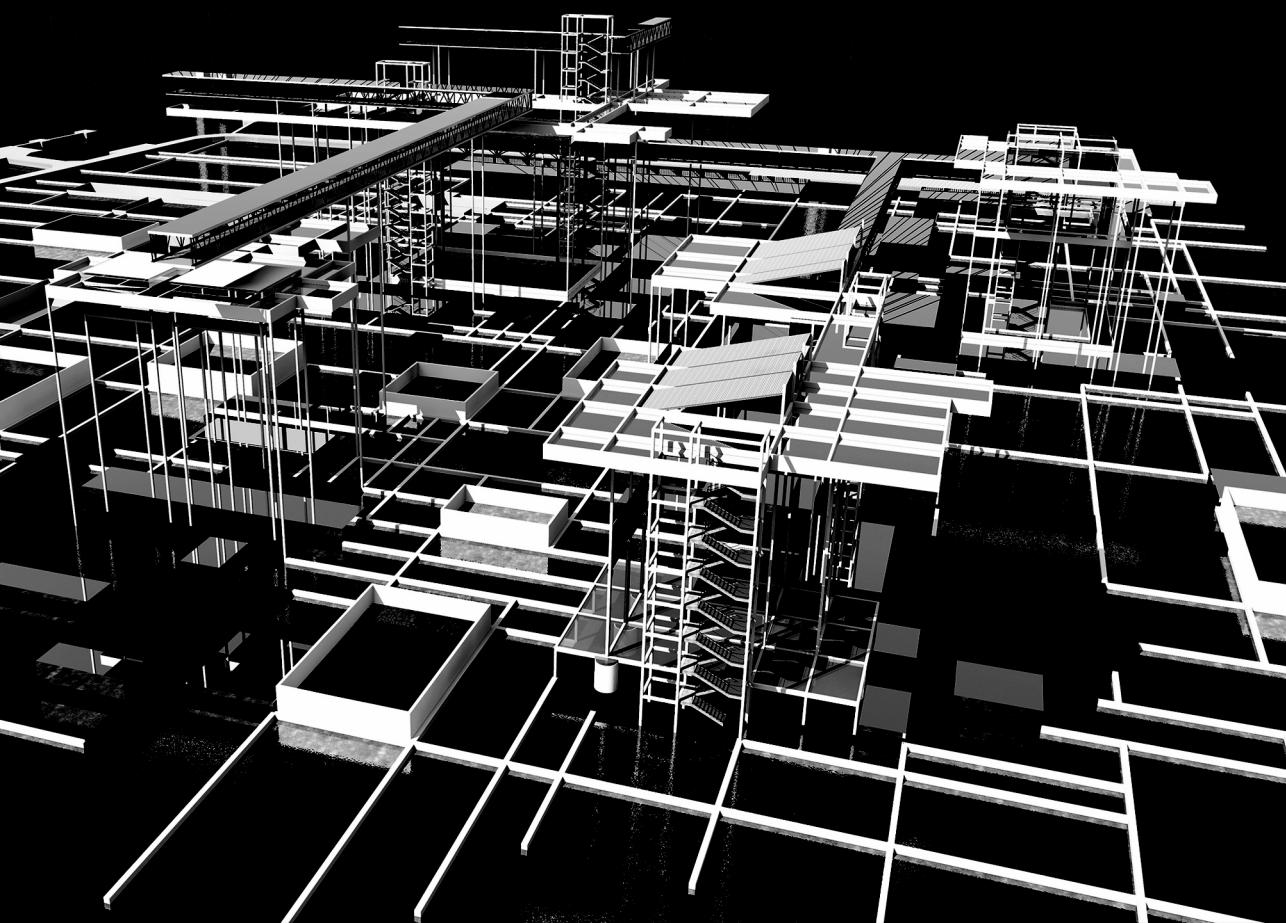


Neo - Metabolism

“How do principles of Metabolism help us
to shape our 21st century megacities?”

Ani Nalbandyan



Neo - Metabolism

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to shape our 21st century megacities?"

