A RESEARCH ON MOBILE ARCHITECTURE THROUGH 20TH CENTURY UTOPIAN MEGASTRUCTURE APPROACHES: YONA FRIEDMAN'S 'THE SPATIAL CITY' AS A CASE STUDY

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ABSTRACT

A RESEARCH ON MOBILE ARCHITECTURE THROUGH 20TH CENTURY UTOPIAN MEGASTRUCTURE APPROACHES: YONA FRIEDMAN'S 'THE SPATIAL CITY' AS A CASE STUDY

This thesis investigates the understanding of mobile architecture of 20th century techno-utopian megastructure pioneers. In this research, firstly, the concepts of mobile and mobility are examined and then concepts such as flexibility, portability, adaptation, and modularity are examined in the context of mobile architecture. In this context, the varieties and reasons for the emergence and effects of the concept of mobile architecture have been examined and the role of the architect has been questioned throughout the process.

The state of being mobile has always been an obligation in evolutionary terms for human survival. The increasing population, migration and developing technology have also increased the mobility of people. The increasing density and decreasing living standards, especially in the cities after the Second World War, led the architects to search for a new understanding of the city. The fixed and rigid rules of the modern movement couldn't be the solution to the problems in the cities. The architects of the period 1950-1970 attempted to bring the city together in a spatial sense, which was increasingly dense. In this period, the optimism towards technology has led the architects to design megastructure projects. The megastructure projects designed in this context have remained utopic since they were very radical and provocative. The concept of mobile architecture has been focused on the projects of megastructure pioneers that emerged in this period, and the role of the architect has been questioned in the process. Yona Friedman has adopted the philosophy of user freedoms as the main principle in the context of mobile architecture. Therefore, his approach was different among other megastructure pioneers, Yona Friedman and his megastructure project Spatial City is examined as a case study.

To sum up, it can be said that mobile architecture is not just a movement-oriented approach; it can be understood and defined in many ways. However, in the thesis, the focus was on the philosophy of freedom of the users in the context of mobile architecture.

ÖZET

20. YÜZYILDAKİ ÜTOPİK MEGA YAPI YAKLAŞIMLARI ÜZERİNDEN MOBİL MİMARLIĞIN İNCELENMESİ: YONA FRIEDMAN'IN SPATIAL CITY PROJESİ

Bu tez, 20. yüzyılın tekno-ütopik mega yapı öncülerinin mobil mimarlık anlayışlarını incelemektedir. Bu araştırmada öncelikle mobil ve mobilite kavramları incelenmiş, ardından esneklik, taşınabilirlik, adaptasyon ve modülerlik gibi kavramlar mobil mimarlık bağlamında incelenmiştir. Bu bağlamda mobil mimarlık kavramının türleri, formları, ölçekleri, ortaya çıkış nedenleri ve etkileri incelenerek süreç boyunca mimarın rolü sorgulanmıştır.

Mobil olma hali, evrimsel açıdan, insanın yaşamını sürdürebilmesi için her zaman mecburi olmuştur. Giderek artmakta olan nüfus, göçler ve gelişmekte olan teknoloji, insanların mobilitesini de arttırmıştır. Özellikle İkinci Dünya Savaşı sonrası kentlerde artan yoğunluk ve giderek azalan yaşam standartları, mimarları yeni bir kent anlayışı arayışına itmiştir. Modern akımın getirmiş olduğu sabit ve katı kurallar, kentlerdeki problemlere çözüm olamamıştır. 1950-1970 dönemi mimarları, giderek yoğunlaşan kenti, bir araya toplama çabası içine girmişlerdir. Bu dönemde teknolojiye olan iyimserlik, mimarları, mega yapı projeleri tasarlamaya yönlendirmiştir. Bu bağlamda tasarlanmış olan mega yapı projeleri oldukça radikal ve provakatif olduklarından birer ütopya olarak kalmıştır. Modern akımın kurallarından çıkılmış ve mobil mimarlık anlayışları mega yapı projelerinde görülmeye başlanmıştır. Tezde bu dönemde ortaya çıkmış mega yapı öncülerinin projeleri üzerinden mobil mimarlık anlayışlarına odaklanılmış ve bu süreçte mimarın rolü de sorgulanmıştır. İncelenen mega yapı projelerindeki kullanıcı özgürlüklerini temel felsefe olarak benimsemiş Yona Friedman, diğer öncülerden ayrılmış ve Spatial City projesi vaka çalışması olarak ele alınmıştır.

Özet olarak, mobil mimarlığın sadece hareket odaklı bir anlayış olmadığı, birçok şekilde anlaşılıp, tanımlanabileceği anlatılmıştır. Ancak tezde, mobil mimarlık bağlamında kullanıcı özgürlükleri felsefesi üzerine odaklanılmıştır.

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1. INTRODUCTION

From an evolutionary point of view, human survival depends on mobility. Being mobile for human beings has always been compulsory. As a result of the growing population and developing technology in the world, the speed of mobility has also increased. There have been researches on mobility in many areas. As a result of these researches, the differences between the concepts of 'mobile' and 'mobility' were examined, and it was emphasized that the concept of mobility encompasses many fields. Various experts, especially in the fields of sociology, psychology, architecture, and geography, approached the concept of mobility differently. Social mobility, spatial mobility, mobility of physical assets (human, object), and mobility of abstract (knowledge, idea) concepts were explained. Then, the subject of the thesis was progressed to the field of mobile architecture and focused on spatial mobility.

Mobile architecture is associated with many concepts. The definitions of adaptation, flexibility, portability, etc. can be an explanation of each other as well as offer different approaches in architecture. These concepts, which have developed, especially in the 20th century, had been interpreted differently by many architects. Since these concepts are related to each other, it was thought that drawing the boundaries would not give productive results. For this reason, instead of classifying these concepts separately, they were examined under the title of mobile architecture.

By focusing on the 20th century when these concepts emerged predominantly in architecture, the pioneering projects were designed in the context of mobile architecture, therefore varieties of mobile architecture developed. After examining these pioneering projects, contemporary mobile architecture projects were examined in the 21st century, and the effects of the developing technology on mobile architecture were shown in the examples.

As a result of the growing migration and population, mobility in cities has increased gradually, therefore various sociologists, architects, and anthropologists have investigated the mobility in cities. These researchers had focused on how social and spatial mobility in cities could be observed and how insufficient existing cities were. The development of technology, especially after the Second World War, had led the architects to propose solutions to this insufficiency in the cities.

The strict rules of the modern movement couldn't solve the problem of urgent housing needs, especially in post-war cities. For this reason, technology-oriented optimism began to be seen in projects designed by young architects after the 1950s. In this period, while architects were looking for solutions to housing needs, they mostly proposed utopian megastructure projects on an urban scale.

Although the focus of the thesis was on city-scale projects in the context of mobile architecture, there were also smaller-scale mobile architecture projects that can be considered as pioneers in this period. As an example, Cedric Price's projects were not on a city scale, the projects he designed using the cybernetic technologies of the period were mentioned in the flow since they reflect the mobile architecture understanding of the period.

The rapidly increasing population and mobility directed architects to design cities vertically, so they wanted to gather the expanding city in a spatial sense. They have paid attention to the fact that cities should be capable of responding to the growing population. In addition, architects of the period envisaged cities that adopt new lifestyles compatible with reduced work-load, increased mobility, and leisure time as a result of the development of automation, transport, communication, and cybernetic technologies. In this context, they stated that cities should be as mobile as possible. Thus, the architects of the period believed that people could adapt to different lifestyles and be freer.

1.1. AIM OF THE STUDY

The aim of this study was to investigate the origins of the concept of mobile architecture, which is a sustainable architectural approach that can adapt to the lifestyles of people who are changing with the developing technology. Mobile architecture is contrary to the rigid and fixed state of existing cities and buildings. In this context, the possible parameters that can respond to the increasing mobility of people and changing lifestyles formed the basis of this research. According to the fact that each person is different, it was thought that pre-determined architecture imposed by the architect cannot respond to the unpredictability of people and cannot adapt to future needs. The idea that people can intervene in their environment whenever necessary in accordance with their own needs is adopted, and as a result, it was thought that the role of the architect should be questioned.

The thesis focused on the post-World War II era in which projects in the concept of mobile architecture emerged. The architects of the period proposed megastructure projects that supported mass production on an urban scale to meet the urgent need for housing. Although these megastructure projects remained utopia, they were examined for their contribution to the development of mobile architecture. The concepts of mobile architecture were examined through utopic megastructure projects designed by architects, architectural groups and artists of the period. The freedoms that these pioneers offered to the user were seen as a dominant idea in their projects. Among these pioneers, Yona Friedman, which has adopted the concept of 'user freedom' as a philosophy in the context of mobile architecture, have been focused.

1.2. SCOPE OF THE STUDY

This study focuses on the 20th century, specifically between the 1960-1970 period, the period when mobile architecture emerged. Mobile architecture was founded by Yona Friedman. Although he later stated that the word mobile architecture was wrong, he used it even so because he thought it was easy to translate into all languages. However, the thesis mainly focused on Yona Friedman's perception of mobile architecture but in the process, other perceptions of mobile architecture considered necessary to be mentioned.

In the thesis, concepts such as flexibility, mobility, adaptation, articulation, portability, modularity, etc. were considered as supporting concepts of mobile architecture and examined together. It was explained in the conceptual flow that the factors and boundaries of the emergence of the concept of mobile architecture cannot be clearly drawn. Then, the relationship between mobile architecture and the city was examined by the discourses of various sociologists, architects, and anthropologists. In particular, it has been investigated how technological developments after 1950 influenced mobile architecture. As a solution to the urgent need for housing that emerged after the Second World War, the focus was on megastructure projects in the concept of mobile architecture, which was considered on an urban scale. The optimism towards technology was adopted by the architects of the period and this optimism developed the utopic megastructure approaches.

For this reason, the concept of mobile architecture was examined through utopic megastructure projects. In order to better examine utopic megastructures, it was considered necessary to investigate the concept of utopia, the relationship between utopia and the city

and the mobile architecture concepts in the utopias of the 20th century. Then, projects that contributed to the development of megastructure approaches in the 20th century were mentioned. After that, the pioneers of the megastructures in the context of mobile architecture, which was the main focus of the thesis, were studied. After examining each pioneer's understanding of mobile architecture through his/her projects, Yona Friedman's mobile architecture theory and Spatial City project, which user freedom and unpredictability were seen as the most dominant, were focused on. The Spatial City project was chosen because it was an indication of Yona Friedman's understanding of mobile architecture on a city scale.

1.3. METHOD OF THE STUDY

In this research, conceptual explanations, examples, and theories of mobile architecture and related fields were investigated with hermeneutic and emancipatory methods, also with qualitative methods, which were grounded theory and a case study.

In chapter 2, the pioneering examples of mobile architecture in the 20th century and the examples of contemporary mobile architecture in the 21st century have been identified through historical and conceptual researches. Then the relationship between mobility and city is discussed through the theoretical and conceptual explanations of various architects, sociologists, and anthropologists. In chapter 3, the pioneers of the utopic megastructures, which contributed to the development of mobile architecture in the 20th century, were examined. In this context, the projects of Constant Nieuwenhuys, Yona Friedman, The Metabolist Group, and Archigram, and their understanding of mobile architecture had been examined in chapter 4 and interpreted in chapter 5.

The secondary data obtained, mainly from two books by Yona Friedman: Pro Domo and Architecture with the People, by the People, for the People. As a result of the secondary data obtained, Yona Friedman's Mobile Architecture Theory and Spatial City project, which were distinguished from other pioneers in terms of ‘the user freedoms’ in concept mobile architecture, had been selected and examined as a case study in chapter 5.

2. CONCEPTUAL FRAMEWORK OF MOBILE ARCHITECTURE

The word ’mobile’ was first encountered in the texts about astronomy in the 15th century. The word "mobile" originated in Latin "mobilis"; means moving, changing, non-stationary, displaceable [1]. The concepts of mobile and mobility have been defined by various philosophers, sociologists, and architects. In this section, the definitions and opinions of these people on this subject were examined.

According to Henri Bergson, immobility is an illusion and not real. According to him, a body or an object is always in motion. Fredrich Engels agreed with Henri Bergson and stated movement is the mode of existence of matter, and motionless substance cannot exist. Therefore the idea of mobility is not a new phenomenon [2]. It’s a versatile concept and a social phenomenon that includes not only physical movement but also mental and technological development [3] It is to understand and interact with the world analytically.

Humankind has been and continues to be mobile since its existence. In an evolutionary sense, the most significant factors in the survival of human beings are the ability to move and adapt [4]. For example, the Rendille nomadic community in Kenya, located in East Africa, is one of them [5]. Difficult living conditions and inefficient lands have forced people in this region to be mobile. It is possible to observe this in many nomadic societies. Bernard Rudofsky stated that in traditional societies, architecture was made without architects and that architects emerged only in aristocratic societies [5]. Relation to this, Figure 2.1 is a visual representation of the structural elements carried by two donkeys on the day of the relocation of the Rendille community. Here the structure is dismantled and taken to its new location.

Figure 2.1. Rendille community on moving day [5].

As another example, in 1873, Jules Verne's Around the World in Eighty Days was a representation of the British empire's mobility and the development of modern transport technologies. Now the world is in the palm of their hands. In his work Grundrisse, Karl Marx described this search for mobility as the "disappearance of space in time" with capitalism. [6]. With this discourse, it is emphasized that being mobile is related to space and time. Therefore, because being mobile is related to time, it accommodates temporality.

> Is the urban program mobilizing, or is being - mobile becoming a program? Mobility. Mobile (without building) designs have existed for centuries; they are in a hybrid category between auto-mobile and building: they have a dizzying diversity from nomadic tents to temporary structures. Historians will probably not be able to decide which category of civilization they are, as biologists cannot decide which category of insect-eating plants [7].

Although there are many types of mobility, such as mobility of people, mobility of information and places, the speed of mobility increases with technological advancements. Therefore, the concept of mobility encompasses many fields and cannot be studied in a single field. Social, cultural, political and economic fields are some of them [8]**.** We have to make small or big choices in our social lives. The diversity of these choices is increasing thanks to mobility. The more mobile we are, the more options we have. As a result, the state of being mobile is becoming an increasingly important factor in expressing ourselves [8]**.** In particular, the ongoing interaction between developments in transportation, telecommunications technologies, developments in the economy, culture has made the concept of mobility the defining characteristic of modern societies [9].

The process of spatial disintegration of various functions and reintegration through mobility emerged slowly during the industrial revolution [10]. As an example, while the headquarters of a company is located in the city, the production center can be outside of the city, and integration can be achieved through mobility.

David Harvey, one of the many scientists who have stated that the space-time gap that narrows/shrinks as a result of technological advances in transportation and communication fields, changes people's understanding of society, said the followings:

> We have been experiencing these last two decades, an intense phase of time-space compression that had a disorienting and disruptive impact upon political-economic practices the balance of class power, as well as upon cultural and social life [10].

Accordingly, Harvey emphasized that the change in the pattern and order of mobility may be the basis of social changes [10]. With this discourse, David Harvey stressed the importance of mobility in social life. Aiwah Ong (2006) also wrote, in support of Harvey, how the concept of mobility became a code/keyword in our understanding of today's global world. John Berger, support these discourses, explains the transformation of the concept of home in the global world; Mobility has irrevocably changed the concept of "home" in the modern world. He gave an example of that the house can no longer be a stable center in the individual's world [11]. In an architectural sense, this approach firstly adopted and used by Le Corbusier in his project called Dom-Ino House.

An example of this situation can be understood as to where an individual migrates from one place to another. The process of adapting to the migrated city, society, etc. is similar to Doreen Massey's (1994) concept of "progressive sense of place." Not only does the individual move physically to the place of migration, but they also carry their own culture and memories. As another example of the home concept concerning mobility, Heidegger stressed that a truck driver could feel at home on the road [11]. According to Yona Friedman, migration is beneficial for the development of the migrated city.

The increasing speed of mobility in social life with the developing communication and transportation technologies and reaching a global level ensured that spatial distances do not constitute an obstacle and developed globalization. Globalization is about increasing the mobility of products, services, objects, information, and people across borders [2].

The French philosopher Jean-François Lyotard stated that it is now possible to access information anytime and anywhere thanks to advanced transport and information technologies. In this way, he emphasized that information becomes independent of time and space [12].

As another approach to the concept of mobility is; it brings freedom as well as an obligation in society. If people were not mobile, they would not be able to exist economically and socially in society and could not have the chance to benefit from even the simplest services. [13]. Mobility obliges people to give rise to radical changes, differences in people's lives and to increase their commitment to others [11].

Mobility research, in its broadest scope, concerns not only physical movement but also potential movement, hindered movement, absence of movement, as well as forms of space

[14]. The mobility of space can generally be described as the geographic displacement of assets or, in other words, the movement of assets from the starting point to the destination on a given route [10]. These mobilities can be physical (human, object) or abstract (information, idea) assets. During or after these mobilities, the value, importance, and even the destination of the asset might change [10]. In connection with this, Yona Friedman, while explaining the theory that global communication is impossible, he stated that the communication within the groups of people is realized by the intermediaries and the information conveyed is effected continuously. He mentioned that the person who conveyed the message might have misunderstood, forwarded inadequately or changed the message, and the more people/intermediaries between the person who owns the message and the person that the message should reach, the more changes the message will face. [15].

In this section, the concept of mobility was defined briefly by different architects, sociologists, and philosophers in the widest range, and that mobility research covers many fields such as sociology, philosophy, architecture, geography, and psychology. In the next section of the thesis, the focus was on the mobility of physical assets such as people or objects in space in the context of mobile architecture rather than the mobility of abstract assets.

2.1. MOBILE ARCHITECTURE

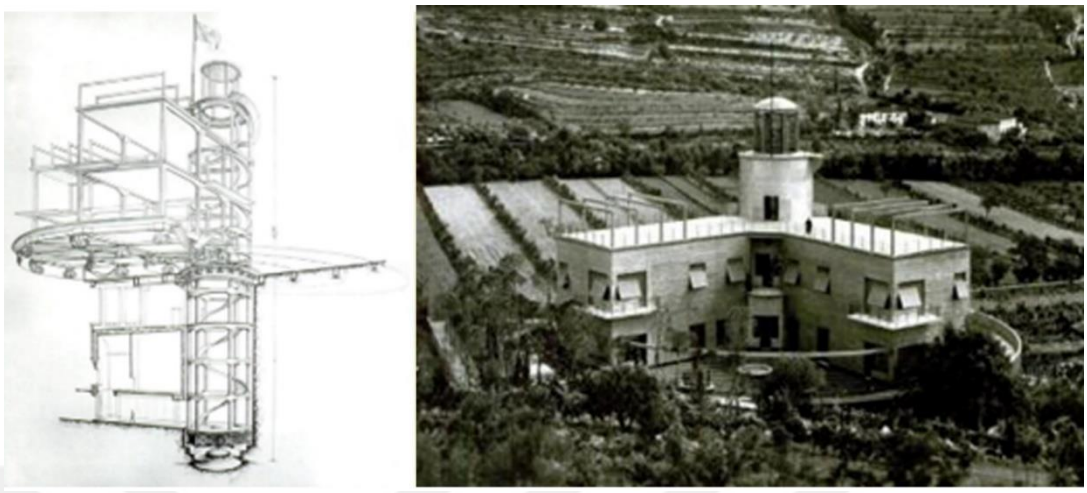
The mobile structure is the structure moving in its simplest description [3]. However, this movement can take place at many scales and approaches within the context of architecture. It can be associated with many perspectives in architecture, it can be a city-scale movement or the fact that the structure itself is independent of the ground, can be dismantled and installed in different places, adapted to different uses and interpretations, or it can be the movement of building components such as doors, windows, and walls. In architecture, movements at these different scales and approaches do not solely represent the word “mobile.” These approaches can be associated with different concepts in architecture such as transformable, dynamic, temporary, multifunctional, floating, flexible, portable, or modular systems etc., and they all have similar approaches [16]**.** In architecture, terms such as flexibility, temporality, mobility, kinetics, portability, etc. are classified as separate concepts in some sources, and in some sources, they are examined by associating them with

each other in the same meaning. These terms may be definitions or explanations of each other, or they may offer different approaches. For example, a structure with a flexible design does not necessarily have to be mobile or temporary, but the concept of flexibility may also depend on the state of being mobile. At the same time, a movable structure does not have to have a flexible design. The divergence here may vary according to the type of design concept in this example of “flexible design.” As another example, the fact that a mobile structure can move does not necessarily mean that it has to move. A mobile structure can be either fixed or permanent. In this context, the boundaries of mobile architecture are becoming indistinct, and it is quite difficult to draw these boundaries. Therefore, in the thesis, these concepts are not classified under separate titles, and it was considered necessary to examine them together under the title of mobile architecture.

Concepts such as mobility and flexibility in architectural structures were first tested in residential buildings. The concept of mobility in residential buildings in architecture was first included in 1908 with Thomas Gaynor's Rotary Building project. In the project, the structure was thought to revolve around itself, so it was considered a mobile project. Thomas Gaynor especially wanted the structure to look conventional from the outside, similar to other buildings of the period. He avoided the idea of the building being too radical [17].

Figure 2.2. Sketch of Rotary Building front elevation and floor plan [17].

After this project, many other buildings were designed that could rotate around itself. Villa Girasole building, which was built in 1931, was thought to be L-shaped. Angelo Invernizzi and several designers built it as an experimental architecture [17]. It can rotate around itself according to the sun. A mechanism installed on the floor provides the rotation of the building.



(a) (b)

Figure 2.3. Villa Girasole. (a) Rotation mechanism, (b) Image of Villa Girasole [17].

Such mobile buildings that can provide rotation around itself exist in many periods. However, these buildings were not examined in detail since they do not have mobility based on flexibility, adaptation, mass production, or articulation, but it was considered necessary to mention these first mobile buildings in terms of the history of mobility concept in architecture.

Concepts such as mobility, flexibility, and adaptation in architecture have increased in technological utopias after the 19th century and have been incorporated into projects through technological developments [18]. Especially after the First World War, the increasing debates in the concepts of standardization, rationalization, constructivism, functionalism have led to the system of 'prefabrication' in architecture [19]. The prefabrication system also increased the impact of the concepts of mass production, flexibility, portability, and automation in architecture and thus played an important role in meeting the housing need. These concepts, which became popular and gained importance in the 1950s, have been studied and developed in many ways in the theories and projects of many architects. Walter Gropius mentioned about the concept of flexibility in 1954 that:

> The architect should conceive buildings not as monuments, but as receptacles for the flow of life which they have to serve [20].

After this discourse, definitions of flexibility concept among architects increased and diversified. Various architects have defined flexible and mobile architecture concepts. In this section, the definitions of architects concentrating on concepts such as flexible, mobile, and portable in architecture were mentioned, and the examples were selected according to these definitions.

Robert Kronenburg defined flexible architecture as a mobile, adaptable, transformable interdisciplinary form of design [4].

Yona Friedman defined flexibility as mobility and freedom [21]. Friedman has adopted the concept of flexibility in its projects. Yona Friedman's understanding of mobile architecture is not the mobility of buildings, but the mobility of users/people. Friedman stated that architecture produces obstacles by its very nature. For example, a wall or other partitions limit the space. However, he stated that these obstacles must be depended on the user and should be changed.

In the projects he called ‘superstructures’ he designed on the city, he proposed a flexible system where users could freely install and dismantle their housing units at any time. The concept of flexibility here also includes ‘transience.’ In this respect, the flexibility that has added ‘time’ and ‘unknown’ concepts to architectural design has also contributed to functional architecture [22].

Schneider and Till stated that one of the most important aspects of the concept of flexibility is to avoid invariance [21]. However, space can contain an infinite variance but that would lead to open-endedness, which eventually would lead to instability in space [23]. The design of fixed/stabile elements of the building, such as the carrier system and service areas, has been important factor for architectural flexibility. Schneider and Till emphasized that two issues can be discussed in the discourse of flexibility. One of them contains mobile transformable spaces as defined paths, and the other one contains infinite variances as undefined paths [21].

Architecture historian Adrian Forty stated that the concept of flexibility is an illusion that gives architects future control of their buildings [21]. Adrian Forty mentioned about the flexibility in architecture that:

> An important modernist term, particularly in the period after 1950 ’flexibility’ offered hope of redeeming functionalism from determinist excess by introducing time, and the unknown. Against the presumption that all parts of a building should be destined for specific uses, a recognition that not all uses could be foreseen at the moment of design made ‘flexibility’ a desirable architectural property [24].

Adrian Forty examined the concept of flexibility in developing architecture in the following three types:

- Flexibility as a spatial abundance
- Flexibility as a political strategy
- Flexibility in terms of techniques

Adrian Forty defines flexibility as spatial abundance as large spaces that can allow different or opposite interpretations and uses [25]. This kind of flexibility concepts is designed to adapt to uncertain developments in space in the future [21].

Adrian Forty stated that flexibility as a political strategy is not a feature of buildings but a feature of spaces and is a feature that has been acquired and established during its use. [25].

Adrian Forty defined two types of architectural flexibility in terms of techniques. The first of these, arrangement and movement of elements in the space, the second is light, demountable floor, wall, and ceiling panels within the carrier system. Forty shows the buildings of Rietveld-Schröder House in Utrecht and the Maison de Verre in Paris by Pierre Chareau as the examples of the first type.

Adrian Forty mentioned that the second type of architectural flexibility in the technical means has developed in the 1950s by Anton Ehrenkrantz and Konrad Waschmann. Spaces that were elevated from the ground level, intended to offer more freedom in the arrangement of school and factory buildings. This above ground system was an inspiration to the European architect Yona Friedman and graphic-artist, painter Constant Nieuwenhuys [24].

In this example of flexible space, who is the authorized and expert person to intervene in the arrangement of the space? Is it an architect, landowner, user, someone else, or something? [25]. This issue was discussed in more detail under the title of Yona Friedman's Mobile Architecture Theory.

Peter Collins wrote that flexibility is, in a sense, a type of functionalism. Ellinor DeGory opposed this view; functionalist theory, although dependent on spatial determinist ideas, it wants the user to be passive and obedient. She stated that this is contrary to the concept of flexibility, which always puts forward the user to be active [25].

Apart from these, many different definitions have been made about flexibility. Accordingly, the common point has been the concept of change/transformation. The concept of change/transformation also depends on the user, function, technology, and time [21]. Change/transformation in architecture includes ‘time,’ ‘space,’ and ‘body.’ Therefore, to better understand the change and transformation in architecture, it is necessary to examine the relationship between the concepts of time, space, and body. In this section, the definitions of these concepts and their relationship with the phenomenon of mobility were examined through the discourses of various philosophers, sociologists, architects, and anthropologists. In this context, the Serpentine Pavilion was selected as an example.

In relation to change/transformation in architecture, Arata Isozaki gave an example about music and piano:

> The important thing is that people live in an architecture that is never fixed. A piano is not music, but today's architects are not interested in music, but only in the structure of the piano [26].

Architecture constructs the movement, flow, and harmony in the space, as well as building stability in the space [27]. In order to build flow and harmony in architecture, it is necessary to define the concept of ‘place’ and explain the other related concepts. Etymologically, the definition of ‘place’ or ‘defined space’ is both to ‘make space distinctive’ and to ‘fully define the nature of space’ [28]. The flow, harmony, and mobility of ‘defined space/place’ are always related to space, body and time. Concerning this, Merleau-Ponty (1968) emphasized that ‘defined space/place’ can exist with the movement of the body over time. He explained the relationship between body and ‘defined space/place’ as follows; the body, in its own time, gives life to the space with its movement, and space offers the possibility for its existence. The posture, position, and perspective of the body perceive the place is in constant change and formation [29].

According to Rudolf Arnheim, the effect on the user as a result of the movement of the body in space varies according to the function of the space. Arnheim, for example, stated that the spatial effect of a corridor in the user's mind is to move on a certain axis, is the effect always remains the same, but that a room will create a more dynamic effect visually as it is perceived from different perspectives and experiences [30]. Therefore, there is continuous transience based on experience in our perception of space over time.

Gilles Deleuze and Felix Guattari, who are critical philosophers of the 20th century stated that space is in a continuous state and therefore contains temporariness and displacement. In this respect, according to Deleuze and Guattari, space has no stable/fixed context; context is a chain of events whose content is constantly evolving and reshaping over time [31].

Carole Lévesque, pointing out another point about temporality in architecture, emphasized that instability arises in the meeting of experience, time, and context and it is impossible to predict the outcome of this combination. According to Lévesque, temporality in architecture is an intervention that grows our desire to discover the unknown and unpredictable possibilities. Carole Lévesque stated that temporary buildings are more economical in terms of usefulness. Also, she emphasized, small-scale temporary structures have the freedom to explore and test by interacting directly with their audience and environment [32]. This understanding of architecture has similarities with the principles of Yona Friedman's Mobile Architecture Theory; which are expressing the importance of architectural experience and process.

The French philosopher Maurice Merleau-Ponty defined a special moment in which the space we experience with our body are intertwined and shifted [30]. Carole Lévesque stated that these experiences are subjective [32]. And this relationship between our body and space creates a sense of place [30]. A sense of place emerges with feelings of enclosure and protection [33]. Therefore, it can be said that each person's sense of place is different and in order to create a sense of place, spaces should be unique for each individual.

The anthropologist Edward T. Hall, stated that the perception of the place first appeared by the people living in the forest. According to him, the relationship between the tree and the limiting elements, such as altitude, created a sense of place. According to the German architect J. Joedicke, the absence of these limiting elements creates a void. Another architect who touches upon the importance of volume and void is Yona Friedman. He stated that there

should be a certain rule between the volumes and voids, i.e., residential units, settlement, natural light, ventilation, etc. As Henri Lefebvre mentioned, it is important to identify and construct fixed and non-fixed in space.

Another point to be mentioned concerning this is who should apply this arrangement? About this, mobilizing architecture has often been linked to the question of permanence, stability, and also question the role of the architect, who is the definer of space [34].

Questioning the concept of 'permanence,' Shadi Nazarian emphasized that the conceptual understanding of this word depends on the perception of time and matter. She stated that concepts such as time and matter also depends on and are influenced by cultural and scientific approaches. And a possible change in the definitions of time and matter would force us to rethink the concept of permanence [35].

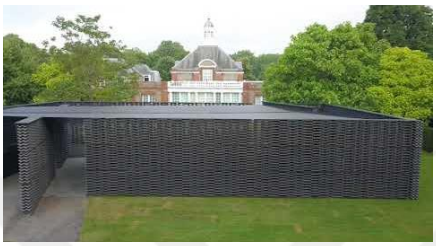
As a result of this, it has been questioned that the meaning of the concept of 'permanence' can also be temporary and flexible. Terminological changes of words can affect many areas as well as architecture. At this point, the importance of mobility of physical or abstract assets in architecture was emphasized again.

The Serpentine Gallery Pavilion in Hyde Park, London, has been studied as an example of this space-time and temporality concept. In the Serpentine Gallery, which was transformed into a permanent art gallery by the British Art Commission in 1970, after 2000, a unique architectural program was started; every year, a different architect designs a temporary structure at the green space in front of the gallery. This cycle continues every year and it can be said that Serpentine Pavilion has become a 'laboratory place.' The structures in this Pavilion have embraced to be temporary and are not designed to resist time. In contrast to this, most of the established pavilions have undertaken missions such as adherence to the earth, identification with it or creating a lasting impact.

In 2016, for example, the Serpentine Pavilion organized the exhibition named 'Summer House' to accompany architect Bjarke Ingels. Yona Friedman, who was among the architects, implemented and exhibited the Space Chains project. Space Chains project was examined under the title of Mobile Architecture Theory of Yona Friedman.

(a)

(b)



(c)

(d)

Figure 2.4. Serpentine Pavillion 2016-2019. (a) by Bjarke Ingels 2016, (b) by Francis Kéré 2017, (c) by Frida Escobedo 2018, (d) by Junya Ishigami 2019 [36].

Another architect, Robert Kronenburg, who has studies on being flexible and mobile in architecture, examined being mobile in buildings in three main groups;

- By moving the structure in one piece
- By applying methods that give movement to the structure
- By moving the structure in pieces and building it on site

Robert Kronenburg, like Yona Friedman, emphasizes that the movement of the majority of mobile structures is ’built on-site’, the third article, to carry the structure in pieces and build it in place. ’Built on-site’ ’is highly preferred especially in areas with difficult living conditions. As an implementation from this, mobile structures aim to solve problems and are therefore mobile. In this context, many buildings can be examples of mobile architecture. Examples are caravans, transportable, floating, air-pressure structures. However, as mentioned, it is not possible to draw the boundaries of mobile architecture. In this context, mobile architecture projects in the 20th and 21st centuries were selected and examined in connection with the subject of the thesis. In order to see this more concretely, in the following section, the pioneering examples of mobile architecture in the 20th century were examined as a subheading, after that, the contemporary projects of mobile architecture in the 21st

century were examined to investigate the ideas about the emergence of mobile architecture in this century.

2.1.1. Pioneering Examples of Mobile Architecture in the 20th Century

In the mid-20th century, reactions to functionality and the rigid rules of the modern movement first led to the development of concepts such as flexibility, mobility, open plan, transparency, and temporality. With the development of technology and industry, production speed, automation increased, new materials and changing lifestyles caused architecture to change [1]. Le Corbusier first proposed the idea of a flexible, adaptable, open-system, mobile structure that would support mass production in the early 20th century in the modern movement. The development of technology has allowed the fixed elements of the structure to be adjustable or to be separated from each other. Le Corbusier's Dom-Ino House, Unité d'Habitation, Rietveld Schröder House, Buckminster Fuller's Dymaxion House, and Chuck Hoberman's Iris Dome are important examples of these concepts, also they have shaped and developed the architectural movements of later periods. These projects utilized contemporary materials and advanced construction technologies. Therefore, they have been selected and examined in the context of the mobility of building components in the 20th century.

2.1.1.1. Dom-Ino House Project - 1914

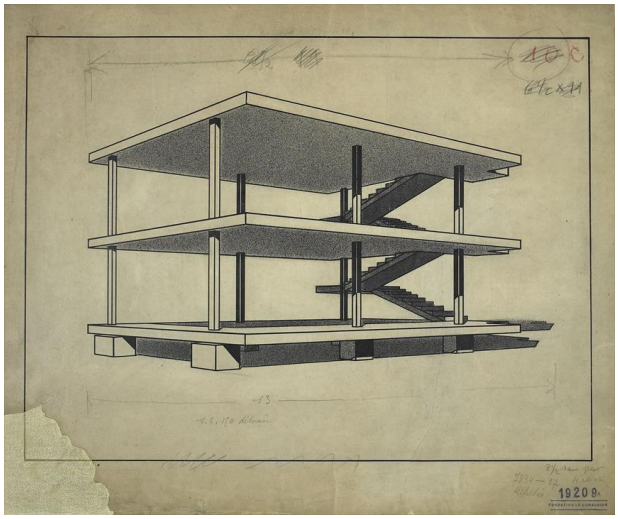


Figure 2.5. Perspective view of Dom-Ino House [37].

The devastation of Flanders in Belgium in 1914 during the First World War encouraged Le Corbusier to design a housing project that could be modified and articulated according to inhabitant wishes [38]. According to Le Corbusier, the solution to the housing problem had been ’standardization.’ In this context, he designed the Dom-Ino House [39]. He called the name Dom-Ino because it could grow by the end-to-end joining of houses like dominoes. Also, the name consists of ’Domus’ which means home, and ’Innovation’ [38]. Le Corbusier wanted to liberalize / separate elements such as garden-soil, window-wall in the Dom-Ino House, which he designed with ideas like ’free plan,’ ‘open system,’ ‘transparency’ and ‘free facade.’ Dom-Ino House is the earliest example of this kind of flexibility and open-system. Le Corbusier took advantage of the opportunities of reinforced concrete and adopting the idea of mass production. Dom-Ino House was a flexible project that could be installed according to the needs and could adapt to different arrangements and variations [39]. Flexibility in this structure was provided by the mobility of building components such as walls, windows, doors, etc. With this project, Le Corbusier allowed decisions such as interior arrangements, interior materials, facade materials up to the user. Many architects of the period questioned how this structure, which should be built on-site with the concrete casting of the carrier system, could be mass-produced. The structure, which appears to be monolithic in perspective, was originally thought to be formed by the combination of fabricated concrete slabs. Although the fabricated concrete slabs are not evident in perspective view, it can be seen in the section drawing of the project.

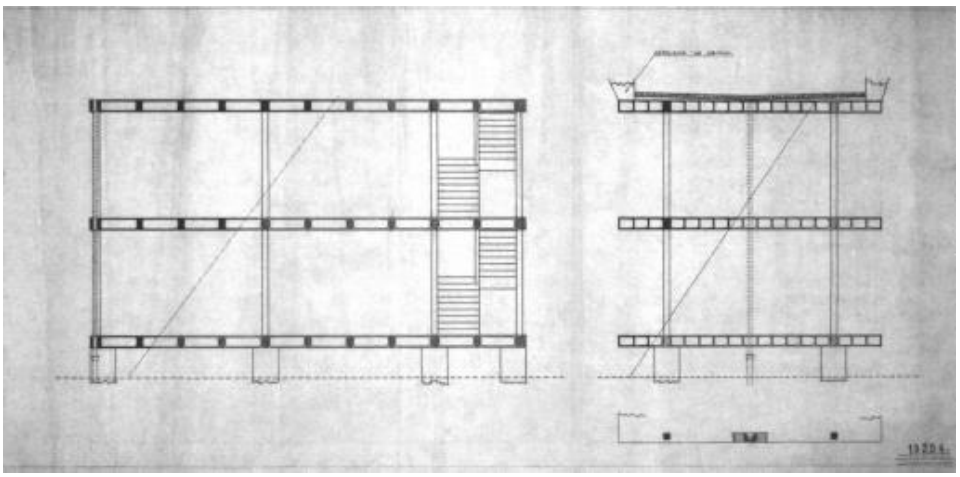


Figure 2.6. Dom-Ino House section showing fabricated reinforced concrete layers [40].

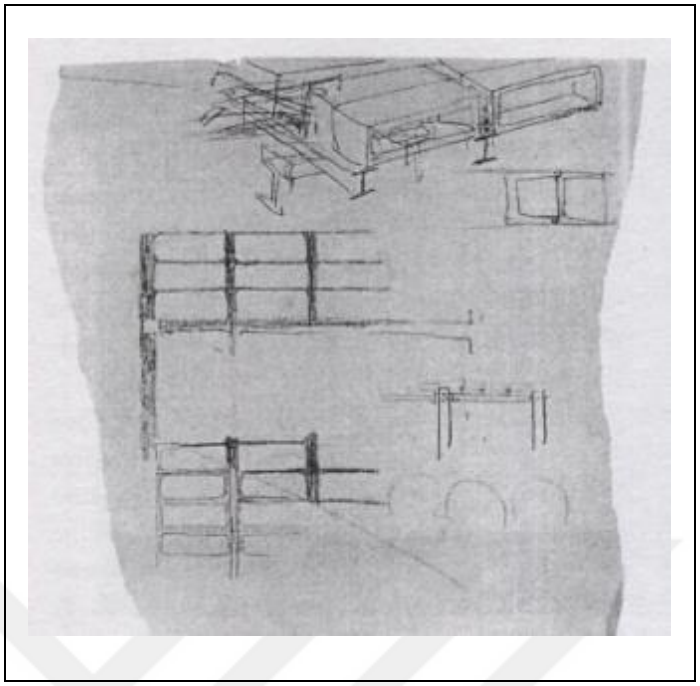


Figure 2.7. Dom-Ino House sketch layout of prefabricated floor slabs and I profiles [41].

