determinist generative approach, where the concepts of "morphogenesis" and "emergence" take an important role. De Landa defines "genetic algorithms" as "computer programs that automatically perform how a gene spreads through a population over many generations in order to define the relation between the virtual genes and the virtual bodily traits that they generate." For him Gilles Deleuze plays a crucial role in the productive use of genetic algorithms since Deleuze, for the first time brought together three philosophical forms of thought –Populational, Intensive, Topological- and he made this the basis for a new concept of the genesis of form.[37] De Landa thinks that, without populational, intensive and topological thinking, mere digital technology would never be enough.

There is a common belief that, genetic algorithms and other evolutionary tools only serve as "form producing" methods. But more than form producing, with these algorithms, it is tried to control all the growing process like in living organisms. For this wrong belief, De Landa claims that:

> "Genetic algorithms will only serve as useful visualization tools if virtual evolution can be used to explore a space in which it is impossible for the designer to consider all potential configurations in advance, and only if what results shocks, or at least surprises. As an aid to design, these techniques would be rather useless if the designer could easily predict the generated form."[38]

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[36] Frazer, John. Evolutionary Architecture. London: Architectural Association, 1995.

[37] De Landa, Manuel. 2002. p.9.

[38] Ibid. p.11.

For most of the architects who are used to conventional representation and production tools, generally it is necessary to modify standard software packages in order to structure both the computational models and the final product. According to De Landa, today's designer should be "architect-hackers" who take existing software (a CAD package and a structural engineering package) and modify it. These "architect-hackers" are always looking for new improvements in genetic algorithms in order to "hack" biology, thermodynamics, mathematics and other areas of science to tap into the necessary resources.[39]

John Frazer explains the genetic algorithms as a class of highly parallel, evolutionary, adaptive search procedures.[40] Similarly to the chromosomes structures in nature, genetic algorithms are also characterized by a string like structure. They include the coded form of parameters which control the design problem worked on.[41]

In his book Evolutionary Architecture, while defining the contemporary design approaches, Frazer defines that, "architecture is considered as a form of artificial life, subject, like the natural world, to principles of morphogenesis, genetic coding, replication and selection."[42] And for the evolutionary architecture he states two important aspects -symbiotic behaviour and metabolic balance- which are also characteristic of the natural environment.[43] In the computer models evolutionary models are developed and depending on their genetic algorithms they are evaluated according to the rules of simulated environment similar with natural systems.

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[39] Ibid. p.11.

[40] Frazer, John. 1995. p.58.

[41] Ibid. p.58.

[42] Ibid. p.58.

[43] Ibid. p.58.

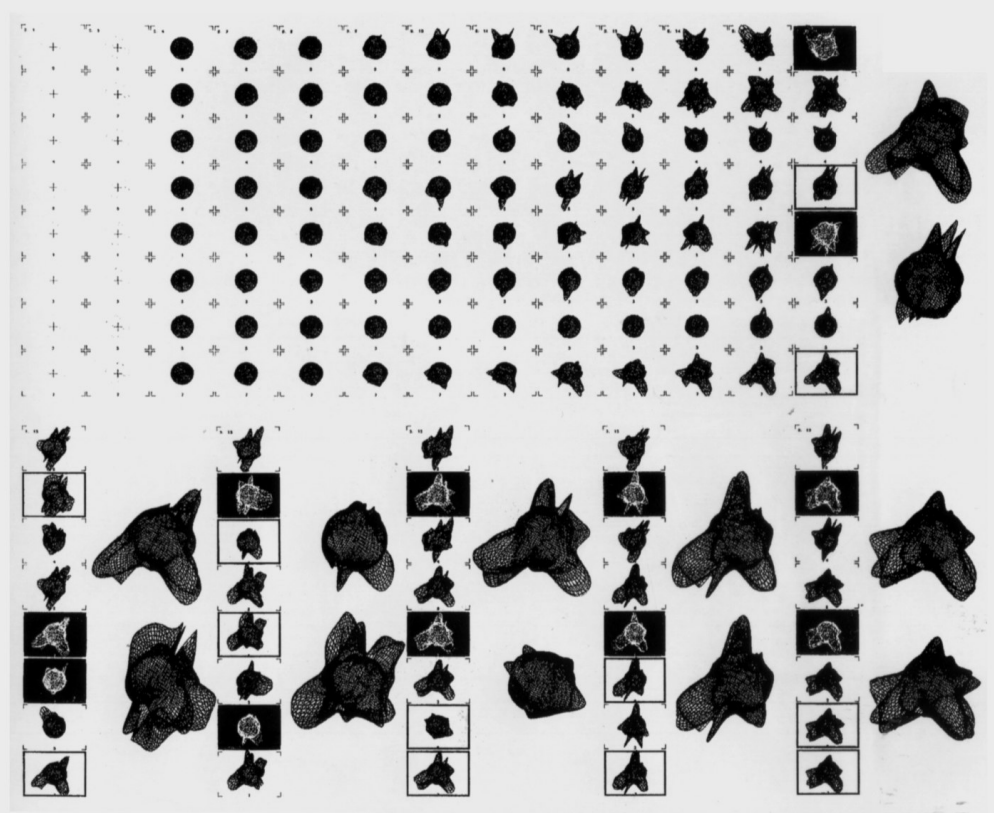

Figure 16: Genetic algorithm: Ichiro Nagasaka, 1992. "The classifier system responds to a set of environmental inputs and evaluates the relative success of that response. Environmental signals can be taken from any of the antennae communicating with the Universal Interactor and a response transmitted to the output antennae. The nature of the response is based on feedback from the environment and more successful responses are gradually developed."

Frazer, John. Evolutionary Architecture. London, Architectural Association: 1995: 79.

Frazer believes that only now the computer technology is sufficient enough to state relationships between simulated environments and our built environment.[44] And he argues that:

> "To achieve this relationship, we have to consider how structural form can be coded for a technique known as a 'genetic algorithm', how ill-defined and conflicting criteria can be described, how these

[44] Ibid. p.58.

> criteria operate for selection, and how the morphological and metabolic processes are adapted for the interaction of built form and its environment. Once these issues are resolved, the computer can be used not as an aid to design in the usual sense, but as an evolutionary accelerator and a generative force."[45]

3.2 Technical Discourse of Uncertainty

The conceptual shift from certainty to uncertainty displays also a technical shift besides. They seem to have fed each other and emerged together in a close relationship. Similarly with conceptual shifts, technical ones have also directly affected the design approaches. As a subject matter of this study, urban design and planning attitudes have also transformed according to these developments.

The changing in the urban design discourse goes parallel with the increasing effect of mathematical control over urban dynamics and developments in computer technologies. De Landa stresses that computer technologies could not produce a magical "technological fix to urban problems".[46] He believes that digital revolution should be evaluated as an addition to older components of urban design and planning:

> "In other words, digital machinery is simply a new node that has been grafted on the expanding autocatalytic loop. Far from having brought society to a new stage of its development, the information stage, computers have simply intensified the flow of knowledge, a flow which, like any other catalyst, still needs mater and energy flows to be effective."[47]

[45] Ibid. p.58.

[46] Manuel De Landa. 1997. p.98.

[47] Ibid. p.98.

3.2.2 Computer Sciences (Software and Hardware)

Besides the conceptual shift in the generative paradigm and developments in complexity sciences, developments in computer technologies have also directly affected contemporary approaches to urban design. This technical improvement also shows a direct relationship with the feedbacks coming from the end users.

The applicability of generative tools and natural models are directly related with improvements in computer technologies and especially the hardware and software produced. The development of CAD/CAM (Computer Aided Design/Computer Aided Manufacturing) technologies provided the infrastructure over which complex computational tools developed. Digital diagramming techniques, animation methods, 3D modeling and printing opportunities are just a few. Time-based and environment-based methods, which create dynamic systems responsive to time, motion, topology, make effective use complex software that evolve similarly to theoretical and conceptual evolution. Patrik Schumacher names this change in design tools as a "new language of architecture" and states that: "This new language (or style) of architecture seems to be based upon the adoption of a new generation of 3D modeling tools. Indeed a lot of commentators tend to construe a direct causal link from this new paradigm back to the IT revolution that has transformed the discipline in last 10 years."[48]

With the help of digital diagramming techniques the opportunity to engage with both the complexity and urban dynamics of the city presents itself. Contemporary computational design practice is seen to favor these methods that provide for parametric control more than conventional analysis or representation. The dynamics of contemporary urban conditions necessitate that analyses consist of an ongoing process that constantly incorporates information on changing conditions. Only computer-aided parametric control mechanisms and digital diagramming techniques can state this kind of analyses.

[48] Schumacher, Patrik. Digital Hadid: Landscapes in Motion, London: Birkhauser, 2004.

As it is explained before, in the contemporary design era, designers use new tools and techniques (such as algorithmic systems, dynamic and flexible modeling techniques and rapid prototyping machines etc.) developed by computer sciences, in order to deal with the high complexity of contemporary urban conditions. Rather than being only "fashionable" presentation tools, these software and hardware are used for parametric control and processing the information.