French architect Robert Mallet-Stevens said about the introduction of reinforced concrete into our lives:

> Abruptly, everything changed. Reinforced concrete appeared revolutionizing the process of construction... Science creates a new aesthetic, forms are profoundly modified.

Le Corbusier emphasized that the concept of housing will no longer be a phenomenon of attachment to a place like in old traditions [42]. At Dom-Ino House, the concept of flexibility and mobility allowed the architect to reflect on his future predictions. The flexibility of the structure also offers a functional diversity in the long term. Another important point in this project is the scalability of the building system with mass production. The project can be given as an example of mobile architecture in terms of user freedoms, such as planning, material choice, and the ability to expand with another Dom-Ino House. The Dom-Ino House project was influential on the emergence of Le Corbusier's Plan Obus, Unité d'Habitation and subsequent megastructures [43].

Figure 2.8. Multiple Dom-Ino Houses integrated [37].

2.1.1.2. Rietveld Schröder House - 1924

Figure 2.9. Rietveld-Schröde House facades [44].

The Rietveld Schröder House was designed by Dutch architect/artist Gerrit Thomas Rietveld in 1924 in Utrecht for Truus Schröder-Schrader and her three children. This project is Rietveld's first architectural building. The Schröder House, with its flexibility based on the mobility of building components, also represents the ideals of the De Stijl (Neoplasticism) movement in the 1920s. It can be shown as one of the early examples of the freedom it offers to the user in the context of interior organization.

The De Stijl community was founded in 1917 by a group of Dutch architects and sculptors during the First World War. De Stijl is a movement that adopts vertical angles, asserts a particular color scale is sufficient and stands against decoration.

Schröder House is an iconic building in the modern movement era. It’s different from the other projects of the period because of its flexible design. It differs from Villa Savoye and Villa Tugendhat, which are the early examples of the modern movement. The difference is in the concept of space and functions of the building.

Gerrit Rietveld demonstrated his vision in the ‘De Stijl’ movement in his first furniture design. First, he designed the’Red-Blue Chair’ and then ’Berlin Chair.’ From this point of view, he designed the Schröder House [45]. Rietveld also worked on standardization, prefabrication, low-cost production, and up-to-date materials.

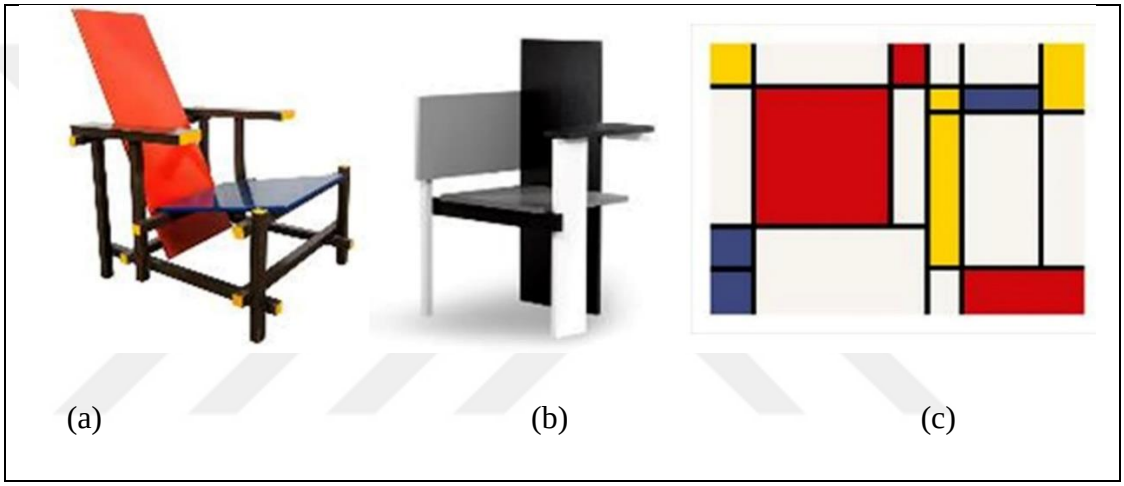


Figure 2.10. De Stijl Movement (a) Red-Blue Chair, (b) Berlin Chair, (c) Abstract composition of Mondrian [46].

Gerrit Rietveld, who was influenced by Piet Mondrian from the De Stijl movement in terms of the color scale, applied this style in the interior of Schöder's house. The use of this color scale, which constitutes the general character of the building, represents freedom of choice in the De Stijl movement. Gerrit Rietveld had no political or emotional intent, his intent was purely compositional [46]. Gerrit Rietveld stated the followings about the project:

> We didn't avoid older styles because they were ugly, or because we couldn't reproduce them, but because our own times demanded their own form, I mean, their own manifestation. It was, of course, extremely difficult to achieve all this in spite of the building regulations, and that's why the interior of the downstairs part of the house is somewhat traditional, I mean with fixed walls. But upstairs we simply called it and 'attic,' and that's where we actually made the house we wanted [46].

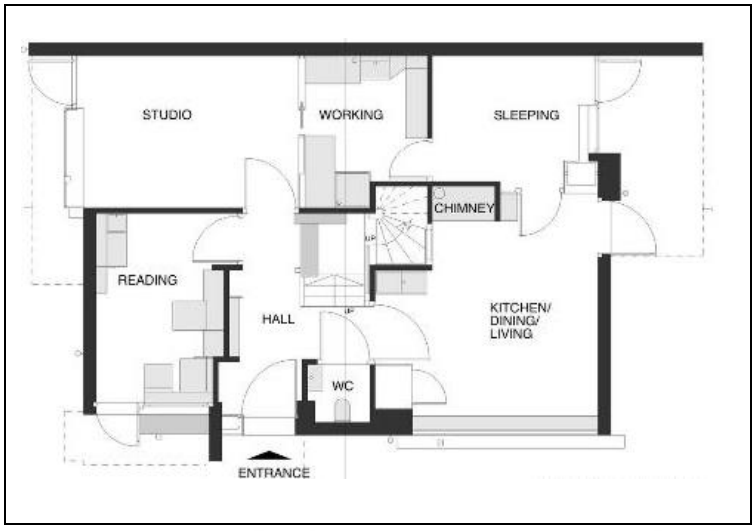


Figure 2.11. Ground floor plan of Rietveld Schröder House [47].

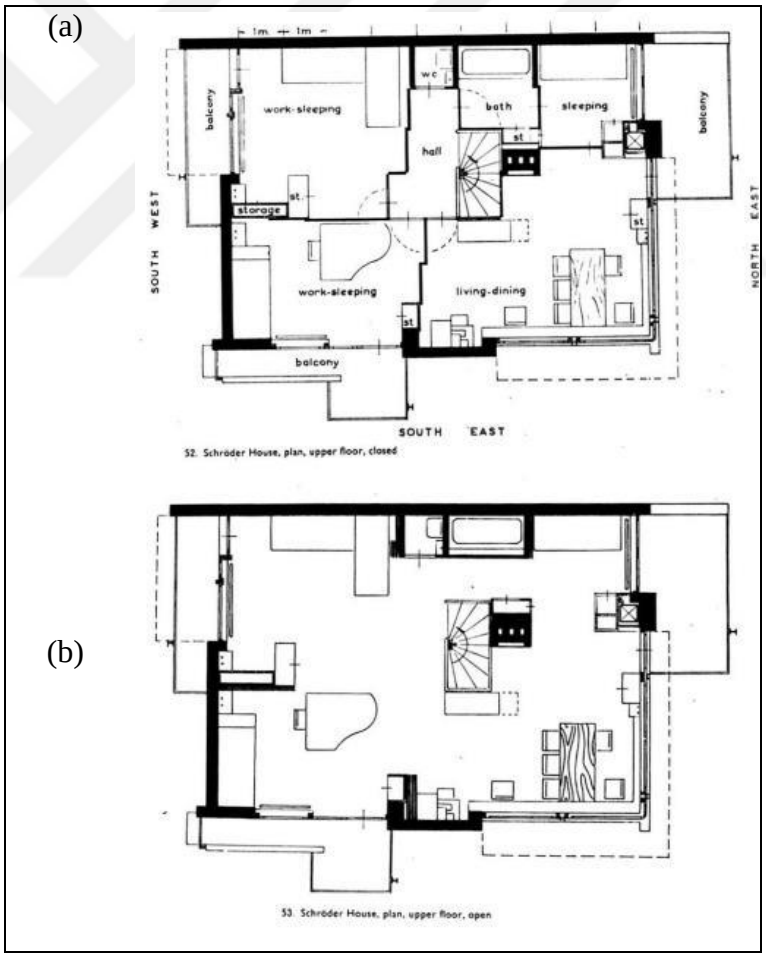


Figure 2.12. Upper floor plan of Rietveld-Schröder House (a) Wall panels' closed form, (b) open form [47].

The interior of the Rietveld-Schröder House can be divided into smaller spaces by movement of the partition walls. At the request of the user, the living area designed on the first floor. The building has two levels; the first floor, in particular, has a completely flexible design. The floors, roof, and windows built with wooden materials, the walls built with plastered bricks, and the carrier system built with reinforced concrete. The Schröder House can be an example of Ellinor DeGory's definition of flexibility in the context of a home. DeGory defines flexibility in the context of a home as the relationship and arrangement of functions and activities that can change in space [25]. It can be said that the movement of the divider panels used in the Shröder House might have inspired the Panel Chains project, designed by Yona Friedman in 1945. The Panel Chains project was examined under the title of Yona Friedman.

The Schröder House has influenced many architects of the period, such as Le Corbusier, and it is an important early example in mobile architecture due to the freedom that the building allows the user to arrange the interior space. Although the building is currently a museum, it was included in the cultural heritage list by UNESCO in 2000.

2.1.1.3. Dymaxion House Project – 1927

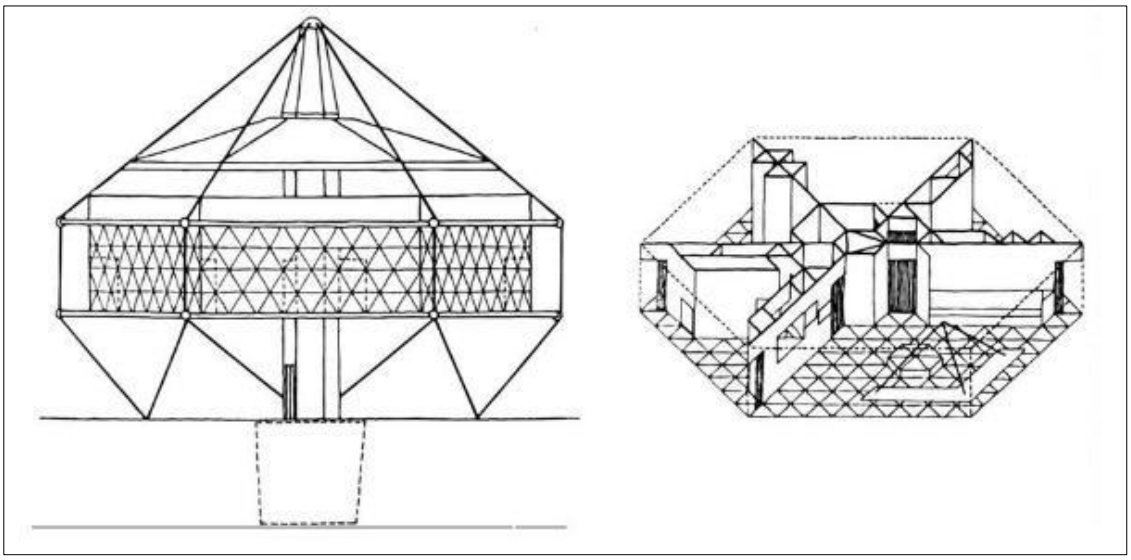


Figure 2.13. Elevation and interior perspective of Dymaxion House [48].

Another pioneering example of mobile architecture is the Dymaxion House designed by Buckminster Fuller. Buckminster Fuller's goal in this project was to provide maximum efficiency that can be achieved with minimum effort [49].

The term dymaxion is a combination of dynamism, maximum, and tension. Buckminster Fuller designed a mobile house that is transformable, economic and energy-efficient. In 1927, Buckminster Fuller returned to the idea of designing this concept. He used wartime technologies and sought solutions for urgent housing needs. Advanced aircraft materials of the period were used such as steels, alloys, and various war materials. Dymaxion House project, which could be placed and transported in recyclable steel cylinders, had two bathrooms. It was contemplated that the service elements such as heating, ventilation, cooling, and cleaning can be replaced with new ones if they become worn. At that time in American homes, more than a third did not even have a sanitary system.

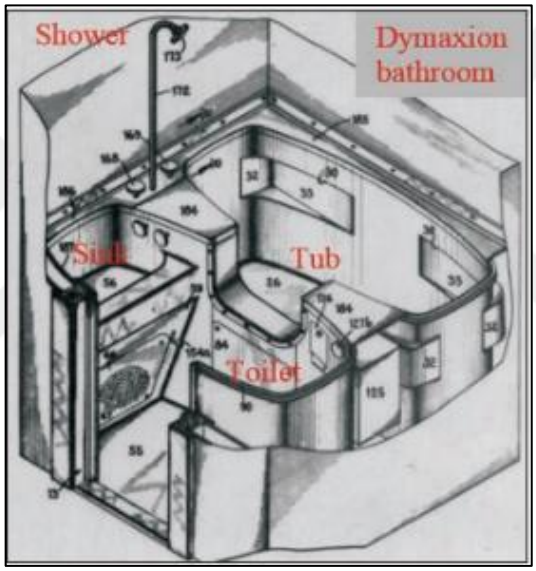


Figure 2.14. Bathroom of Dymaxion House [48].

Dymaxion House is an important example of mobile architecture since it has flexibility features such as easy transportation and installation, adaptability, growth capacity such as placement on top of each other, and becoming a skyscraper or ‘4D Tower’ as Fuller called it [49].

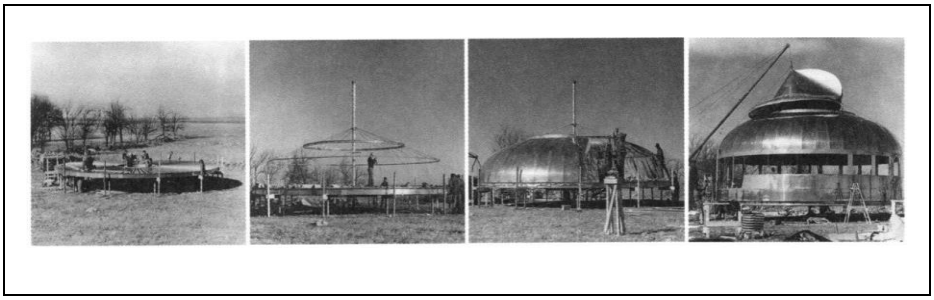


Figure 2.15. Installation of Dymaxion House in Wichita (1946) [48].

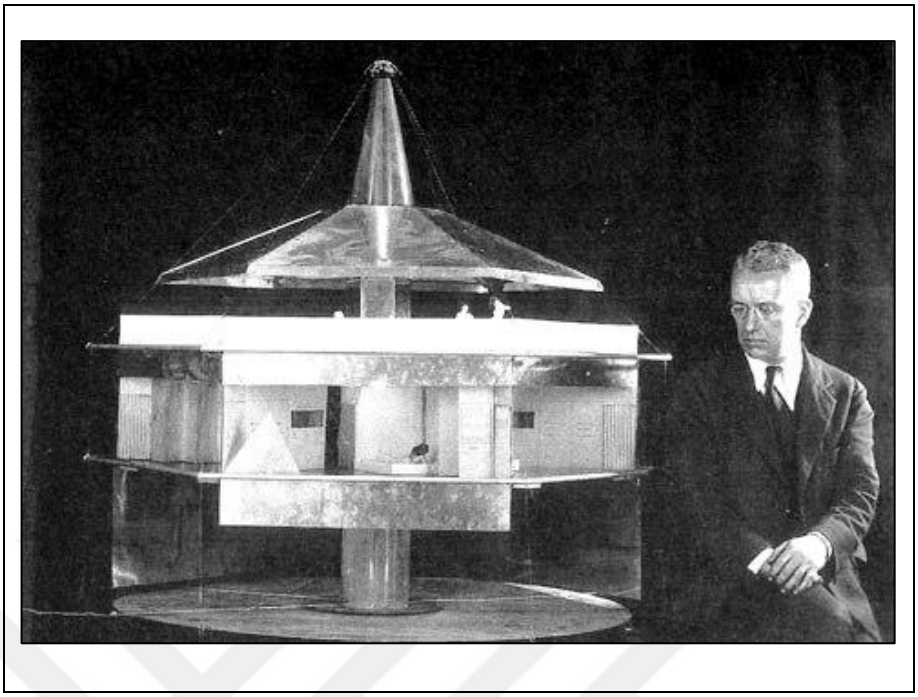


Figure 2.16. Model of Dymaxion House [50].

Figure 2.17. Interior of Dymaxion House, Wichita (1946) [50].

Figure 2.18. Illustration of Dymaxion House and Dymaxion Car [51].

The main concepts of Dymaxion House were as follows; light-weighted, durable, movable, low-budget construction and capable of mass-production. Buckminster Fuller also thought that the structure should be resistant to tornados, which is the most occurring natural disaster in America [52]. Buckminster Fuller stated followings:

> In architecture, a form is a noun, in the industry, a verb. I live on Earth at present, and I don't know what I am. I know that I am not a category. I am not a thing- a noun. I seem to be a verb, an evolutionary process – an integral function of the universe [50].

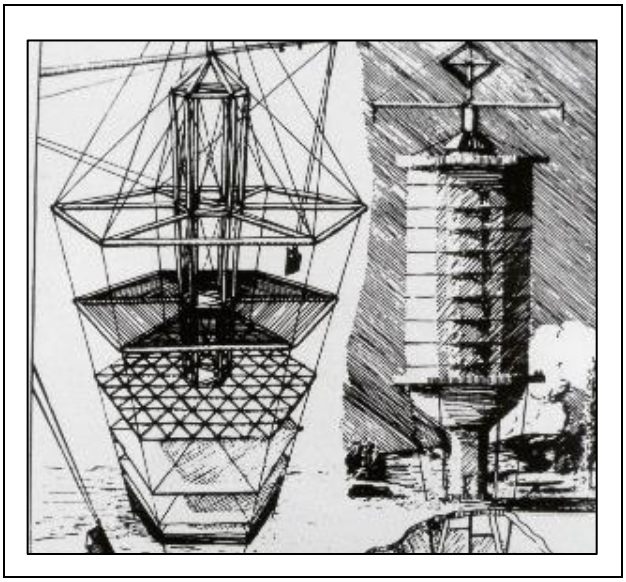


Figure 2.19. Drawing of 4D Tower formation [53].

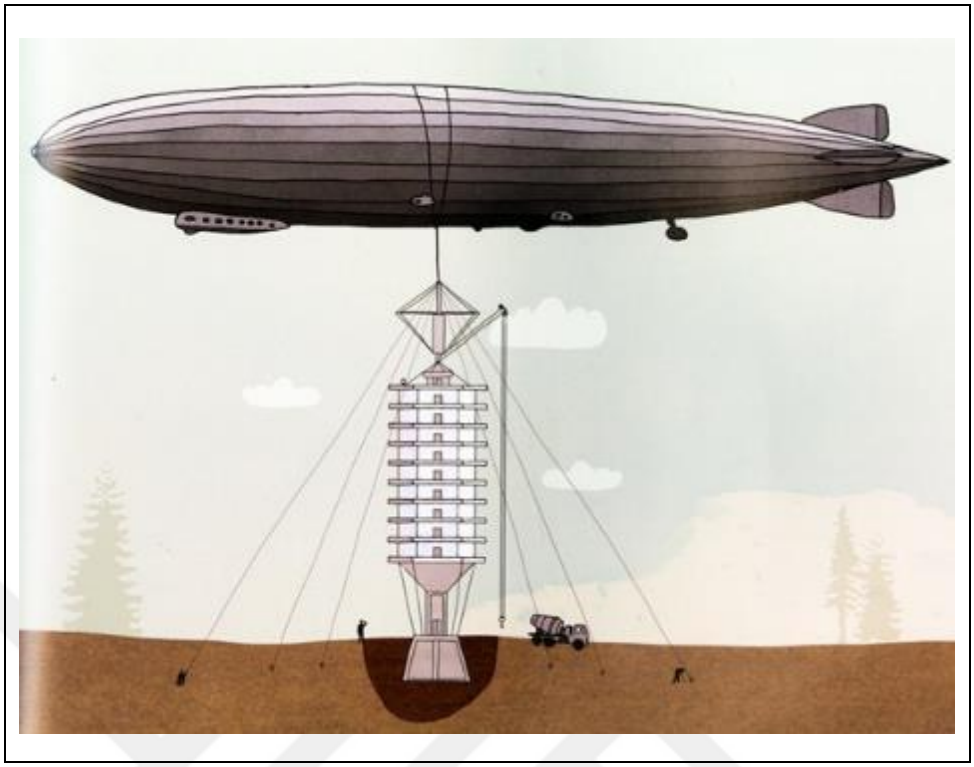


Figure 2.20. Installation of 4D Tower [48].

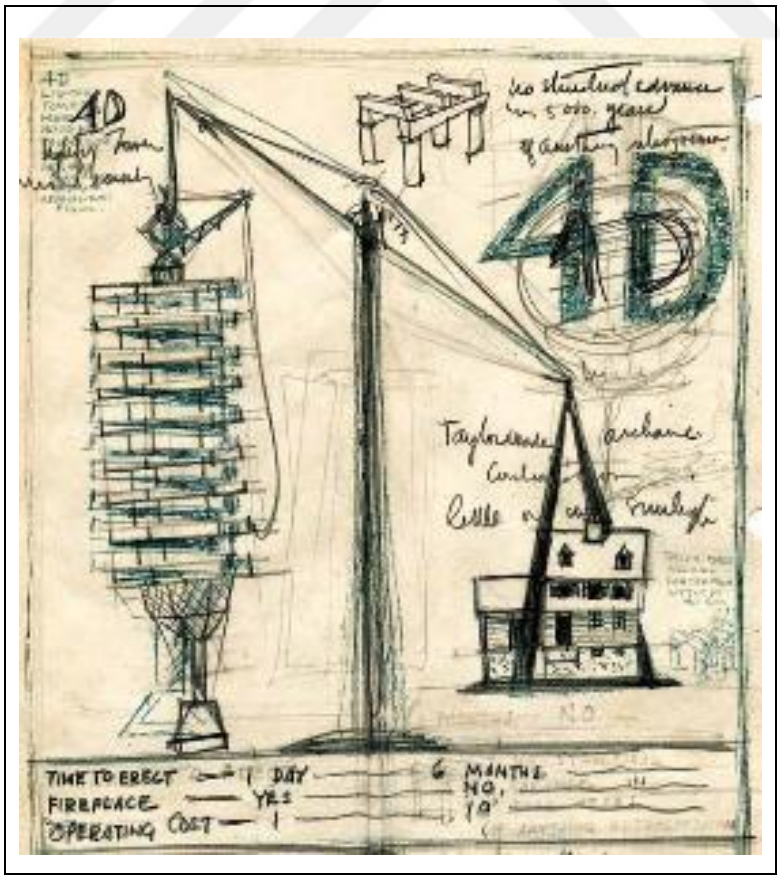


Figure 2.21. Sketch showing that 4D Tower is lighter than the houses of the period [50].

2.1.1.4. Unité d'Habitation - 1945

Unité d'Habitation project influenced the utopic megastructure pioneers in the 1960s, which constituted the main structure of the thesis, and it also influenced the birth of the avant-garde architecture.

One of the early examples of mobile architecture was the Unité Marseille (Unité d'Habitation) project designed by Le Corbusier in France in 1945-1952. The ideas of the project have inspired many architectural groups and designers such as The Metabolists and Archigram.

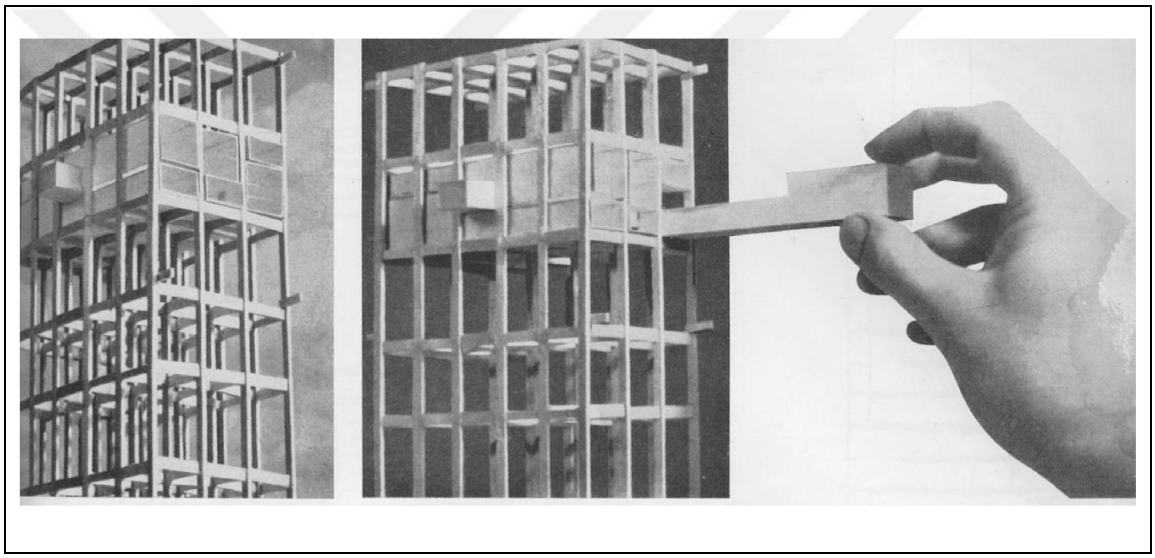


Figure 2.22. Settlement of Unité d'Habitation housing units [54].

In 1948, Kenzo Tange was very impressed with this project when he visited while it was under construction. In particular, the idea of removing and installing housing units from the carrier system was later adopted and developed by the Japanese Metabolist Group and Kenzo Tange.

Architectural historian Kenneth Frampton has interpreted the Figure 2.22 image as follows;

> This hybrid approach to fabrication went so far as to envisage complete apartments being hoisted directly into position as prefabricated units, an idea depicted in a provocative photomontage where a godlike hand simply inserts factory-made dwellings into the frame, like stacking bottles in a wine rack... Although this was not the manner in which the units could finally be fabricated and assembled [55].

The Unité Marseille (Unité d'Habitation) project model and Le Corbusier's various sketches highlighted the variability of the housing units and their independence from the carrier system. Le Corbusier gave an example of 'a wine rack' in his book called Oeuvre Completé. In the book, wines were stated as housing units and rack as a carrier system [43]. In this context, he also explained the concept of Plug-In. However, as Kenneth Frampton mentioned, this idea wasn't implemented in the building and remained an inspirational concept, which later adopted by many designers in their utopic megastructure projects.

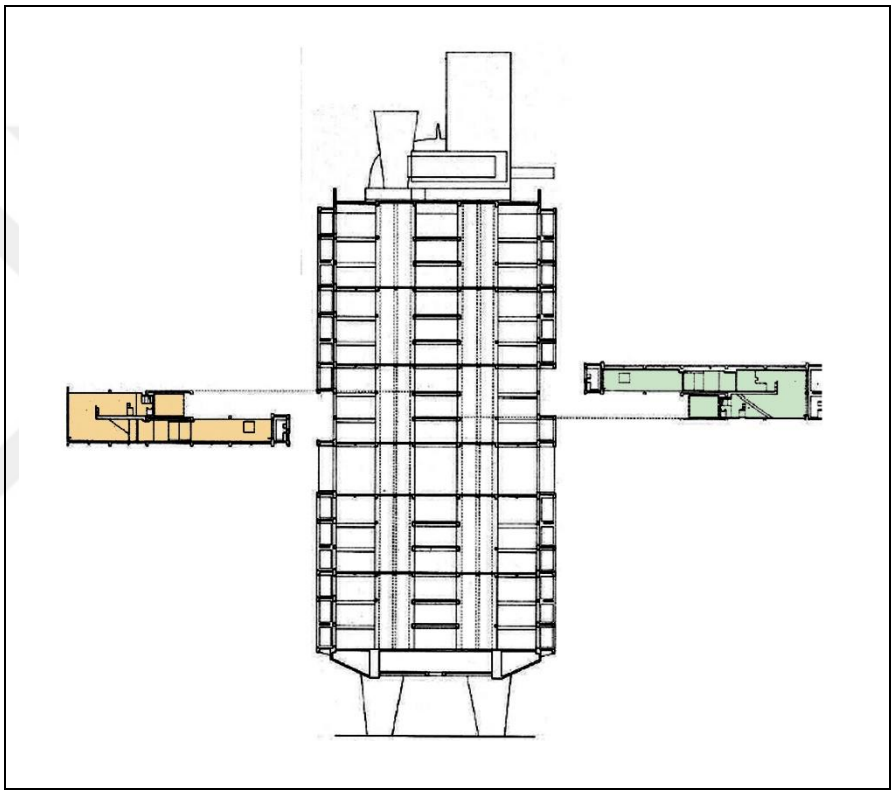


Figure 2.23. Section of the Unité d'Habitation housing units [54].

Figure 2.24. Section of the Unité d'Habitation housing units and the corridor [54].

Figure 2.25. Image of Unité d'Habitation [37].

The Unité d'Habitation project was one of the most important megastructures of the period, with the idea of containing the entire neighborhood in a single building. Other than accommodation, it has functions such as shops, kindergarten, restaurants, and hotels in it [56].

It was the Quartiers Modernes Frugés project in Pessac, France, in 1924 that led Le Corbusier to design the Unité d'Habitation project as a flexible building. Quartiers Modernes Frugés mass housing project developed for the French working class. The inhabitants in this project did not live a passive life, as Le Corbusier predicted. They wanted to be active, to intervene in where they live, and personalize their environment. They have experienced the spaces presented to them, then they added and modified it according to their needs. Le Corbusier, who learned from this process, approached differently to this project and designed the Unité d'Habitation flexible for the inhabitants [57]. Relation to this Laclau and Zac stated that:

> Failure will trigger new acts of identification […] Which attempt (vainly) to master those destructuring effects […]. This is why there is a permanent and alternating movement whereby the lack is rejected and invoked, articulated, and annulled, included, and excluded [11].

Laclau and Zac stated that with this discourse, change always arises out of needs and failures and is in search of a solution. Le Corbusier Quartiers Modernes Frugés' project was an example of this failure. Thus, later he gave one of the most notable examples of mobile architecture.

2.1.1.5. Iris Dome Project - 1998

The Iris Dome project designed by Chuck Hoberman in 1998 and it was inspired by the geodesic dome of Buckminster Fuller, which contributed to the utopic megastructures in the 1960s, which constitutes the main structure of the thesis. Also, it's mobility based on parametric design, and it is an indicator of the possibilities of contemporary structural mobility in today's architecture or any other related fields.

Chuck Hoberman, inspired by Buckminster Fuller's idea of maximum efficiency with minimum effort and used this idea in his projects. He has made various projects on geometric, movable, foldable, deployable structures. The Iris Dome project, which was implemented in 1998 in Expo 2000 Hanover, Germany, has a parametric design that can be expanded and shrank [58]. The project was designed to symbolize the ruined and then reconstructed Frauenkirche Cathedral in Munich [59].

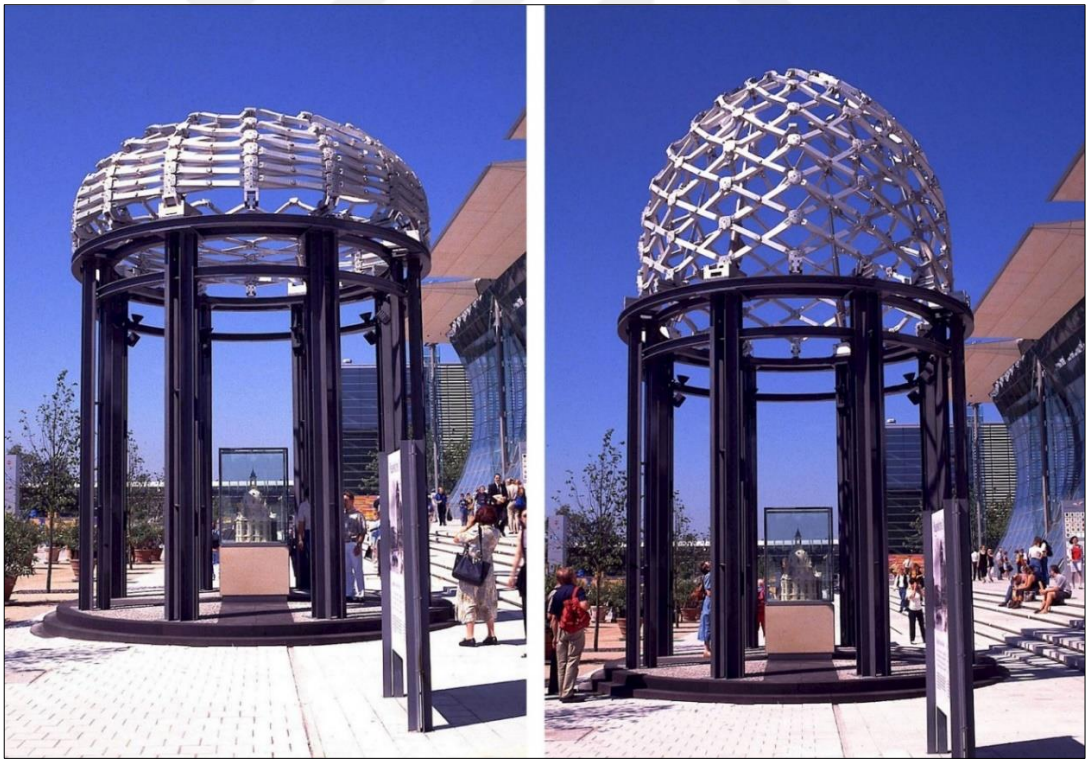


Figure 2.26. Iris Dome Project Expo 2000 Hanover, Germany [60].

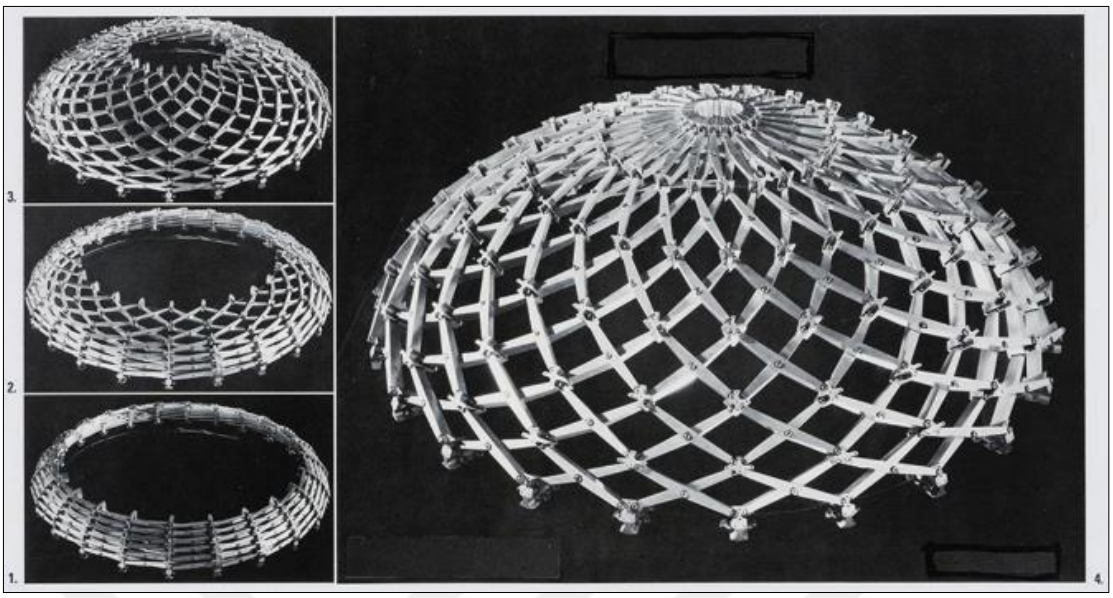


Figure 2.27. Closed and Opening Phases of Iris Dome Operation Model [60].

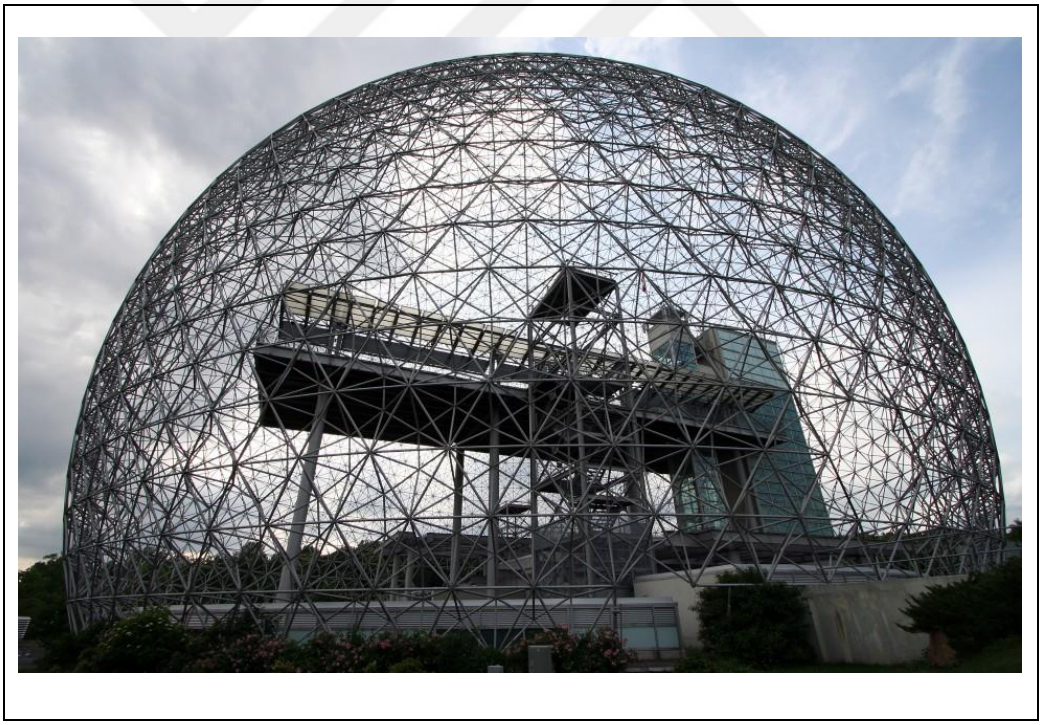


Figure 2.28. Buckminster Fuller's Geodesic Dome in Montreal, Canada [61].

The geodesic dome, designed and patented by Buckminster Fuller in 1947, can be compared with Hoberman's Iris Dome. Buckminster Fuller's geodesic dome structure is capable of covering a large area. Fuller proposed to cover Manhattan with his geodesic dome. By doing so, he aimed to provide permanent climate control in Manhattan and stated that it would be

economical in many ways. There would be no need to save funds for heating, cooling of any house or any snow removal requirements.

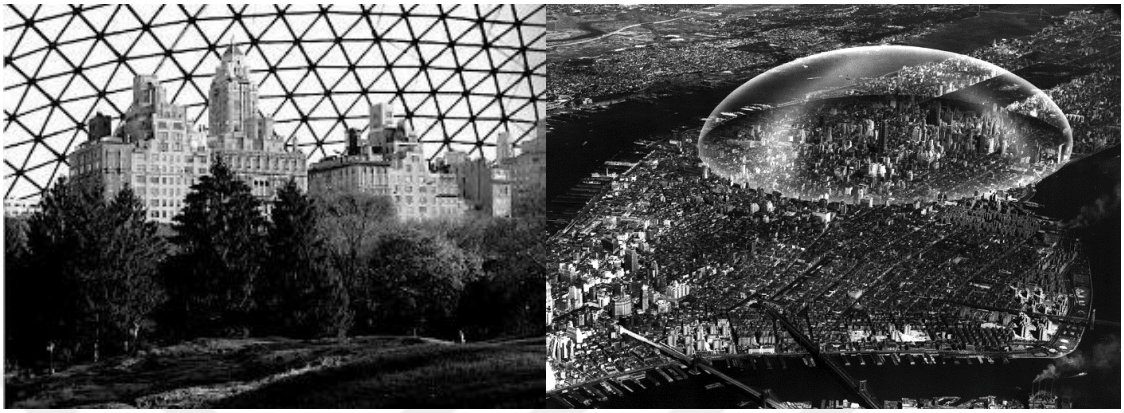


Figure 2.29. Dome Over Manhattan Project [61].

However, Fuller’s geodesic dome didn’t design to move, shrink or expand. In contrast, the pioneering idea of Hoberman's Iris Dome was to cover a wide area and expand or shrink as needed. Chuck Hoberman's idea of this transformation mechanism has both biological and mathematical foundations. It’s a structure that can expand or shrink, and in doing so, it could maintain the rigidity and stability at each stage. It is almost impossible to achieve the accuracy of such a complex structure without the computer-aided design [62].

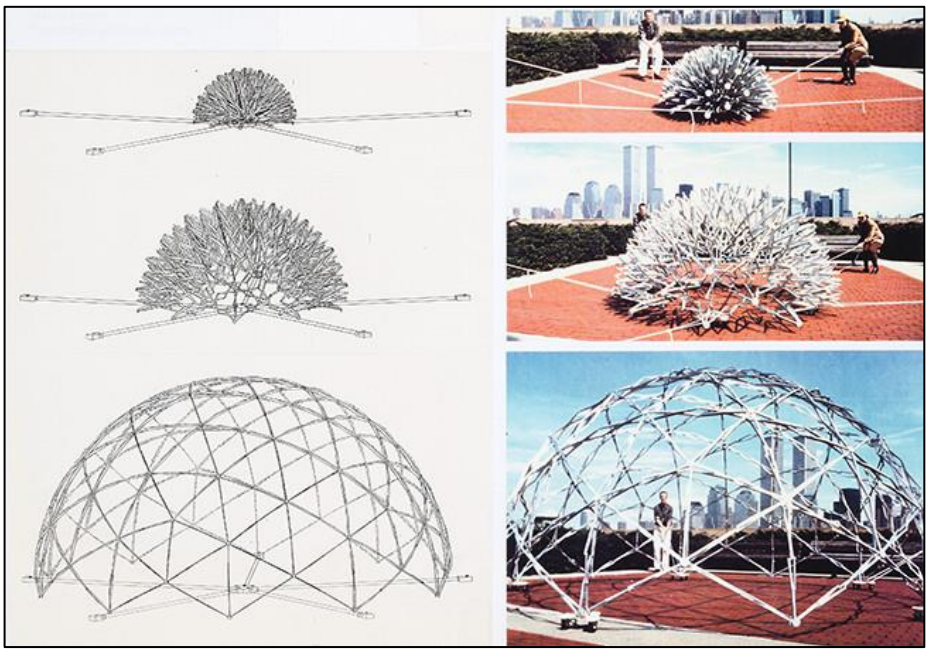


Figure 2.30. Closed and opening phases of the Hoberman Hemisphere [63].

Figure 2.30 shows the stages from the opening state to the closed state of Chuck Hoberman's Hemisphere. The patented Hoberman Sphere can be moved to the desired location and installed [64]. It is an important example in terms of the mobility of structural components in architecture.

Santiago Calatrava, another architect of the period, could be considered as a pioneer in terms of mobility of structures and its components. However, the mobility concept adopted by Calatrava is limited because it does not have any potential for articulation and growth. Chuck Hoberman's projects, which have concepts such as articulation, flexibility, and portability, selected and studied as pioneers of the era in the context of mobile architecture.

By combining concepts such as flexibility, adaptability and origami, engineering, and robotic technologies, Chuck Hoberman searched for how the materials, large-scale structures, and furniture could be made into transformable objects; they could be opened and closed. Chuck Hoberman describes his researches; as converting the energy generated by a simple push or pull motion into a physical transformation process. This flexible design concept can be realized in many scales. It is stated that there is a design understanding that can be used and developed to meet the need for urgent housing in post-disaster scenarios with large-scale applications, other than that it can help patients who struggle with heart problems in the health sector with its small scale applications and can extend to many sectors at every scale. Chuck Hoberman searched for the efficiency and automation of transforming, opening and closing large-scale structures. To achieve this, he used the air pressure inflation technique [65]. This technique can be associated with the Cushicle project of the Archigram group. The Cushicle project was examined under the title of Archigram.

2.1.2. Contemporary Examples of Mobile Architecture in the 21st Century

In order to see the possibilities and development of today's contemporary mobile architecture, examples from the 21st century have been identified and examined. In this context, Harley VI Research Station, U-Build system, and OPod Tube House projects were examined.

2.1.2.1. VI Halley Research Station - 2006

VI Halley Research Station designed by Hugh Broughton Architects in 2006. The station emphasizes the importance of mobile architecture as it monitors global weather on a global scale. It was also the first mobile research center in the world and was selected and examined for these reasons. It is also a representation of the necessity of being mobile in terms of adaptation under difficult conditions.

Halley VI Research Station was built on an ice shelf in Antarctica. The construction process lasted four summers. The structure was transported in parts and installed on-site, hydraulic feet were added, therefore its movement was ensured. The construction stages of the structure are as follows.

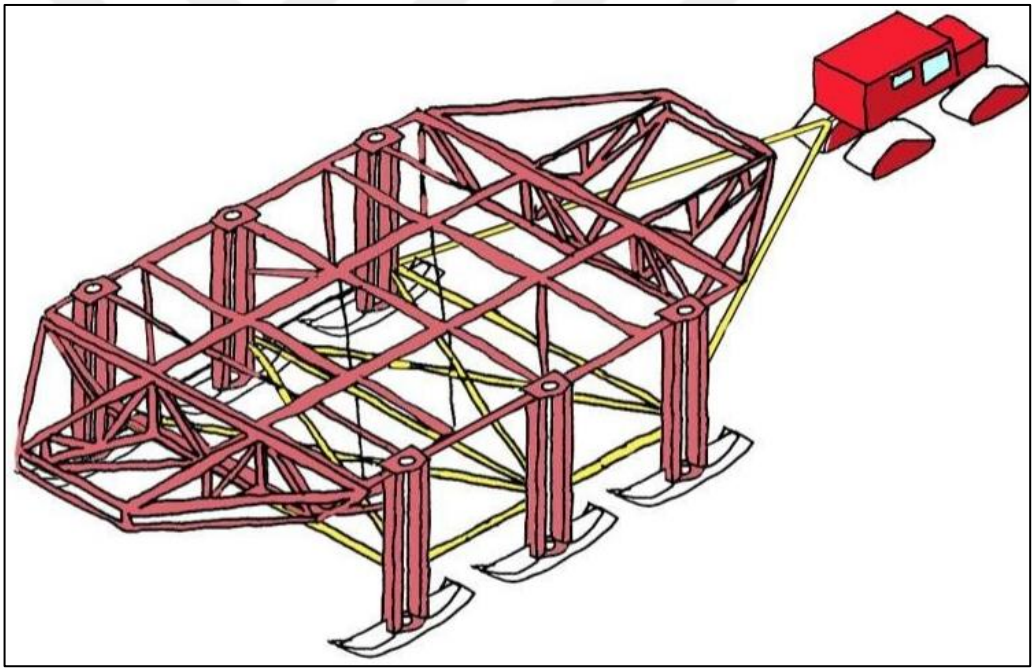


Figure 2.31. Stage 1: After the steel structure is installed, temporary skids are installed and loaded onto the ship [66].

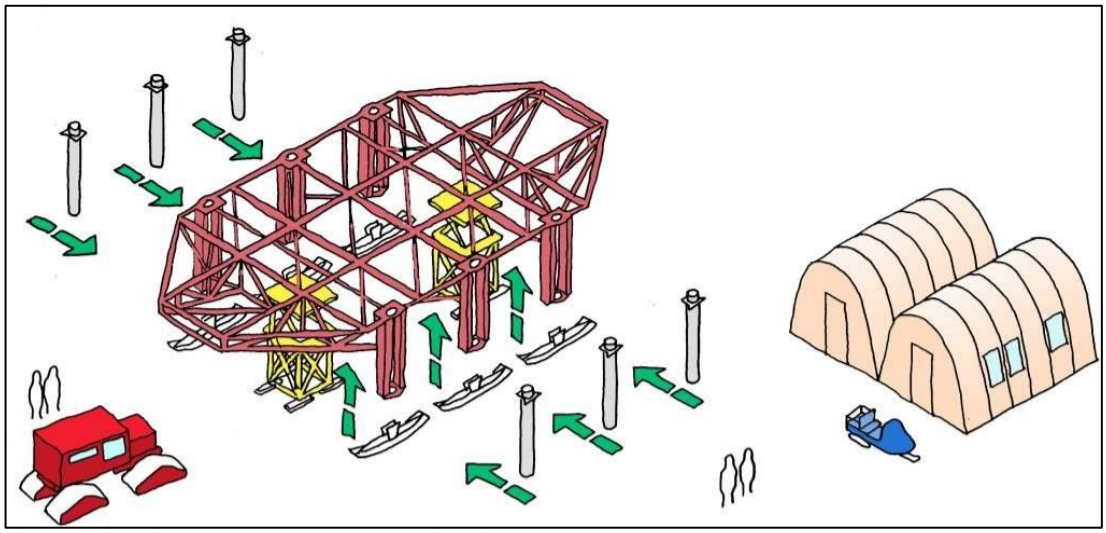


Figure 2.32. Stage 2: Once the structure transported to Antarctica, hydraulic legs and runners are implemented [66].

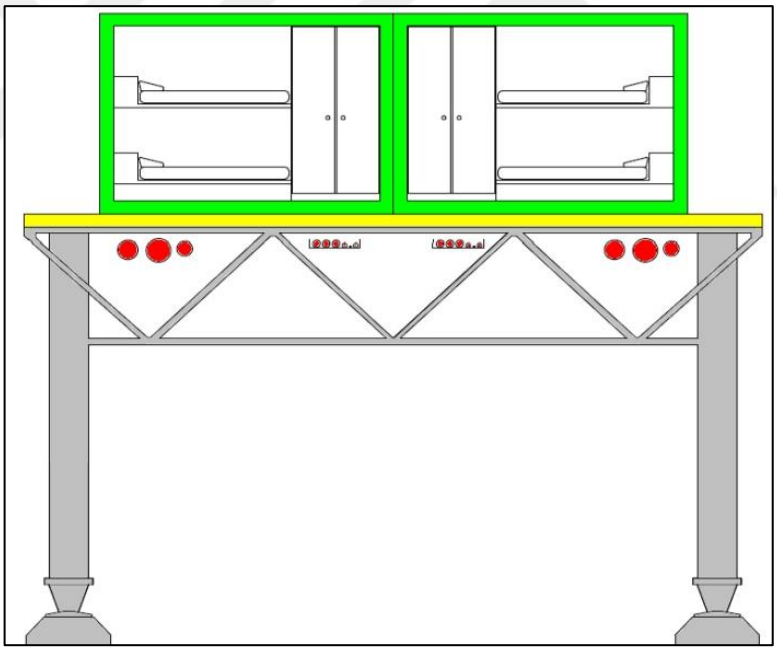


Figure 2.33. Stage 3: The Floor is installed together with the mechanical and electrical installations, then housing units are placed [66].

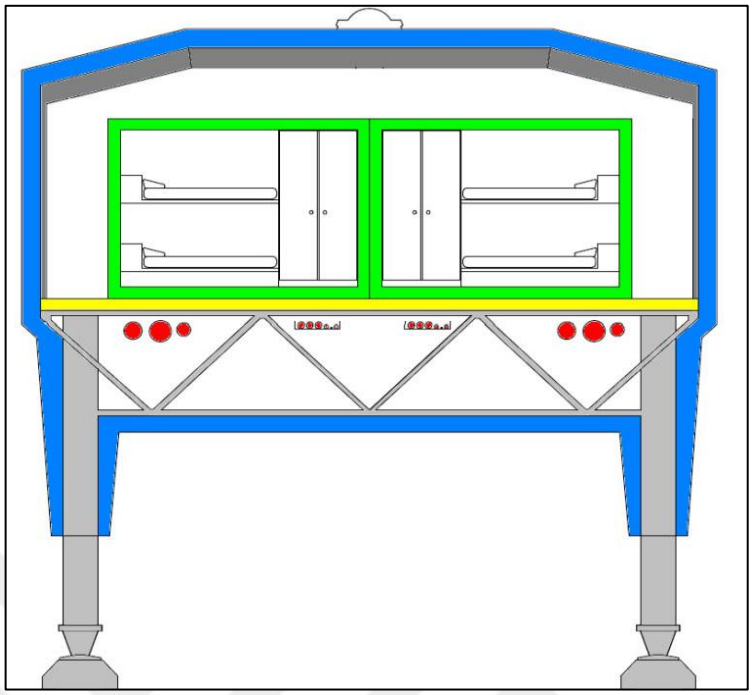


Figure 2.34. Stage 4: The steel structure is added and plated [66].

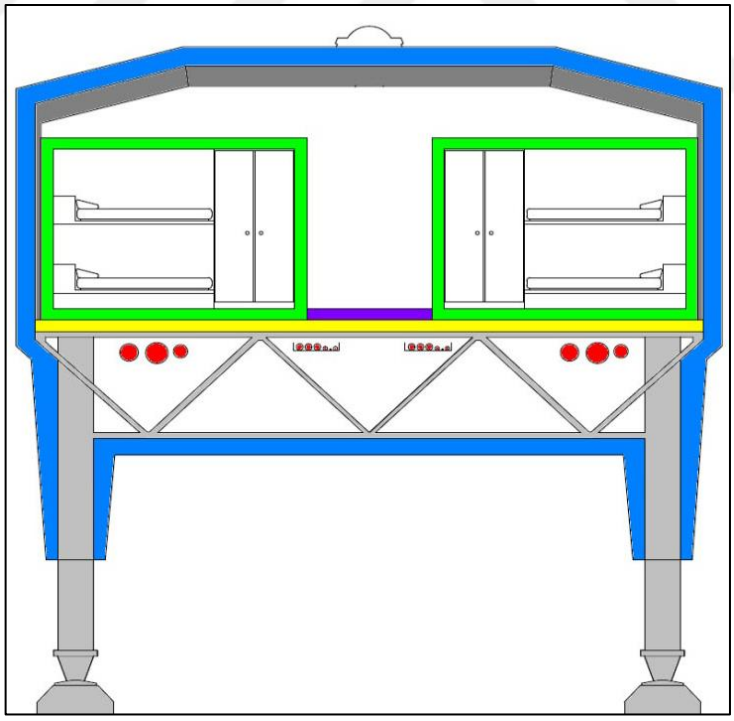


Figure 2.35. Stage 5: Corridor floor is added. [66].

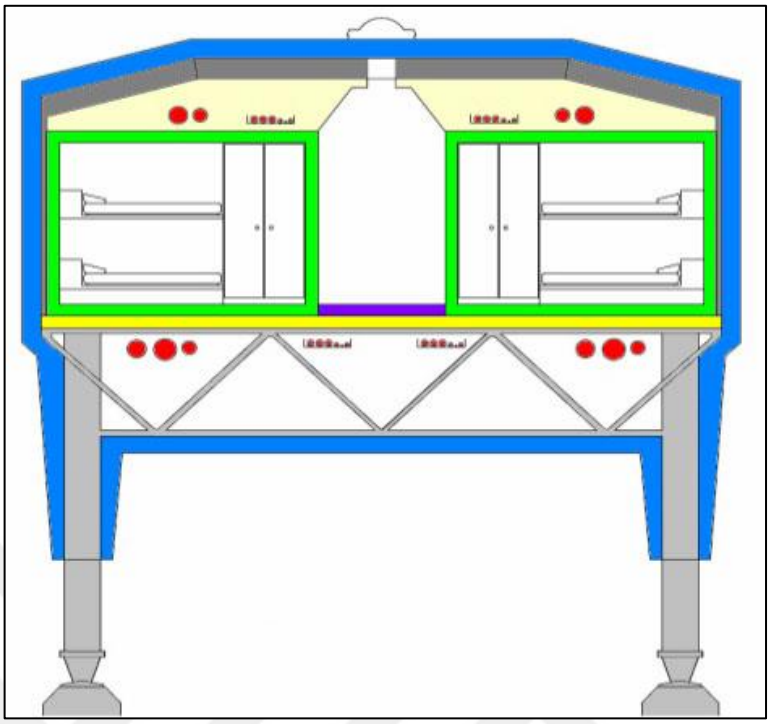


Figure 2.36. Stage 6: Ceiling panels are installed after the mechanical and electrical installation [66].

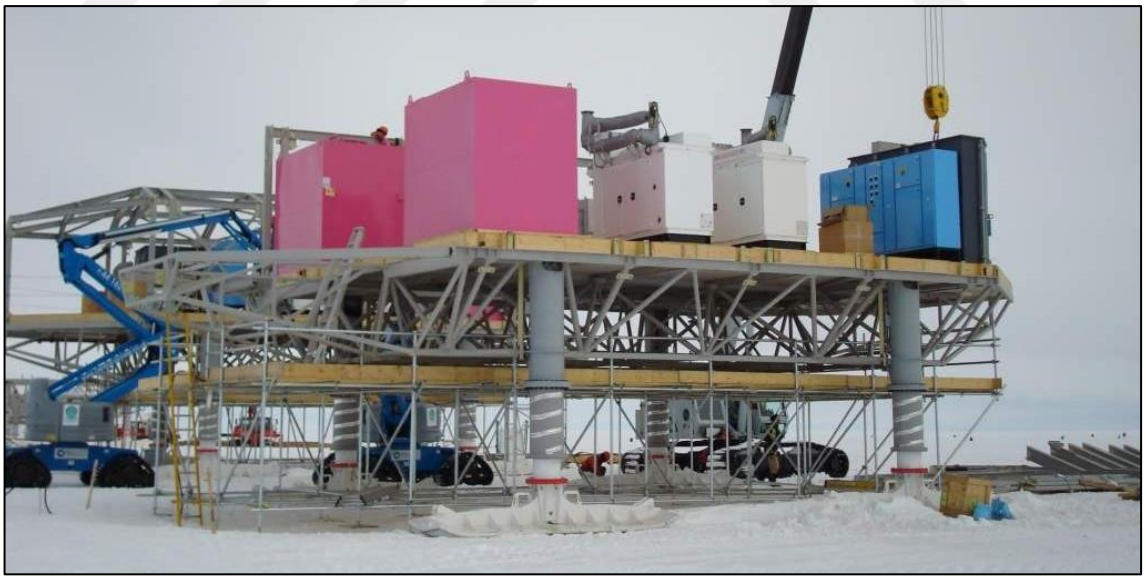


Figure 2.37. Image of VI Halley Research Station under construction [66].

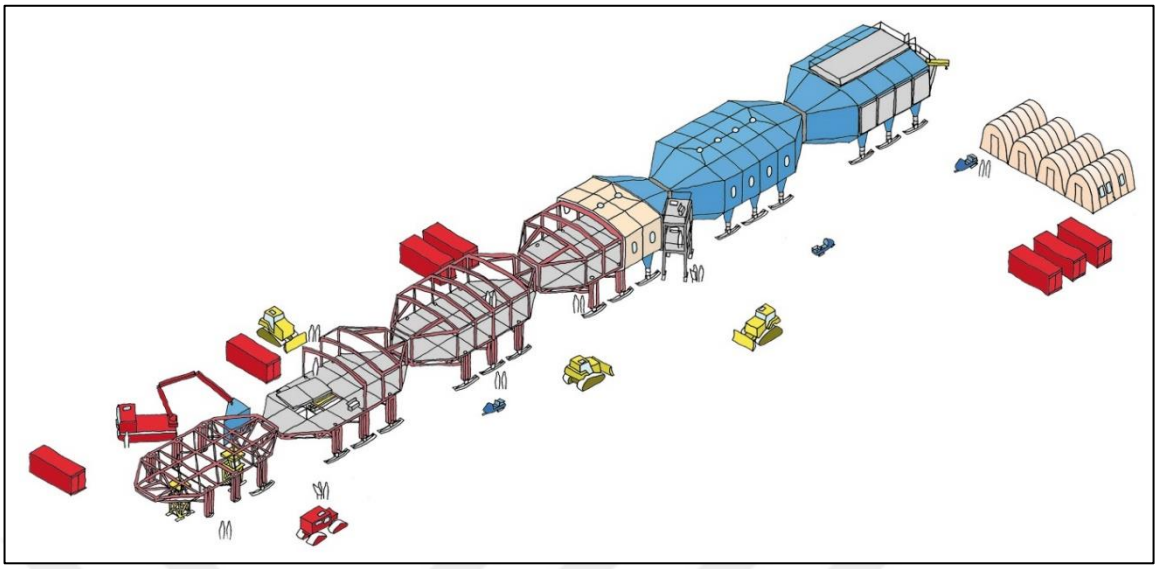


Figure 2.38. Installation stages of VI Halley Research Station [67].

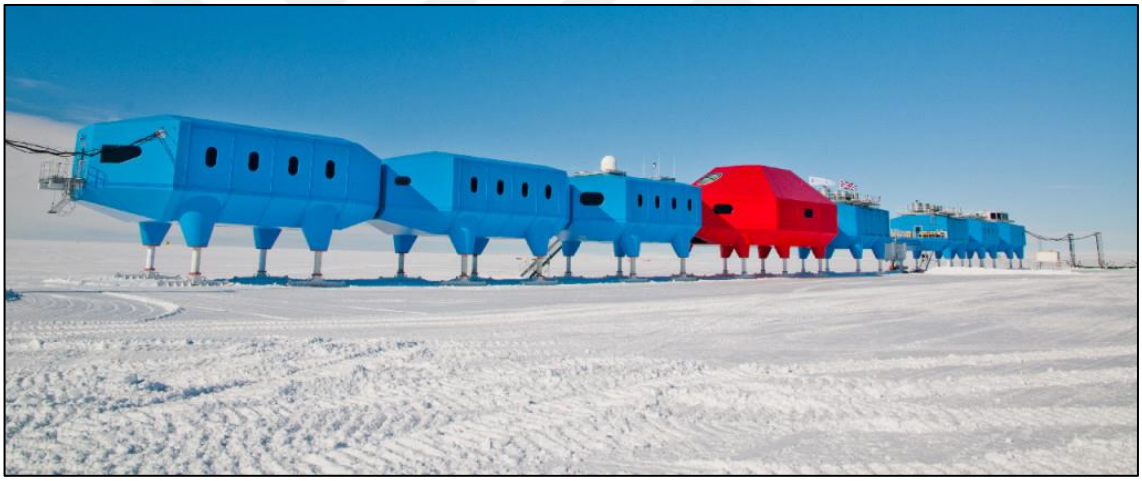


Figure 2.39. Image of completed VI Halley Research Station [68].

2.1.2.2. U-Build System "Box House" - 2016

The U-Build system was founded in 2016 by the Studio Bark architecture office. The construction materials of the system were selected as wooden OSB. Wood materials can only be combined with rammers and drills, and a modular structure can be formed according to the desired function. The plan layout of the project is selected by the user and can be built by the user. This selection can be made by computer-aided software. In this software, the preferences of the project are presented to the user in three dimensions. Once the user has made the decisions, the materials are shipped to the user together with the guide book for installation after the CNC printer cuts them in pieces. The woods can be combined easily,

considering the comfort of the user. The installation consists of four stages as shown in Figure 2.40. After the woods are combined and turned into boxes, they are insulated, and then the roof and floor parts are implemented, openings such as doors and windows are mounted to the desired location, and finally, the desired coating is made on the walls [69].

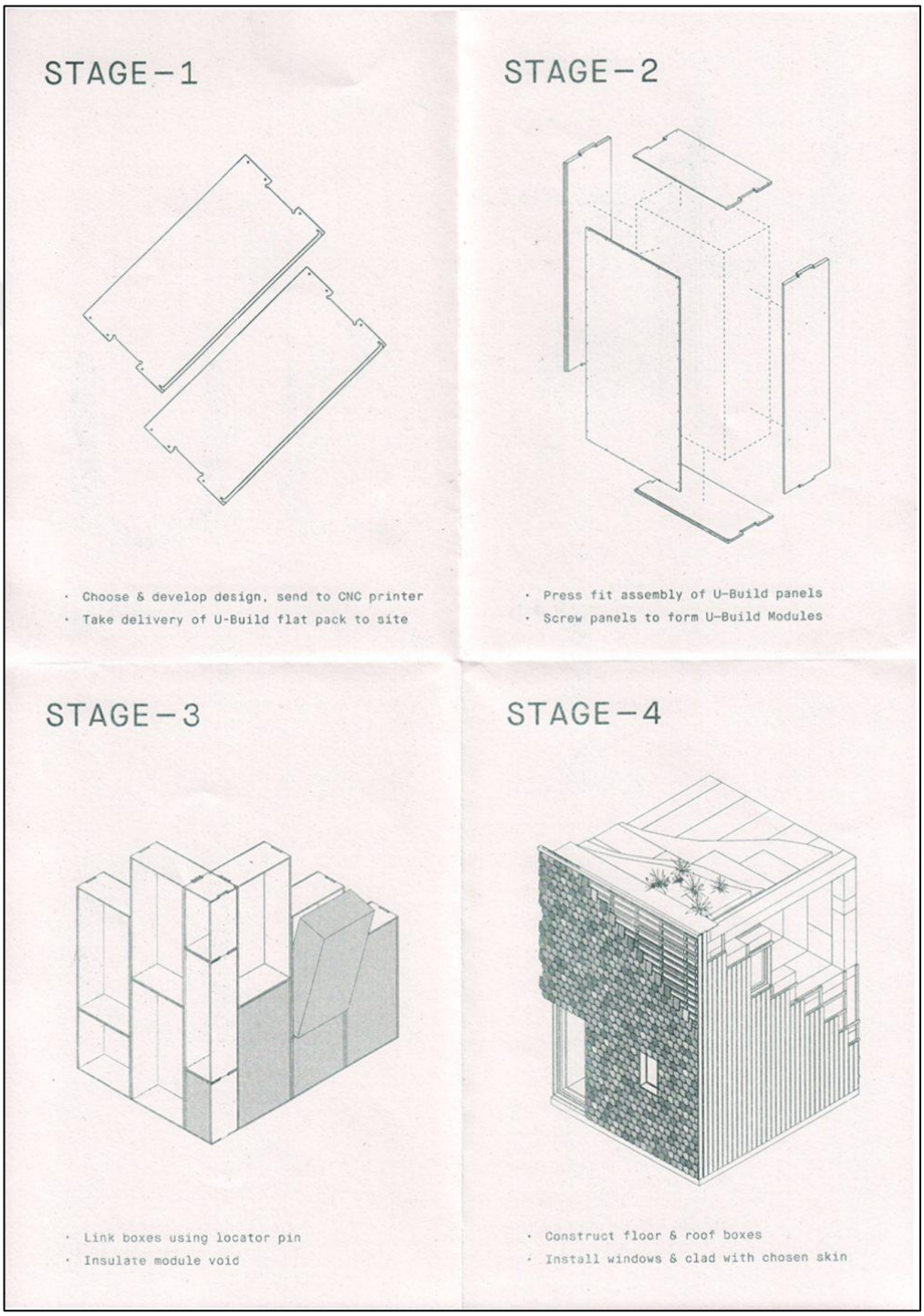


Figure 2.40. Installation stages of U-Build [70].

The U-Build system is not only for designing and constructing buildings, but it can also build many objects or building components such as furniture, storage areas, stairs, dividing walls [69]. Thus, U-Build can be applied to the existing structure according to the desired function. The Box House project, which was built with this system in 2018 by its users with the support of Studio Bark in the Graven Hill community in Bicester, England. There are a total of 1900 self-built houses in Graven Hill.

Figure 2.41. Image of Box House [71].

Figure 2.42. Floor Plans of Box House [71].

Figure 2.43. Elevation Views of Box House [71].

Figure 2.44. Interior Image of Box House [71].

Figure 2.45. Interior Image of Box House [71].

This system eliminates intermediaries such as the architect or designer from the process. There are only the user and the physical structure in the process. The role of the architect or designer is different in this system. The architect's role is to create the system. All control is given to the user. Studio Bark stated that with the U-Build system, the local community members could design and build their own environment, rather than hiring construction workers for the construction, which requires higher budgets [69].

The ideas of the U-Build system has some similarities with Yona Friedman's mobile architecture theory in terms of architectural processes. Yona Friedman's approach is similar to the idea of changing the role of the architect and intermediary and giving all the control to the inhabitant.

2.1.2.3. OPod Tube Housing Project - 2017

OPod Tube House was designed in 2017 by James Law Cybertecture architecture firm. It is an experimental project and an economical solution to the housing problem in Hong Kong. Cylinder-shaped concrete water pipes of 2.5 meters in diameter were used for each housing unit. The housing units designed to provide maximum benefit from the interior with its 9

square meters. These housing units are for 1 or 2 people and have a bathroom, kitchen, and living area. In addition, technologies such as smart homes and wi-fi have been used to provide modern living standards.

Figure 2.46. OPod Housing (a) Living Space, (b) Bathroom, (c) Kitchen [72].

OPod housing units can be transported by cargo ships and can accommodate 100 housing units per ship. Thus, both in the event of a disaster in order to meet the need for emergency housing and the user can move the housing unit to the desired location. OPod Housing units for one or two people designed to be 14 square meters, and BoxPods designed to be 19.5 square meters to accommodate four people. In addition, OPod Housing units can be placed on top of each other and create mass housing.

Figure 2.47. Transportation of OPod Housing Units [72].

Figure 2.48. OPod Housing Units [72].

In Figure 2.48, it can be seen that OPod units can also be placed in the voids of the city. Each OPod unit weighs 20 tons and can be transported by a crane.

Figure 2.49. OPod Mass Housing [73].

This project was realized as a prototype, the designer James Law explained that the OPods could be appealing to the student audience because of their low-cost and that they could live in these units for a year or two. He stated that in the event of a possible disaster, it could also be a solution to the urgent need for housing may be provided in the short term. [74].

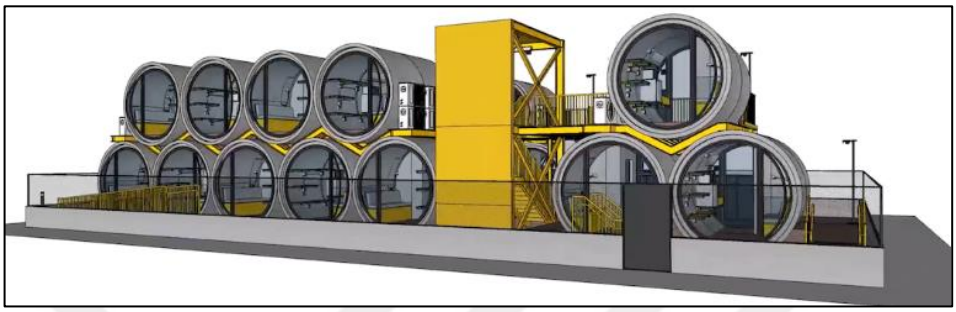


Figure 2.50. OPod Housing Project [72].

Figure 2.50 shows two-storey OPod mass housing project, which consists of 21 units in total, designed in Hong Kong's To Kwa Wan region and is expected to be completed in 2020. [72].

In terms of form and layout, OPod Housing project is similar to the Cylindrical Shelter project designed by Yona Friedman in 1953-1958. The Cylinder Housing project was examined under the title of Yona Friedman.

2.2. RELATIONSHIPS BETWEEN MOBILITY AND CITY

> Urbanism, if it is to mean anything at all, is a fluid matrix of things that do their own thing. In William Burroughs' words, we must keep our bags packed and ready to move all the time [34].

Cities have always been the center of life and attraction for human beings. For this reason, people's social and spatial mobility is mostly seen in cities. With this context, the conceptual explanations made by various sociologists, architects, and philosophers were examined. Also, the types of mobility, their relationship with the city, how these individuals investigated the movements in the city and why the existing cities became inadequate with the advancement in technologies in the context of mobility were examined.

Jean-Marie Duthilleul, about the concepts of city and mobility, emphasized the importance of the question of why individuals want to make themselves and, therefore, their cities

mobile? According to Duthilleul, people's desire to benefit from the opportunities and capabilities of the city at maximum speed made them mobile. Mobility of people provides access to work, health services, recreation and social interaction [75]. Vincent Kaufmann, a Swedish sociologist who investigates concepts such as movement, social life, motility, and mobility, stated that; people prefer the city centers because they want to be close to the opportunities offered by the city, despite the high rent and small apartments. However, people do not take advantage of these opportunities, but knowing that those opportunities are there and accessing them whenever they want is the actual reason for them to decide. As a result, Kaufmann stated that most of the time, the potential of people to benefit from these opportunities, remained in the potential phase, and thus, mobility remained in the potential phase [76]. Therefore, it can be said that people cannot be forced to be mobile. In relation to this, Yona Friedman criticized Constant Nieuwenhuys for forcing people to be mobile in his project called New Babylon. This criticism explained more in detail under the title of Research of Megastructure in the context of Mobile Architecture.

Mobility is not just a physical movement. It is an essential phenomenon of urban life and social interactions of people. Also, mobility is the metabolism of the city [34]. In relation to this, the Archigram member, Warren Chalk, said the followings:

> The old fixed and static elements that built our cities are becoming increasingly irrelevant… In a transient society, the mobile searchlight pinpointing an automobile sale or a movie premiere is more important than any building, a credit card system more meaningful than a high-rise bank [77].

Here, Chalk emphasized that the fixed elements that built the city have reached the end of their lives and that with the development of technology, society has been formed on the concept of disposability and temporality. Vincent Kaufmann also referred to the social change that Warren Chalk spoke of.

Kaufmann stated that mobility is related to many other areas as well as sociology and therefore, it also refers to social change. Kaufmann described social mobility as the class/status change of various groups, families and individuals within a particular social structure. Tim Cresswell pointed out that mobility varies according to socio-spatial dimension, race, status/class, gender. Tim Cresswell also emphasized that mobility should not be perceived as just going from A to B, many types of mobility can be understood, researched and applied [77].

In order to better investigate the types of mobility, comparison between social and spatial mobility of people within the city can be examined. Vincent Kaufmann, who has researched the concept of mobility, said that the link between daily distance and social mobility is becoming uncertain. For example, the social mobility of an individual who lives in the city center and whose distance between home and workplace is too short is different from that of an individual who is far from home and workplace. The individual who has a short distance from home and workplace has more social mobility than the remote individual. Role change is important here. He takes on the role of 'employee' in the workplace and roles such as 'father' or 'husband' at home. Every time he moves, he also moves socially. For example, contrary to this, an individual who has a longer distance between the workplace and home has less social mobility because he always in the same role in terms of sociality by traveling great distances and spending a lot of time in planes or hotels. According to Vincent Kaufmann, there is a clear connection between the movement and the social realm. He also stated that traveling fast and far does not always make us mobile; for this, it requires more role change with participation in various functions in space-time [76]. Social mobility in the city can be examined through role changes, and spatial mobility in the city can be examined by other research techniques.

Henri Lefebvre analyzed the rhythm issue to obtain more useful information about spatial mobility and everyday life in the city. According to Lefebvre, rhythm is related to urban life and movement in space but also related to our understanding of time and repetition/renewal [78]. In our social life there is a certain rhythm that everyone adapts; events such as going to work at certain times of the day in the city, returning from work, certain times when traffic will increase or decrease, can be counted as city rhythms and everyone adapts to this rhythm [2]. Lefebvre, who has studied these rhythms in the city, has rhythm analysis studies. Jani Tartia also investigated this issue. Jani Tartia investigated the rhythmic quality of everyday urban mobility. For this, he examined the walkings of people in the city. Jani Tartia mentioned that the movement shaped the space. According to him, spaces are in continuous formation. Rhythm analysis is about walking in the city, creating spatial rhythms, but also observing rhythms, being influenced, and experienced by rhythms [34]. It is possible to examine the subject of rhythm analysis in more depth but it was considered necessary to briefly mention in order to understand Constant's idea of making people independent from the rhythm of everyday life in New Babylon project, which was studied in chapter 4.

Yona Friedman also investigated the ways to observe physical movements in the city. Depending on the movement of the individual in the city, he stated that we could not observe the route, identity and the reason for going there. What we can observe is the number and frequency of people going to a certain place in a certain time in the city, and the transport networks that can reach it where the individual wants to go in the city. In terms of these possibilities, Friedman associated the movements of people in the city to the Brown Movement [79]. We can briefly describe Brown's Movement as time-dependent random movements.

These movements in the city have increased with the development of transportation technologies. The development of transportation networks in the city increases the speed of the mobility of society [80]. But these developments reduce the quality of life and reliability in cities. The overwhelming density of vehicles and traffic has been effective here. In a spatial sense, the city center has spread excessively that the distances to be covered eliminate all the advantages of living in the city [26]. Le Corbusier (1947) noted the importance of transport networks and traffic in CIAM; he emphasized that zoning is important in cities. He stated that these three functions, housing, work, and recreation, will bring order to the city, while another function, traffic, has a single purpose; is communication between the other three functions [81].

In the 1960s, especially in Europe, architects believed that concepts such as mobility, flexibility, modularity, etc. should be introduced into urban life because of the growing population, globalization and advancement in technologies [34].

Raymond Ledrut talked about how these concepts could be implemented in urban life. Ledrut stated that in order to change the city, a new social and cultural lifestyle should be adopted. He said that it was inadequate to make plans, define borders and maintain the order in the city. He stated that it’s necessary to organize the change and said the followings:

> Urbanism can only be an art of regulation in a changeable and vibrant society that is subjected to intense movements, uninterrupted changes and rapid transformation [26].

With this discourse, Raymond Ledrut stated that the existing cities are insufficient against the developing technology, growing population and accelerating mobility, and mentioned the necessity to keep up with the changes instead of planning the cities in advance. E. A. Gutkind, similar to the idea of Ledrut; He stated that the current cities were not built for the

society, they were invaded by the society and he emphasized how insufficient the infrastructure of the existing cities is [26].

Unlike E.A. Gutkind and Raymond Ledrut, Henri Lefebvre believed that society was in evolution, not disjunction. He did not see urbanization as a result of industrialization but industrialization was a stage of urbanization. Henri Lefebvre's conception of the city center is an improvised place where coincidental encounters and cultural exchanges take place [26]. Henri Lefebvre said the following about the city center:

> Why not respond to the concept of an eternal city with temporary cities and centrality that constantly moves to stabile city centers? [26].

Henri Lefebvre distinguishes between city and urban. According to him, the city is a specific location within a historical context, and the urban is the framework of the processes and experiences created for the city [81]. Accordingly, Lefebvre questioned what could change in the city. He stated that in order to understand this, it is necessary to comprehend the current movements and inactivities. He also emphasized that it is necessary to understand the relationship between transformed and non-transformed in the city and intervene when necessary [81].

As a result of the increasing speed and mobility in cities, especially in the 21st century, various kinds of destinations, trajectories, and different forms of mobility have emerged [11]. The main factor affecting this increasing mobility was the Second World War. In the following years, migration has reached a global level and as a result of the growing population, architects proposed futuristic experimental projects as solutions to the urgent housing needs and unbalanced urban developments. Architects of the period benefited from the technologies in construction.