Similar to De Landa's "architect-hacker" argument, Kolatan and MacDonald claim that, instead of architectural software, architects now work with non-architectural software, both animation software and industrial design software. And they also claim that, the issue of cross-platforming becomes automatically problematized when architects and urban designers choose to work with software specifically designed for industrial design and for film animation rather than for architectural design.[49]

In addition they claim that design projects are no more progressing from stage to stage by translation, but evolve through transmutation: "from a line of digital particles in the computer, to the cv's on a topological curve, to a line of material particles emitted by rapid prototyping tools."[50]

3.3 Modeling Approach

As stated previously, some problems with higher degrees of complexity have no analytical solutions. Cities and urban areas have such kind of problems and it is hard to predict their future development. Analytical solutions or determinist strategies are insufficient for these kinds of situations. In these kinds of systems the best way to see the development or result is to observe the process and reach the target result.

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[49] Kol/Mac Studio [Sulan Kolatan and William MacDonaId]. 2003.

[50] Ibid.

A model is needed to simulate the natural growth as realistically as possible since it is not possible to observe the whole development of an urban area for decades. At that point some concepts such as emergence, evolution and genetics that originally belonged to biology become important. Urban systems are thought as living organisms and in order to construct their natural growth, genetic algorithms and generative models are being used. With these naturalistic models, the process and transformations can easily be experienced and it becomes possible to reach to a solution.

Today, many theorists and designers accept cities and their parts as non-deterministic systems. So if we consider that urban systems have chaotic conditions, it could be easily seen that the valid solutions about urban design or urban development problems could be done by naturalistic modeling techniques and by realistic simulations. These process dependent techniques are also named as "evolutionary".

John Frazer defines the aim of evolutionary architecture as achieving within the built environment, the symbiotic behaviour and metabolic balance that are the characteristics of the natural environment.[51] In contemporary design practice, the mathematical models can be used for generating designs, evolving forms and structures in morphogenetic processes within our computational environments and tools. John Frazer notes that emergence and morphogenetic strategies play an important role in the process of continuous adjustment of a system to its environment. In contemporary design practice, the mathematical models can be used for generating designs, evolving forms and structures in morphogenetic processes within our computational environments and tools.[52]

[51] Frazer, John. 1995. p.9.

[52] Ibid. p.9.

Emergence can be defined as the properties of a system that cannot be deduced from its components.[53] Similarly, Emergence and Design Group quotes the explanation of Francis Heylingen for the term "emergence" as a classical concept in systems theory, where it denotes the principle by which the global properties defining higher order systems or "wholes" can in general not be reduced to the properties of the lower order subsystems or "parts".[54] Heylingen adds that such irreducible properties are called emergent.[55] On the other hand, Emergence and Design Group defines emergence as both an explanation of how natural systems have evolved and maintained themselves and as a set of models and processes for the creation of artificial systems that are designed to produce forms and complex behaviour, and perhaps even real intelligence.[56] According to them, emergence provides models for life cycles, and the way in which different life cycles interact with each other in an ecosystem.[57] This could be evaluated as a key to understanding the ecology of densely occupied environments like city structures in which topological, structural and programmatic integration take place. The current computational groundwork in evolutionary computation and generative computation presents promising potentials to instrumentalise the natural processes of evolution and growth, to model essential features of emergence and then to combine these within a computational framework.[58] The aim is to apply these computational models as generative design tools that can produce complex and adaptive architectural and urban forms.

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[53] Weinstock, Michael. 2004. p.11.

[54] Heylighen, Francis. "Self-Organization, Emergence and the Architecture of Complexity", Proceedings of the 1st European Conference on System Science, Paris: AFCET, 1989.

[55] Hensel, Michael , Menges, Achim and Weinstock Michael (guest editors). "Emergence in Architecture", Architectural Design: Emergence: Morphogenetic Design Strategies, vol. 74, no 3, London: Wiley Academy, 2004. p.9.

[56] Ibid. p.6.

[57] Ibid. p.9

[58] O'Reilly, Una-May , Hemberg Martin and Menges Achim. "Evolutionary Computation and Artificial Life in Architecture: Exploring the Potential of Generative and Genetic Algorithms as Operative Design Tools", Architectural Design: Emergence: Morphogenetic Design Strategies, vol.74, No.3, London: Wiley Academy, 2004. p.49.

On the other hand, morphogenesis is the creation of forms that evolve in space over time; it is the account of growth and form.[59] Computational models of morphogenetic processes are adapted for architectural researches and physical form-finding processes. Mathematisation and computation of forms and the relationship between biology and mathematics play a crucial role for morphogenetic processes in digital environments.

Morphogenetic processes, which are taking an important place in contemporary design understanding, are directly related with the computation of formal structures. As Michael Weinstock mentions, the convergent lines of thought between biology and mathematics were initiated early in the 20th century, particularly in the work of D'Arcy Thompson.[60] D'Arcy Thompson was a zoologist and mathematician, who worked on the formal structure of living things which he defined as "diagram of forces".[61] Weinstock claims that, Thompson's observations of the homologies between skulls, pelvises and the body plans of different species suggested a new mode of analysis, a mathematisation of biology.[62]

As Zeynep Mennan mentions, "the insufficiency of mathematical tools and topologico-geometric models was however still an obstacle in 1917 when D'Arcy Thompson wrote his major treatise *On Growth and Form,* developing a morphogenetic theory repositioning the problem of form as a mathematical

[59] Weinstock, Michael. 2004. p.12.

[60] Ibid. p.12..

[61] Thompson, W.D'Arcy. On Growth and Form. vol.1 and vol.2, (2nd ed.), London: Cambridge University Press, 1968. p.16.

[62] Weinstock, Michael. 2004. p.12.

problem, and that of growth as a physical one."[63] Mennan also argues that D'Arcy Thompson attempted a remarkable formalization of the organic, and she adds that:

> "That a common typological and determinist drive underlies the invariable laws generating form, whether inert or animate, not only denies a special status to the living, but also claims the subordination of the irreducible organic to a computable and determinable behaviour. According to D'Arcy Thompson, the only obstacle in reducing the complexity of natural forms into a mathematical intelligibility would be the lack of quantitative measures and methods for differentiation and not an irreducible residue in the vital element. This remarkable formalization of the organic went largely unheard in the early modern artistic and architectural practices redeeming the new geometries as new plastic opportunities revealed only through the intuitions of the artist."[64]

It is obvious that D'Arcy Thompson opened a new perspective in the computation of biological forms. He believes that physical and mathematical laws should guide us in biology and formal structures of living organisms.[65] But differently from today's understanding his attitude stays strongly deterministic and formalist as can be seen in Thompson's words:

> "The waves of the sea, the little ripples on the shore, the sweeping curve of the sandy bay between the headlands, the outline of the hills, the shape of the clouds, all these are so many riddles of form, so many problems of morphology, and all of them the physicist can more or less easily read and adequately solve: solving them by reference to their antecedent phenomena, in the material system of

[63] Mennan, Zeynep. "Des Formes Non Standard: Un 'Gestalt Switch'." (Of Non Standard Forms: A 'Gestalt Switch), Architectures Non Standard, in Migayrou, Fréderic and Zeynep Mennan, (eds.), Paris: Editions du Centre Pompidou, 2003. pp.34-41.

[64] Ibid.

[65] Thompson, W.D'Arcy . 1968. p.11.

> mechanical forces to which they belong, and which we interpret them as being due."[66]

D'Arcy Thompson's approach could be evaluated as the starting point of morphogenetic design strategies. But when we compare with today's paradigm, his approaches stay determinist since depending on quantitative measurements and diagrams with Cartesian coordinates and mechanical sciences.[67]

3.3.1 Reformulation of the Organic

It is hard to criticize the consistency between the theoretical approach of the generative paradigm and its practice since very few projects could be realized. They are usually structured as experimental projects. On the one side, being experimental encourages to concentrate on the conceptual aspects but on the other side it makes them impossible to be experienced realistically.

It is obvious that the contemporary naturalistic approaches are different from the previous organic understanding, in the sense that they are not directly derived from formal similarities with living organisms. Instead, contemporary naturalistic models are searching for real and natural growth processes that can be useful for urban systems.

Today, computer simulations and dynamic modeling techniques are needed more than before in order to analyze the complex systems. With the improvements in complexity sciences, computer sciences and evolutionary biology it is possible to work with naturalistic and generative models of urban structures. Theoretical and conceptual developments improve together with technological developments and

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[66] Ibid. p.10.

[67] In her article *Of non standard forms: a 'gestalt switch',* Zeynep Mennan states a relationship between D'Arcy Thompson's works and John Frazer's theory of Evolutionary Architecture. She claims that, "While D'Arcy Thompson considered the genetic model insufficient in accounting for growth, Frazer refers to computer genetic algorithms as a new design technique for the emergent field of architectural genetics, an evolutionary accelerator and generator modeling inner logic rather than external form. Though both treat artificial and natural systems equally, Frazer's design technique leaves form unspecified to oppose the determinism of D'Arcy Thompson."
Zeynep Mennan. 2003. pp.34-41

contemporary approaches become ever more sensitive to time, environment, urban dynamics and topology.