There were many other factors that influenced the designs of architects of that period. Some of them were; advancements in speed of mobility, personal automobiles, communication technologies, cybernetics, automation, increased leisure time, evolving environmental awareness, increasing social and political movements and the desire for new nomadic lifestyles. Many avant-garde architects, architectural groups and artists of the 20th century implemented these factors in their experimental utopic projects [34]. These utopic projects of the period intend to consider the city as a whole and take it into a single structure. In this context, they considered infrastructures to make this ideal understanding of society possible.

For this reason, architects often designed utopic megastructures, while imagining of this ideal society [82]. Within this concept, the latest construction technologies of the period provided more freedom to the inhabitants. The architects of the period adopted mobility, adaptation, flexibility, modularity etc. concepts in their megastructure projects, unlike adopting fixed spaces in mainstream architecture. Yona Friedman, whose ideas are the main structure of the thesis, has also proposed a megastructure in the context of mobile architecture. For this reason, the history of the utopic megastructures and their effects in the field of architecture considered necessary to be examined more thoroughly.

3. MEGASTRUCTURES AS AN UTOPIAN APPROACH

Megastructures, which generally adopt the concept of open-ended, can be extended horizontally or vertically and provide flexibility in interior spaces. Some architects and groups have proposed megastructures that could actually be realized by taking advantage of developing materials, techniques, and technologies, while others have proposed megastructures that can be defined as utopic. Konrad Wachsmann and Buckminster Fuller in the 1950s can be considered as the pioneers of the concept of megastructures [34]. Particularly after the Second World War, the understanding of megastructure did not last long and remained a utopia. In the next section of the study, the concept of utopia was briefly examined, then the focus was on the relation of utopias with the city and the utopias' understanding of mobile architecture.

3.1. A BRIEF SUMMARY OF THE CONCEPT OF UTOPIA

Etymologically, the word Utopia originates from the Greek word "topos" (place) and the "eu"(good) and "ou" (non-) [83]. Utopia means "absencia/absentland" [84]. Means both "nowhere" (outopia) and "a good place"(eutopia).

Utopias are generally based on Plato, but Usta (2005) states that utopias have a history of five thousand years in his book titled "Utopias of Antiq Era". It was first utilized by Thomas More in 1516, in his literal work "De Optima Reipublicae Statu Deque Nova Insula Utopia". Thomas More criticized the English royal by using the word utopia and imagined an equal social order. In his book "The City of the Sun" published by Tommaso Campanella in 1623, he dreams of a strengthening phenomenon such as social equality, common ownership, and patriotism. Many such utopists have come up with texts about their just, free and egalitarian social order. Some of them are Francis Bacon, Edward Bellamy, Charlotte Perkins Gilman, Etienne Cabet, Aldous Huxley, Ursula K. Le Guin, Ernest Callenbach [85].

Utopia is an ideal social order for the future which can be established in dreams and thoughts. Myths have influenced the emergence of utopias, and the common source of inspiration is the belief that people deserve to live happily in a just society. Accordingly, utopias emerged as a result of crises, inequalities, wars, classifications and so on. [86]. Emil Michel Cioran,

who opposed the concept of utopia, stated that utopias are against the tragedies and all forms of opposition. Utopias do not contain any coincidence or contradiction. E.M.Cioran associated imagined individuals in utopias to robots and stated that utopias have nothing in common to the daily lives of people. Utopia is a mixture of infantile rationality and angelic that is independent of religion [84]. Le Corbusier on utopia, in contrast to E.M.Cioran's ideas; regarded the utopia as the reality of tomorrow and stated that the utopia of yesterday was the reality of today.

While some writers such as E. M. Cioran argue that perfectionism in utopias can only be achieved through a repressive rule, however, it is a uniform system in which every individual is forced to be perfect, while some authors find utopias exaggerated and contradictory [85]. In utopias, individual freedoms and differences have been ignored due to the imagination of social unity and prosperity. Therefore, a totalitarian and centralist rule was dominant in utopias to establish an ideal society. Utopias reflect the traces of the period in the political, economic and social sense, but also reflect the designer's vision [87].

Utopias have been associated with many areas with their references in search of ideal social order. For this reason, many definitions of utopia and, therefore varieties of utopia have emerged [87]. It is possible to classify utopias as positive (utopia) or negative (dystopia) together with branches of art such as literature, architecture, and painting [85].

The relation of utopias with architecture can be seen in the depictions of space in literary texts. As an example of this, in Thomas More's utopia, the gardens and streets were arranged in detail, with the row houses [18]. Plato and Aristotle stated that cities were the most productive environment in which ideal society could form. Since cities are centers of production and settlement, they have been convenient for imagining the ideal society [87]. In the next section of the study, the relationships between utopia and the city were examined in a more detailed way.

3.2. RELATIONSHIPS BETWEEN UTOPIA AND CITY

Although utopias are fiction and unreal, they seem to be in search of urban experience for humankind [88]. Because utopias need living spaces to create the ideal life imagined. These living spaces have also been generally cities [87]. Lewis Mumford claimed that the first

utopia was the city itself [88]. Utopias, apart from the proposal of urban order, is the organization of the ideal dimension of this order. The fact that the ideal life/order in utopias was not imagined in rural areas but the city. This approach also shows how utopias face social realities. Therefore, utopia does not seek an ideal life outside the city. The reason for this underlies in the fact that being a city dweller in life, symbolizes civilization. For this reason, utopia doesn't imagine detached social life, but being with society. Utopias produce alternatives to the city and the existing social order within the framework of an ideal life, but again, this ideal life still imagined in the city [89].

In the Middle Ages, the effects of enlightenment and scientific processes that emerged with the Renaissance were observed, but the cities maintained their order in Antiquity.

In the 19th century, they were in search of a new city by opposing the negative effects such as increasing population growth, unhealthy conditions, and inequality. Sarcey's 19th-century utopias emphasized the longing for both the developing city with the industrial revolution and the Middle Ages.

After the end of the 19th century, utopias were based on optimism towards technology. The Second World War and the economic crisis reacted to the modern movement in architecture. In particular, the urban designs of Le Corbusier, Frank Lloyd Wright, and Ebenezer Howard, which were modernist architects, were among the reasons for this reaction to the modern movement. Accordingly, there was no longer a belief that certain forms would be solutions to urban problems. The architects, artists, and architectural groups of the period designed technology-based projects. The 20th-century urban utopists, who believed that the idea of a certain city center should not exist anymore because the developing communication, transportation and information technologies changed the lifestyles of people. Architects adopted the ideas of mass production, growth, adaptability, mobility and proposed projects in this direction. In the next part of the study, these concepts examined in the 20th century architectural utopias.

3.3. MOBILE ARCHITECTURE CONCEPTS IN THE UTOPIAS OF 20TH CENTURY

In this part of the study, it has been examined how advancements in technologies of the 20th century affected the concept of mobile architecture in utopias particularly between 1950-1970s when mobile architecture developed.

In utopias, the belief that "what it can be" or "what it should be" is always superior to the belief that "what it is" [90]. For this reason, utopists have discussed the problems of daily life throughout history and suggested solutions. Utopias are also a holistic method that can help us establish the relationship between past, present, and future mobility [91]. Referring to the positive side of the utopias, Henri Lefebvre stressed that in order to increase the likelihood of future events, it is necessary to desire what seems impossible and turn it into action and strategy. As an example of this utopian discourse in the context of mobility; a city where automobiles do not exist can be imagined [81].

With the developments of automobiles in 1940, utopists imagined highways in the city circulation. Highways have increased urban mobility and became a vital experience in our daily lives. It can be observed that these utopian ideas were close to reality in the 2000s [92]. An example of this utopian thought is Le Corbusier's Plan Obus in 1931. In the Plan Obus project, Le Corbusier designed roads for cars at the top elevation of the megastructure. Utopias had always imagined of making the current negative situations into ideal ones, also have traces from the period in which they were designed. Accordingly, when the Plan Obus project was designed in the 1930s, it was observed that dirt roads became increasingly insufficient for advanced cars; therefore asphalt roads increased and became cheaper. As a result, the concept of mobility, which was once utopia, realized in daily life in the following years with the advancement in technology. Plan Obus project has been examined in detail under the title of Megastructure Approaches.

Rapidly developing technology, wars, and ecological problems, especially in the 20th century, affected and diversified utopias. Many kinds of utopia, such as ecotopia, technotopia, ecological-technological utopia, emerged in this period. [85]. The groups and architects of the 1960-1970 period were influenced by latest communication and construction technologies and used various freedoms provided by these technologies and

proposed techno-utopic projects. They have used concepts such as open-ended, disposable, flexible, mobile etc. However, projects have become increasingly complex and more dystopic [93]. The experimental projects in the concept of mobile architecture in the 1960-1970 period can be considered as techno-utopic projects. For this reason, the thesis focused on the techno-utopic and related projects in this concept.

In utopias, technology-oriented solutions can be defined as techno-utopia, that is, technological utopia or technotopia, as Felicity D. Scott described. Technological utopia dates back from the late 19th century to the present day. Techno-utopic projects of the period were designed with optimistic attitudes, and latest materials that emerged with the development of technology were continuously tested in the projects [94]. There were also many people criticized the idea of techno-utopia. Jane Jacobs, Christopher Alexander, and Aldo Rossi were among these critics. They believed that such technological optimism was contrary to human nature and the fact that cities were a symbolic phenomenon. In essence, these two opposing views also shaped the architectural education of the 1960s [95]. In this respect, the architects of the period showed similar approaches in the context of techno-utopic urban designs as well as different approaches. These approaches paved the way for the formation of various architectural groups. In this context, some of the radical design groups and architects that emerged in Europe in the late 1960s, especially in Italy, such as Archizoom, Superstudio, Utopie, UFO, 9999, Coop Himmelblau, Haus-Rucker-Co, Ant-Farm, Ziggurat, Walter Pichler and more [96]. These architectural groups took advantage of emerging cybernetic technologies and proposed provocative and symbolic designs. In order to limit the thesis, these groups have not been studied. The focus was on pioneering architectural groups, architects and artists in techno-utopia concept.

In the 1950-1960 period, interest in terms such as mobility, flexibility, technology, cybernetics increased and architects and architectural groups wanted to free people from working, capitalism and bureaucracy in their projects. The utopist Cedric Price, who has benefited from cybernetic technology and inspired the Archigram group, can be regarded as a pioneer in terms of his projects in the concepts of cybernetics and mobility. In this context, Cedric Price stands out with Fun Palace and The Generator projects. Especially with the cybernetic system used in The Generator project, it gave one of the earliest examples of intelligent buildings. With the computer-aided software, users could arrange the interior design; therefore, they would be involved in the architectural process. Another architect who

used cybernetic technology before Cedric Price was Yona Friedman. Friedman has created a computer-aided software called The Flatwriter, which gives the inhabitant millions of options to arrange the design of his/her house.

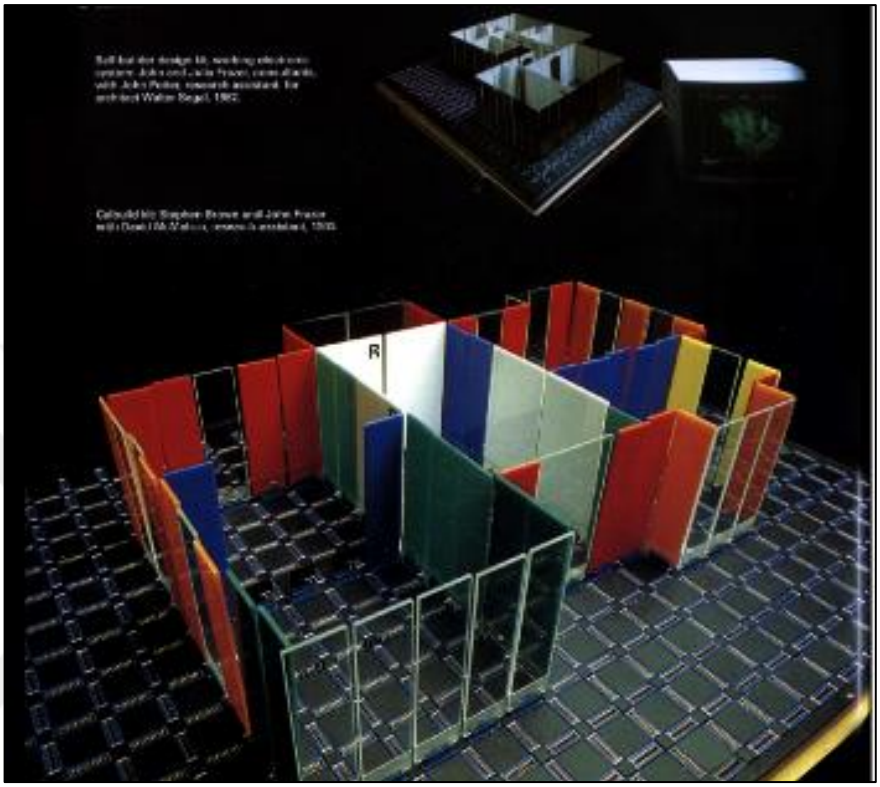


Figure 3.1. The Generator Project [97].

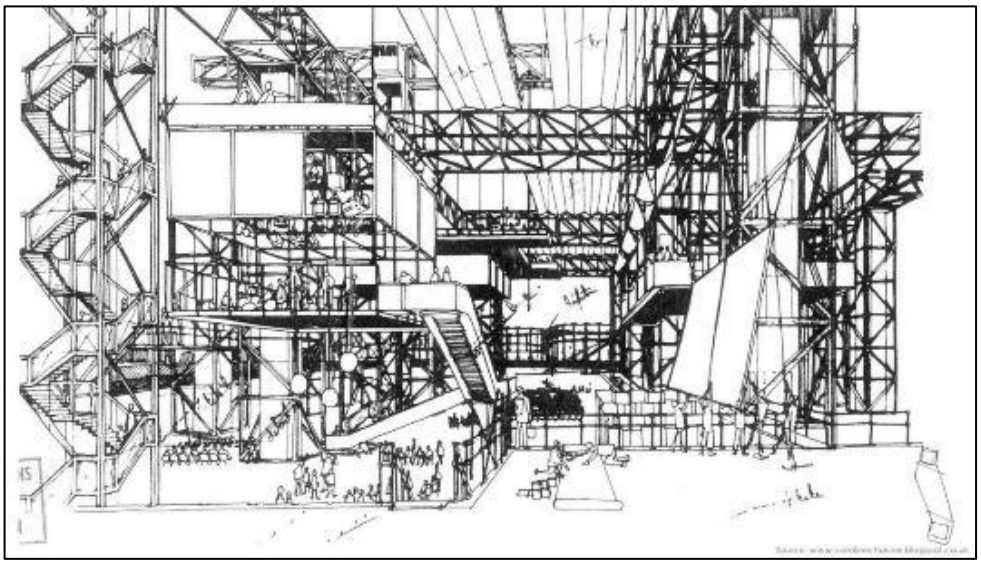


Figure 3.2. Fun Palace Project [98].

The original idea of the Fun Palace project, another Cedric Price project, was created by avant-garde theater producer Joan Littlewood. With Littlewood's vision and Cedric Price's interactivity, the experimental architectural approach led to the Fun Palace project in 1961. The project was seen as a solution to Britain's post-war crisis, increased leisure, and crime. Cedric Price and Joan Littlewood believed that mechanization would become more and more integrated with our lives. They sought temporary solutions for the project. It was designed as a learning and entertainment center that can be adapted, disassembled, installed and can meet the needs of the user. In terms of process, Cedric Price defined Fun Palace as events that change over time rather than objects in space and adopted uncertainty concept as the main design principle.

Cedric Price mentioned that his creativity comes from the pleasure of the unknown. He stated that within the framework of architecture and planning, the predetermined projects would result as safe and mediocre solutions, which traps the architects 'try to do right at the first time'. For this reason, Cedric Price used the latest cybernetics, game theory, and computer technologies in this project and thought that The Fun Palace would be a project that constantly learns from the users and predicts, plans and continuously renews the future activities. The Fun Palace project was partially implemented but later demolished. Since there was no fixed predetermined program, programs might vary according to the latest trends and events [98]. He also expressed this unpredictability with the following words: "What is it? Indeed, just what was the Fun Palace? It was an event, not a thing" [99].

In 1965, Cedric Price summarized his ideas and vision about the city with few paragraphs of texts, sketches, and perspectives through his collection of drawings called 'City of the Future'. Accordingly, he emphasized that some of his ideas in the Fun Palace project might also be implemented in the city. He stated that buildings could be moved. Since the thesis focuses on techno-utopian urban designs, these projects of Cedric Price were also examined in the conceptual flow. The Generator and Fun Palace projects were not urban scale projects but they have been considered necessary to mention briefly because these projects reflected how advanced technologies could develop the concept of mobile architecture in 20th century utopias.

In the 1950-1960 period, techno-utopic urban designs and pioneering projects in terms of mobile architecture have emerged. These techno-utopic urban projects were mainly proposed by Archigram, Metabolists, Yona Friedman, and Constant Nieuwenhuys. Mobile

architecture concept was the predominant factor in techno-utopic urban projects. In this respect, these architectural groups, architects and artists are considered as pioneers. For this reason, the thesis focuses on these groups and architects. Mobile architecture approaches that they proposed in techno-utopic urban projects had some similarities as well as differences. The mobility they proposed varied in many ways from urban scale to human scale. For example, mobility in Archigram's Walking City project was on an urban scale. The Cuschicle project, which was also one of Archigram's project, had human-scale mobility. As another example, the housing capsule concept adopted by the Metabolist group had building-scale mobility. The projects of these groups and architects were examined in detail under the title of Research of Megastructure Pioneers in the Context of Mobile Architecture.

In this section, it was explained how the advancing cybernetic technologies in the 20th century affected the understanding of mobile architecture in utopias. Utopian architects, artists, and architectural groups believed that the mobility of cities would increase with these advancements in technologies. They stated that the increasing speed of mobilities with mechanization, the developments in technology and automation would affect the cities, and the perception of the city would change in this context. Accordingly, the utopist architects, groups and artists of the period believed that it would be accurate to think of the city as a whole system, and in this context, they designed megastructures.

In the next section, megastructure approaches were examined, and it was explained that megastructures did not emerge in this period and the role of mobile architecture in megastructure approaches was emphasized.

3.4. MEGASTRUCTURE APPROACHES

Megastructure approaches were developed in the 1950s as a solution to the urgent need for housing after the Second World War and ended in the 1970s. The word megastructure was first introduced by Fumihiko Maki, a Metabolist Group, in his 1964 publication called ‘Investigations in Collective Form’ [43]. In fact, in 1957, the French geographer Jean Gottmann, for the first time when he introduced the concept of megalopolis in his article, referred to the idea of megastructure [100]. According to Fumihiko Maki, the word ‘megastructure’ was a large skeletal system in which the city, or part of the city, contains all

the functions, and the mobile parts within it [43]. What Fumihiko Maki had missed from this description was the DNA of the megastructure. According to Yona Friedman and GEAM, megastructures resembles cellular growth that molecular biologists refer to. This cellular growth could occur not only as a form, as a specific pattern or as a structure but by arranging the limited number of elements [101]. In 1968, Ralph Wilcoxen described megastructures as follows; should be installed as modular units, have unlimited or too many additions/growth capacity, other structural units (rooms, houses, small buildings, etc.) should be added/installed in the carrier system, the carrier system should be able to function much longer than the structural units added/installed to it [102]. Fumihiko Maki stated that technological developments and advanced construction technologies would enable the development of megastructures [103].

Eckhard Schulze-Fielitz, a GEAM member, said the followings in 1960 about megastructures:

> The space structure [or megastructure] is a macro-material capable of modulation, analogous to an intellectual model in physics, according to which the wealth of phenomena can be reduced to a few elementary particles [101].

The futuristic architects of the 1950-1960s proposed megastructure projects, especially in the aftermath of the Second World War. Rosemary Wakeman in her book called ‘Practicing Utopia’ stated that avant-garde architects of the 1950-1960 period believed that they would change society by changing the physical structure of the city [104]. Mobile, flexible, interchangeable concepts in megastructures designed by many architectural groups and designers in accordance with modern social life [85]. Some of the prominent groups and designers were as follows; Metabolist group and Kenzo Tange from Japan, Archigram and Cedric Price from England, GEAM, Architecture Principe and Utopie from France, Hans Hollein, Coop Himmelblau, Friedrich St. Florian, Haus Rücker Co. from Austria and Archizoom, Ettore Sottsass and Superstudio from Italy. According to these groups/architects, megastructures represent new modernity independent from the social and technical boundaries of the past [101].

In 1960, at the Museum of Modern Art, the exhibition Visionary Architecture was organized by Arthur Drexler, various megastructure proposals such as from Kiyonori Kikutake's Floating City (1959) to Buckminster Fuller's Dome over Manhattan (1950) and Paolo

Soleri's Arcology (1959). This exhibition was considered as an announcement of the focus on the megastructure concept of the period by many architects.

Rosemary Wakeman emphasized that brutalism was effective in designing such gigantic and monumental megastructures [104]. Jonathan Barnett described the megastructures as ‘’the city as a building’’ [105]. The idea of megastructure was always at the center of the modern architectural concept, but it was also linked to the future utopic city [106].

The megastructure approaches hadn’t been a long-term architectural understanding. The emergence of the Vietnam war and political radicalization had negative effects on megastructure’s interest, therefore it lasted a little longer than ten years. Architects and groups could not go beyond than drawing the image of the future. This understanding, which once seemed to be an opportunity to build society as a whole, later became a utopian ideal and an unreachable destiny. Reyner Banham, an architectural critic, and historian said the following about megastructures: ‘’A whitening skeleton on the dark horizons of our recent past’’ [101].

Similar criticisms came from Ettore Sottsass and Superstudio, who were part of the megastructure movement. Ettore Sottsass's The Planet as Festival (1972-73) and The Continous Monument (1969) were designed in a devastating, apocalyptic scenario. The understanding of megastructure deviated from its original purpose and went beyond the logic of modern discourse. According to the French sociologist and critic Jean Baudrillard, a member of Utopie, the beginning of megastructures began in the 1950s with Team X, Yona Friedman, and The Metabolists ended with Utopie and Superstudio. Manfredi Nicoletti, a member of GEAM, described the descent of megastructures as follows:

> Never perhaps in the history of architecture has such a large availability of ideas and practical means corresponded to such a tremendous chance of creating. It is appalling to witness, in this moment, how problematic the encounter between the possible and the concrete has become. We are actually facing a sort of paradoxical reality that has all the features of a Utopia [101].

The criticisms about megastructure projects also came from the sociologist and philosopher Neo-Marxist Herbert Marcuse; he stated that the freedom and right of choice that megastructures recognize in the context of adaptation and transience were an illusion. He mentioned that these rights or freedoms were, in fact, fixed/unchanging alternatives that were pre-determined by the designer in the mega system. He compared this to people in

supermarkets. He stated that consumers' right to choose in supermarkets is actually an illusion because the products in supermarkets are already predetermined [101].

Apart from the mobile architecture, the first traces of the idea of a megastructure dates back to ancient buildings in various parts of Europe, such as Colosseum and Circus Maximus in the ancient Roman period. For example, the Old English Bridge (1176-1831) had been a pioneer of megastructures with more than six centuries of existence. It was a multi-layered structure that contained many functions such as houses, workshops, shops, temples, and watermills and was continually changing [56]. There were many examples can be considered as ancestors of megastructures such as the Aerodome project proposed by Henry-Jules Borie in the city of Paris in 1865 or the Linear City project designed by Arturo Soria [106].

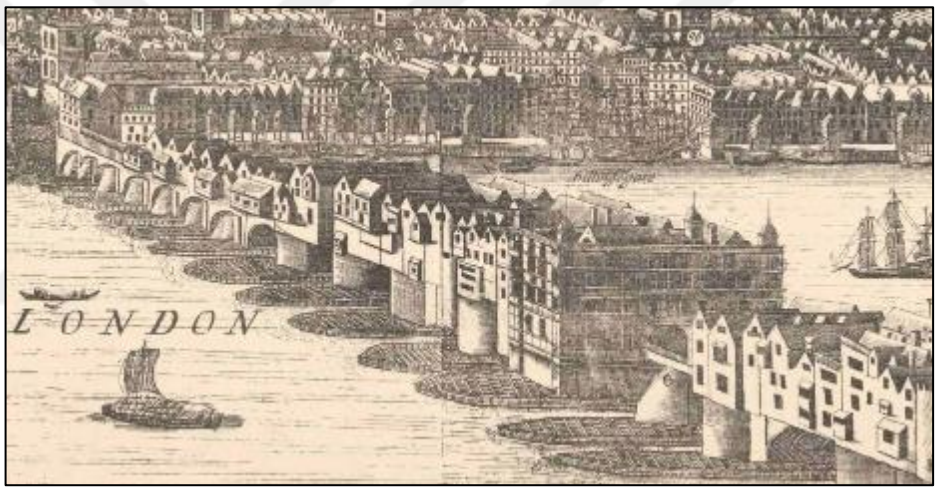


Figure 3.3. Old English Bridge (1176-1831) [107].

In his book ‘Megastructures’, Reyner Banham investigated the origins of megastructure projects. Reyner Banham first began his research by examining the characteristics of megastructures. Its enormous size, carrier system, and spatial units had been the determining factors in this research. He then studied the first examples of the megastructure concept historically. The first project reminiscent of Reyner Banham's megastructure, was designed in 1955 by a group of students at the Architectural Association School [108]. According to Banham, the first examples of megastructures projects emerged and ended in schools [109].

Reyner Banham first considered the Ponte Vecchio in Florence in 1345 as a megastructure. Paul Rudolph also found the Ponte Vecchio as the best example of megastructures [110]. Reyner Banham preferred this building because it had a multi-storey and various functions

in a temporary environment [111]. Later, however, he considered Walter Gropius's Wohnberg project (1928) and Le Corbusier's Plan Obus (1931), which could be considered as the true ancestor of megastructures [112]. Prior to these projects, La Citta Nuova (1914), designed by Antonio Sant Elia, was considered as the ancestor of megastructures. Banham stated that it would be more appropriate to perceive the concept of megastructure as an attempt to connect individual buildings to the city. In this context, he stated that the first megastructure designed consciously was built by the Japanese Metabolist group and Kenzo Tange. Kenzo Tange's MIT Boston Harbor (1959) and Kiyonori Kikutake's Marine City projects were considered as the first true megastructures by Reyner Banham [112].

Other architects such as Alison and Peter Smithson influenced by Le Corbusier's Plan Obus and Unité d'Habitation housing projects. Alison and Peter Smithson proposed the Golden Lane mass housing project in 1952 as a solution to the increasing need for housing during World War II. This project was influenced by futuristic megastructure projects by Constant Nieuwenhuys, Yona Friedman, Archigram and Metabolist group [43]. Therefore, Le Corbusier's Plan Obus project, Golden Lane project, and then MIT Boston Harbor project were examined.

3.4.1. Plan Obus Project - 1931

Although Le Corbusier had modernist tendencies, he expressed the cities and architecture with organic and biological discourses. He emphasized that; of a city, it's finance and management as its head, its culture as its heart, its houses as its lungs, its industry as its legs, and its transport networks as its veins. Le Corbusier also saw the city as a place to escape. In his designs, the vertical elevation was emphasized as being closer to the silence and getting away from city noises, chaos, and diseases. Art historian Simon Richards stated that Le Corbusier's asocial urbanism was deliberate. In this respect, it can be said that Le Corbusier was a radical utopist. [113].

Le Corbusier was invited to Algeria in 1930 and thought about what kind of future city he could offer. Le Corbusier, who has worked on the culture of this place over time, applied the techniques he learned in his next projects. Such as the convention building in Chandigarh and Unité d'Habitation in Marseille [113].

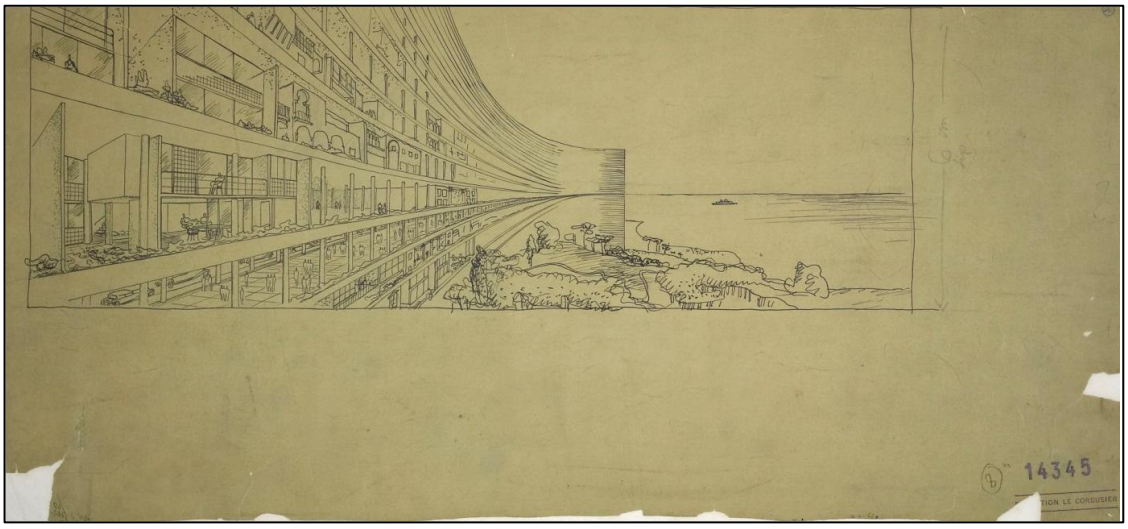


Figure 3.4. Image of Plan Obus [114].

The Plan Obus project was intended to correspond to the slopes of the Atlas Mountains in Algeria. Le Corbusier designed a multi-storey structure, as a solution to the problems in Algeria. The living conditions were difficult; at that time, about 250 thousand people emigrated and had limited opportunities for growth [43]. At the height of 160 meters above sea level, the viaduct connected with the roof level of the 31-storey office building at Quartier de la Marine. Le Corbusier considered the office building as the financial center of the city. The project was a megastructure consisting of long viaducts.

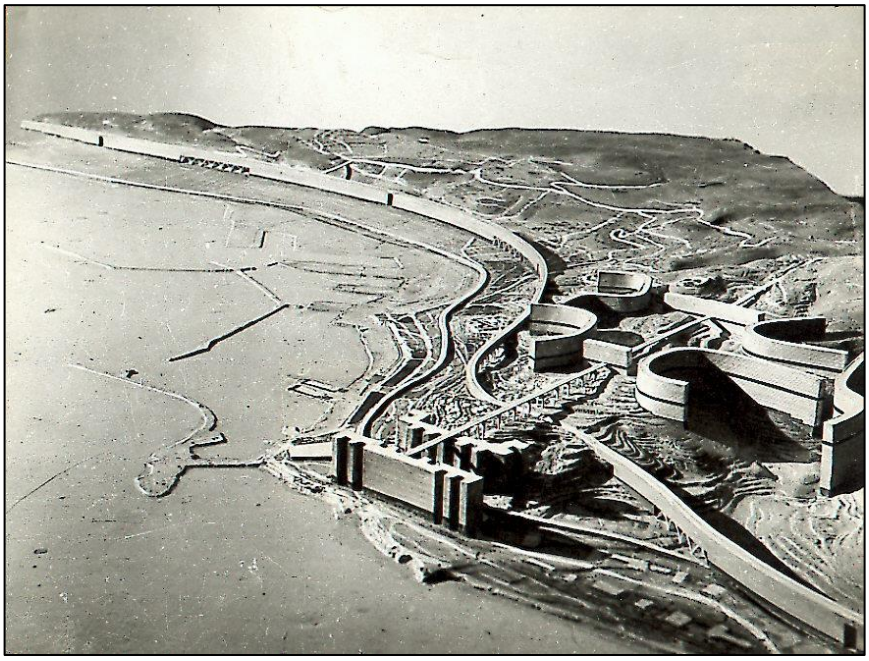


Figure 3.5. Plan Obus Project [37].

Before the Plan Obus project, Le Corbusier had designs and sketches that matched the idea of megastructure. These sketches were considered in places like Sao Paulo, Rio de Janeiro, Montevideo, and Buenos Aires.

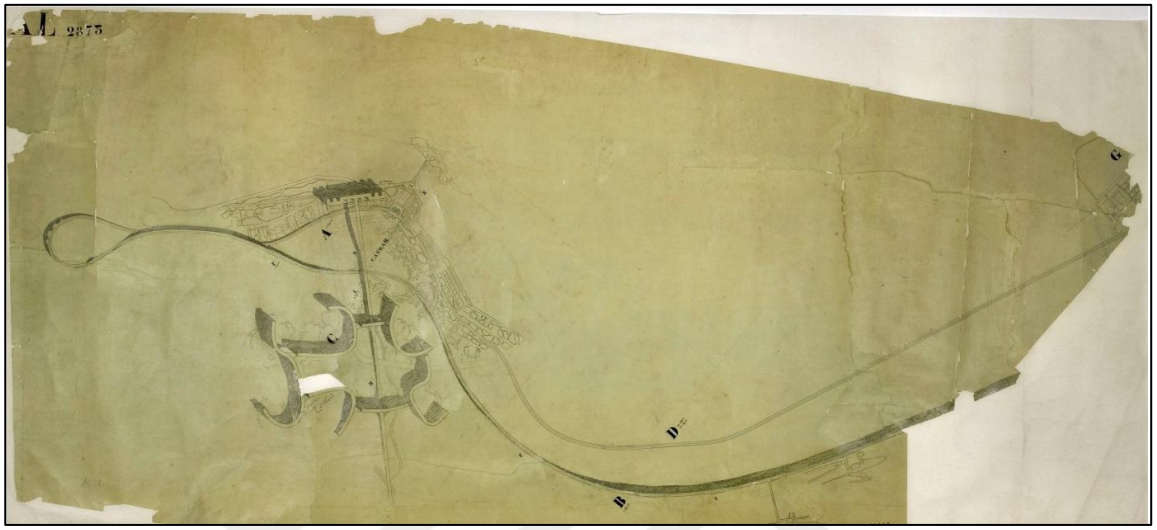


Figure 3.6. Plan Obus site plan [114].

The Governor of the time, Charles Brunel, stated that the Plan Obus project would be costly, and its construction would lead to the destruction of the entire city. He noted that the apartments were tiny, and nobody would want to live there [114].

In 1958, as Algeria entered the fourth year of the liberation war, the French authorities used some of the features of Le Corbusier's Plan Obus to appease the revolution and constructed the Plan de Constantine.

Le Corbusier’s Plan Obus project also had unlimited growth capacity; one structure, which accommodates all the functions of the city, could cover the region. This idea later influenced designers such as Constant, Yona Friedman, Metabolist Group and Archigram. Similar to the Plan Obus project, the Metabolist group, Constant Nieuwenhuys, Yona Friedman, and the Archigram group were also influenced by the Golden Lane Project designed by Allison and Peter Smithson [111].

3.4.2. Golden Lane Project - 1952

Prior to the formation of the Team X group, in 1952, Alison and Peter Smithson proposed the Golden Lane Project at the ninth CIAM congress in a post-war London housing competition for the working class. This project designed to introduce a flexible system for the city. The project was located around the crater traces caused by bombs during the war [43]. They proposed the concept of ‘streets in the air’. A street/corridor layout was considered on all three floors. This arrangement was located in the front, not in the middle, in contrast to the corridors of Unité d’Habitation, designed by Le Corbusier. To simulate Le Corbusier's “wine rack,” Smithson's suggested the corridors facing the façade would strengthen the lateral support, and each apartment door considered as a “bottle cap.” This concept stated that the idea of a street was more important than the physical pavement of the street [57].

According to Alison and Peter Smithson, the first element defining the city is the "house." Houses can also be arranged to form the street, whereby the "street" is the second element defining the city. With the arrangement of the streets, "regions" are formed, which is the third element representing the city.

Alison and Peter Smithson put forward the idea of a new mass housing against new forms of production, consumption, transportation, and living conditions. Opposing the strict rules of CIAM, the Smithsons argued that cities might have more flexible planning as follows: "What we are after is something more complex, and less geometric. We are more concerned with flow than with measure."

The Golden Lane proposal can be seen as the essence of Smithson's environmental and social life philosophies [57].

Although the Smithsons did not win the competition, they inspired many designers. Twenty years later, the project they proposed Robin Hood Housing, which adopted the ideas of the Golden Lane proposal and Le Corbusier's Unité d’Habitation, became realized [57].

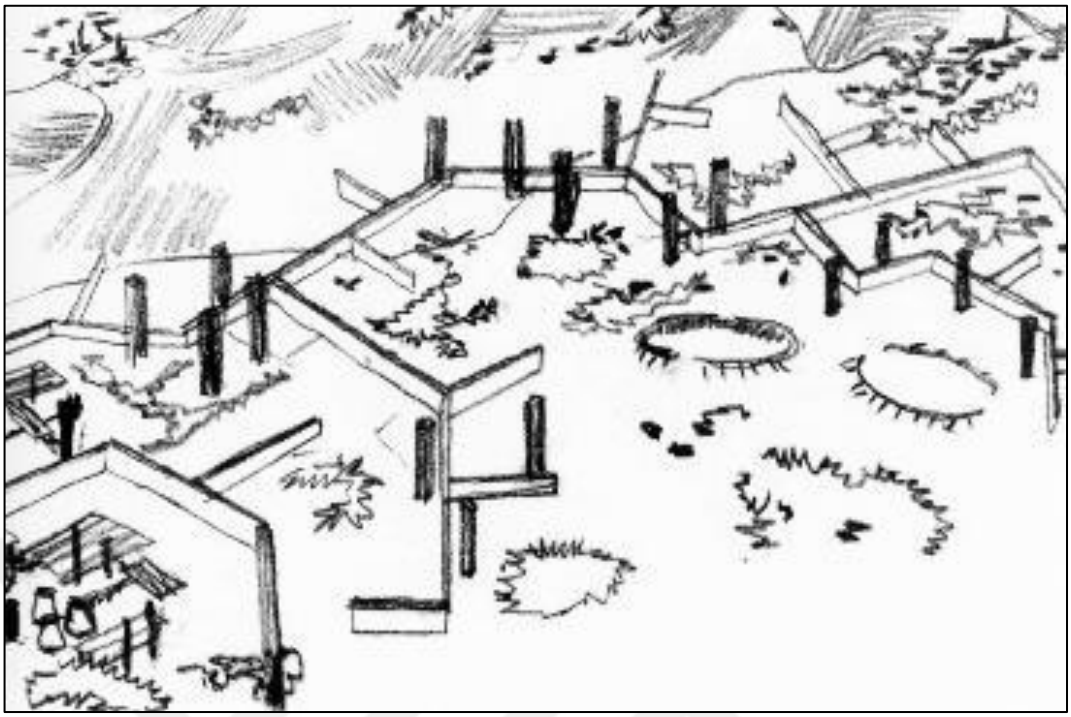


Figure 3.7. Golden Lane Project [115].

According to Alison and Peter Smithson, social cohesion was formed by the freedom of grouping and the ease of communication.

The Golden Lane project proposal had the same concern as Le Corbusier's Unité d'Habitation project. These concerns were the harmony of social life and psychological development in a balanced society. The Golden Lane project proposal was never designed to address universal concerns. It was designed to seek solutions to the problems of the working class in a given region [57]. However, the project also includes the principles of growth and development based on randomness. Random aesthetics in architecture dates back to old times. But for the first time in the town planning, the aesthetics in the Golden Lane Project was based on the randomness and not based on the simple geometries.

Yona Friedman also impressed with the idea of randomness and at that time, The Golden Lane Project was visually the closest project to his ideas. But, in Golden Lane Project the randomness decided by the architect, which was completely opposite to Friedman's ideas [15].

(a) (b)

Figure 3.8. Golden Lane Project and New Babylon. (a) Golden Lane Project [115] (b) New Babylon [116].

Concepts such as flexibility, mobility, randomness, and expendability in architecture led experimental architecture from the late 1950s to the mid-1970s. Constant's New Babylon was an early example of this experimental architecture. Constant adopted the concept of Team X in the New Babylon project and reflected the similarities in the form strategy [116].

Team X stated that the city infrastructure must be considered and designed for growth and change. The Smithsons stressed that cities would never reach the finished / final state, that cities would constantly be in unpredictable changes, and therefore they rejected the concept of urban planning. In this respect, they stated that each architect should take over the city in the same way as to how the previous architect had left and added on to the existing infrastructure.

Constant developed these ideas in a different direction. Smithson's housing project proposal was developed on the concept of conservation. New Babylon project, on the other hand, developed on the evaporation of the housing concept, in other words, the disappearing of the housing concept [116].

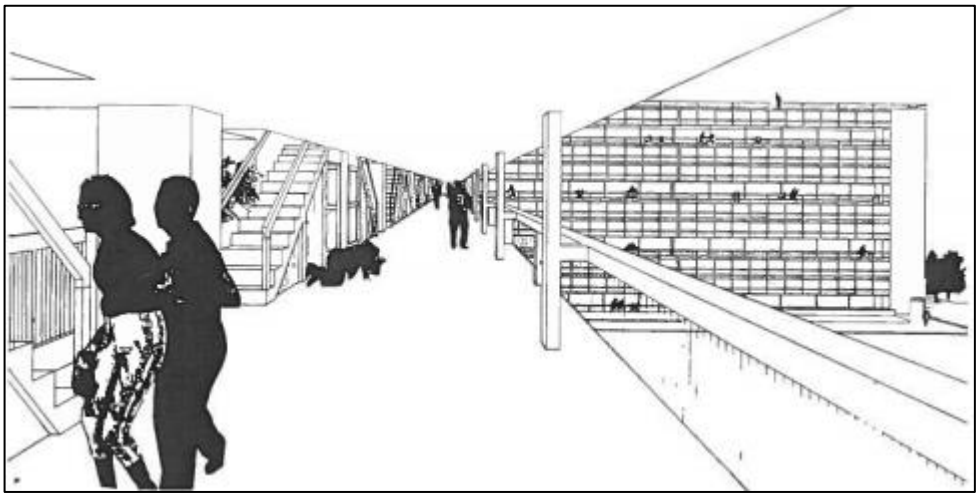


Figure 3.9. Golden Lane Project decks [115].

3.4.3. MIT Boston Harbour Project - 1959

From 1959 to 1960, Kenzo Tange was a design studio instructor at the architecture school of MIT (Massachusetts Institute of Technology). Kenzo Tange and his students designed a housing project in Boston, which could accommodate 25,000 people. In this project, it was aimed to define the current scale difference situation in the human scale of the housing units and the huge scale of the highway system existing in the modern city and to design a mid-scale mass housing project in order to cover this gap [112].

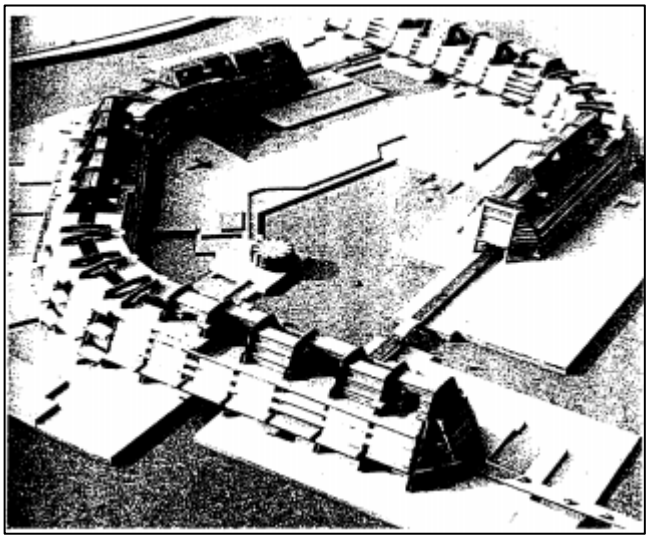


Figure 3.10. MIT Boston Harbor Project [112].

Tange wanted to integrate the various functions in the city into the project, and in this context, he examined projects among seven groups. The team, including George Pillorge, Edward Haladay, Ted Niederman, and Gustave Solomons, have integrated the city's contemporary transport network system into the project and took advantage of it. The four blocks in the project area were connected by two linear concave blocks. It was similar to Walter Gropius's Wohnberg project and Antonio San't Elia's The Citta Nuova. In The Boston Harbor project, public functions such as school, recreation areas, housing units dissolved on the ground floor. Housing units were considered on the upper floors, and public areas, which designed on artificial lands, were considered on every third floor [112].

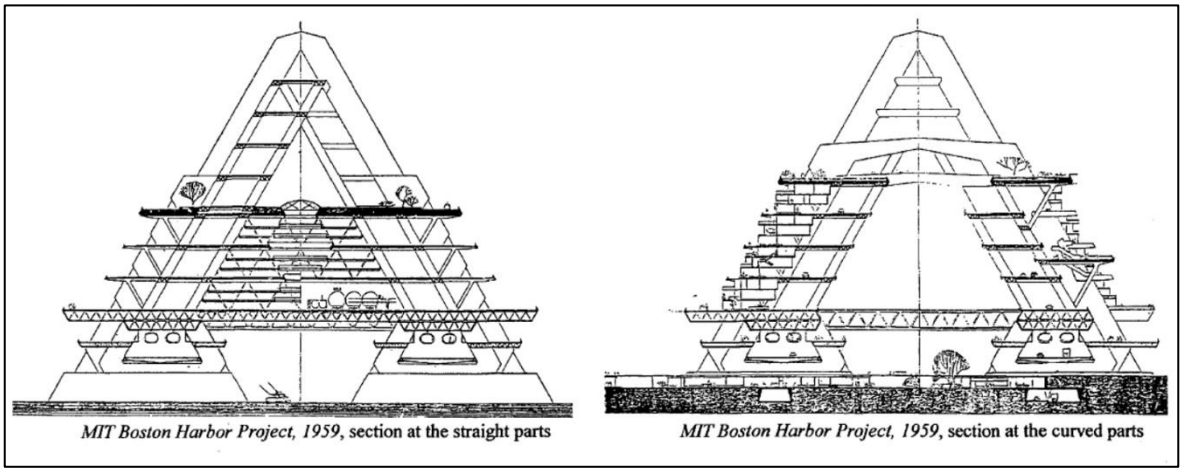


Figure 3.11. MIT Boston Harbor Project section [112].

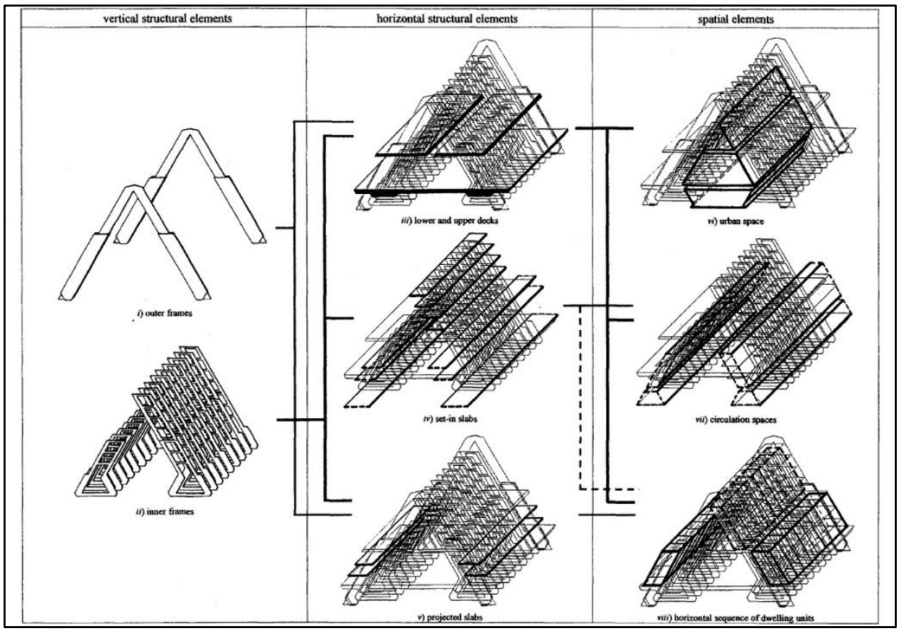


Figure 3.12. MIT Boston Harbor Project spatial & structural elements [112].

This selected project has been published in many places and mentioned by many architects. The Boston Harbor Project was described by Reyner Banham as the first true megastructure project. The reason for this is that for the first time many functions of the city have been consciously thought in the megastructure. Manfredo Tafuri stated that the MIT Boston Harbor project was inspired by Le Corbusier's Plan Obus project. The project was separated from the other ancestors as it was discussed in relation to the structural and spatial elements in the A-frame system. The project has brought a different approach to the megastructure concept by considering public areas on artificial lands at the lower and upper levels. Subsequently, the ‘artificial land’ idea was used in Metabolist Group projects. In addition, it can be said that it is an example of a megastructure with the potential of an open-ended concept considering the continuity of the circulation areas in a linear manner at horizontal levels [112].

Kenzo Tange advanced in this direction in response to the positive feedback that he received from the project. From the principle of functionality, he adopted the principle of structuralism, and in this context, he designed A Plan for Tokyo in the following year [95]. MIT Boston Harbor, Kenzo Tange's first megastructure project, followed by A Plan for Tokyo, inspired the Metabolist group, founded in 1960. These two projects of Tange were considered as an articulation between the individual structures and the city, in addition, the project influenced the other post-war approaches with its three-dimensional circulation system.

Kenzo Tange's MIT Boston Harbor project was examined in terms of Reyner Banham's statement as the first true megastructure and as a source of inspiration for the Metabolist group's understanding of the megastructure. It was also considered necessary to examine the history of the megastructure approaches of the 20th century, the Golden Lane and Plan Obus projects, such as the MIT Boston Harbor project. Before examining the megastructure projects in the context of mobile architecture, it was aimed to explain which projects were an inspiration for architects, artists and architectural groups such as Constant, Yona Friedman, The Metabolists, and Archigram. Also, it was deemed necessary to examine how the megastructure concepts of this period were shaped. In the next part of the study, the pioneers of megastructures in the context of mobile architecture were examined.

4. RESEARCH OF MEGASTRUCTURE PIONEERS IN THE CONTEXT OF MOBILE ARCHITECTURE

Urban mobility conceptually covers not only architecture but also sociology, geography, economy, politics and visual arts. The avant-garde architectural experiments of the 1960s and 1970s gave important examples in the concept of mobile architecture [34]. The demands for mobilizing architecture and the city have increased in recent years with the discourses and practices such as temporary use and instant urbanism. These approaches emphasizes the concepts of mobility, flexibility, spontaneity, and improvisation. In the context of mobile architecture, the megastructure concept, which embraces people's own aesthetic lifestyles and sensibilities, and has adopted their equality and freedom, has become a controversial issue within the current capitalist system. [106]. These were the main reasons that megastructure projects in the context of mobile architecture remained utopia.

During the 1960-1970 period, some similarities were observed in the architects and architectural groups of the era in the concept of megastructure. Reyner Banham compared the concept of the three-dimensional grid plans of Yona Friedman's Spatial City to the vertical core system of Kenzo Tange's administrative units at the center of the A Plan for Tokyo project. The effects of the Metabolist group can be seen in Paul Maymont's Floating Island Project (1963) and City Under the Seine Project (1962) [111]. In that period, many influential projects designed in the concept of megastructure. Therefore, many definitions of megastructure had developed from various scholars.

The connection between megastructures and mobile architecture can be seen in Ralph Wilcoxen's description of megastructures. Concepts such as unlimited growth capacity, modularity and articulation, which Wilcoxon has mentioned, were used by architectural groups, architects and artists who have been examined in this part of the thesis.

These groups, artists or architects had similarities as well as differences in their understanding of mobile architecture. As an example, Yona Friedman, the Metabolist group and Team X discussed how cities should grow and adapt like a living organism in the future. Unlike Team X, according to Yona Friedman and the Metabolist group, they wanted to develop a method that not only units were mobile, but the whole system was mobile. Kenzo Tange suggested that modern science, physics or mathematics should be used as an approach

to this method [101]. Yona Friedman stated that Team X has advanced in the direction of classic Bauhaus concept, which was the principle of ‘doing everything for the people’, in contrast to this idea, Friedman emphasized that the architect cannot ‘do everything for the people’; therefore, the people/users should decide on their own environment [117].

As another difference, Yona Friedman and Constant can be discussed. The differences in mobile architecture understanding expressed by Friedman and Constant in meetings, symposiums can be clearly seen. The ideas of Yona Friedman and Constant about urban mobility differed politically and aesthetically. Constant emphasized that the concept of urban settlements developed in the industrial revolution should no longer be held on to and he envisioned a city that adopted a more nomadic lifestyle, without borders, raised from the ground, and where social spaces and the environment were constantly formed according to the activities of life. Constant's New Babylon was an anti-capitalist world in search of a new urban culture with provocative designs, rather than a physical form, [34]. Constant agreed with Friedman's social critiques of contemporary urbanization and the idea of a culture of automation. However, he stated that Friedman's Spatial City project did not address these critiques. Stating that the Spatial City project could not go beyond being a functional city, he emphasized that private housing units avoided the newly developing mass-culture and stated that it was not enough to transform the city in social, cultural, technical, and practical terms. Constant argues that the future city should emphasize a new assessment/use of social space, not displacement in order to find housing or basic needs [116]. Yona Friedman, on the other hand, stated that Constant played a very authoritative and a lot of artist-director role in the New Babylon project [34]. Friedman also emphasized that the New Babylon project was an artist's vision. He said that everyone could design according to their own needs and tastes, and questioned why people were forced to follow the vision of a single person who has declared himself as an expert. According to Friedman, the stylistic approaches on architecture has a short and limited life. Friedman believed that instead of providing mobility to everyone, it would be more beneficial to provide mobility only to individuals who want to be mobile [116].

Another difference can be seen between the Metabolist and Archigram groups. Although the two groups had designed projects with similar approaches such as techno-utopic, futuristic and optimistic images, the main difference was ‘what should be the main elements in the city’. Archigram believed that the idea of “plug-in” would bring new lifestyles to the

individual in the city. Metabolists, on the other hand, addressed the mass population rather than the individual scale and considered the city as a whole [106]. Another difference can be seen between Yona Friedman and Kenzo Tange. Friedman, who didn't believe Kenzo Tange's understanding of a city of 20 million people, has limited the population to 3 million in the Spatial City project [118].

Contemporary commentators and practitioners have acknowledged that these concepts were developed by the avant-garde architectural experiments of the 1960s, including Archigram, Yona Friedman, Constant and the Situationist group [34]. In addition, the Metabolist group from Japan had become one of the leading groups in the megastructure concept. In this section, the megastructure projects and understanding of mobile architecture of the designers and groups were examined.

4.1. CONSTANT NIEUWENHUYS

Dutch artist Constant Nieuwenhuys was born in 1920. According to Constant, who was influenced by Marxism, the concept of art in future societies emphasized that it would not be an elitist phenomenon, but a phenomenon that could be done for everyone and by everyone. Constant, who was a member of Situationist International (1958), left the group in 1960. Constant worked with another Dutch architect, Aldo van Eyck, and proposed the New Babylon project [119]. When Constant proposed this project, he had already some recognition and popularity for being a painter and a member of the COBRA group [120]. The original name of the project was called 'Dériville' (Drift City) which was later changed by French Marxist philosopher Guy Louis Debord, whom Constant worked with, to 'New Babylon.' The name was first written in June 1960 in the fourth issue of Internationale Situationniste [116].

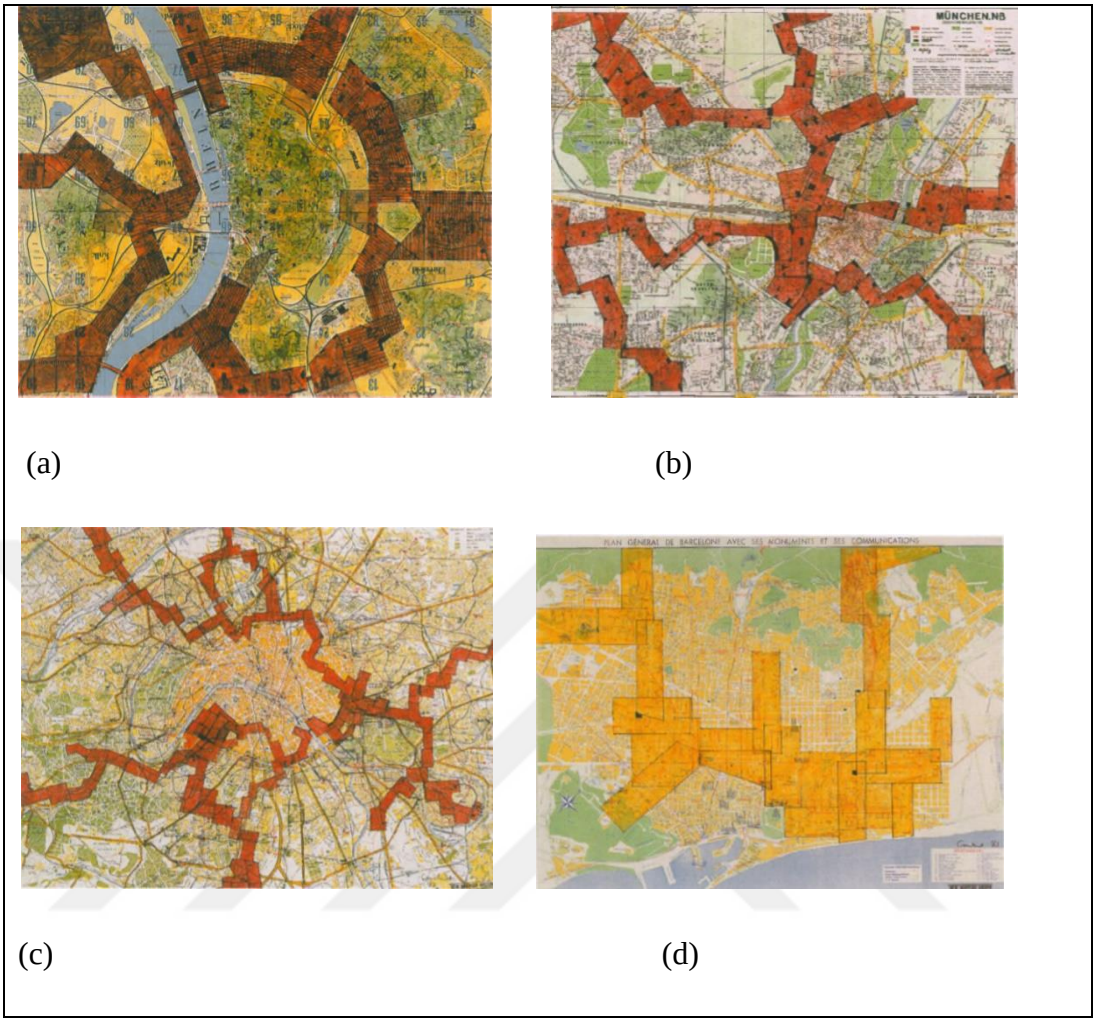


Figure 4.1. New Babylon on cities (a) Köln, (b) Munich, (c) Barcelona, (d) The Hague. [116].

From 1956 to 1969, he prepared many models, maps, and sketches for the project. New Babylon project sought a new understanding of society [119]. Constant conceived agricultural automation and collective ownerships in New Babylon, also there would be no demand for work and has no fixed time.

In New Babylon, very few areas receive natural light. That was because Constant wanted to make people independent from the rhythm of urban life and thus believed that people could find their own rhythms without a particular concept of time. There would be no routine in daily life in New Babylon [121]. Urban rhythms were briefly examined under the title of Relationships Between Mobility and City.

According to Constant, there was a direct relationship between creativity and violence. According to him, people were struggling to meet simple needs such as food, drinks,

dressing, etc. For this reason, their creativity had always been hindered, and their creativity had been manifested through violence. Constant believed that as long as the simple needs of people are met, people's leisure time would increase, and they would bring the concept of play, the simplest instinct of everyone, into their lives. In Constant's vision, there was no violence in New Babylon, and problems were tried to be solved through creativity [121]. This understanding, along with the developing technology, was a city where the individual could demonstrate his creativity. In this proposal of the future city, it was thought that technology took over the laborious works, and thus, people would choose their own environment and organize their own spaces [119].

Constant denied New Babylon project was a utopia. According to him, New Babylon was more close to reality than a utopia. New Babylon project designed as a solution to the discontent and frustration of cultural deprivation. It was a manifesto of the potential of the individual who was going through social change. A new social space was required for this to be possible. This social space was a place that could allow for opposing views, but it’s also a place where people exhilarated with plays. Constant emphasized the importance of the concept of temporariness. Constant wrote the followings about this matter: ‘’Living becomes rest, the pause after a climax’’ [116].

People are highly influenced by the building and the atmosphere in which they live. Due to the growing population and the need for mobility, the ever-decreasing spatial inadequacy, Constant stated the followings about the issue: ‘’What we lose in geometrical space we must recover in the form of psychological space.’’

With this discourse, Constant emphasized that research on psychogeography should be examined [116]. Psychogeography is a research on the potential of geography by observing its effects on human life [122].

Accordingly, in the New Babylon project, the psychological quality of each point in the urban structure would be continuously changed to strengthen the experiences of people in the city. Therefore, all possibilities and forms of mobility, including structural mobility, had been encouraged [116].

In New Babylon, the quality or the ambiance of each place could change at any time according to user needs or wishes. Settings such as acoustics, light, color, ventilation,

temperature, humidity have unlimited variations. The New Babylon project consisted of heterogeneous spaces with no boundaries, also, moving transparent layers designed to interact with each other. The image of New Babylon would continuously change. Therefore, the project didn't have a specific identity. The New Babylon project was not an image of the future, but an image of what the future might require.

The movable transparent layers in the project designed to contain the necessary technical systems, also these layers designed to allow the separation of the spaces with panels. New Babylon project planned on various regions called 'sectors.' Each 'sector' would have a different carrier system.

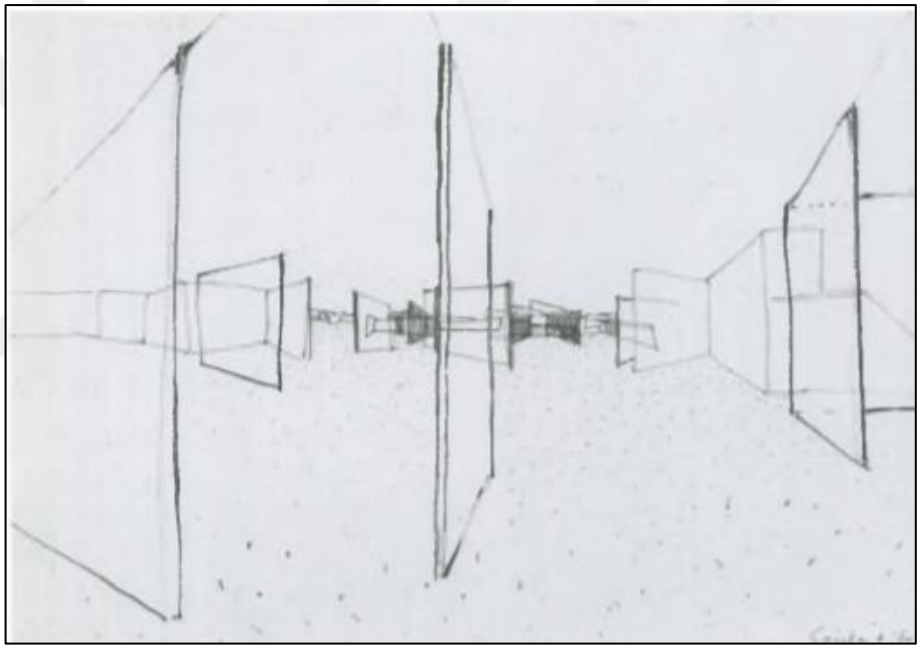


Figure 4.2. Interior mobile walls of New Babylon [116].

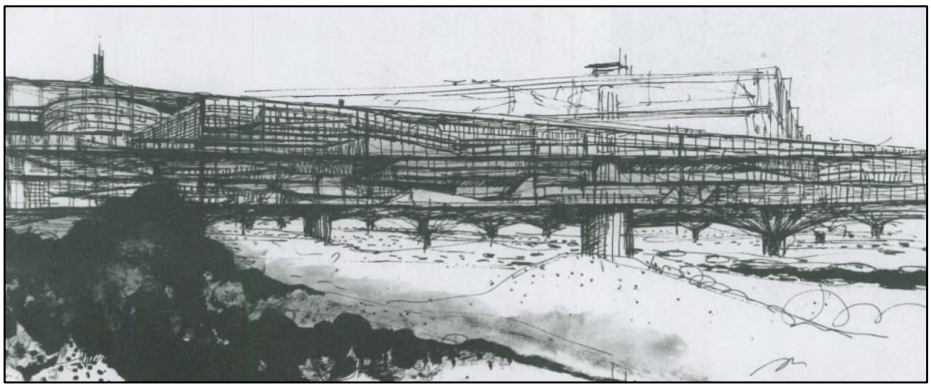


Figure 4.3. View of a Sector [116].

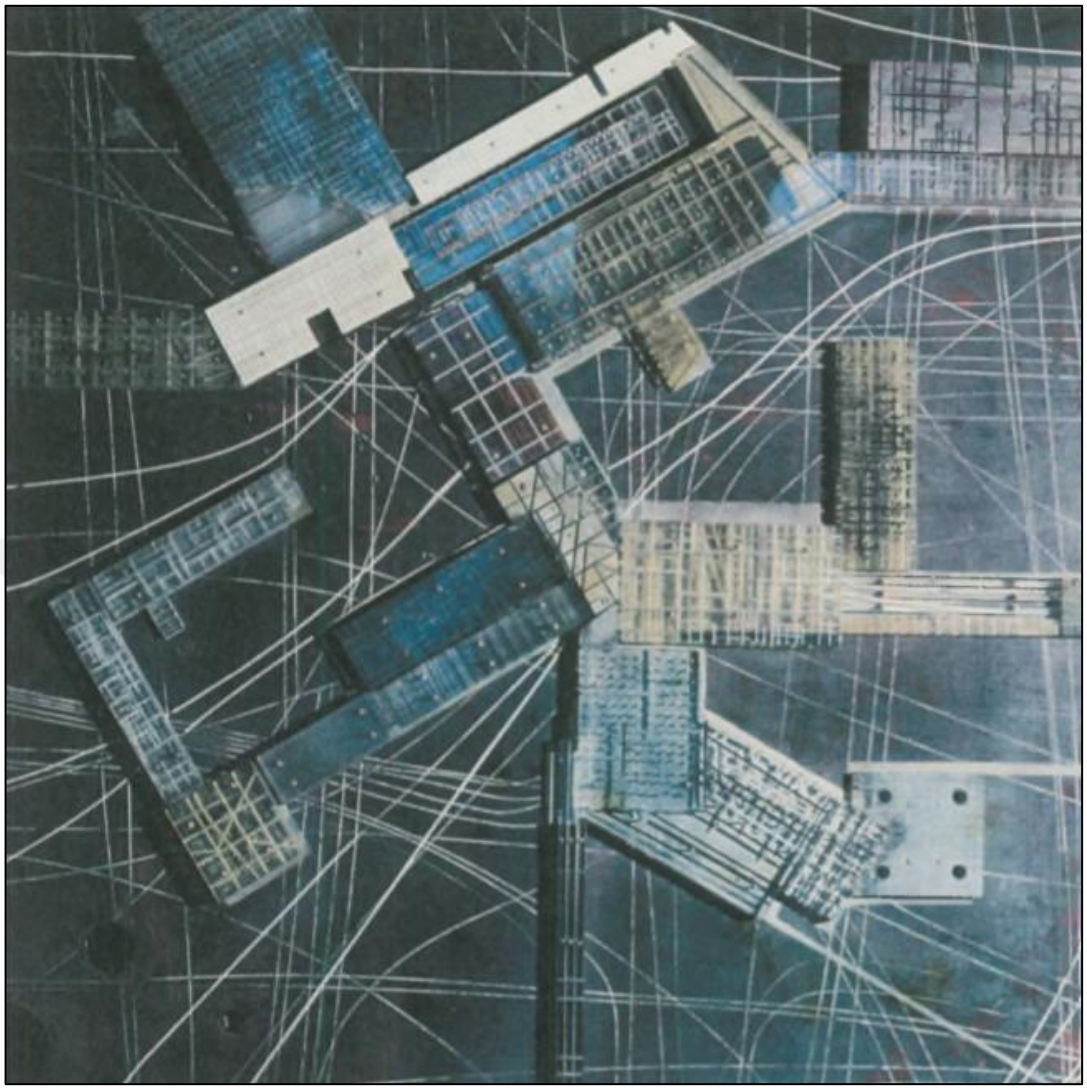


Figure 4.4. Group of Sectors [116].

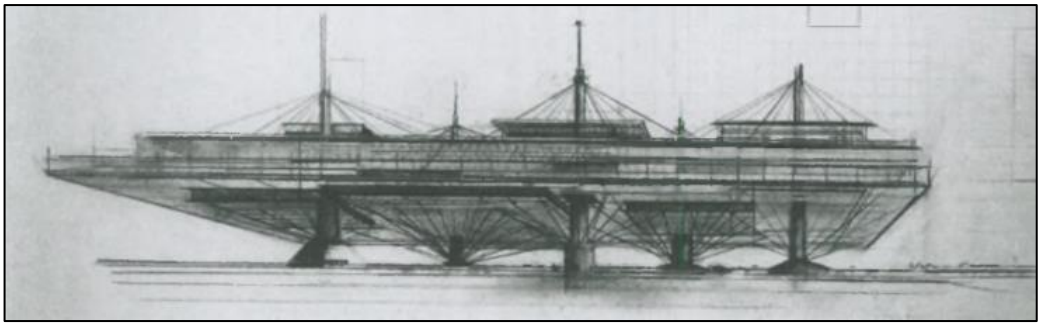


Figure 4.5. Sketch of a Sector [116].

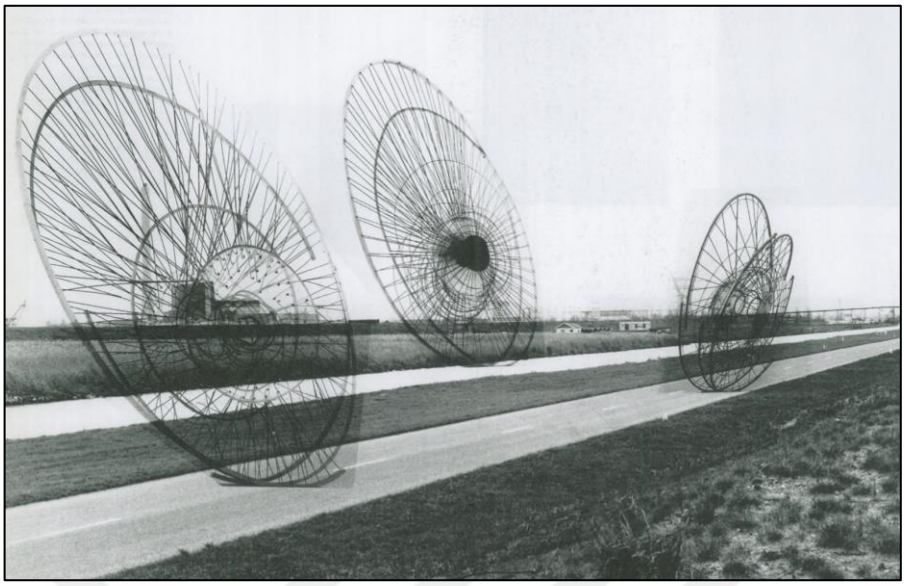


Figure 4.6. Three Nébuloses mécaniques [116].

Figure 4.7. Spatiovore (Space Eater) New Babylon [116].

Constant adopted the ‘dérive’ idea in New Babylon, which was also the discourse of the Situationists, as ‘architectural science fiction’. There was no concept of working in this futuristic project. Unlimited and endless moving interiors were designed to form playgrounds. Continuous moving floors, partition walls, ramps, staircases were also designed to form constantly changing heterogeneous labyrinths. The project consisted of constantly discovered venues. According to Constant, mobility and disorientation would increase social interaction. In New Babylon, heterogeneous or contradictory thoughts were

always in a collision, and consequently, new spaces formed continuously [116]. In the New Babylon project, the ground level was reserved for transportation networks, agriculture, wilderness, and historical monuments. The sectors were designed to be 16 meters above the ground, with minimum contact on the surface [123]. In this context, similarities between New Babylon and Yona Friedman's Spatial City can be seen. These projects are similar in terms of mobility and flexibility [124].

There were other similarities between Friedman and Constant's ideas. Constant believed that space is psychological, therefore, it should be up to the inhabitant. Friedman also adopted a similar approach, he stated architecture is part of human behavior. Friedman believed the pre-determined architecture imposed by the architect doesn't reflect the facts of daily lives. As he mentioned, the designs are not interesting until the inhabitant uses it in his/her own way. For instance, the inhabitant doesn't follow the plan or ask the architect when he/she wanted to change the arrangements of furniture. Therefore, in a way, 'the power of the line' of the architect is eliminated by the inhabitant. This was also the idea of the Situationist Group and Constant. They believed drawing a simple line, always implies the separation between the inside and the outside, and this decision should not be up to the architect. In New Babylon, spaces were continuously changing by the users. As Mark Wigley mentioned, Constant's New Babylon was an attempted revolution against the power of the line.

4.2. YONA FRIEDMAN

Yona Friedman was born in Budapest in 1923. At a young age, he realized, a house does not exist alone; it does not end with the boundaries of the ground floor, the street, the park, nor with the house on the opposite street. According to Friedman, to imagine a house is to imagine the whole world [15]. Because they are connected and therefore, human beings are intertwined with them. For instance, a person lives within her/his neighbourhood and with all of its components, such as other houses and worlds they dream of. This place, in fact, constitutes our environment [15]. In an architectural sense, Friedman believed, each individual should have the authority to intervene in his/her own environment therefore his/her environment should adapt to the user.

Friedman did not approach architecture in an artistic manner but in the context of social reality. He questioned the reasoning of those who decide an architectural plan is good or

bad, he also questioned who can truly determine the value of a project. According to him, there is a role of the user as well as the role of the architect in the architectural processes [117]. He stated the concept of home and world is different from each other. Friedman, in addition to this difference, emphasized that the form, plan, and arrangements of each house can vary over time. He started to search for a technic by considering all these variables [15].

As the first result of this researches, in 1945, Friedman proposed the idea of prefabricated chains of panels, which could be modified and did not have a specific geometric order. These panels were foldable and could connect by hinges [15]. In this project, however, Friedman stated that the roof on the panels would not have a smooth form because the panels were movable and could not carry the roof and therefore had to have a different layout. Friedman stated that Panel Chains was the simplest irregular structure. These irregular structures were examined under the title of Yona Friedman's Mobile Architecture Theory.

Figure 4.8. Panel Chains [125].

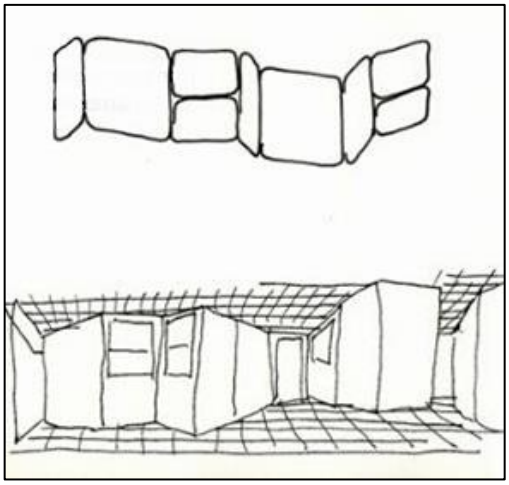


Figure 4.9. Panel Chains [125].

Friedman thought that the roof could preserve the construction of the movable panels within a geometric frame system. For example, Panel Chains could be used in the Spatial City project. In the Panel Chains project, it was thought that users could design the interior as they wish.

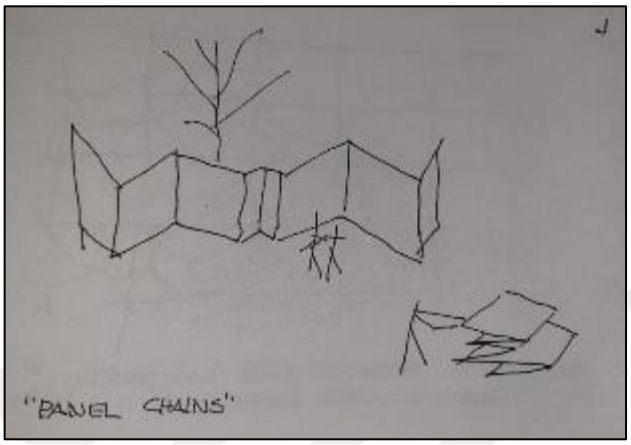


Figure 4.10. Panel Chains [15].

Yona Friedman proposed the idea of this prefabricated panel system in order to meet the need for housing after the Second World War.

After years of war and exile, Friedman went to Haifa in 1946 and studied architecture at the Israel Technical School. In the third year, he continued his education in the Budapest Polytechnic School. In his education here, he was asked to design projects compatible with reinforced concrete style architecture, which was generally the architectural approach of the period, rather than his own ideas.

Yona Friedman had made researches with this direction and stated that even in a standard mainstream project, mobile elements could be quasi-furniture(furniture-like). According to this, he mentioned that places such as bathrooms and kitchens could be quasi-furniture by implementing certain installation arrangements. Thus, he emphasized that the spaces could be reshaped according to the wishes of the user. From 1953 to 1957, he applied these ideas in Cylindrical Shelters, Sahara Cabins and 40 years later in his housing projects for the homeless. Yona Friedman considered the Cylindrical Shelters and Panel Chains projects as his first experiments in the concept of unplanned architecture; in other words, improvised architecture.

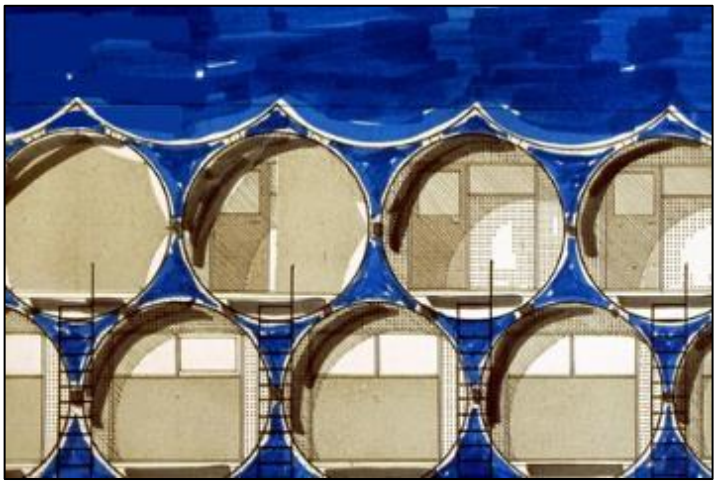


Figure 4.11. Cylindrical Shelters [125].