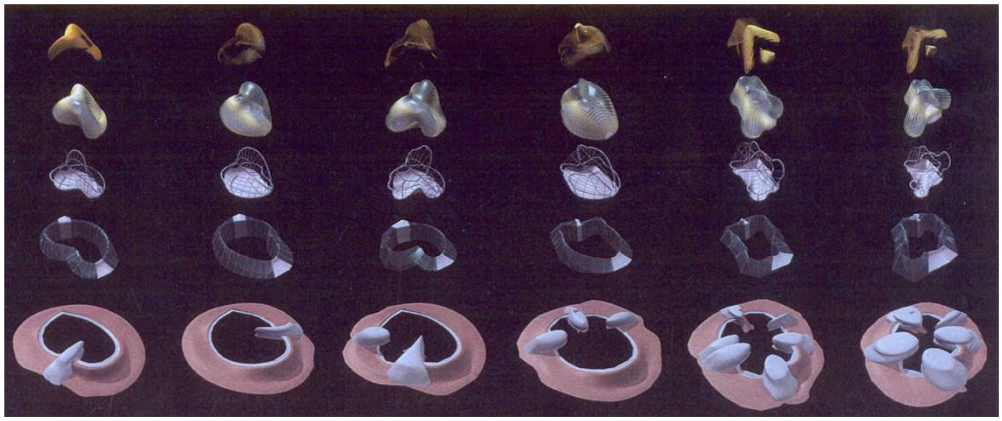

Figure 17: Greg Lynn's "Embriyological House" System Components.

Rahim, Ali (guest editor). Architectural Design: Contemporary Processes in Architecture, vol. 70, no 3, London: Wiley Academy, 2000. 26-27.

These naturalistic models include all informative data about the urban system and the simulation of their future growth. With the help of these simulations urban strategies are developed, replacing the top-down models of deterministic with self organized and flexible solutions.

3.3.2 Mimetic to Process

As much as the emergent software and materials get complex and improved, it becomes possible to control and design cities according to the logics of natural systems. It has been noted that as a result of contemporary techniques, design procedure has become process-oriented and open-ended rather than product-oriented. For this shift, Sulan Kolatan and William MacDonald argue that the product which is continually updated and adapted stays "fresh" without reaching a "final" state.[68] Parallel with design procedures, they claim that the software

[68] Kol/Mac Studio [Sulan Kolatan and William MacDonaId]. 2003.

industry has employed a similar strategy. “New versions of existing software are "tested" by potential end users whose evaluations and alterations are incorporated into the product.”[69]

John Frazer defines this process oriented design principle starting from the genetic code to the end product. As Frazer explains, it is first needed to describe the design principle or concepts in the form of genetic codes in order to make it generative. After this point, computer programs play a leading role since genetic codes are mutated and developed into a series of models in a simulated digital environment. The evolution process of the code of successful models goes on into the digital environment with time-based and diagram based models until a particular stage of development is selected for prototyping in the real world. The selected model or the selected stage of process should be capable of interactive response to the changing environment on a short time-scale. As a result it could be said that the entire design concept is process-driven; depending on form-generating rules which consist not of components, but of processes.[70]

While arguing about the importance of process rather than product in contemporary approaches and especially in naturalized models, Whitehead’s statement in 1920 becomes important: Weinstock says that, the mathematician and philosopher Whitehead argued process rather than substance was the fundamental constituent of the world, and that nature consists of patterns of activity interacting with each other.[71]

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[69] Ibid.

[70] Frazer, John. 1995. p.65.

[71] Weinstock, Michael. 2004. p.13.

CHAPTER 4

CASE STUDIES

Although most of the projects proposed in contemporary design approaches still stay conceptual, there are also some attempts to realize these kinds of attitudes. In this thesis two projects are chosen as case studies that are tried to be analyzed and criticized. The first project is, Zaha Hadid Architects' *"Kartal Sub-Center and Kartal-Pendik Waterfront Urban Transformation Project"*. It is a competition project that was proposed for one of the new developing areas of İstanbul.[1] This project is chosen since it constitutes one of the most recent examples of contemporary approaches in urban design and also because, during the last few months it has been an important subject of discussion on the Turkish architectural and planning agenda. The second project is, KOL/MAC Studio's *"Project MUTEN İstanbul"* proposal for the Galataport Area in İstanbul.[2] It is an important project for the purposes of this thesis since the main concept of the project is highly dependent on generative and naturalistic models that are developed in order to deal with one of the problematic areas of İstanbul. With the help of these two case studies, the conceptual contributions of contemporary approaches will be tried to be concretized and evaluated. Although both projects remain unrealized, they are significant in bringing current strategies and discussions into the national field of urban design.

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[1] Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP), İstanbul: 2006

[2] Kolatan, Şulan and MacDonald William (Kol/Mac Studio). "Project Muten İstanbul", Exhibition, İstanbul: Garanti Galeri, 30 May-22July 2006.

4.1 Zaha Hadid Architects – Kartal Sub-Center and Kartal-Pendik Waterfront Urban Transformation Project

During the second half of 2006, Zaha Hadid Architects' urban transformation project stayed at the center of several discussions in the Turkish architecture and planning agenda. As a result of some political and professional struggles, most of the discussions about this project focused on the competition, in which Hadid's project has been chosen as winner. Struggles about the planning decisions of the Municipality for the area of competition and also about how the competition has been organized, have taken over the conceptual and technical aspects of the project. In this research, rather than the political critiques or the problems about the organization of the competition, the project's technical properties and the new features that it has brought to urban design will be analyzed.

In order to develop new fields of business and tourism in the Eastern side of İstanbul, Metropolitan Planning and Urban Design Center (İMP), which is a founding of the municipality, has organized a competition.[3] In the press statement of İMP, several reasons have been stated about why Kartal had been chosen as a new sub-center of İstanbul. Starting from the 1950's, the Kartal district developed as an industrial zone but in time most of the factories moved from the area and the region stayed as disused.[4] While explaining the objectives of the competition, it was declared that:

> **"**The Kartal Sub-Center and Pendik Waterfront Region Covering an area of 555 Hectares –which lies entirely within the boundaries of those two municipalities - will be transformed into a magnetic, lively, and beautiful area with all the functions of a

[3] Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP), İstanbul: 2006.

[4] Sorkin, Michael et al. "Report of the Evaluation Commitee for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project and Küçükçekmece – Avcılar Inner and Outer Waterfront Project", İstanbul Metropolitan Planning and Urban Design Center, İstanbul: 31 March 2006.

> town center, including commerce, tourism, residence, culture, administration, and recreation."[5]

Besides an outstanding architectural career, Hadid and her partners have also proved their success in urban design projects. In her official web page, Hadid is expressed as an architect who consistently pushes the boundaries of architecture and urban design: "Her work experiments with new spatial concepts intensifying existing urban landscapes in the pursuit of a visionary aesthetic that encompasses all fields of design."[6]

Zaha Hadid creates here a flexible grid iron system that shows adaptable behaviors in harmony with the urban landscape. Michael Sorkin, who was also in the competition committee, states that her proposal is a solution based on a loose grid of streets connected to the existing urban fabric and linked to the actual infrastructure.[7] He adds that, within the loose grid, Hadid suggested a generative zoning which could be defined as strictly morphological, within which, she designed different building districts, which will be constructed by different groups of architects, and with differentiations in size, height, and function, she reaches to a rhythm and harmony with the site.[8]

Basically, Hadid tries to create a dynamic system based on the infrastructural properties and transportation criteria of the area. She proposes a dynamism with the use of a flexible network system in plan, and with fluid-formed structures in different heights and volumes and with solid-void relations in third dimension. Hadid's flexible grid system is attempted to act as a living organism that covers

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[5] Ibid.

[6] Hadid, Zaha. "Zaha Hadid's Profile", last accsessed in January 2007 <http://www.zaha-hadid.com/>

[7] Sorkin, Michael. "Brief summaries of the project presentations on March 30, 2006 at İstanbul Metropolitan Municipality", Press Bulletin, İstanbul Metropolitan Planning and Urban Design Center (IMP), İstanbul: 2006.

[8] Ibid.

the area and shows adaptable transformation with the rest of the city. Korhan Gümüş also evaluates her network system as a natural organism and states about the project that: "The blocks with cruciform plans that developed after the grid plan and the public circulation areas have a complex organization, and that the settlement itself consists of a single flexible network just like a natural organism."[9] Actually "the organic" attitude can be seen in most of Hadid's projects but not as a formalistic approach. While defining their organic attitude, her partner Patrik Schumacher argues that:

> "Our projects remain incomplete compositions, more akin to the Deleuzian notion of assemblage than to the classical conception of the organism. Our concept of organic integration does not rely on such fixed ideal types. Neither does it presuppose any proportional system, nor does it privilege symmetry. Instead integration is achieved via various modes of spatial interlocking, by formulating soft transitions at the boundaries between parts and by means of morphological affiliation. The parts or subsystems that are brought together to form a larger organic whole do not remain pure and indifferent to each other, but are mutually adapting to each other."[10]

Hadid claims that like the other major metropolises, İstanbul must gain a new and distinctive polycentric character.[11] It is possible to evaluate this approach as a way of zoning. But the most important factor that makes Hadid's proposal interesting here is the re-interpretation of conventional urban design tools with contemporary techniques. At the same time as a result of that approach, the applicability of the project is being increased. According to Hadid, the importance of the historic core

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[9] Gümüş, Korhan. "Hadid ve Fuksas'ın Metaforları", Arkitera, 7 April 2006, last accessed in January 2007-01-13
http://www.arkitera.com/news.php?action=displayNewsItem&ID=8180

[10] Schumacher, Patrik.. 2004.