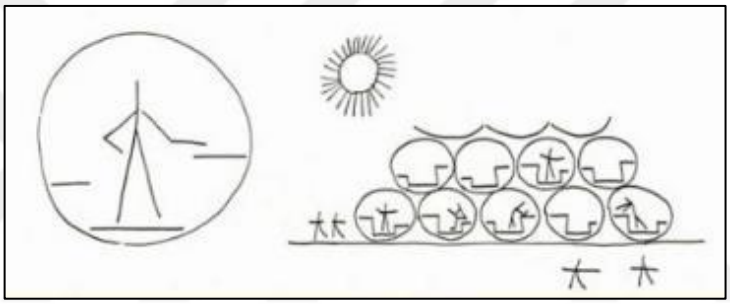


Figure 4.12. Section sketch of Cylindrical Shelters [125].

The Cylindrical Shelters project was designed to protect people from warm climates of Israel. Friedman used dysfunctional water pipes and stated the housing units would have natural air circulation due to their cylindrical shape. In the Cylindrical Shelters project, cylindrical units could overlap one another and form vertical layers. They could be placed on top of each other, could move in the axis direction. Also, interiors could be combined in a simple operation with another cylinder, and the spaces could be carried by train and multiplied.

Although the Cylindrical Shelter project had not been implemented in Israel, it attracted attention in France and was partially implemented. Thus, in 1958, it became the most cost-effective industrial housing project in Europe.

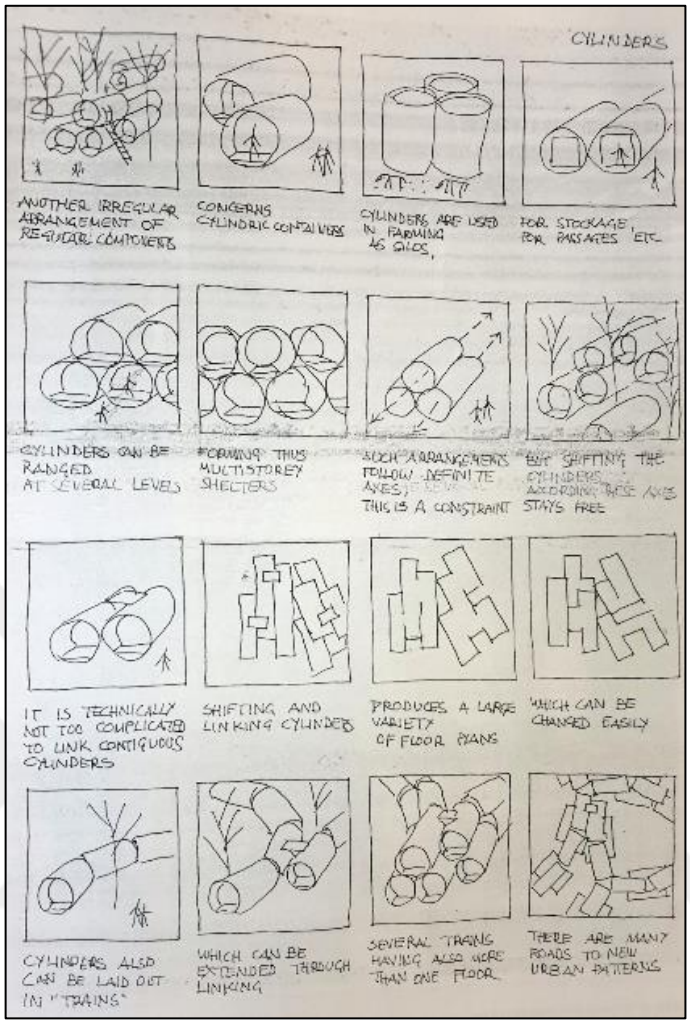


Figure 4.13. Variation of Cylindrical Shelters [15].

Figure 4.14. Cylindrical Shelters [125].

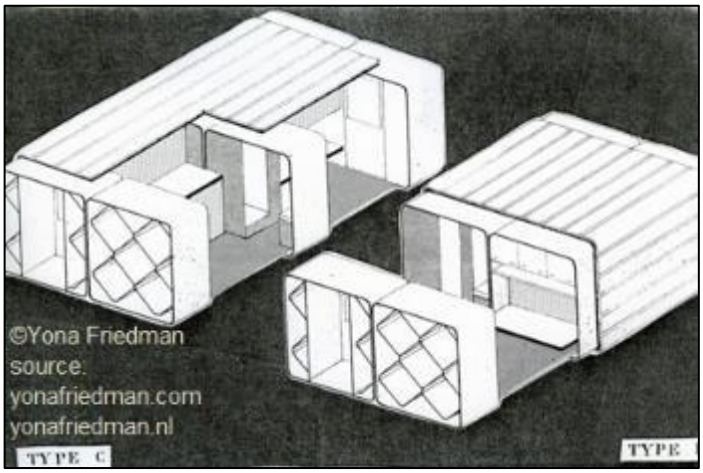


Figure 4.15. Sahara Cabins [125].

Yona Friedman was involved in the film industry in 1960 and had drawn various cartoons. The drawing techniques he developed during his teaching years were useful in cartoons and later in the manuals he created. Friedman aimed to use the first Manual in the education of primary schools. In addition, he used it as a guide in his self-planning projects. He used these manuals to help the non-expert people to construct and design. Accordingly, Friedman has two building projects that met the users. One is the 200-user office building in Ivry, and the other was the high school building in Angers with 1500 users. The building in Angers was designed with the participation of future users, teachers, and students. According to Yona Friedman, the realization of these buildings proved that mobile architecture was not merely a utopia [15].

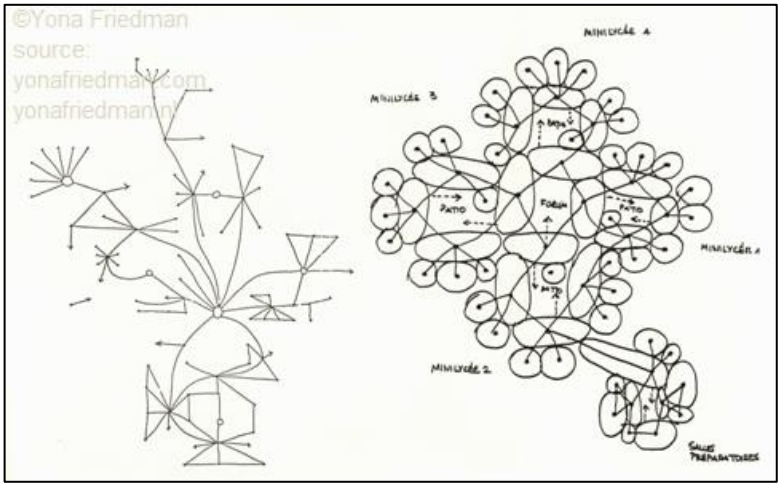


Figure 4.16. Schematic analysis according to user requirements [125].

Figure 4.16 shows a sketch diagram of the requests of the users prepared by Friedman. The structure and floor plans designed accordingly. Friedman stated that this process could be repeated at any time in the project.

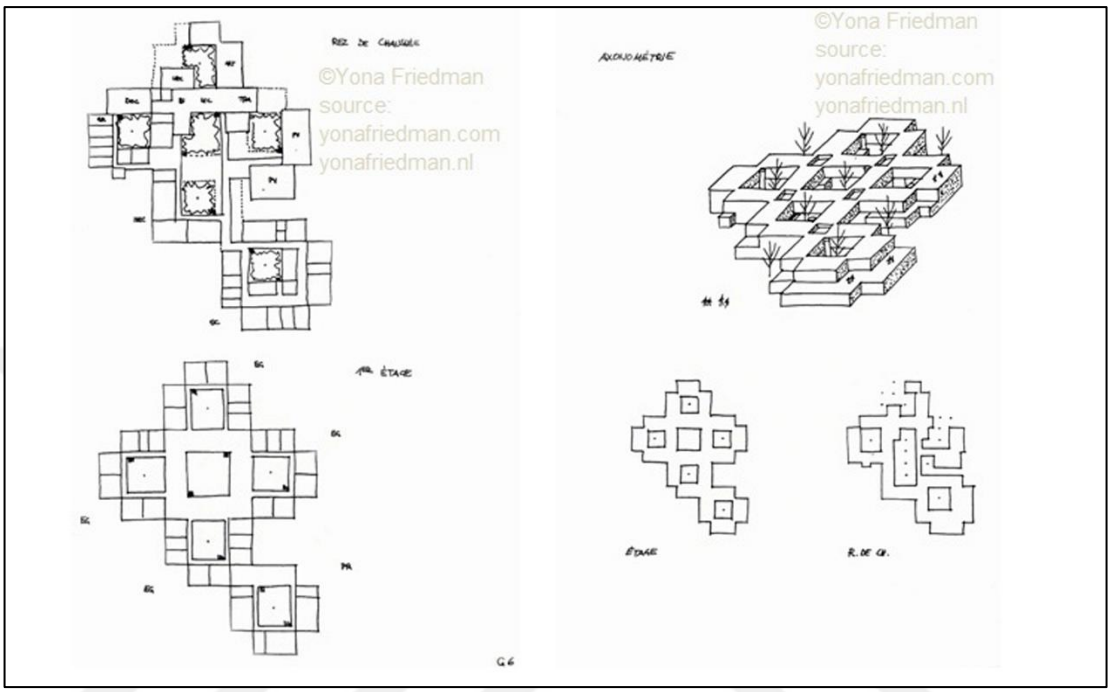


Figure 4.17. Drawings of high school in Angers [125].

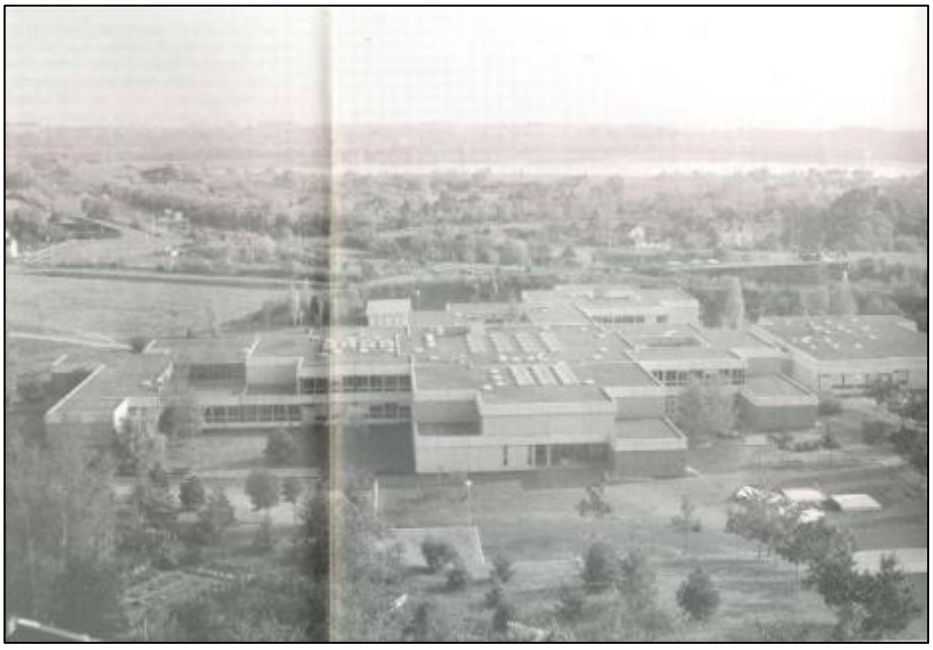


Figure 4.18. Image of high school in Angers [125].

Friedman designed a manual called ‘Housing is My Business’ and he was asked by UNESCO, the European Union, the French Ministry of Environment, and Indian President Indira Gandhi to make more manuals on other themes. In addition, his films led Yona Friedman to do ideographic writings which later led him to develop various pictogram designs. There are numerous decorative designs that he developed from human figures to graphic design.

Since the 1970s, Friedman has gradually lost interest in technology and convinced that no megastructure could be realized. He later stated that advanced technology is a sort of dictatorship and today’s architecture imprisoned by ready-made software. Therefore he avoided sophisticated technology. He believed in sophisticated ideas with simple technology. He also criticized the term ‘megastructure’ and emphasized the ‘structure’ is the least important element in architecture.

For this reason, Friedman returned to his early works. He had focused on low-cost, simple-to-do projects such as Cylindrical Shelters and Sahara Cabins. While working with UNESCO and the United Nations (UN) he designed self-planning projects for underdeveloped countries. The best known of these was the Museum of Simple Technology (1982) project in Madras, India.

The project was built with improvisation methods by making use of the manuals designed by Friedman without any planning. [117]. The museum was built by basket makers from local people living in slums [126]. Local materials, such as bamboo and aluminum foil, were used [15].

The museum installed especially in the open space because Friedman believed that the buildings should not imprison museums. Museums should be in a place where everyone can attend, add something from them. Friedman stated, if the aim of the museum is not to exhibit an architectural structure, then the structure has a confounding effect and therefore, it is of minimum importance. Friedman emphasized that the architectural structure has a negative effect on the collection in the museum. When the effect of the architectural structure is too strong, it dominates the collection or decreases the value of the collection when it is too weak [117].

The Museum of Simple Technology, which was re-installed and exhibited at the Dhaka Art Summit 2018, addressed concepts such as freedom, self-reliance, and flexibility that Yona Friedman mentioned in his mobile architecture manifesto [127].

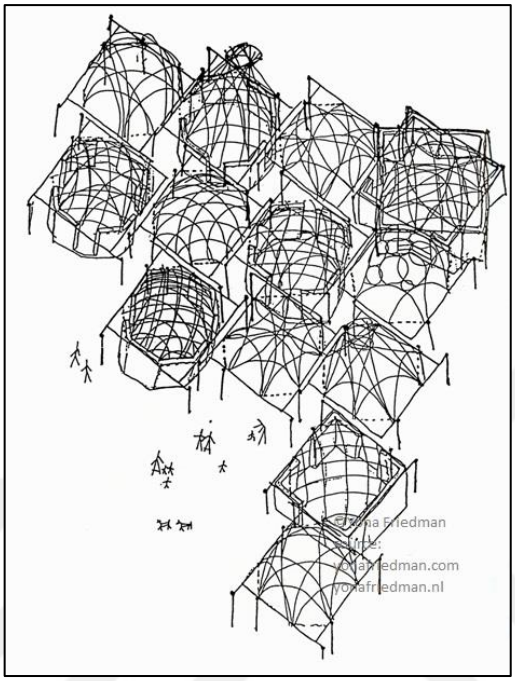


Figure 4.19. Drawing of The Museum of Simple Technology [125].

Figure 4.20. The Museum of Simple Technology [125].

Figure 4.21. The Museum of Simple Technology (Dhaka Art Summit 2018) [127].

4.3. THE METABOLIST GROUP

Metabolism is a biological term that describes the anabolic and catabolic processes of living things. This expression can be seen in the article The Growth of Cities, published in 1925 by the city sociologist Ernest Burgess. Burgess used the term social metabolism to explain the growth and change of cities in his article. The term 'metabolism' in Japanese means regeneration or refreshment.

Kenzo Tange was an important figure in the development of the metabolism movement and, although not a member of the Metabolist group, he had guided the group with his ideas. Thanks to Kenzo Tange's growing international recognition, he held the World Design Conference in Tokyo in 1960. The metabolism movement was introduced to leading architects and young architects of the period. After this conference, the Metabolist group was internationally recognized and considered as avant-garde architects of the time. The main members of the Metabolist group were Asada, Noboru Kawazoe, Kisho Kurokawa, Kiyonori Kikutake, Masato Ota, and Fumihiko Maki. Noboru Kawazoe, who chose the name ‘Metabolism’, wrote followings at the conference:

> Metabolism is the name of the group, in which each member proposes future designs of our coming world through his concrete designs and illustrations. We regard human society as a vital process – a continuous development from atom to nebula. The reason why we use such a biological word, metabolism, is that we believe design Tamari 205 and technology should be a denotation of human vitality. We are not going to accept metabolism as a natural historical process, but we are trying to encourage active metabolic development of our society through our proposals.

As a concept, Metabolists had designed futuristic utopia projects on a mega scale. They thought of the whole city rather than a single structure or a series of structures. In their projects, Metabolists considered the city to be democratic and equal for all and saw it as a constantly renewing and changing, growing, living organism. They have designed innovative living spaces by making use of mass production resulting from technological developments. Metabolists embraced the city as an organic entity and, with this concept, brought a new identity to Japan and proposed an image of a utopian future. The concept of the Metabolist group was deeply linked to the development of organisms and natural processes. This was one of the essential features of living things, replacing the old one with the new means of regeneration or replacement [106]. However, Arata Isozaki, an architect who was close to the Metabolist group, appreciated their discourses of the city as a process, reflecting the understanding of the organic city of metabolism, but he was skeptical of the design of the ever-developing city by using linear lines. According to Arata Isozaki, the development of the city was unpredictable and had no specific form. The city could suddenly encounter various disasters. The fact that Japan had experienced disasters such as atomic bombs, earthquakes and floods could prove Arata Isozaki's discourse on the city.

In the 20th century, the age of the machine can be remembered in architecture with the statement ‘a house is a machine for living in’ of Le Corbusier. In contrast to the machine age, Metabolists adopted ’the age of life’. About this, Kisho Kurokawa said: ‘’Machines do not grow, change, or metabolize of their own accord. Metabolism was indeed an excellent choice for a keyword to announce the beginning of the age of life.’’

Kenzo Tange stressed the importance of being prepared for a new technological revolution. He believed that these technological developments in the 20th century could bring new examples of human life. This belief also prevails in European architects. In this regard, the main characteristics of the metabolism were; capsules or cells attached to the main structure. These capsules/cells could be plug-in or plug-out to the main structure. The standard

capsules idea was to support mass production, and it was also cost-effective. In addition, the installation or detachment of capsules would not require a difficult construction.

> Future society should be constituted of mutually independent individual spaces, determined by the free will of individuals [128].

The Marine City projects of Kiyonori Kikutake can be shown as an example of the capsule system. The project designed on artificial islands as a floating city. Thus, it was aimed to prevent decreasing living standards and limitations on land. Kikutake had divided Marine City projects into two groups. The first was “Floating Structures” and the other was ’Linear Ocean Cities’. After 1990, Kikutake made proposals for the "Linear Ocean City" designs. In the Marine City project in 1958, Tower-Shaped housing structures were designed under the floating platforms. In the Marine City project designed in 1963, these towers were thought to be on the floating platforms. In 1958 Kikutake introduced the first Marine City project and then he developed the original project and designed the Marine City Unabara project in 1960. In 1963, he returned to the original Marine City project and made changes. Unlike the Marine City 1958 project, the city's growth strategy in the other two projects was considered with the formation of floating platforms, which was planned with the concept of the cellular division [111].

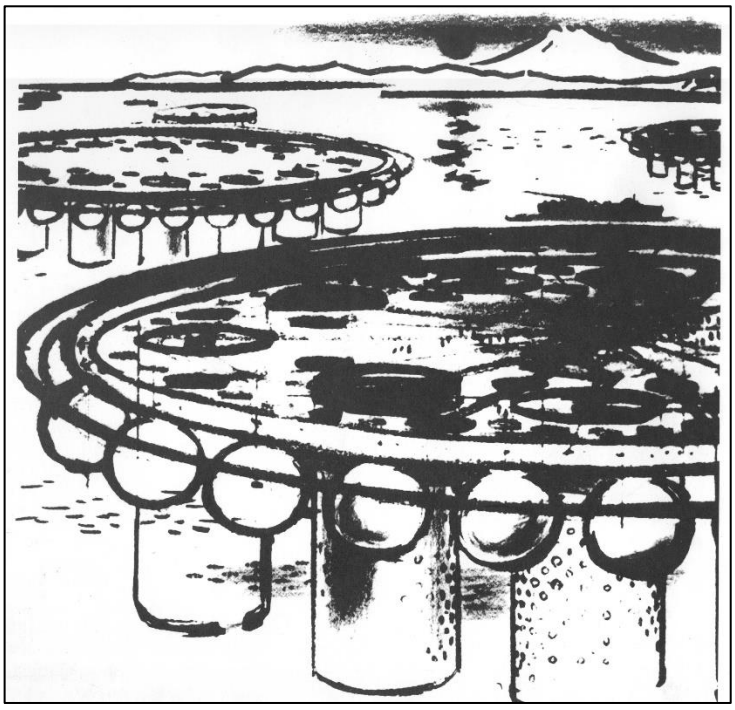


Figure 4.22. Marine City Project (1958) [129].

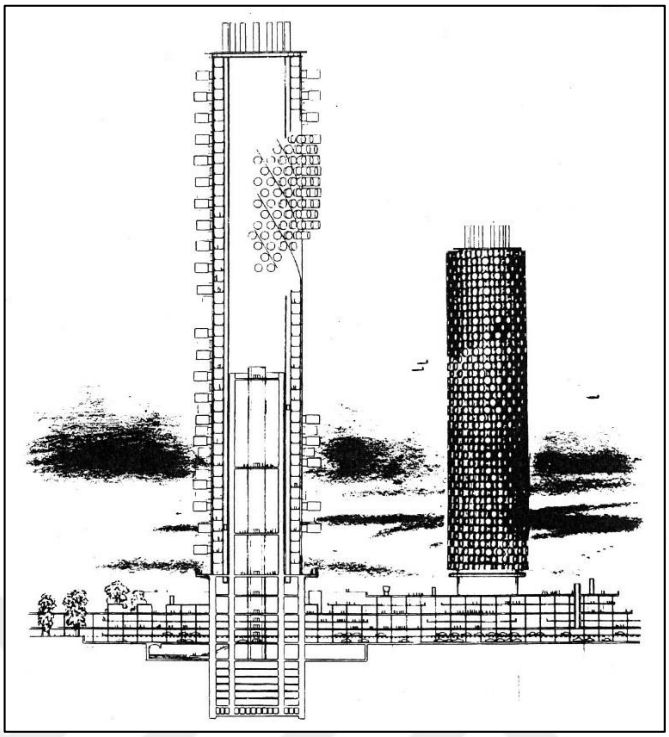


Figure 4.23. Tower-Shaped Community Project (1958) [129].

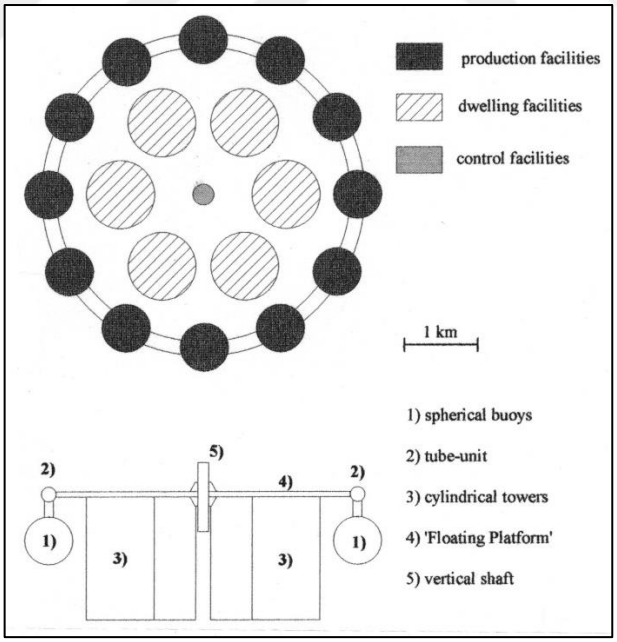


Figure 4.24. Functional zoning of Tower-Shaped Community Project 1958 [129].

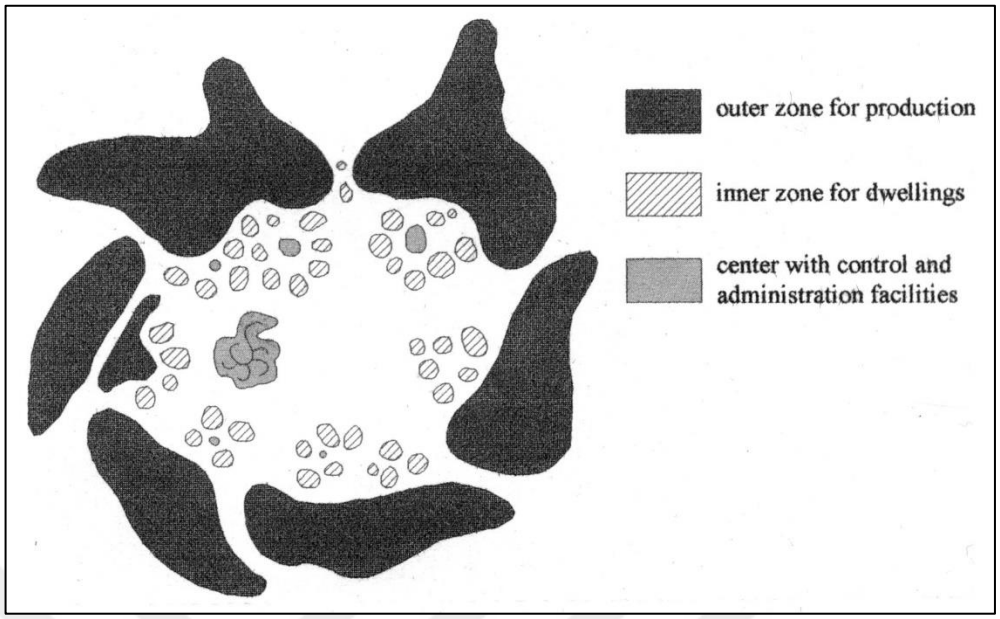


Figure 4.25. Functional zoning of Marine City Project 1963 [129].

There was unlimited growth and renewal capacity in the Metabolist's megastructure approach. In this respect, the megastructure never ends, on the contrary, it was continually growing and dying. In other words, the city considered as a process, temporary and could change, therefore it had no specific form or plan [106]. About the temporality of cities, Italian futurist Antonio Sant'Elia said that objects have a shorter life span than people and therefore people should build their own city in every generation. However, metabolism idea was different from Antonio Sant'Elia's discourse. The Metabolist group sought cultural and social continuity through urban transience.

In the understanding of metabolism, the change in the city was more important than the size of the city. In addition, they aimed to adapt to developing technology and temporary social and economic conditions in the building and urban proposals.

However, they could not bring technical solutions to these projects. The fixed structure in the megastructure proposals and the features of the mobile units connected to it had been considered to respond to the transition from the industrial era to the digital era. However, in an existing fixed/stable system, the reliability of the improvised architectural strategy has been the subject of debate in an increasingly globalized world.

Mass production and consumption had raised the problems of massification and individuality in contemporary architecture. Modular and capsule systems had been adopted as a solution

to these problems by the Metabolist group. However, these concepts did not have the qualities to support the complexity of contemporary social structure and advanced technologies. For example, advanced communication technologies had not developed in a hierarchical order, as predicted by the Metabolist group's projects [95].

In contrast to Frank Lloyd Wright's idea of giving each individual a minimum of land in the Broadacre City project, Metabolists had embraced the idea that ‘land is the property of the society, not the individuals.’ They stated that more freedom and mobility could be provided for people with the independence of the land [106]. This idea was adopted by many of the utopian designers of that time, such as Yona Friedman and Constant. However, although the Metabolist group aimed to provide the desired lifestyle for everyone as a concept, it was contradictory in practice. On the one hand, they aimed to bring democracy and freedom to everyone, on the other hand, they thought of a central management approach in the futuristic cities they proposed. They thought the administration of the city should be given to the most knowledgeable architects about the city system. They emphasized that the chosen architects should control not only the physical order but also the lives of the people in the city [106].

Metabolist group projects have not been realized at the urban scale due to the economic and technological conditions of the period, but their concept realized in some buildings. For instance, Kurokawa’s Nakagin Capsule Tower built in 1972. Their megastructure projects could not go beyond showing the image of techno-utopian future cities [106]. In the next section, the Archigram group, which also had techno-utopic designs, is examined.

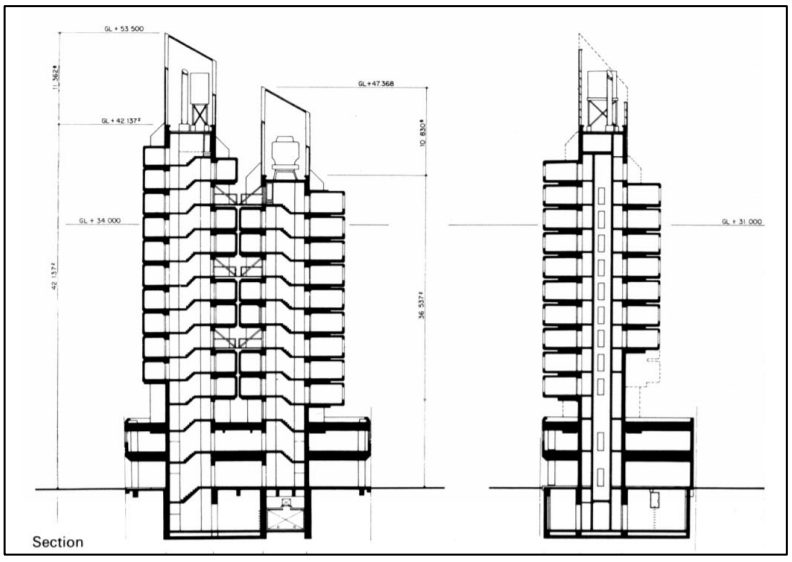


Figure 4.26. Nakagin Capsule section [128].

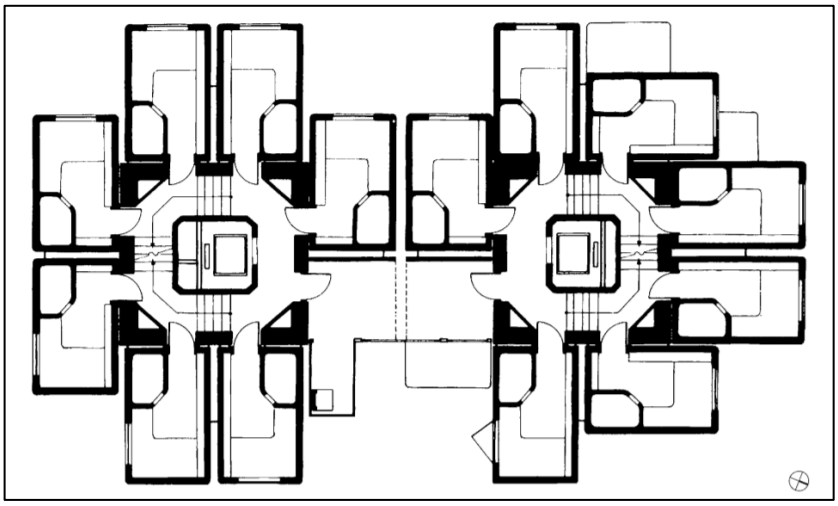


Figure 4.27. Nakagin Capsule floor plan [128].

Figure 4.28. Nakagin Capsule Tower (1972) [128].

4.4. ARCHIGRAM

The British group Archigram, founded by architect and writer Sir Peter Cook, adopted mobile, temporary, flexible architecture and designed utopic megastructures in the 1960s. Archigram had six main members: Peter Cook, Warren Chalk, Dennis Crompton, David Greene, Ron Herron, and Michael Webb. The name of the Archigram group came from the words Architecture and Telegram. This name shows the group's interest in communication and media. According to Archigram, architecture was about communication and ideas as well as materials and structures. American pop culture and increasing mass consumption reflected their utopic designs. They showed what could occur by thinking about social change, technology, and engineering together [81]. Archigram believed that technology would eliminate politics. In this view, they denied that politics, which is a social fact, provides mediation for conflicts in daily life.

Archigram thought that urban functions should be a whole together, and they designed megastructures in this context. Archigram designed megastructures as a view against the modernist and traditional architectural forms of the time [87]. In modern urban experience, Archigram has adopted concepts such as transience, ephemeral, disposability and mobility as opposed to permanence [87]. Archigram stated that:

> Cities should generate, reflect, and activate life, their environment organized to precipitate life and movement.

Especially in the post-war period, the idea of architecture without buildings became an important idea and was adopted by the designers of the period. Archigram adopted this idea and designed many utopic projects. In 1960, Peter Cook presented a manifesto called ‘Eight Alternatives for the Future’ at the Environment and Architecture Conference in London. These eight predictions were as follows; They are faster, personalized, demountable, more sensitive, comfortable, and expendable [94].

Rather than structures, objects, and artifacts, the fact that the philosophy of the Archigram group was based on and concentrated on people and its environment. According to Archigram, there was no difference between architectural and industrial production. Archigram had been criticized for being apolitical also for based their philosophy on technology [81].

Archigram, similar to Johann Huizinga (1963), emphasized the importance of the idea of entertainment and play, such as Situationists and Cedric Price. The Archigram group was influenced by the Situationist group, especially Constant Nieuwenhuys, in this context [81].

Plug-In City, one of Archigram's megastructure projects, was a city-scale and change-oriented design. Archigram’s understanding of mobile architecture was based on continuous circulations and consisting of units that could be added or removed [81]. The desire of avant-garde architects in the 1960s, which was the idea of ending physical labor with automation, was considered in the Plug-In City project. In the project, Peter Cook sought solutions to traffic problems, population growth, and land use, which were making cities unsustainable. Dennis Crompton stated the followings:

> Self-determination became an important thing. We were interested in how the consumer could be part of the design process, not a recipient.

The Plug-In City project was inspired by the ideas of Le Corbusier's Plan Obus and Unité d’Habitation projects. Interchangeable housing units and fast transportation networks designed in Plug-In City. The project had the aesthetics of unfinished, clarity, and uncleared chaos.

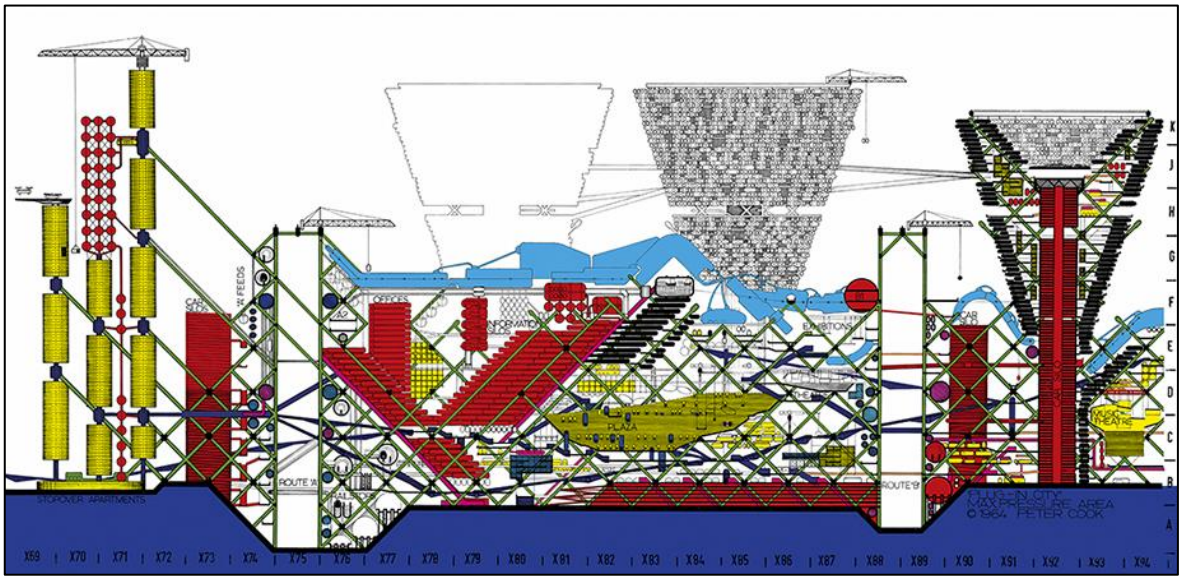


Figure 4.29. Plug-In City section [130].

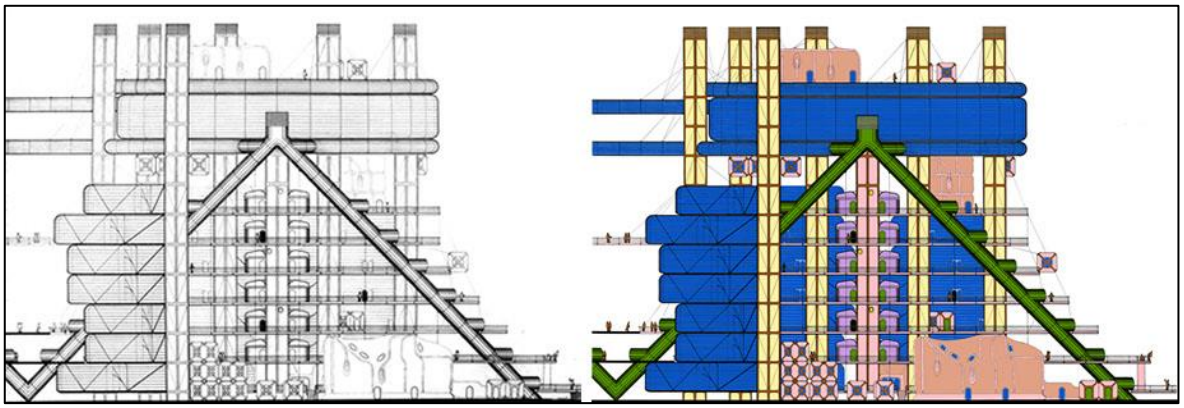


Figure 4.30. Plug-In City university node elevation [130].

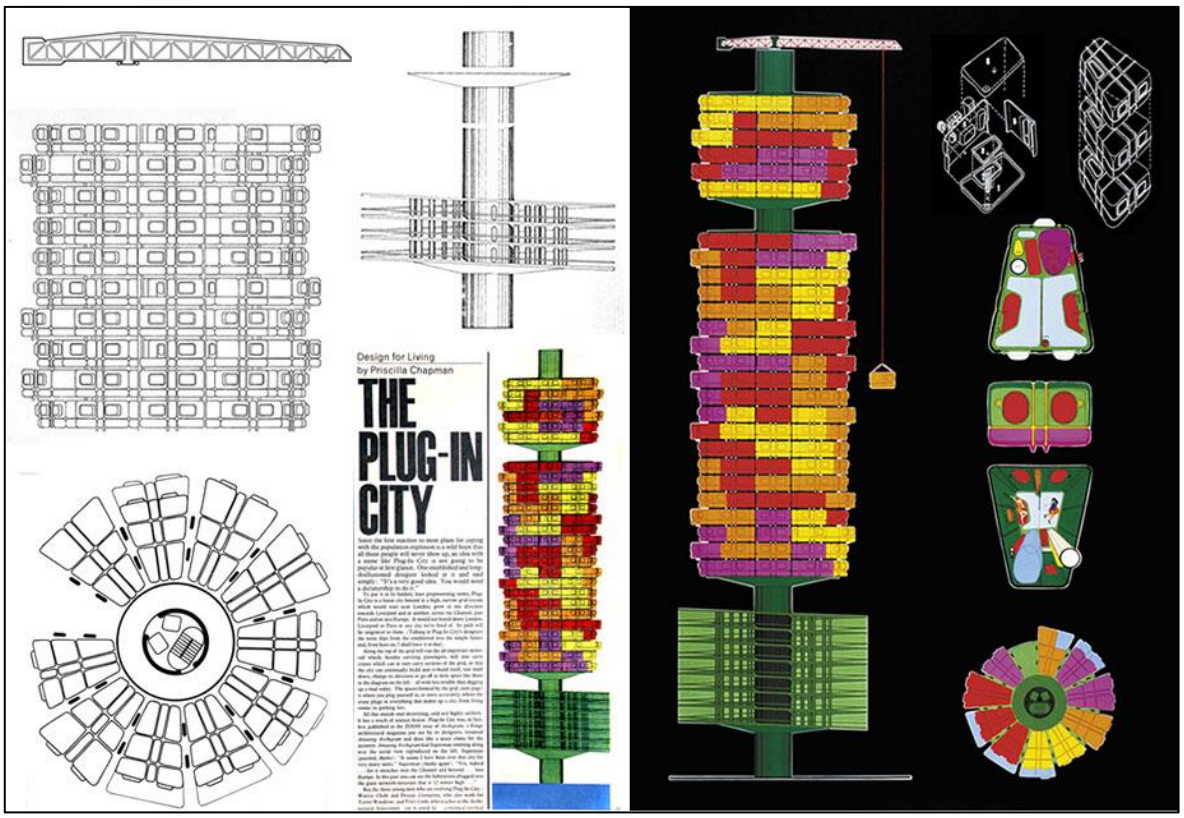


Figure 4.31. Plug-In City Capsule Tower [130].

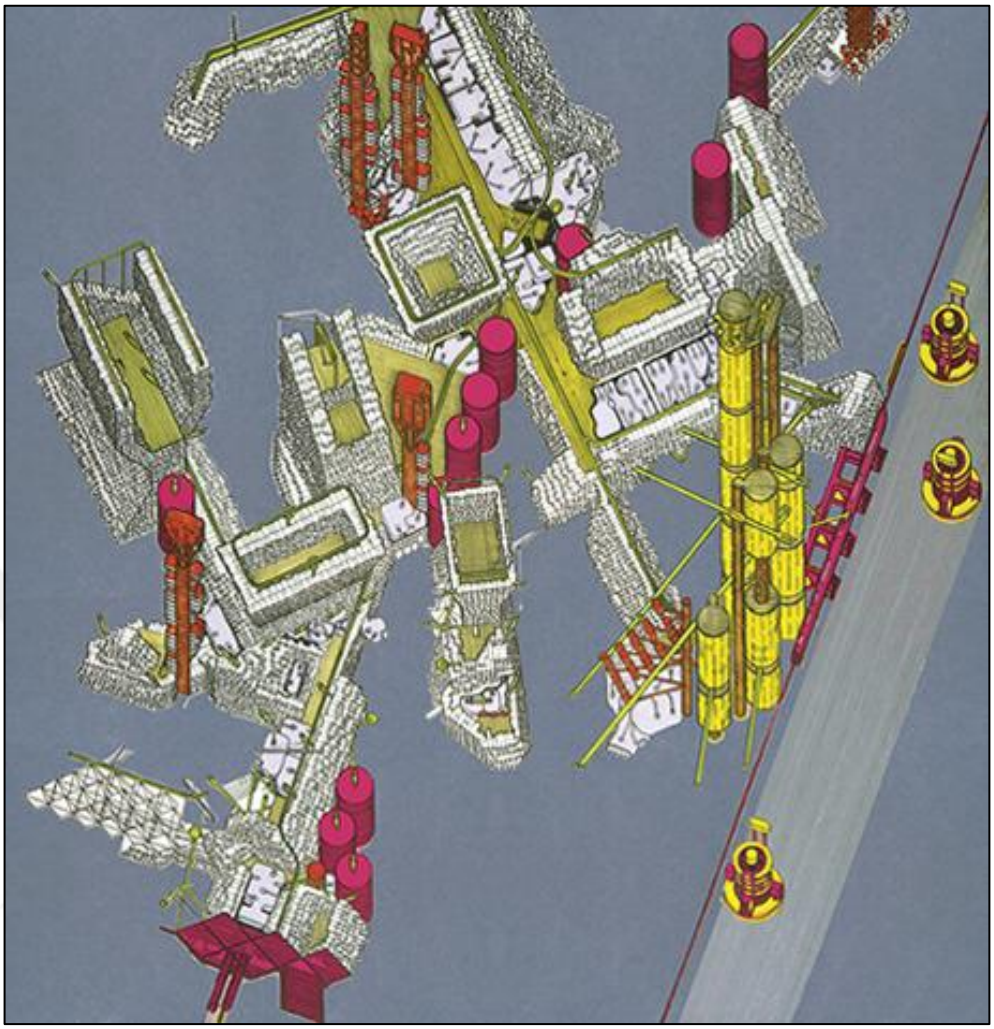


Figure 4.32. Plug-In City axonometric [130].

Archigram thought the city was a single organism. They presented the Plug-In City at the Living City exhibition in 1963. In the exhibition, they tried to determine and classify the cycles of the individual based on collective movements, including the origins, destinations, speeds, and routes [81].

One of Archigram's best-known urban-scale utopias was Ron Herron’s The Walking City project. As a concept, they designed megacities that could walk on water or land with robotic technology. Ron Herron was inspired by the construction of the Maunsell Forts, built by Civil Engineer Guy Maunsell during the Second World War. The city was a combination of insects and machinery. These marching cities could combine to form a larger megapolis [131].

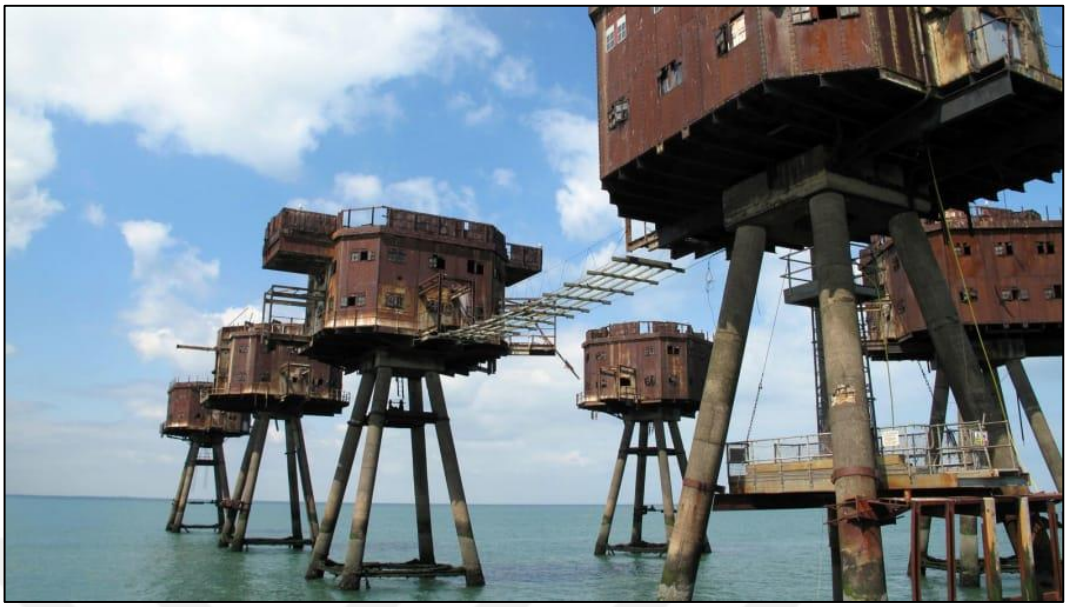


Figure 4.33. Maunsell Forts [132].

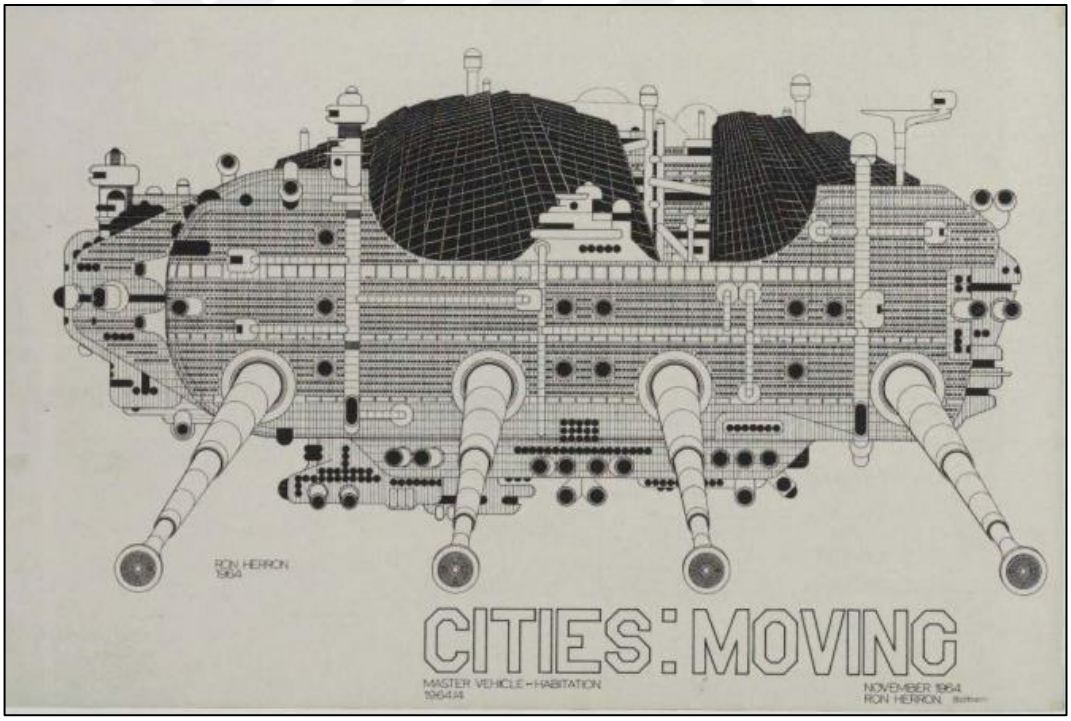


Figure 4.34. Ron Herron's Walking City [101].

The Archigram group had designed mobile projects at building scales as well as city scales. Examples such as the Cushicle (air CUSHion VehICLE) and Suitaloon projects designed by Michael Webb in 1966. In the Cushicle project, he designed a full-function housing capsule that could shrink and transport as a backpack is considered [49].

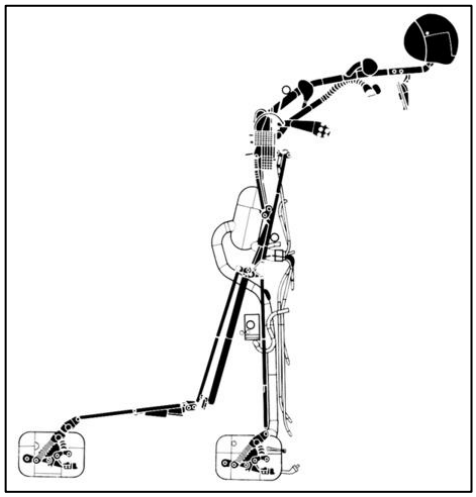


Figure 4.35. Side elevation of Cushicle [133].

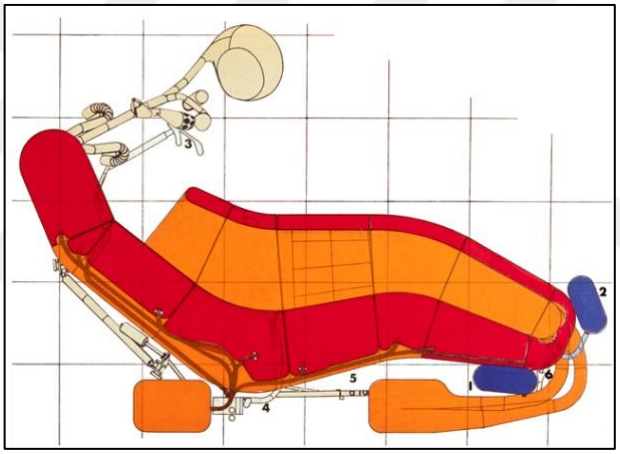


Figure 4.36. Side elevation of empty suit attached to the Cushicle [133].

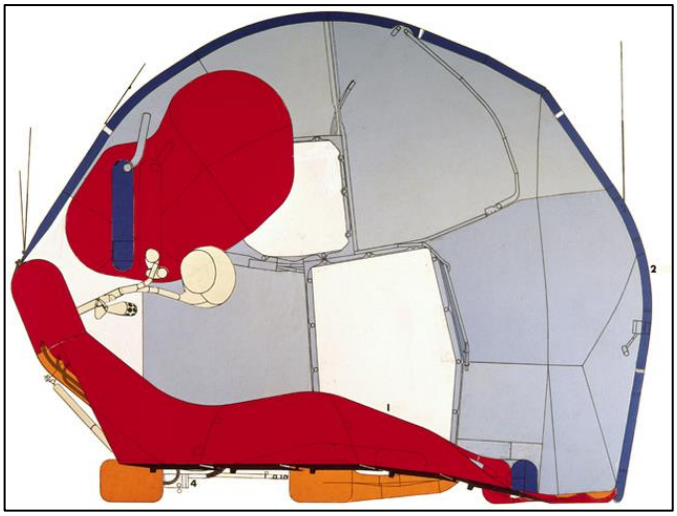


Figure 4.37. Side elevation of fully inflated Suitaloon and Cushicle [130].

In the Cushicle, the robot in the headgear section designed to provide entertainment activities such as TV and radio. In the Cushicle, options were provided for the addition of different service nodes. The Suitaloon was added later to the Cushicle. Although the Cushicle was the source of power, it also provides movement. Suitaloon was designed to create a space that could be worn and inflated to cover a larger area.

David Greene, another member of Archigram, designed the Living Pod project as another project in the Cushicle and Suitaloon concept. Similiar to the Cushicle and Suitaloon project, Living Pod project is designed to settle in space [49].

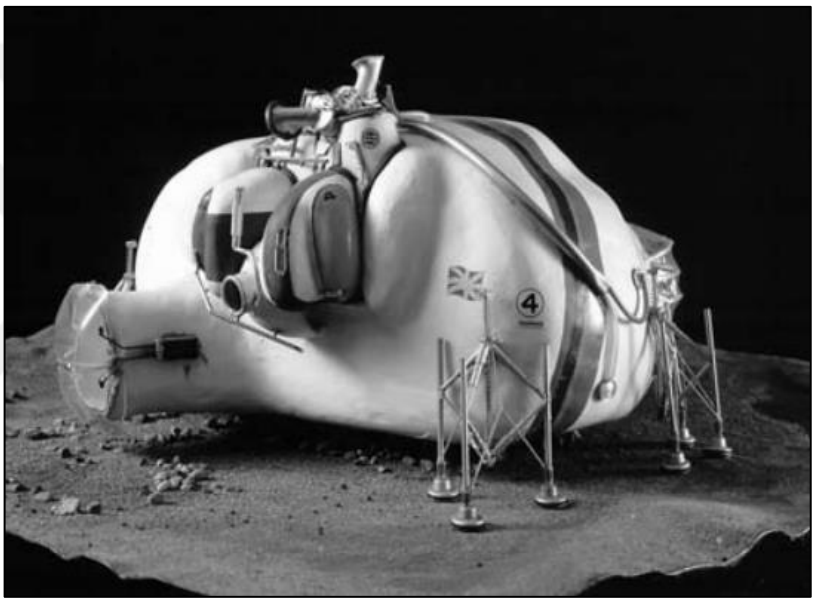


Figure 4.38. Living Pod model by David Greene [49].

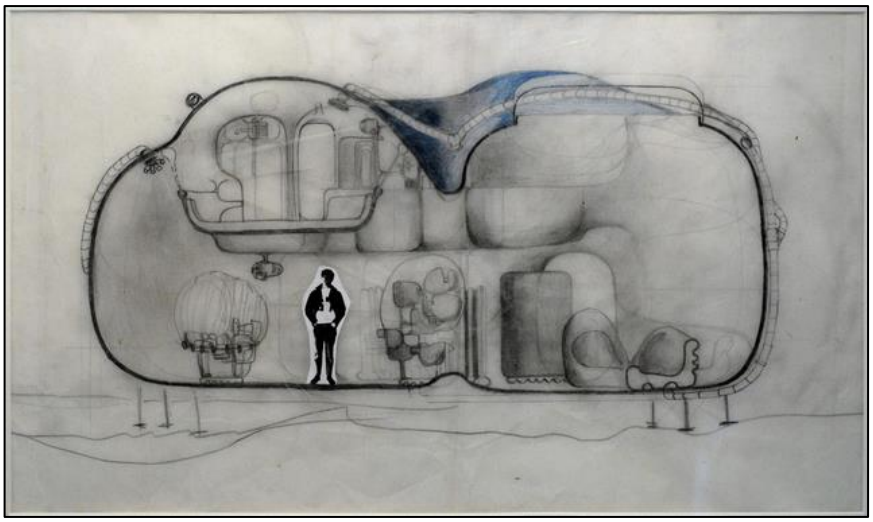


Figure 4.39. Living Pod section drawing [133].

As with other pioneers, the concept of mobile architecture that Archigram Group has adopted in its projects had been about user freedom. Although the projects of these pioneers remained utopia, they believed that their projects could be realized. In this chapter, the similarities and differences in these pioneers' understanding of mobile architecture were explained through megastructure projects. In the next chapter, the focus was on Yona Friedman's Mobile Architecture Theory, which has adopted user freedoms as the fundamental philosophy in the context of mobile architecture.

5. RESEARCH OF MOBILE ARCHITECTURE THEORY OF YONA FRIEDMAN IN THE CONTEXT OF UTOPIC MEGASTRUCTURE

In this section, Yona Friedman, one of the pioneers of megastructure in the context of Mobile Architecture, is discussed. Friedman distinguished himself from the other pioneers of the megastructure by the fact that he was the first architect to introduce mobile architecture and his understanding of mobile architecture. As examined under the title of megastructure pioneers, the mobile understanding of each architect, artist, and the architectural group was different from each other. However, the freedoms that users had in the concept of mobile architecture is considered more prominent in Yona Friedman's projects and theories than in other pioneers. Other pioneers had put the user/inhabitant into a pre-determined life. The other pioneers previously determined the circulation in the cities, the form of the buildings, the interior space and the settlement within the city. From this point of view, it can be said that the freedom granted to the user is restricted by other pioneers. In these projects, users would have to live according to the architect's own vision, aesthetic understanding, and planning. Yona Friedman opposed this view and believed that designing should be realized by the user. In this context, he published his mobile architecture manifesto and designed the most well-known Spatial City project within the megastructure concept.

The Spatial City project was thought to be able to adapt to this even if technology develops in the coming years. In contrast to the projects of other megastructure pioneers, the Spatial City project is a timeless idea because it has not been addressed aesthetically, it has adopted continuous change and unpredictability, and leaves the design to the user. Therefore, the ideas of Yona Friedman and the Spatial City project have been examined.

5.1. YONA FRIEDMAN'S MOBILE ARCHITECTURE THEORY

Yona Friedman worked as an instructor at the Technion School until 1956 [15]. The same year he was accepted to participate in CIAM X in Dubrovnik. CIAM (Congrès International d'Architecture Moderne) was founded in 1928 [90]. Friedman attended this convention because he believed that his ideas would bring something different to architecture, not something new. Friedman stated that the contact of structures to the ground level should be minimized, and that's the only way cities could be mobile. Friedman's drawings and ideas

gained attraction in the Congress. Friedman stressed that people's spare time was increasing, and cities should be qualified to respond to this. He said that architects should listen to such needs of the people and be as mobile as possible in their solutions. Yona Friedman explained these ideas in his Mobile Architecture manifesto. Later in the congress, he shared his ideas with young architects of the period, including David Georges Emmerich, Oskar Nikolai Hansen, Günther Kühne, Paul Maymont, Frei Otto, Werner Ruhnau, Eckhard Schulze-Fielitz, Jerzy Soltan, Jan Trapman, Günther Günschell, Frieberger, and Camille Frieden [26]. They gathered the group called GEAM founded by Yona Friedman. They designed megastructure systems that could change the shape of the city in the context of mobile architecture. They were primarily focused on space grid systems. In 1963, the group disbanded. In 1965, Yona Friedman founded the International Group of Prospective Architecture (GIAP). Until 1967, they gave many lectures and focused on contemporary issues on urban planning. Although the groups he founded were dissolved, Friedman carried out theoretical studies on mobile architecture since 1945. He examined the types of mobile architecture, what it could produce and its social consequences. Later, he stated that the term mobile architecture was the wrong word and he was hesitating to use it, but in the end, he chose to use it because the word ‘mobile’ was easy to translate into all languages.

Yona Friedman defined mobile architecture as people’s architecture. Friedman considered this view as a reaction to the modernist vision. He emphasized that buildings should adapt to people and not the other way. In his mobile architecture manifesto, he considered the user/inhabitant in a decision-making position and sought a technique that could adapt to the heterogeneous structure in our social system. To sum up Friedman's principles of Mobile Architecture:

- Minimal contact with the ground level.
- Removable and movable.
- Must be able to be transformed by the user [15].

Friedman expresses his philosophy of mobile architecture by acknowledging the fact that the unpredictability of human behavior, the illusion of planning, and the fact that each individual is different. He emphasized this was not valid only in the field of architecture but also in all fields. He believed there was no definite and clear result of something, and therefore, the important thing was the process.

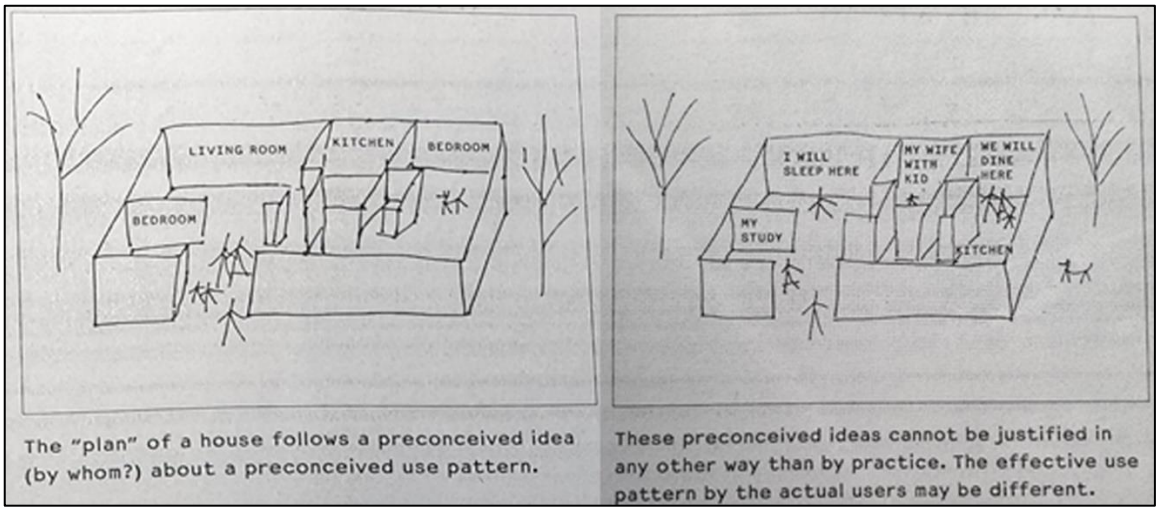


Figure 5.1. Sketches of architectural process of preconceived ideas [15].

Accordingly, Friedman, who researched architectural processes, aimed to free the user from the architect and urban planner. Friedman believed that the user must design and build his/her environment, not the architect. In this respect, he shared the same view with Dutch architect John Habraken. Friedman stated that users should be in a decision-making position and questioned the role of the architect in doing so. According to Friedman, it is only the user experience that proves whether the architect's predetermined planning is appropriate for the user [15]. In addition, Friedman said the architect could not entirely fulfill the user's wishes, and the only solution is that the architect should develop a technique which excludes the middleman (architect, builder) from the process and give all the control to the user [117].

He explained how insufficient the current mainstream architectural processes were. After experiencing the pre-determined spaces, users try to adapt them according to their wishes. Friedman called these types of architectural processes as planning machines and classified them into three stages.

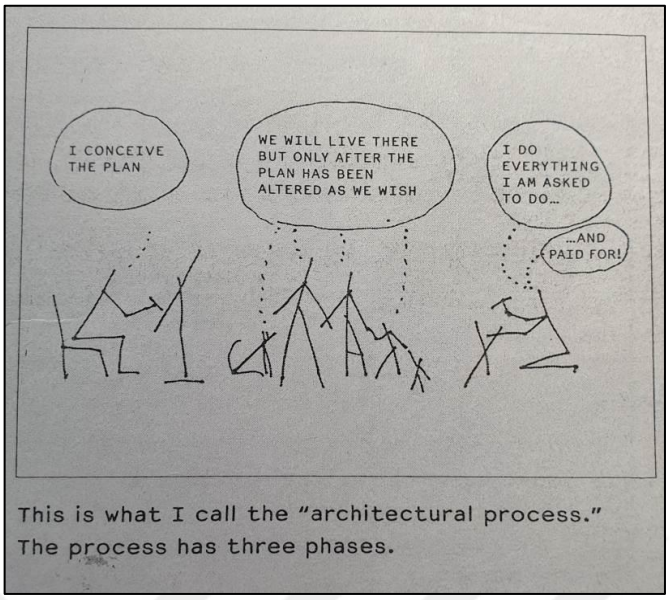


Figure 5.2. Sketch of architectural process by Yona Friedman [15].

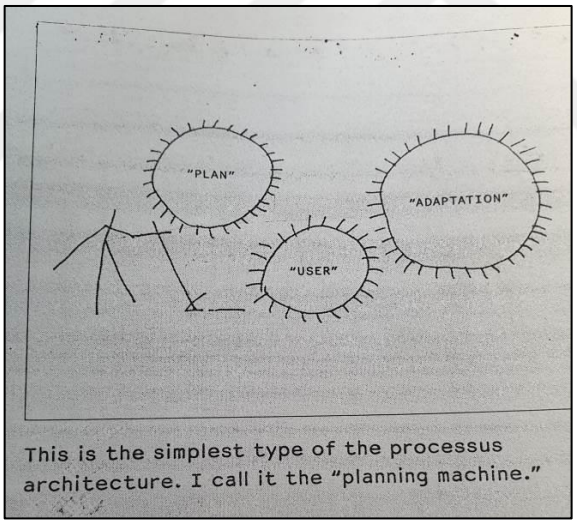


Figure 5.3. Planning machine architectural process [15].

The first stage was to find the idea according to 'the average man' then prepare the plan of the house, the second stage was an adaptation of the user to the designed house, and the third stage was to transform the house in accordance with the demands of the user.

Another type of the architectural process is that the user, builder, and designer can be the same person. This process is easy to implement, but the idea, user and builder need to be knowledgeable in these areas. Yona Friedman called this architectural process super-machine planning.

Comparing the planning machine process to the super machine process, Friedman noted that a process of the super machine type would make the future user less disappointed, even if surprising results might appear. However, since a single person determines the stages of this type of architectural process as opposed to the stages of the planning machine process, it can be difficult to return to the steps because they can be ambiguous.

For all these reasons, Friedman emphasized that the architectural processes have to be slow and transparent and stated that the architectural process does not end with the completion of the building and the process continues as long as the use of the building is active [15]. In fact, with the concept of mobile architecture, all these architectural processes can be simplified and accelerated for the user to experience and change its space. This process summarizes the Trial and Error processes that Friedman mentioned in mobile architecture theory.

As a mainstream architectural process, which includes; architect, user, and builder, the architect has to translate the wishes of the user in a way that the builder understands in order to construct the building. Mostly, the user's ideas are ambiguous and the architect needed time to gather more information. This process is not possible in the current type of collective construction. In this respect, architects have designed according to the ’average man.’

> A dictatorship starts out being good intentions. One wants to help people and so runs the risk of destroying their personality [15].

According to Friedman, there is no average man, and he emphasized designing structures for the average man means no one can be fully satisfied. For this reason, he sought new architectural processes and the role of the architect in these processes.

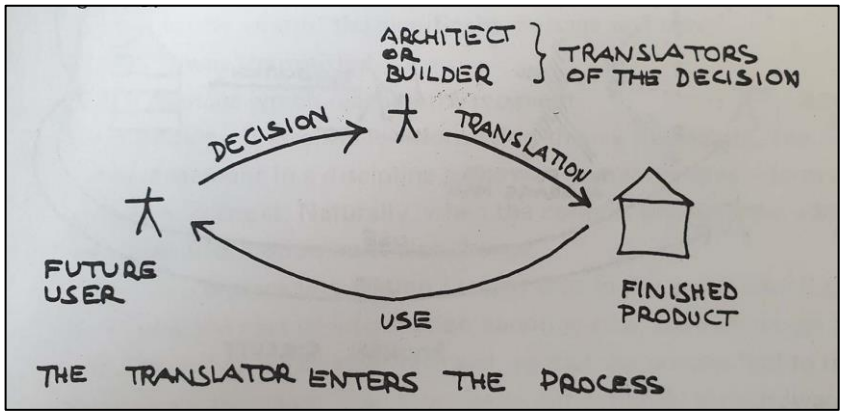


Figure 5.4. Architectural process of the user, architect or builder and the end product [79].

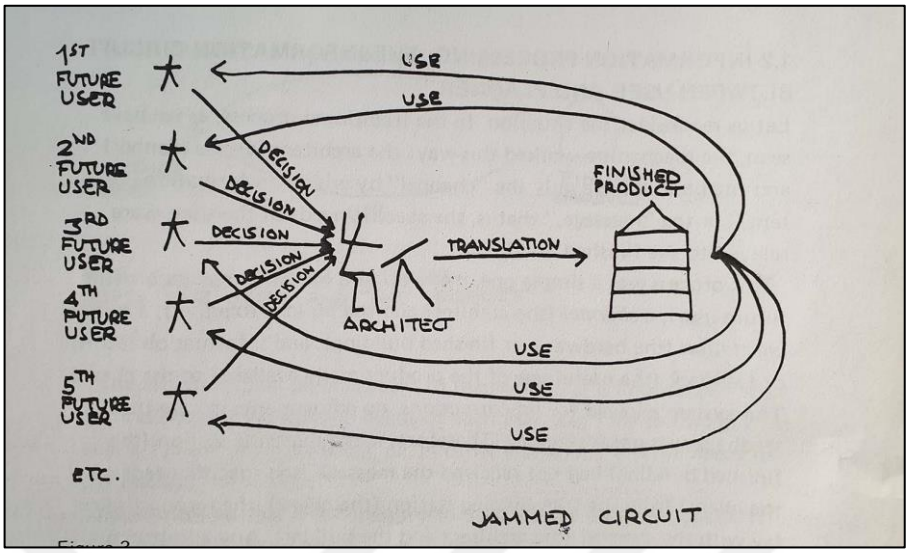


Figure 5.5. Increased users in architectural process [79].

The architectural process in Figure 5.5 shows, as the number of users increased, it became impossible for the architect to fulfill the wishes of each user.

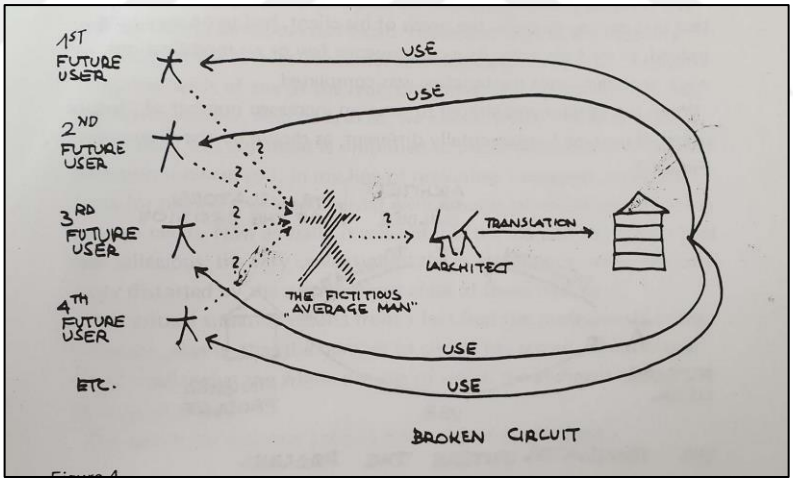


Figure 5.6. Included middleman in the architectural process [79].

In the architectural process in Figure 5.6, the person in the position of the intermediary 'average man' who conveys the requests of the future users to the architect did not facilitate the process, on the contrary, a new intermediary added, therefore the chance of the architect to make mistakes increased and the process weakened.

Friedman sought solutions to these architectural processes. Accordingly, he removed the architect and the intermediary from this cycle and considered an architectural process that includes only the user and the end product.

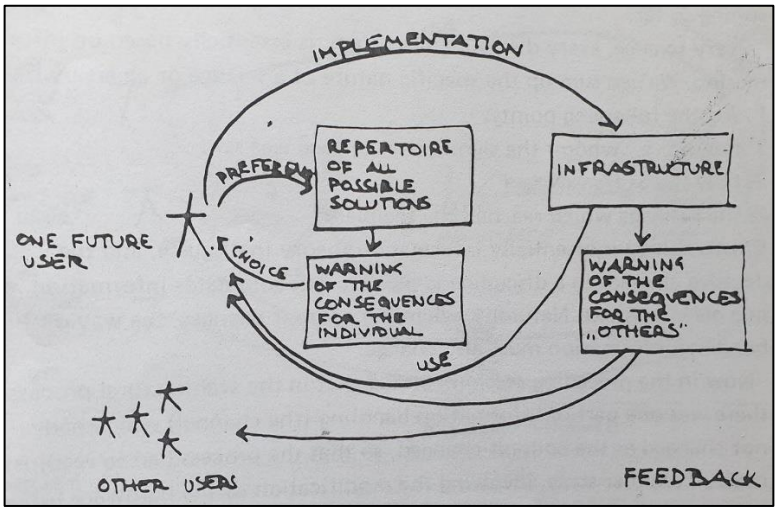


Figure 5.7. The feedback system in architectural process [79].

According to the process in Figure 5.7, the user transmits her/his wishes, and all the results according to these requests are presented to the user with advantages and disadvantages in a way that the user can understand. After this stage, the user puts the planning into practice, which determined by himself. Then, the physical structure is built. After that, other users are warned. As the number of users increases, the system could continue. A warning might be advantageous for an individual, and disadvantageous for another. For this reason, these warnings should be made according to the person. The process ends with informing the users about the consequences of the physical structure to the environment and society.

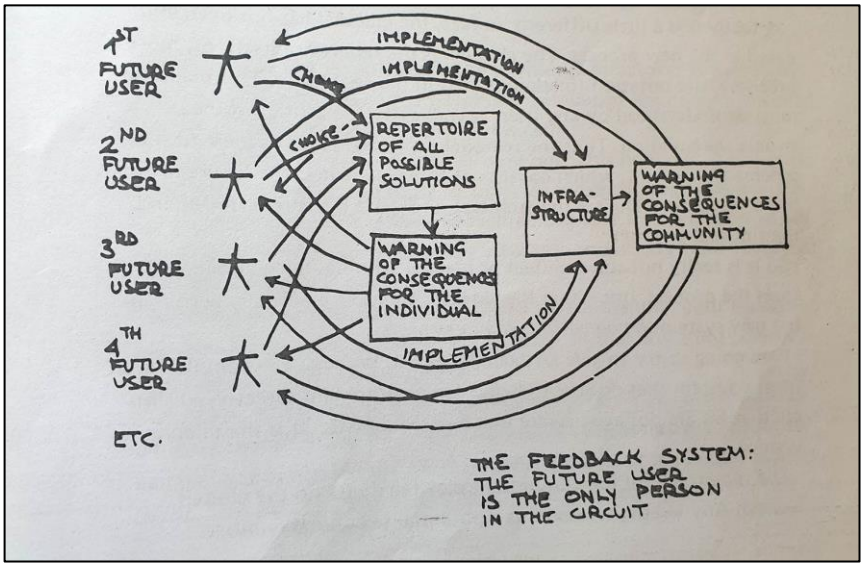


Figure 5.8. Increased users in the feedback system in architectural process [79].

In this process, the architect may not appear in the cycle, but in fact, he was involved, and only his role changed. The architect prepares the repertoire and mapping in a way that the user and the builder can understand. The architect also informs the society about the building and notify them about the warnings. Friedman, who examined how the architect could prepare a repertoire, developed The Flatwriter in this context. He used computer technology to accommodate millions of possibilities within the repertoire [79].

Friedman, who has worked on improvisation, randomness, and unpredictability concepts which is inherent in mobile architecture, searched for tangible solutions to make these concepts realize. Therefore he had worked on various irregular or erratic structures and made researches on the forms, materials, and interchangeability of these structures. He stated that even those who did not have an architectural background could use these structures, in various functions without any specific tools, because they have no rules. He stressed that facilitating construction techniques in a way that non-experts could understand would lead to significant social benefits. He stated that irregular structures would encourage people to improvise and the results could be plastic arts in architecture and allow the individual to express himself/herself [15].

Friedman stated that these structures should be tested and the Trial and Error method would provide consistent results only if these structures are tested on a real scale. Friedman compared the utilization differences of these irregular structures to cooking recipes. He stated that everyone could cook differently, and in fact, it’s an improvisation. Based on these, Friedman made various recipes using irregular structures and demonstrated how it could be integrated into architecture by using different forms and materials. Accordingly, light metal mesh, cardboard, sheet, plastic, foil with simple materials such as the desired forms can be given. He also stated that irregular structures might occur from regular elements. For example, Friedman’s Cylindrical Shelter project can be shown. As another example, the combination of containers can produce many forms, but the functions can also be varied. Irregular structures have also been effective in changing the interiors of existing buildings. The exhibition spaces can be shown as an example. These irregular structures might be changed as desired in a communal living or isolation.

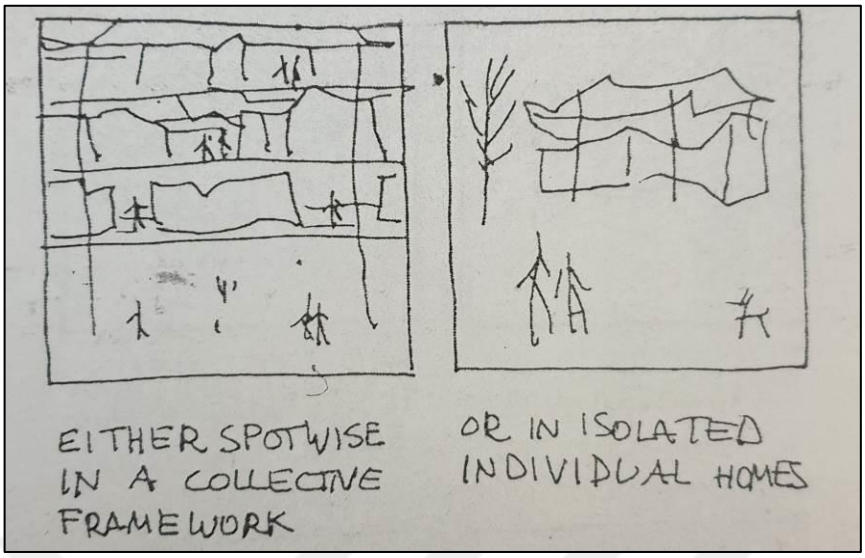


Figure 5.9. Variation of uses of irregular structures [15].