[11] Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP) Archive, İstanbul: 30 March 2006

depends upon the emergence of new and compelling concentrations of urban and economic resources around the metropolitan region. She argues that "the challenge is always to secure their differential identities while linking them effectively in a region transport system".[12] And she believes that, in the Kartal-Pendik area, İstanbul shows the beginnings of an effective metropolitan infrastructure.[13] In this project, the integration of circulation infrastructure into the urban fabric is thought as the most important aspect. And in order to deal with this problem, "multi-scalar and three dimensional exploration of the architecture of movement" is tried to be achieved for connecting the infrastructure and the phases of urban development.[14] According to Hadid, a successful urban plan needs to state a balance between an overall guiding structure and the flexibility to respond to environmental changes. She claims that: "If our urban calligraphy suggests a guiding structure to differentiation, it is our project-based experience with the three-dimensional architecture of movement that will allow us to define the specific qualities of new urban districts."[15] While defining the idea of the "net", which is stated as the basis for the project, she considers that "it (the net) has proven a compelling metaphor across time, as much associated with the resilience of ancient fishing communities as with the efficiency and flexibility of tomorrow's media structures."[16] And she defines how they evaluate the net structure as follows:

> "In our work, the graphic medium of the net becomes the calligraphy of an urban landscape. In our approach to the ambitions for Kartal-Pendik, the net provides a unifying structure for the pursuit of patterns of differentiation. This calligraphy forms the background for the planning and design process

[12] Ibid.

[13] Ibid.

[14] Ibid.

[15] Ibid.

[16] Ibid.

> which will engender the formation of distinct and exciting urban quarters. The multiplicity of patterns and densities which one can envision forms the basis for a future plan attentive to economic flexibility and the differentiation of urban character."[17]

The existing circulation systems of Kartal-Pendik area are then taken as a base pattern and create a flexible spatial system in harmony with the urban landscape. The varieties in ground coverage, height and floor area amplify this rhythm and allow a distinctive architecture to emerge in each district: "The cultural, educational, and leisure uses envisioned for the project will find their places throughout the fabric, sharpening the particular qualities associated with each district."[18] Parallel with these objectives, three main commends of the evaluation committee explain briefly the important properties of the project:

> - The flexibility of the organizing net and the successful application of the loose grid in joining the project to surrounding areas and conditions.
> - The idea of an adaptable regulatory framework as an armature for collaboration in the future development of the project.
> - The underlying practicality of the Project in its incorporation of traditional planning elements, including block form, variegated parcel sizes and shapes, density regulations, and logically but not coercively distributed uses.[19]

Opposing this point of view, Korhan Gümüş defines the project as a "metaphor" rather than a concrete architectural proposal.[20] Gümüş criticizes the municipality with perceiving the project's visible images as a "manner of construction" rather than "architectural metaphors". He argues that, these metaphors are not a

[17] Ibid.

[18] Ibid.

[19] Sorkin, Michael et al. 2006.

[20] Gümüş, Korhan, 2006.

construction tool, but a tool for exploration, and that contemporary architecture uses this kind of images not to give information about construction but to deconstruct by querying urban processes.[21]

However Hadid is seen to consider and bring forth a model of development: "The regeneration of the Kartal-Pendik area will be experienced as an emerging mosaic of new urban quarters each structured around a particular logic of investment appearing in time."[22] She also argues that, this project has been planned to help to balance the two sides of İstanbul. It is said that: "Through decentralization, this project aims to create a new alternative commercial, residential, administrative, and cultural center on the Eastern Side of İstanbul, helping to relieve the metropolitan central business district, the Historical Peninsula, Beyoğlu and the Bosphorus Bridge."[23] Since the project and the discussions about the organization are still new, it is not clear whether these claims will be realized or not. But even if it stays just as a conceptual proposal, the project is significant in the sense that contemporary design approaches and generative models in urban design have started to be discussed in Turkey, though in mostly conservative ways as in the case of Gümüş. In practice this project, which covers quite a wide area in urban scale, looks difficult to be realized in the short term, but the design approach and the discourse it introduces opens new visions.

What is important about Hadid's proposal is that, although she uses conventional urban planning and design strategies, she approaches them with contemporary generative tools. This dialogue between the traditional needs and demands of the city and the novelty and originality of the approach constitutes an important aspect of the project. This attitude also constitutes the main difference with KOL/MAC Studio's Project MUTEN İstanbul proposal as it will be explained

[21] Ibid.

[22] Hadid, Zaha, et al. 2006.

[23] Ibid.

further. The main idea of creating a "masterplan" is a very common strategy among planners for almost a century. But evaluating the masterplan as a flexible network, which shows adaptable responses to environment, opens here a new perspective. However, it could be argued that this flexibility stays mainly space-vise. Even though the structural adaptation can be seen in formal representations, it is not clear how the generation of the master plan and the adaptation of network systems to environmental changes will occur. It is not easy to talk here of a time-based adaptation and flexibility which are important issues in planning and urban development. Although flexibility and fluidity are suggested by visual means, it is still not clear that how this fluidity will be realized in practice and flexibility stays mainly as a formal property. When the urban parameters are taken into consideration, it could be said that the proposed "flexible grid-iron" or the re-interpretation of net concepts are not so different from the conventional approaches. But at the same time this approach presents yet an advantage; keeping with a "masterplan" while approaching it through a different paradigm provides for a link between traditional and contemporary strategies, and contributes to its reception. I believe that Hadid's attitude then makes itself more understandable and acceptable, while KOL/MAC's project has been subject to criticisms coming from a paradigm thoroughly external to the project.

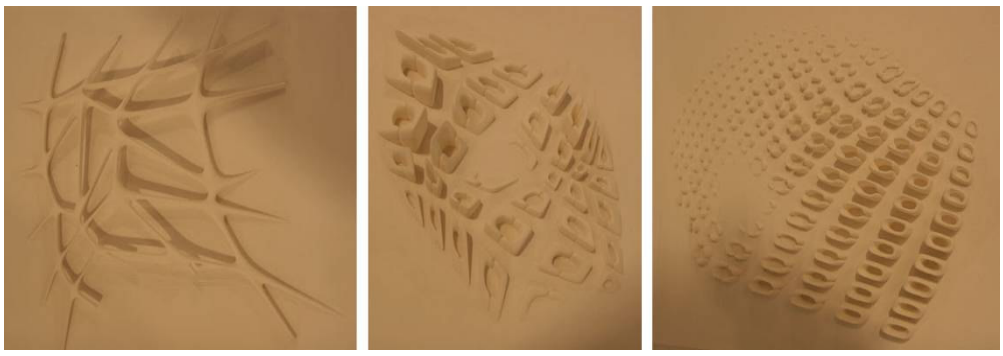

Figure 18: Concept model photograps.

Arkitera, last accessed in October 2006
http://www.arkitera.com/competitionproject.php?action=displayProject&ID=88&year=&aID=579

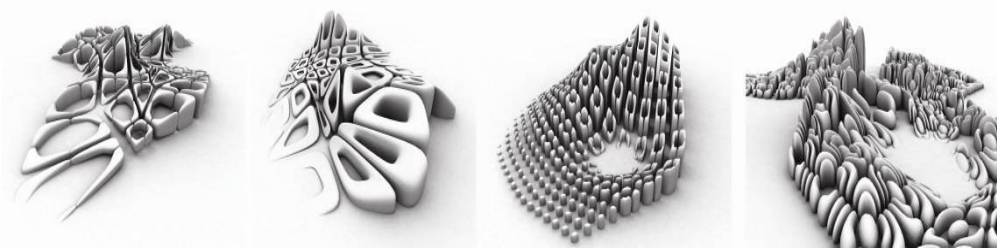

Figure 19: The emerging mosaic, "Perspective Views".

Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP) Archive, İstanbul: 30 March 2006. Reprinted with the permission of IMP**.**

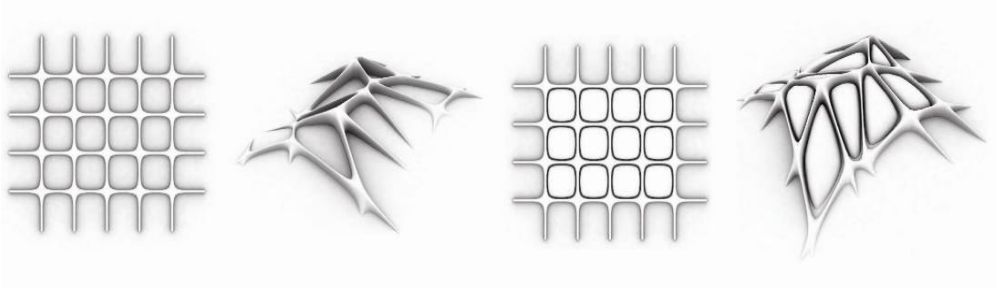

Figure 20: The masterplan: An exploratory vision, "The Net System".

Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP) Archive, İstanbul: 30 March 2006. Reprinted with the permission of IMP**.**

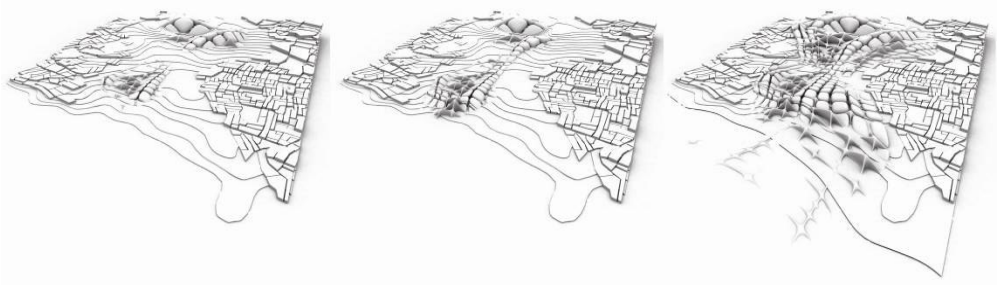

Figure 21 The masterplan: An exploratory vision , "Phasing".

Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP) Archive, İstanbul: 30 March 2006. Reprinted with the permission of IMP**.**

Figure 22: Districts and Flexible Net

Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP) Archive, İstanbul: 30 March 2006. Reprinted with the permission of IMP**.**

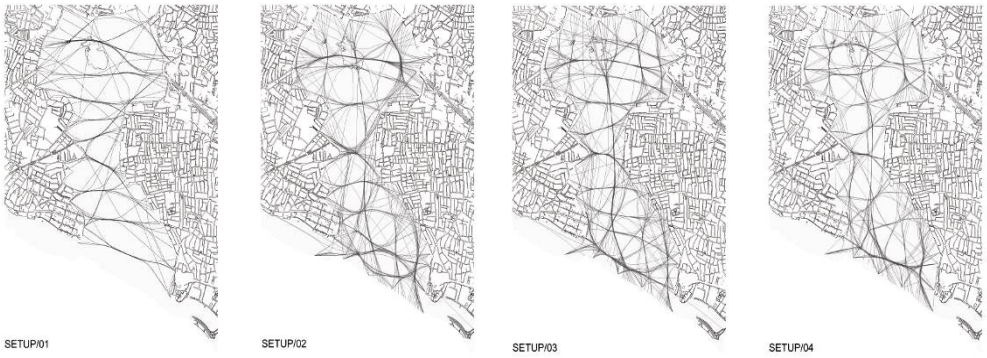

Figure 23: The regeneration o the İstanbul city region, "Network System".

Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP) Archive, İstanbul: 30 March 2006. Reprinted with the permission of IMP**.**

Figure 24 Envisioning urban lifescapes, "Masterplan".

Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP) Archive, İstanbul: 30 March 2006. Reprinted with the permission of IMP**.**

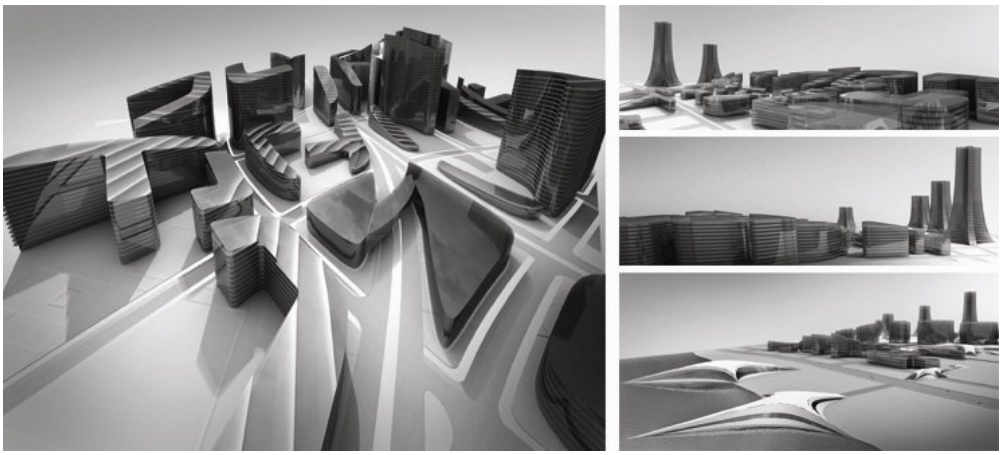

Figure 25: Perspective Views.

Hadid, Zaha. "Zaha Hadid Architects' Project Presentation for the Kartal Sub-Center and Kartal Waterfront Urban Regeneration Project (Zaha Hadid Group: Zaha Hadid, Saffet Bekiroğlu, Patrik Schumacher), İstanbul Metropolitan Planning and Urban Design Center (IMP) Archive, İstanbul: 30 March 2006. Reprinted with the permission of IMP**.**

4.2 KOL/MAC Studio - Project MUTEN İstanbul

Project MUTEN[24] İstanbul is an urban design proposal for the Galataport area which was exhibited at Garanti Gallery İstanbul in June 2006.[25] Related with the concepts of urban and industrial ecology, sustainable urban development, naturalistic growth and inter/intra city transportation networks, the project is based on network intelligence and strategies derived from 'Proto MUTEN İstanbul Workshops' that prepared for the project and the exhibition.[26] Since Galataport's quasi-industrial former functions create a kind of isolation from the surrounding city structure, Şulan Kolatan and William Mac Donald claim that its future viability depends on its successful re-integration.[27] Before going into the details of the project, it is important to define Kol/Mac's design approach that is closely related with the contemporary design strategies. While defining the changing paradigm in architecture and planning they argue that:

> "Architecture is becoming a less pure and more composite discipline. The shift from standard to non-standard approaches signifies above all a fundamental change in understanding and managing complexity, both in theory and practice. While the former approach uses a reductive logic with regard

[24] "MUTEN Urbanism: MUTualistic ENvironmentality; a term Kol/Mac Studio constructed to suggest a relational mode of operation."
KOL/MAC Studio. "Project Muten Istanbul Exhibition", Exhibition Catalogue, İstanbul: Garanti Galeri, 2006. p.1.

[25] Kolatan, Şulan and MacDonald William (Kol/Mac Studio). "Project Muten İstanbul", Exhibition, İstanbul: Garanti Galeri, 30 May-22July 2006.

[26] "Proto MUTEN İstanbul Workshops: In 1993 and 1995, Şulan Kolatan taught two Columbia University-sponsored workshops in Istanbul directed toward the Antrepo site and the Karaköy-Galata Bridge-Eminönü area. The first workshop recorded and mapped new appropriations of public space through the convergence of inherited DeCerteautian "everyday practices" with new technologies. The second used this information as a basis to formulate design strategies for the Antrepo site. The studies uncovered a very rapidly changing, adaptive-emergent crowd behavior in which persistent local practices [ad-hoc street markets], merged with imported temporal practices [eastern-european trade and international tourism], personalized technology, physical environment and transportation patterns to engender a wholly unprecedented networked system thriving on the feedback between cultural, commercial and routine urban activities."
Kolatan, Şulan and MacDonald William (Kol/Mac Studio). 2006. p.3.

[27] Kolatan, Şulan and MacDonald William (Kol/Mac Studio). 2006.

> to systems and their constituent elements, the latter recognizes that the emergent-adaptive behavior of complex systems is more than the sum of its parts, and thus has to be examined as a whole. The complexity discourse encompasses network behavior of which we still know relatively little."[28]

In this project the importance of naturalistic models and emergent systems can be observed. Indeed, Kol/Mac starts by asking the question of "What is natural?". Kol/Mac believes that it is necessary to utilize networked tools and methods in order to deal with the complex problems of contemporary urban environments.[29] As it was explained before, with the improvements in emergent software and generative models, it becomes possible to use naturalistic models as urban design tools in this project. The architects argue that:

> "This naturalized urban design approach generates relational spatio-temporal models registering and creating otherwise elusive vital interconnections between such divergent categories as geology and sociology, oceanography and biography, vegetation and transportation, nature and culture."[30]

In the previous case study, Hadid's urban transformation project, the contemporary tools were acted over the conventional way of planning the 'masterplan'. On the contrary here, a dynamic method is proposed as an alternative.[31] It is argued that, the master planning concept addresses the temporal dimension of urban design expressed in 'phases', and that this creates a fundamental problem of unabling the factor of change over time. Masterplans are not designed to react to environmental changes and are not adaptive. In this project self-organization, adaptation and emergence are important qualities of

[28] Ibid. p.3.

[29] Ibid. p.4.

[30] Ibid. p.1.