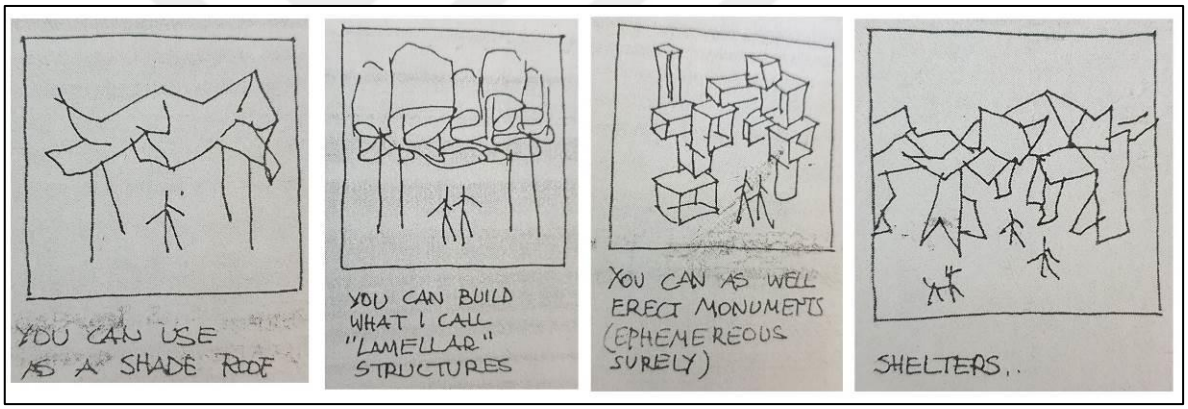


Figure 5.10. Variation of uses of irregular structures [15].

As in the leftmost image in Figure 5.10, crumpled sheets can serve as a roof consisting of twisted foils, as well as the desired arrangements by combining materials with different functions. The stress load on the structure is reduced by the bending process. In the image next to it, the structure Friedman called Lamellar (Leafy) can be made of foil, metal mesh or cardboard. The structure, which can take the desired form by simply gluing the joints, can be combined with different materials and used in various functions. In the image next to it, the desired form can be given simply by using cardboard boxes, and the cardboard boxes can be recycled at the same time. The rightmost image shows the irregular structure, which Yona Friedman called Merzstrukturen by referred to Kurt Schwitter's Merzbau. Friedman mentioned that Merzstrukturen could consist of all kinds of materials such as wood, glass, metal, etc. and could be given the desired form. He stated it was very much available from

industrial wastes, which was one of the big problems of our age and could be used as raw materials.

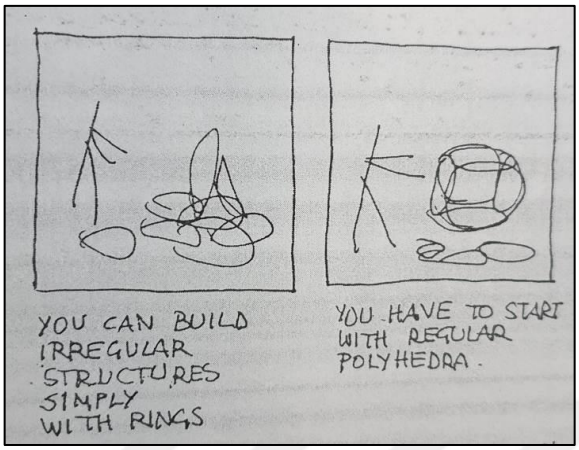


Figure 5.11. Sketches of Space Chains [15].

Another irregular structure consists of rings called Space Chains. The desired form can be given by a combination of these rings. These rings can be formed with any material as long as they can easily bend to the desired level and retain their shape and rigidity.

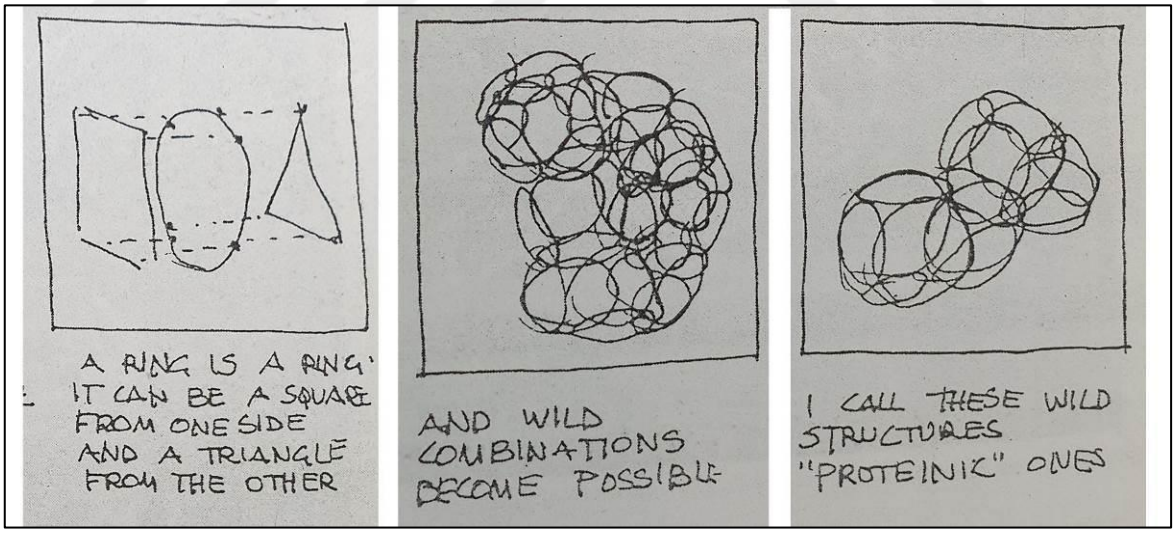


Figure 5.12. Combination possibilities of Space Chain structures [15].

One side of the ring can be integrated with different geometric forms. Also, multiple combinations of these irregular structures can be made. Yona Friedman called these combinations ‘’Proteinic Chains’’. Space Chains exhibited in many pavilions such as Serpentine Pavilion in 2016.

Figure 5.13. Serpentine Summer Houses 2016 ‘Space Chains’ by Yona Friedman [36].

Another irregular structure was called Gribouilli Structures by Yona Friedman. This structure can be drawn on a sheet of paper in two dimensions, or it can be made in three dimensions with wire material. It can take any shape and function. Friedman saw Gribouilli as the most improvised structure.

Figure 5.14. Possibilities of Gribouilli structures [15].

Another irregular structure is referred to as Tensegrity Systems (tension integrity), Friedman stated that there were many studies on this type of structure and it was first designed by Buckminster Fuller. Friedman noted that this structure could have many functions and forms.

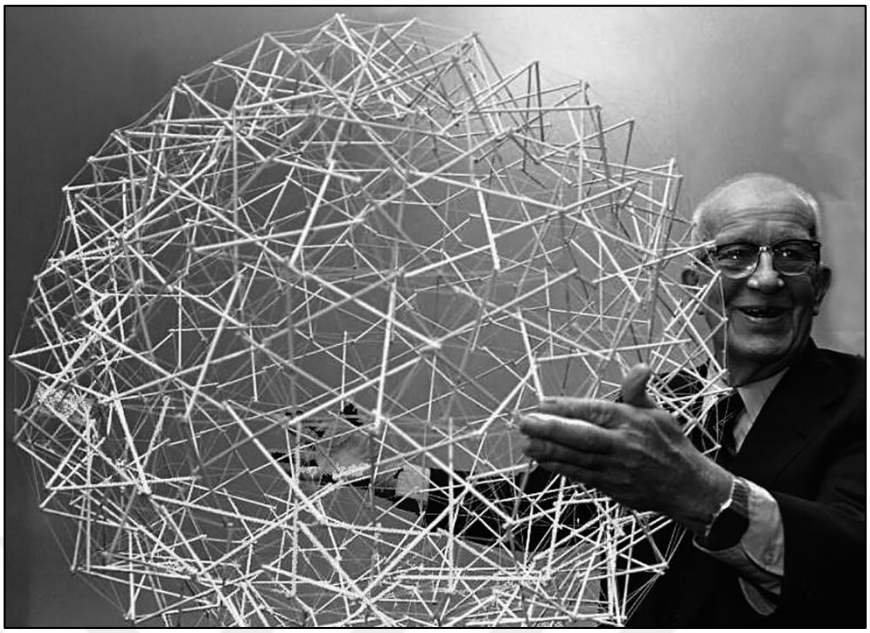


Figure 5.15. Buckminster Fuller Tensegrity Sphere [134].

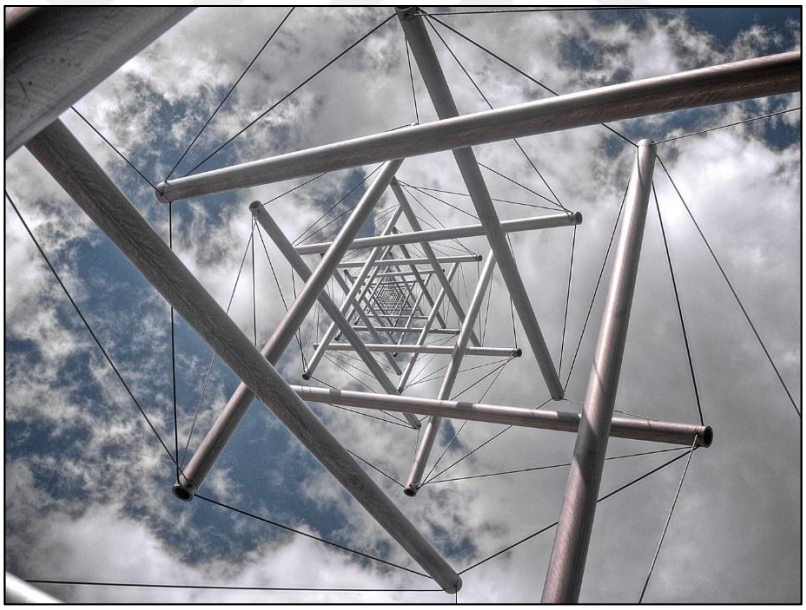


Figure 5.16. Needle Tower [134].

In Figure 5.16 Needle Tower implemented in 1969 by Kenneth Snelson who was Buckminster Fuller's student. Tensegrity systems have developed over time, and there are many other examples of the system.

5.2. YONA FRIEDMAN'S SPATIAL CITY (VILLE SPATIALE) PROJECT

According to Friedman, the most important architecture influences of the 20th century were Konrad Wachsmann's space frame system and Kurt Schwitter's artwork Merzbau. Alexander Graham Bell, who invented the space frame system and Konrad Wachsmann, who later developed it, inspired Yona Friedman as well as many other designers. Konrad Wachsmann stated the followings:

> Buildings should develop in an indirect way, as a multiplication of cells and elements in accordance with the laws of industrialisation [117].

Friedman defined Konrad Wachsmann's space frame system as 'geometric order' and Kurt Schwitter's Merzbau as 'emotional order' [15]. In this context, he started publishing the Spatial City projects which he designed in the late 1950s. He made visualizations for many cities in the concept of Spatial City. He extended the Spatial City project to the urban scale and considered an ongoing structure, thus became a megastructure project as a concept [117].

Principles of Spatial City projects consists of span-over blocks supported by stair towers constructed at 60-meter intervals, and the other was raft-blocks of boxes placed on the floor and supported by beams. The Cylindrical Shelters project could be an example of the shelf-blocks principle. The idea of span-over blocks embodies the main principles of the Spatial City project. Technically, it reflects Yona Friedman's principles of mobile architecture. The first sketches of the span-over blocks were designed with a suspension technique. But then it changed to a space frame system [15].

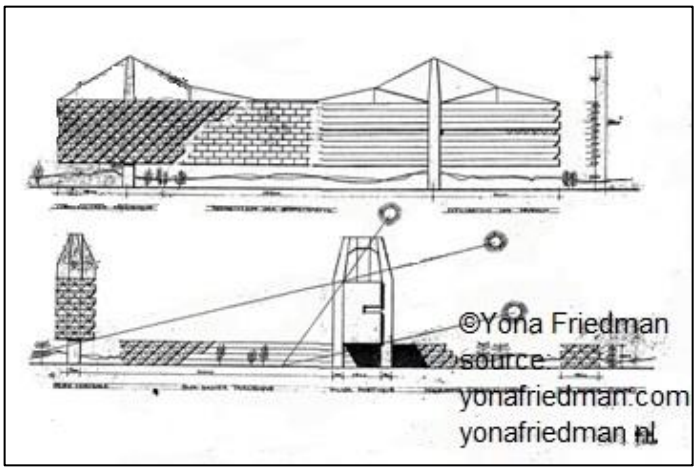


Figure 5.17. Suspension technique section of the span-over blocks principle [125].

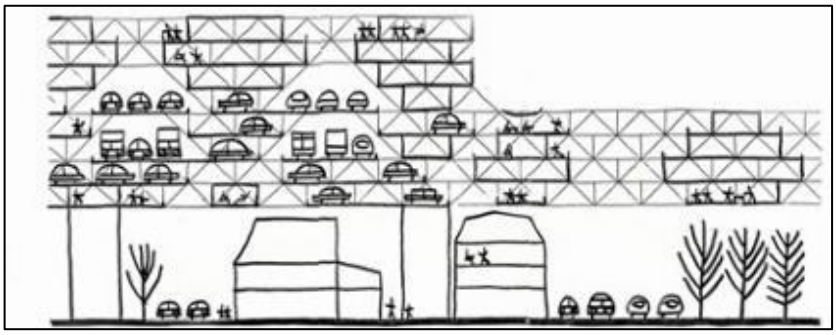


Figure 5.18. Section of the space frame system technique of the span-over blocks principle [125].

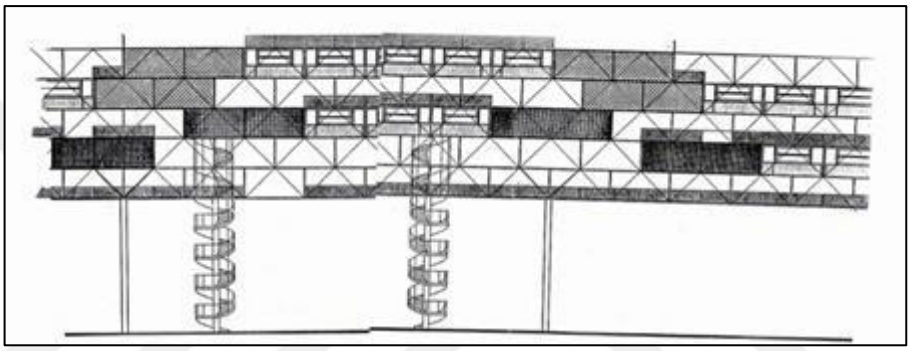


Figure 5.19. Vertical circulation concentrated within the pillars [125].

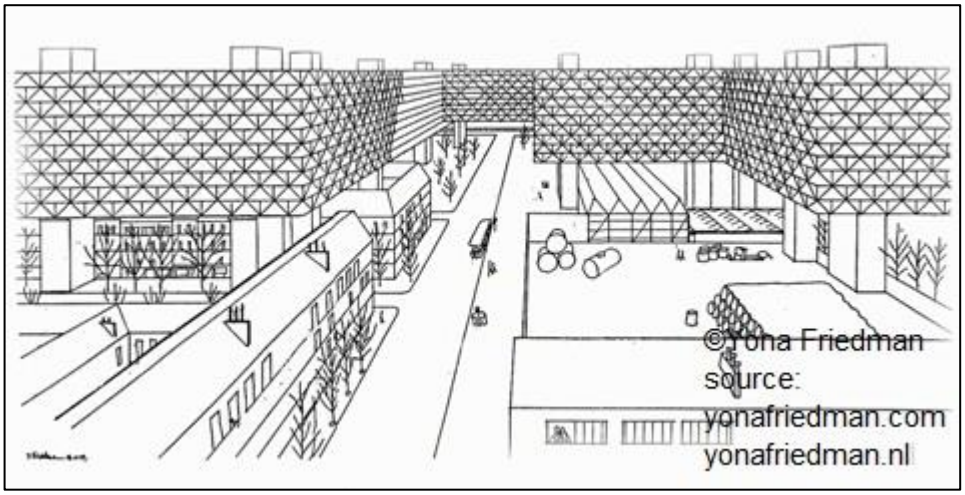


Figure 5.20. Drawing of span-over blocks [125].

In our age, which is a mass-scale industrialized world and dependent on mass production and automation, Friedman referred to the trend of where individuals desire to be different in society and called "mass-individualization" to this social culture. By making an architectural analogy to this situation, he perceived the concept of Konrad Wachsmann’s space frame

system to industrialization, mass production and automation, and Kurt Schwitter's Merzbau concept to individualism. [15]. He used this interpretation in his Spatial City project.

Figure 5.21. Merzbau of Kurt Schwitters [135].

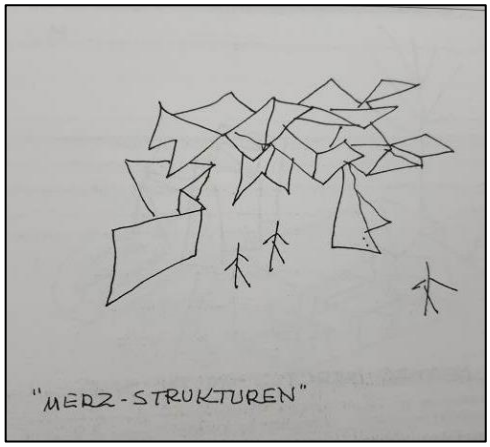


Figure 5.22. Merz-Strukturen [117].

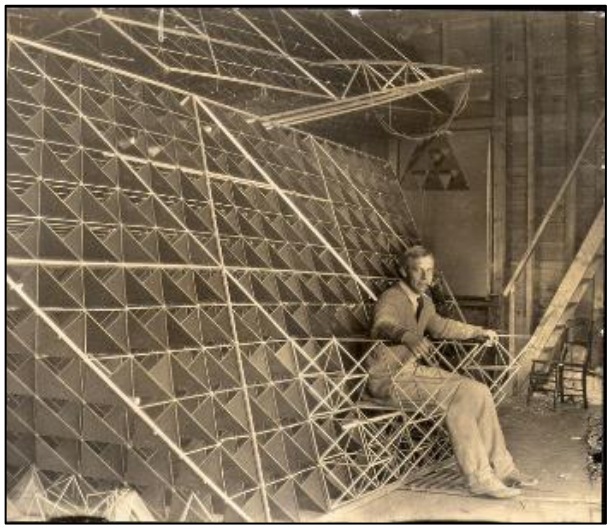


Figure 5.23. Space-Grid structure developed by Alexander Graham Bell [136].

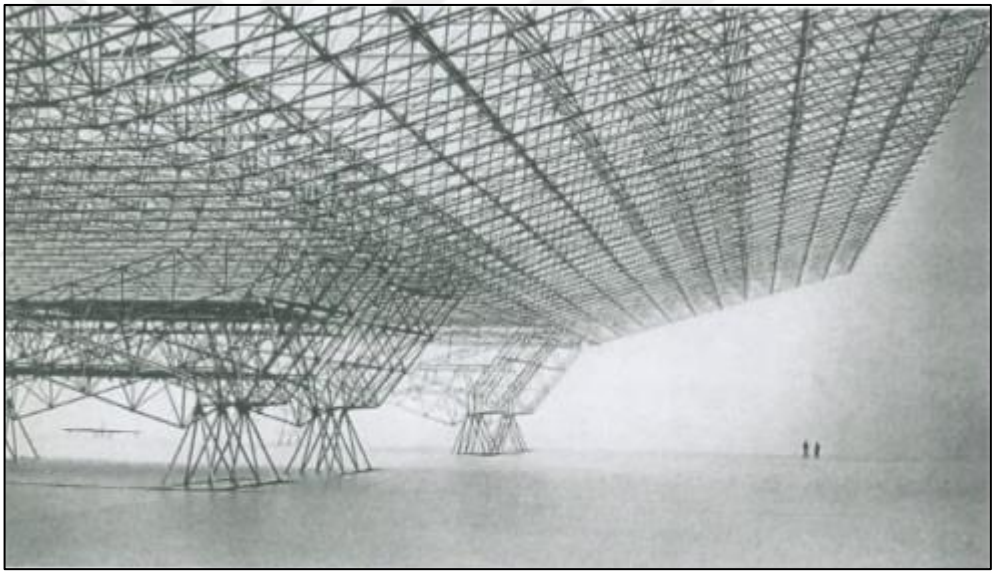


Figure 5.24. American Air Force Aircraft Hangar, Konrad Waschmann [116].

Friedman spoke of analytic and holistic images. According to him, people see the components analytically but feel them in a holistic sense. Friedman, for example, stated that when people look at the bookshelf, they see the library as a whole, not the books or the shelf. He also evaluated these approaches in cities [15].

According to Friedman, cities determine the behavior of the people and represent people. He considered the urban concept as a combination of analytical and holistic interpretations. The analytical interpretation of the city is the accumulation of individuals' homes. Rules might be ignored such an order of accumulation, but the analytic concept of the city remains

essentially the same. The cities of the past had added wholeness to this analytical interpretation. As a holistic interpretation, it could be thought of as the collective accumulation of houses within the city walls. With this approach, Friedman developed the Spatial City and Continent City projects [15].

According to Friedman, Spatial City was urban planning within the city walls. The individual houses were independent of the space frame structure in terms of form and order.

Friedman proposed ten principles of mobile urban planning in 1959 as follows :

1. Cities will become centers of leisure, recreation, and entertainment in the future, and other functions will become increasingly automated.
2. The new urban society should be independent of the influence of the urban planner.
3. Agriculture is a social need in cities.
4. Cities should be prepared for climatic conditions.
5. The structures should comply with the urban technical scale.
6. The new city should be the condensed version of the existing city.
7. The urban technique with a three-dimensional grid system also allows the neighbourhoods to be positioned side by side or on top of each other.
8. Building structures should have skeletons that can be filled at any time.
9. The city of three million inhabitants is experimentally optimal.
10. It is possible to place the entire European population in 120 cities with a population of 3 million [15].

Friedman believes people can improvise the city and cities should not resist the inhabitants but should obey the inhabitants. Therefore he thought these principles of mobile urban planning would be helpful to produce the open-ended improvised architecture. Later he stated that, with these principles, the city could be adapted to other uses and he believed Spatial City could be technically implemented. The integration of Spatial City on the existing city would be beneficial for living in harmony.

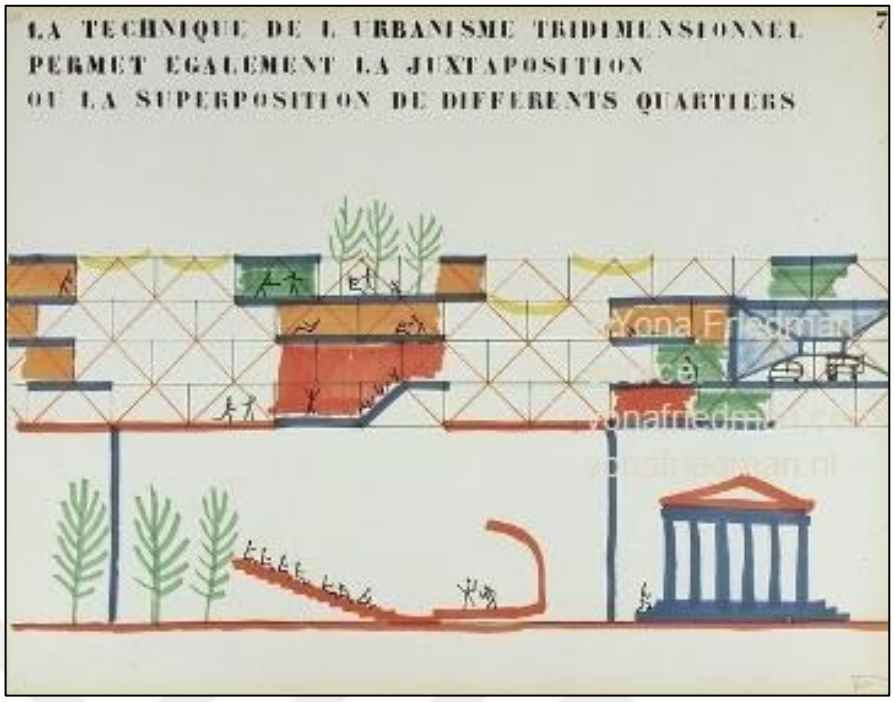


Figure 5.25. Sketch of Spatial City section [15].

Friedman stated that the main feature of the Spatial City proposal was the socialization of the space frame system. He stated that the volumes within this system were furniture. In addition, he emphasized freeing the ground level, which would bring out more public space on the ground level. He also stated that the location of any building or street could be easily changed in the Spatial City project. He emphasized that in order to make this change in existing cities, the foundation of the structures must be excavated, and in this case, it's not sustainable.

Yona Friedman expressed the state of today's public spaces as corridors between built volumes, in contrast to this situation, in the Spatial City proposal, there would be no need for any destruction to reorganize the public or green spaces. The Spatial City project could be installed on an existing city, on a rural area or on a water surface [15]. Thus, there would be no need for any demolition in buildings, spaces or cities that have historical value to be preserved. He stated that the realization of Spatial City on the cities could prevent unnecessary spreads of the cities and land occupations.

Friedman stated that historically, urban planning mostly deals with solid architecture. The city buildings were built to be permanent in most civilizations. Nomadic societies have rarely left permanent traces. The search for a softer architecture started due to the overwhelming

of the cities, and the first sign of this emerged with the adaptable buildings. However, adaptable buildings did not become adaptable cities. Single adaptable buildings did not make the city soft. According to Friedman, the adaptable city would be like the Spatial City project. The Spatial City project was a non-permanent city where the urban texture could be easily changed at any time [15].

Friedman talked about how utopian it is to hope to find someone who is capable of projecting or planning the modes of use that exist in the city but cannot be determined. Therefore, in relation to these modes of use, Friedman argued that designing a physical infrastructure with maximum neutrality makes the most sense for the architect or urban planner [15]. He stated that it is impossible to know them in advance and to design accordingly, since these modes of use in the city may vary from person to person or from time to time.

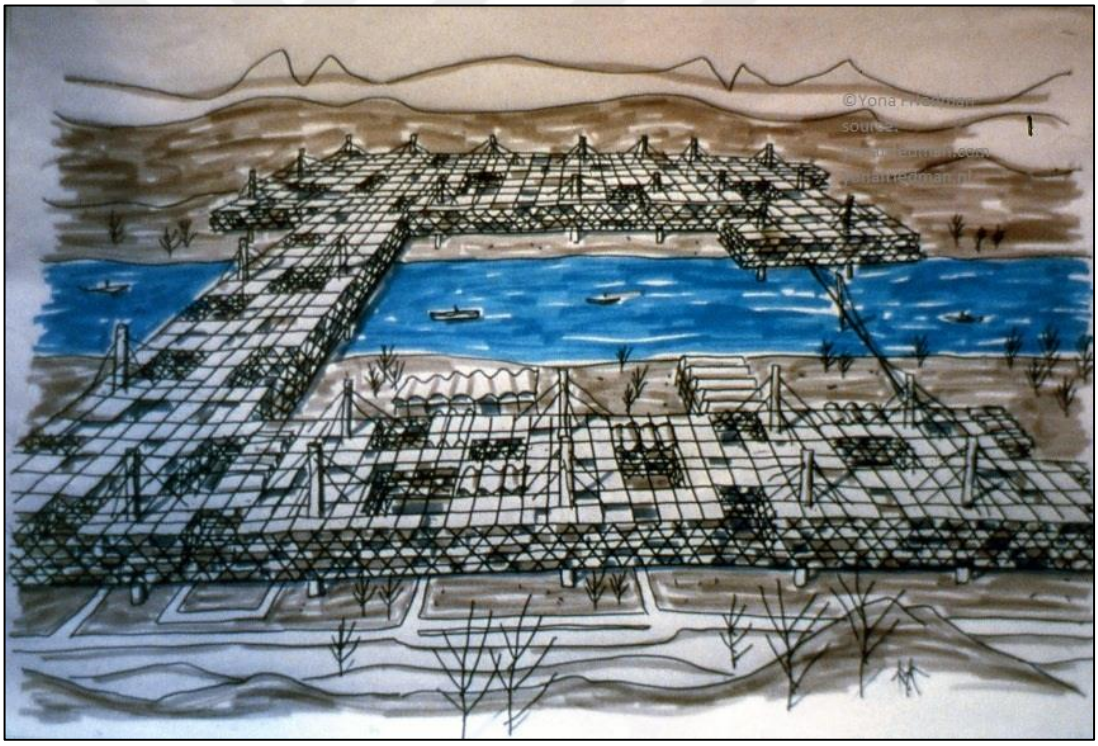


Figure 5.26. Bridge-Town integrated with Spatial City [125].

> Mobility, in this sense, is a kind of natural law. I attempted to establish a general theory of mobility. I expressed it in quite a naive way and I did not find the solution I have now come to accept: What is important is the process, not the steps of the process. As for the last step, it does not exist [15].

According to Friedman, general mobility means the infinite process within the rigid reference frame. Having investigated the concept of randomness in this continuous process, Friedman thought about what the constant variability of random concept in architecture means since 1959 and tried various arrangements in his models. Within the framework of mobile architecture, he stated that for randomness or irregularity to occur, he must first establish order, and that order was the spatial infrastructure of the Spatial City project, said that randomness and irregularity were the units determined by the user in the space frame system [15].

> Agreed on randomness, but it is defined according to an order. Randomness is the factor that breaks order, and for that to be, the order must pre-exist. In terms of mobile architecture, to leave randomness a clear field, first, I had to establish an order.

Schwitter's artwork Merzbau was made with randomly selected materials. Inspired by this work, Friedman adopted Merzstrukturen's name and the idea that the individual buildings in Spatial City could be built with randomly selected materials. According to the Spatial City proposal, the user would be able to apply his/her idea with a trial and error process. There would not be any economic loss while constructing. Only the user could realize this process. The architect or any other person who has no right to make mistakes, would not be able to participate in this process. According to Friedman, Trial-and-error processes could be a path to architectural innovation [15].

In his book Pro Domo, Yona Friedman stated that mobile architecture and, in parallel, spaces are designed with the free will of individuals and that free will constitutes ‘a potential space’ in principle. In the Spatial City proposal, he stated that the image of this ’potential space’ was the order of the volumes within the space frame structure and each volume represents a potential space. He emphasized that the imaginary form of mobile architecture would emerge with the free will of the user. Thus, the void and volume arrangements within the space frame system was a result of the free will of the user. However, Friedman stated that the arrangement of volumes should not interrupt the natural light, ventilation and circulation areas of other users and defined various rules in the project to prevent this problem.

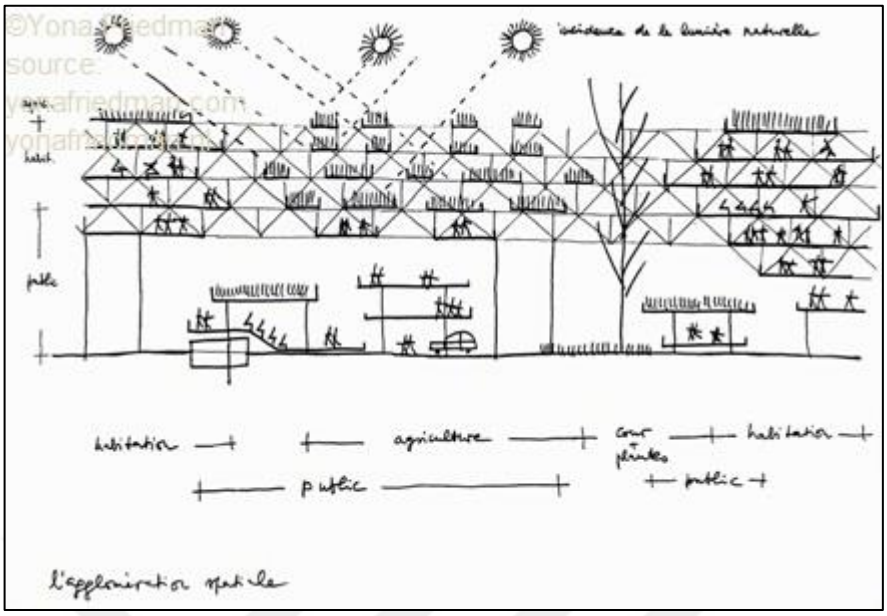


Figure 5.27. Spatial City density and access of natural light [125].

He also mentioned that the irregular structures he examined could be applied in the Spatial City project. For example, the Spatial City project could consist of Panel Chains, Space Chains, Merzstrukturen, boxes, cylinders, foldable foils, metal sheets, Lamellar, Gribouilli, and Tensegrity systems. Any combination could be made with these structures since they do not consist of geometric order.

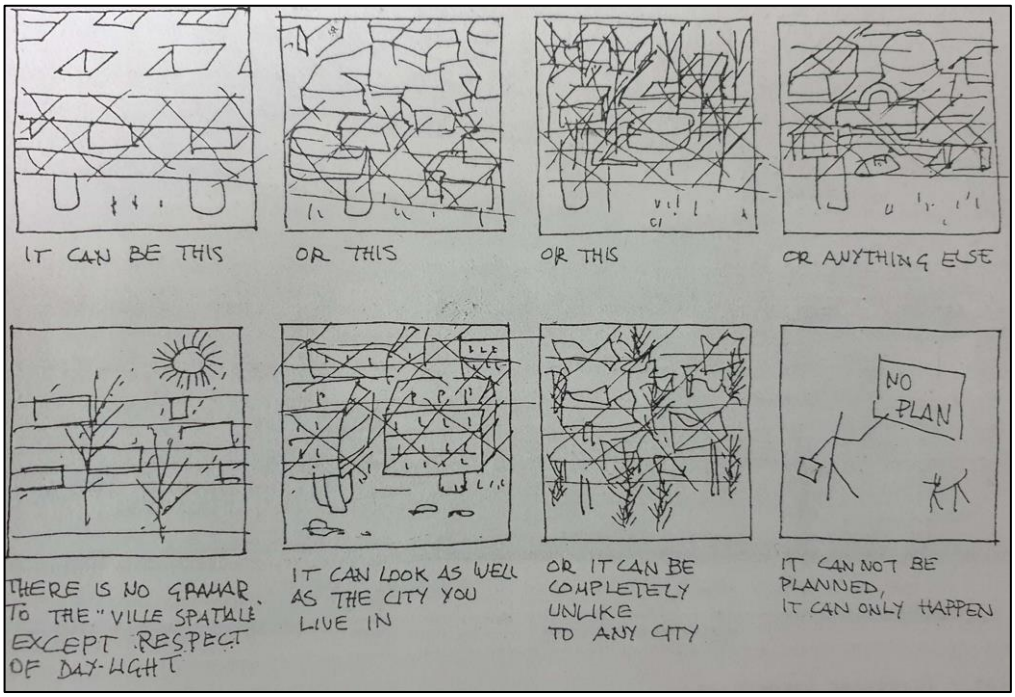


Figure 5.28. Variations and unpredictability of Spatial City [15].

Therefore, Friedman mentioned how difficult it was to visualize the Spatial City project [15]. For this reason, the Spatial City project can only happen; it cannot be planned. The Spatial City project had no facade or floor plan because both the facade and the floor plans were thought in continuous formation with the combination of the elements that would make up the interior spaces.

Figure 5.29. Sketch of Spatial City [125].

Films can be given as an example of this visualization. Films are formed by the continuous movement of the images. Films has provided a solution to this contrast between ‘fixed’ and ’mobile’. Each frame is an image. The combination of these images over time creates a logical fiction. Therefore, ‘fixed’ is not the opposite of ‘mobile’, but it is a function of ‘mobile’ [11].

Friedman approached architecture as a social reality, not aesthetically. Friedman considered his approach to architecture as a ‘democratic’ approach in terms of the freedoms of the user. He approached the Spatial City project sociologically and thought of it as a place where every individual could express himself without disturbing society. In this respect, he considered it as a society with diversity but no conflicts. He stated that ‘average man’ does not actually exist, that each individual is different and architecture should be designed by users and realized by users. Friedman stated that the role of the architect in this process might be to propose ideas, construct the system and develop techniques. He inspired many architects and designers with his ideas and projects.

6. CONCLUSION

The mobility of people and population growth that's been gradually increasing makes the cities inadequate. The concept of mobile architecture, which may be an architectural solution to the diminishing quality of life in cities, began to emerge towards the middle of the 20th century. The origins of this concept, started to develop especially after the Second World War, and the areas it is related to, have been examined both conceptually and through projects and focused on the megastructure projects in which mobile architecture began to be seen for the first time on an urban scale.

The megastructure projects, in the 20th century, remained utopia because they were very provocative and radical. The thesis focuses on the pioneers of utopic megastructure projects proposed in the context of mobile architecture in this period. Accordingly, Constant Nieuwenhuys, Yona Friedman, The Metabolist Group and Archigram were examined. These people and groups reflected their understanding of mobile architecture in their megastructures. Each of them emphasized in their projects and discourses that user freedoms should be the basis of the concept of mobile architecture. It has been examined that these groups and designers had some similarities and differences in their understanding of mobile architecture.

The similarities were they aimed to gather various functions in the city into a certain structure, therefore they all designed projects in the concept of megastructure. They also adopted individual freedoms and thought of a certain growth strategy in cities. These growth strategies could be understood as the articulation of the existing structure with other structures.

The differences were the reflections of the mobile architecture approaches they adopted within the framework of their own visions in their projects. Thus, different understandings of mobile architecture emerged. Unlike Yona Friedman, other pioneers proposed projects based on their own aesthetic understanding. Other pioneers considered the user in a pre-designed space in their projects. Although their projects had the capacity to move, articulate, and grow, they did not belong to the user because the form and material selection of the space was predetermined.

Based on the examined megastructure projects and ideas, it was observed that Yona Friedman was predominant in adopting user freedoms among others. Therefore, The Spatial City project he designed in the context of mobile architecture was selected and examined. Unlike other pioneers, Friedman had benefited from simple technologies and cost-effective structures that could be used by non-professionals without any sophisticated and costly technology. Thus, he believed that every individual should be able to architecturally intervene in their environment in his/her own way.

Friedman, while explaining the theory of mobile architecture, stated that pre-designed planning would not satisfy the user, that each individual was different so that planning was an illusion. In the Spatial City project, he implemented this idea and considered the user in a decision-making position on issues such as form, arrangements, settlement location, and material selection.

Although some of these megastructures could be technically implemented, the idea of freedom and equality they had adopted could be the main reason that these projects remained utopia in this capitalist world. Although capitalism embodies equality under the law, it also nurtures the status quo and power diversity, which comes from economic inequalities.

As expressed, even if the architect or urban planner designed the cities or buildings according to the current needs of the users, they would not be able to predict what users' future needs would be. In accordance with this, it can be said that a mobile architecture concept that is supporting the Trial and Error process, which emphasizes all control should be given to the user, is sustainable in terms of both economic and user satisfaction.

In conclusion, it has been explained in the thesis that the freedom of users is directly related to mobile architecture, and mobile architecture is not only moving from point A to point B. In Friedman's discourse, it was emphasized that structures should adapt to the people, not the other way around. Mobile architecture reflects the freedom of expression and unpredictability of people, and it was emphasized that users should be included in the architectural processes. Architects should also adopt users' unpredictability and assume a role accordingly. As the number of users increases, the architect should take an egalitarian approach that allows each individual to intervene in his/her own environment, and in doing so, should seek a technique that as neutral as possible.

The concept of mobile architecture can be useful in reducing some of the negative effects of rising sea levels and global warming in the world. In particular, the idea that Yona Friedman which he mentioned in his Mobile Architecture Theory; to position the cities with minimum contact with the ground level is thought to decrease the effect of rising sea levels on people, at the same time, it has been thought that air pollution can be prevented and the effects of global warming can be reduced by allowing soil ground to be available for agriculture. The concept of mobile architecture is also useful in extraterrestrial settlements along with emerging technologies. Especially modular structures that can be opened, closed, move, or articulated by structural mobility can be used in extreme conditions.

Architects had proposed mobile architecture as a solution to past problems, and it is thought that it can be a solution to current and future problems, and it can sustain its existence. In terms of all these, it can be said that mobile architecture is a timeless architectural concept since it is based on ‘change’ and ‘adaptation.’

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