[31] Ibid.

urban entities (defined as intelligent agents) which evolve within controlled time intervals as a function of time-based methods involving memory and learning.[32] Concerning the ecological paradigm of the project, it is stated that:

> "The ecological paradigm defines the workings of this naturalized world as 'massive systematic transformations of materials' with networks of actors doing the producing and consuming of materials and energy. Much of what makes eco-systems perform in the ways they do -what gives them emergence, as it were- is a function of the networkedness of its 'actors'".[33]

In Project MUTEN, the linear time concepts of projection are replaced with notions of feedback and looping implying renewal. Kolatan and MacDonald argue that these kinds of applications are seen in industrial ecology through the advance from "cradle-to-grave to cradle-to-cradle models".[34] Related with this shift from linear to non-linear attitudes, De Landa mentions that: "Today our theories are beginning to incorporate nonlinear elements, and we are starting to think of heterogeneity as something valuable, not as an obstacle to unification[35] While defining the main approach of the project, Kolatan and MacDonald state that:

> "Our approach installs individual urban systems not in layers but as massive crowds of "intelligent agents". In the layered method connectivity is viewed as linkage, not as constitutional. Each group corresponding to an urban system has its own identity which is embedded as parametric "behavior". Intelligence translates as simple decision-making capacity in relation to other groups or environmental conditions. In this way complex urban heterogeneity is managed without having to fall back on reductivist methods. The resulting

[32] Ibid. p.5.

[33] Ibid. p.1.

[34] Ibid. p.5.

[35] De Landa, Manuel. 1997. 274.

> organizational patterns are harvested as abstract blueprints for design."[36]

Another important creation of Kol/Mac Studio in the project is what they define as 'aquanets': "These are 3-dimensionally intersecting surfaces with resulting regions that are of more than one surface."[37] Here, again a linkage is stated with connections since it is believed that architecture is systemically already linked to the city and industry. [38]

Although Project MUTEN refers to a piecemeal approach, the latter is seen to be holistic. This idea is based on the principle that a change in a single piece of the city (or another complex system) directly affects the neighboring piece and also the rest of the system.[39] As Mennan explains, this piecemeal approach defines the dynamic relationship between the small pieces of the ecosystem and the whole greater ecosystem.[40] This piecemeal approach is very close with Christopher Alexander's theory of incremental growth and his holistic evaluation of the city as explained in previous chapters.[41] In Project MUTEN, in order to define the spatial qualities of each piece, it is tried to define "agents" that show similar behaviors.[42] These spatial similarities are defined according to several variables. According to the spatial heterogeneity, pieces are defined as unique ecosystems which are also

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[36] Kolatan, Şulan and MacDonald William (Kol/Mac Studio). 2006. p.4.

[37] Ibid. p.3.

[38] Ibid.

[39] Mennan, Zeynep. Doğallaştırma Süreçleri Üzerinden Bir Sergi Okuması: Project MUTEN, Kol-Mac Studio. (Naturalization Processes in Urban Design: The MUTEN Project by Kol-Mac Studio), İstanbul: Garanti Galeri, 26 June 2006.

[40] Ibid.

[41] Alexander, Christopher. A New Theory of Urban Design. New York: Oxford University Press, 1987.

[42] Kolatan, Şulan and MacDonald William (Kol/Mac Studio). 2006.

integrated to a larger network. In order to state similarities and other relations Kol/Mac Studio makes use of Kohonen Maps.[43]

At that point it seems necessary to explain briefly what the Kohonen Maps are. Kohonen maps are what are known as Self Organising Maps (SOM).[44] Developed by Teuvo Kohonen from 1989 on, they use neural nets to perform an automatic analysis and categorization of the semantic contents of textual documents. The graphical output of this analysis is a 2D map of categories in which each category occupies a space proportional to their component's frequency. The more frequent patterns occupy a greater area at the expense of the less frequent ones.[45] Peter Kleiweg explains about Kohonen Maps:

> "A *Kohonen map* is created using *Artificial Neural Network* (ANN) techniques. A set of vectors is input repeatedly to a map consisting of *units*. Associated with each unit is a *weight vector*, initially consisting of random values. Units respond more or less to the input vector according to the correlation between the input vector and the unit's weight vector. The unit with the highest response to the input is allowed to *learn*, as well as some units in the *neighborhood*. The neighborhood decreases in size during the training period. Learning is done by adjusting the weights of the units by a small amount to resemble the input vector more."[46]

With increasing computer capacities researchers in various fields have begun to apply artificial-neural-network algorithms to very different problems: ANN algorithms are commonly used in such areas like finance (credit analyzes),

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[43] Ibid.

[44] Kohonen, Teuvo. Self-Organization and Associative Memory. Berlin: Springer-Verlag, (3rd edition), 1989.

[45] Ibid.

[46] Kleiweg, Peter. "Extended Kohonen Maps", last acsessed in December 2006 http://www.let.rug.nl/~kleiweg/kohonen

internet (spam mail protection), environmental analyzes, medical sciences, biology and production technologies.[47] Kohonen states that, the SOM algorithm was developed in the first place for the visualization of nonlinear relations in complex systems. He adds that, the pure form of SOM defines an "elastic net" of points (parameter, reference, or codebook vectors) that are fitted to the input signal space to approximate its density function in an ordered fashion. The main applications of the SOM are thus in the visualization of complex data in a two-dimensional display, and creation of abstractions like in many clustering techniques."[48] Kleiweg claims that, the result of the training is that a pattern of organization emerges in the map. Different units learn to respond to different vectors in the input set, and these units closer together will tend to respond to input vectors that resemble each other.[49]

In Project MUTEN, a dynamic relation is stated between the urban ecosystem and its parts. Each piece and also the whole system transforms and evolves continuously. So while each piece has autonomous flexibility and dynamism, the whole system keeps its stability. It is an important approach to improve dynamic models for urban development. It is aimed to design urban surfaces that have "remembering" and "learning" abilities with the use of Artificial Intelligence Softwares (AIS) and of GIS (Global Information Systems) mapping methods. It is tried to create dynamic urban patterns that could show adaptation to environmental changes and evolve as a result of these abilities.

MUTEN İstanbul Design Proposal

As a result of topological analyzes of the Galataport area and rest of the city, Kolatan and MacDonald claim that there is a gradual homogenization of patch dynamics (relation of the small pieces that creates the whole network) and the

[47] Kohonen, Teuvo. Self-Organizing Maps. Berlin: Springer-Verlag, (3rd edition), 2001. p.263.

[48] Ibid. p.86.

[49] Kleiweg, Peter. 2006.

encroachment of the urban surface on the natural surface which they think is a worst case scenario for the urban ecology.[50] With the idea of creating holistic heterogeneity, a complex surface is designed with the potential to positively affect the flow of water and wind as well as the absorption of solar energy which are the basic components of eco-systems.[51] With this complex surface structure it is also aimed to create a correspondence between "topology patches" (small pieces of topological network) and "ecology patches" (small pieces of ecological network). Also, with the use of time-based simulations and Kohonen Maps (self organizing maps) variations are organized according to a catalog of similarities again depending on the capacity to affect the flow of water and wind as well as the absorption of solar energy (Fig.26).[52] And with each variation, a combination between buildings, nature and infrastructure is constituted in the form of different degrees, sizes and shapes (Fig. 28).[53] Although these formal analyzes may look like the main target and the products of the project, this not the case. The project is based on the creation of naturalistic urban planning and design strategy with using different software and ecological paradigms. Formal analyzes are related with the structural part of the proposed design and planning strategy for the Galataport area.

On the ecological and morphological side of the project, water takes an important role since the architects include water as an essential parameter for the project. Two separate systems are created to relate water to the site. With coral like structures and a close relation with sea water it is aimed at a rich underwater population and an opportunity for scuba diving and other underwater activities.[54] It is also defined in the project catalogue that: "With a separate system of scoops

[50] Kolatan, Şulan and MacDonald William (Kol/Mac Studio). 2006.

[51] Ibid. p.6.

[52] Ibid.

[53] Ibid.

[54] Ibid.

and chambers collects, filters and stores fresh rainwater and the run-off from the hill behind in a vast underwater cistern that supplies the whole site with water."[55] With this relation between the site and water, a new interpretation of the 'Yalı' is developed, which appears in the form of water-lobbies inside the buildings' bases.[56] Kolatan and MacDonald argue that: "With this project we hope to provoke thought and inspire action toward building a new kind of İstanbul --a spectacular city with a uniquely and boldly constructed identity for the 21st century."[57]

While evaluating the project, Zeynep Mennan claims that in order to work within a new paradigm, one need first to be discontent with conventional tools and approaches, and second be curious about the promises of the new paradigm in order to leave one's already mastered conceptual and technical tools. She also adds that within this paradigm shift, the conservative attitudes will have to re-define themselves for their own legitimation. In this sense, Mennan asserts that the new approaches which bring a new perspective to our boring planning codes can also be used as a control set for the conventional attitudes.[58]

In addition, when discussing about the aesthetic reception of the project, Mennan takes note of another important aspect. Although Project Muten and most of the other "non-standard" projects are criticized in aesthetic terms, there is not yet any mature aesthetic language for this new paradigm and it is still talked within the older aesthetic language which should have already been out of date. Mennan argues that this absence of aesthetic discourse is also related with the architects' own withdrawal from such discussions and notes that this withdrawal is even more problematic than the conservative formalist critiques.[59] Most of these

[55] Ibid. p.7.

[56] Ibid.

[57] Ibid.

[58] Zeynep Mennan, 2006.

contemporary projects stay experimental and the realized ones still need time to evaluate efficiencies and effects on urban problems. Mennan problematizes the tendency to analyze these projects with conventional tools that are insufficient to define the new paradigm. As a result, she thinks that, without understanding the conceptual nature of transformations, unfair esthetic arguments inevitably come to stage, leading to the aesthetic rejection of these projects.[60] Mennan mentions further the need to create a new set of esthetic vocabulary besides the technical and conceptual ones, in order to analyze these kinds of projects.[61]

Project MUTEN states an entirely new stance with its planning and design strategies. With its use of naturalistic models and emergent software, it is almost the first project of its kind in Turkey. It provides for an example that may contribute to the evolution of alternative approaches for the well known districts of our cities. The main difference between Zaha Hadid's and Kol/Mac Studios' projects is in the strategies proposed. In Hadid's proposal, the conventional planning and decision making tools are re-interpreted with contemporary techniques. Although generative techniques have been used in the design of urban spaces, it is hard to argue that this urban design approach shows flexibility and evolutionary characteristics. Even some of the decision making methods could be evaluated as deterministic from certain aspects. In Project MUTEN on the other hand, totally new urban planning and design strategies are defined, which provide for an instance of the paradigm shift in urban design introduced by naturalistic approaches. Actually, the project could be seen far from applicability at the moment and also it is hard to understand the generative software and form finding processes used here since their technical details of them are not accessible. But it is important to discuss this project from the point of view of a new design strategy proposed. Here the core issue is to state a learnable and evolvable urban model

[59] Ibid.

[60] Ibid.

[61] Ibid.

with the help of AIS based on ecological paradigms. Also, this experimental study is important in order to concretize the naturalistic models related with complexity discourses which have been tried to be explained in the previous chapters.

Being a problematic area, Galataport was designed by Murat Tabanlıoğlu as part of an urban transformation project in 2001.[62] Departing from political or economical considerations and arguments, if we compare these two projects spanned by only five years and produced for the same area, we can easily see radical conceptual and formal differences between them (Fig. 29-30). Tabanlıoğlu's project is standing pure, cubical and looks like lots of other buildings that we are used to see since last years, while Project MUTEN is standing "digitally formed" with its curvilinear and non-ordered structures. But the difference is not only a formal or representational difference. The real difference is in the way of evaluating the urban problem. Actually it would be unfair to compare Tabanlıoğlu's Galataport and Kol/Mac's Project MUTEN since one is designed in order to correspond to actual needs and economical objectives in a realistic way according to present planning and building codes, while the other has been produced as an experimental study to introduce contemporary strategies. But in order to concretize the paradigm shift, it is interesting to see together these two different projects, which stand at the opposite sides of urban design approaches within the same historical period.

Lastly it is important to stress again the difference between Hadid's and Kol/Mac Studio's approaches. Kol/Mac Studio defines the problematic in a completely non-conventional way and their tools and way of thinking stands in a different position with the use of generative models, complex mathematical solutions and computer engineering. But unlike Zaha Hadid's project, this brand new approach to design and planning, as much in its conceptualization as in its tools, may also create problems in terms of people's understanding and identification of the

[62] Tabanlıoğlu, Murat. "Galataport Project Proposal", Galataport, last accessed in January 2007 http://www.galataport.org/images/gp-v2_buyuk.gif

project. While Hadid started from a "masterplan" (though arriving at one we are unfamiliar with), an idea we know very well, Kol/Mac's naturalistic models, Kohonen Maps and other tools an techniques stayed as alien as the urban form they produced, though the project has a strong and coherent conceptual and technical ground. This unfamiliarity leads to its evaluation just as a practice on urban morphology. But it is important that with this project naturalistic and evolutionary strategies in urban design and related discussions and questions have been introduced to the field.

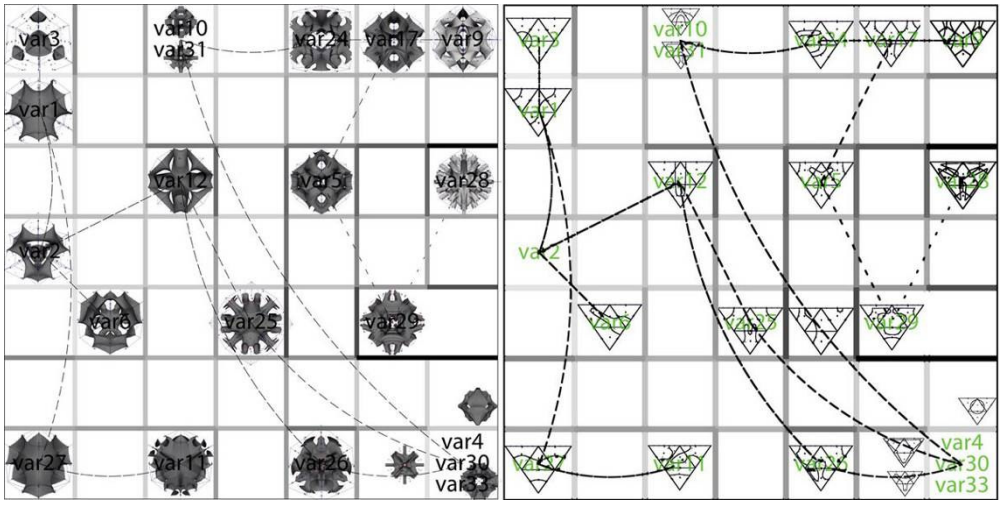

Figure 26: Kohonen Map examples from Project MUTEN**.** Sample topologies organized as Kohonen Maps (according to similarities) and base units for these sample topologies with variable boundary definitions (Kohonen Maps).

KOL/MAC Studio. "Project Muten Istanbul Exhibition", Exhibition Catalogue, İstanbul: Garanti Galeri, 2006

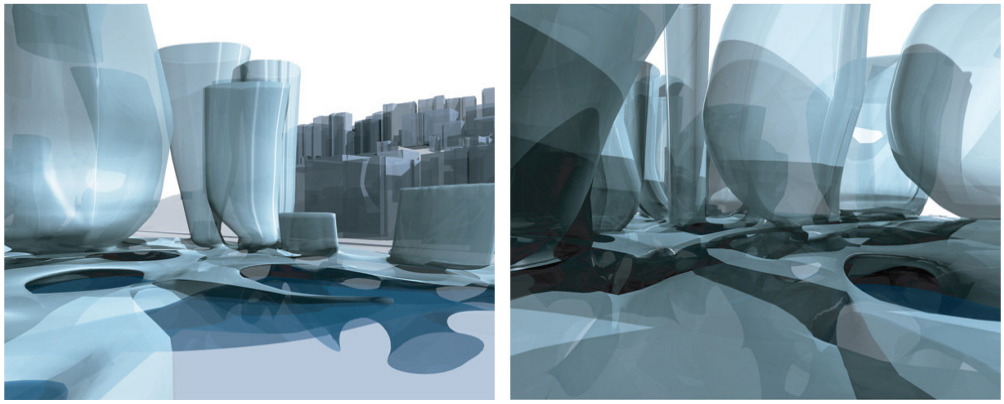

Figure 27: Perspective views – Project MUTEN.

KOL/MAC Studio. "Project Muten Istanbul Exhibition", Exhibition Catalogue, İstanbul: Garanti Galeri, 2006

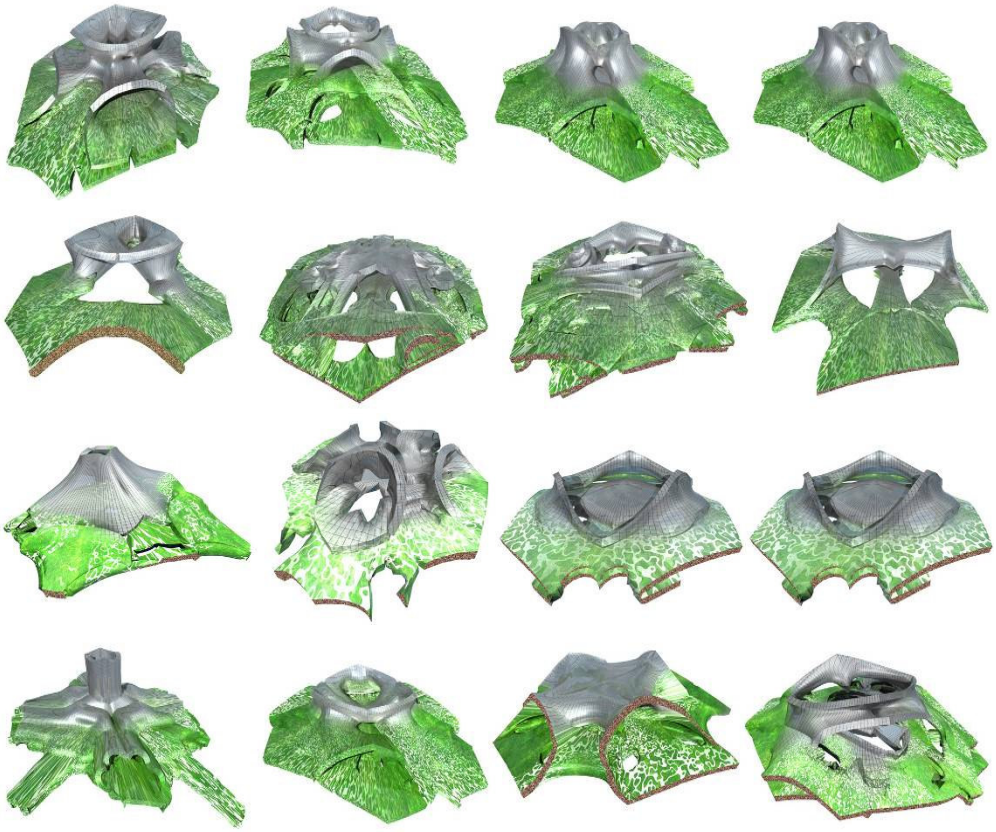

Figure 28: Formal Analyzes for Project MUTEN.

KOL/MAC Studio. "Project Muten Istanbul Exhibition", Exhibition Catalogue, İstanbul: Garanti Galeri, 2006

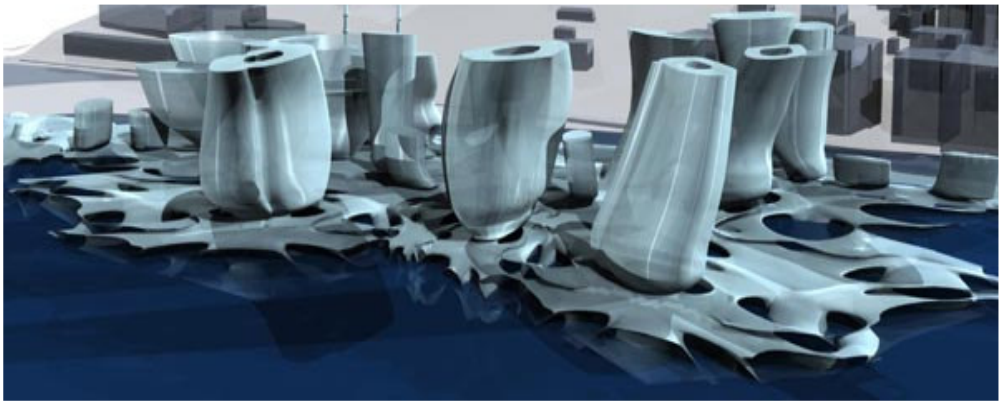

Figure 29: Perspective view – Project MUTEN.

KOL/MAC Studio. “Project Muten Istanbul Exhibition”, Exhibition Catalogue, İstanbul: Garanti Galeri, 2006

Figure 30: Tabanlıoğlu Architects’ Galataport Proposal.

Tabanlıoğlu, Murat. “Galataport Project Proposal”, Galataport, last accessed in January 2007 <http://www.galataport.org/images/gp-v2_buyuk.gif>

CHAPTER 5

CONCLUSION

The research questioned the ways in which new effective design strategies based on complexity theories could be developed in order to understand the complexity of the contemporary city, in particular the premises of complexity theory and evolutionary models in urban design. The main focus point has been on the non-reductionist design approach and its implications on urban scale, more specifically its reflections on contemporary architectural examples which directly affect the urban scale. The study has evaluated the improvement of these new approaches in urban design that develop along interdisciplinary lines and their theoretical and practical outcomes against a background of modernist urbanistic principles and applications. While analyzing contemporary approaches, their antecedents and precedents have also been clarified in order to research on the ways contemporary discourses and techniques relate to former ones. The study confronted Modernist urban design policies based on determinism, materialism, reductionism, and linearity to contemporary approaches based on complexity sciences in order to question whether they respond better to the necessities of contemporary life and city structure.

Contemporary approaches have been evaluated in terms of a different response they bring to the problem of control. It has been argued and attempted to show that contemporary approaches are not just improved design techniques based on technological developments. The understanding of control mechanisms has been seen to alter as well during the course of the century. The constitution of non-reductionist models have not led to the disappearance of control mechanisms. Still it is one of the main targets in urban planning to control the development process

at different scales. It can even be argued that these have become more effective and stronger. And it is still important to state short term or long term development models. When we look at the beginning of the century it is obvious that predicting and determining the final situation was more important than the control of the process. All the targets and predictions had been structured at the very beginning and it had been hoped that all the process would work according to these predictions and decisions. Planners and architects have projected their thoughts in the form of a plan based on numbers: floor area ratios, population densities and migration patterns. As Ali Rahim mentioned, this has resulted in cities whose structures are hierarchical (top-down), with a specific image of fixed, bounded forms.[1] These control mechanisms were totally based on determinism. It was believed that with perfect calculations for urban growth and strict predictions all the control would have been achieved. As it has been told before, this was the result of evaluating the city as a static, homogenous and fixed structure. On the other hand, totally free evolving systems, the opposite of incremental and deterministic development, were not preferable since they were usually associated with chaos, anarchy and aimlessness. But today it has become clear that the city is a highly complex organization, leading to the development of the contemporary approaches discussed in this study. These have been seen to continue pronouncing themselves on the issue of control. Related with this idea, Johan Bettum and Michael Hensel claim that:

> An alternative to deterministic closed systems and freely evolving, open systems would be a process that establishes a dynamic relationship between the determining forces of design with the emergent qualities of evolving systems. Such a strategy would potentially draw upon synergetic effects between designed and evolved conditions within the urban matrix.[2]

[1] Rahim, Ali. 2000.p.20.

[2] Bettum, Johan, and Hensel Michael. 2000. p.39.

Today, it is tried to constitute naturalistic models that simulate realistically the urban areas' future development. So by the help of these naturalistic simulations, the projections about the growth and development are tried to be stated. According to these models, control policies are shaped and applied. It is important to establish a dynamic relationship between the determining forces of design and the emergent qualities of evolving systems. Such a strategy could be an alternative to deterministic closed systems and also to freely evolving systems since it creates a relation between the designed and evolving conditions within the urban matrix. [3]

It needs to be noted that the effect of contemporary approaches and naturalistic models have been increasing from day to day. Though it is not possible to argue for a total paradigm shift from reductionist strategies to generative models, it can be said that a shift has started with respect to modernist precedents and shaped into stronger alternatives to determinist urban policies. This research did not argue for a dichotomy between modernism and contemporary approaches. Indeed, it has only referred to a limited selection in early modern approaches to urban design in order to to stress that, like in all other branches of design, there has been a paradigm shift in urban design, supported by the theoretical and scientific developments. With this paradigm shift, urban design and planning strategies have been changing in order to adapt to the complex needs of 21st century cities which have also undergone important transformations during the last century. Therefore, instead of creating dichotomies or focusing on critiques of architectural periods, it has been essential in this study to clarify contemporary processes against determinist planning strategies, the criticisms of which had already started within Modernism itself, and developed during more than half century up to day. For the comparisons about modernist and contemporary design understanding, Zaha Hadid and Patrik Schumacher observe that:

[3] Ibid. 39.

> "The history of (built and unbuilt) Modern Architecture has been paraded as villain and quoted as a symbol for the vanity of failed utopian claims. After 50 years of world-wide adoption, the projections and principles of the modern heroes can hardly be discussed as "mistakes", even if the socio-economic transformations of the last two decades - achieved on the back of the material advances of the modern period - mean that the social ideals, desires and requirements with respect to the architecture of the contemporary city have since developed in radical anti-thesis to the modern utopias."[4]

In the contemporary world, the needs of cities are changing, complexity sciences and computer technologies are improving rapidly as never been before. Related with all these conceptual and technological developments, design and planning strategies show a parallel transformation. A subject matter of this study, the emergence of the generative and naturalistic models in urban design is a part of this paradigm shift. Although it is hard to decide whether naturalistic modeling techniques will succeed in solving the complex problems of urban areas, it seems important to develop a consciousness and analyze these attitudes deeply, as has been the aim of this study.

Today it is not easy to observe and discuss the results of contemporary strategies since most of the projects stay conceptual and experimental. However, it would be misleading to restrain their discussion merely to the generation of urban form, or in other words, the flexibility of form finding processes. The main goal of naturalistic approaches is to generate realistic urban models depending on computer technologies in order to maintain the needs of complex city structues and state sustainable urban developments. Therefore, more than focusing on formal studies, generative techniques are developed for stating alternative urban design and planning strategies.

[4] Hadid, Zaha, and Schumacher Patrik (Eds.). "Introduction", Latent Utopias: Experiments Within Contemporary Architecture, Wien, New York: Springer Verlag, 2002.

The approaches examined in this study also present some handicaps in dealing with the social structures of cities since they are more depending on the economical or the physical parameters of the environment. But there is no doubt that, with the improvements in computer technologies and complexity sciences, this new paradigm in urban design will develop further and naturalistic modeling strategies will become widespread in the near future.

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