Architectural Thesis
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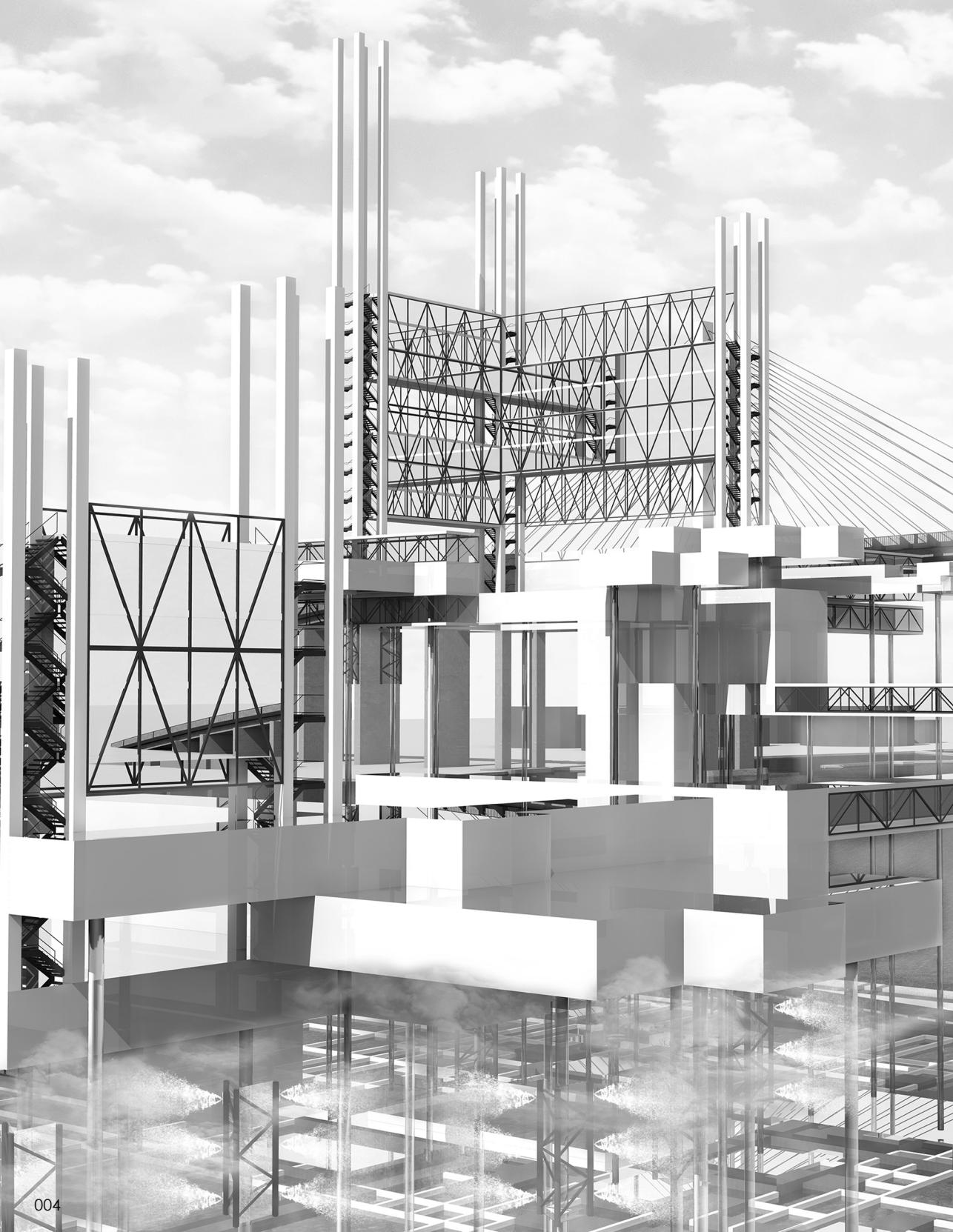
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ABSTRACT

The focus of this paper is firstly, research of Metabolism and Megastructural proposals by analysing the most significant and influential case-studies, secondly, research of challenges which contemporary cities are or will be faced with and thirdly, it is a proposal of Neo-Metabolism movement, which borrows principles of current interest from the movements of 1960s and adapt them to contemporary megacities by incorporating with modern principles of sustainability, ecology and with the use of modern technologies.

From the beginning of human history and especially in the modern period our world has been constantly expanding, and architects, as specialists in organizing spaces for life, should depict their own vision for the growing cities of the Future.

According to the statistics and forecast (United Nations estimates) by the year 2035 the global population is expected to reach nine billion people and 70% of them will live in the cities. Lack of space and necessity to build are challenges for expanding into the water and the air. Another challenge is the climate change and consequently rising of sea level, that is why flood risk is a great design challenge, which is becoming increasingly relevant to a number of cities. Sea occupies two third of the Earth's surface and there is a possibility that it can become a new living environment for humans.

In 1960 Metabolists were faced with a similar issue of overcrowding, but unlike modern issue of overcrowded cities which is a result of economic growth of modern megacities, in Japan it was a post war condition that leads them to seek solutions on the water and air. Today, in the 21st century we are in the midst of a technological revolution which gives a rise to new opportunities to reassess how we conceive of space and building. With increasing threat from global warming and estimated population growth we need to reassess the way we occupy land, water and air. And our modern technologies and innovations give this opportunity for creating experimental living spaces in the water and the air, so, this thesis seeks to identify a new set of principles for Neo-metabolism architecture in the West which is based on the ideas and principles of the future cities and the future architecture which were proposed in 1960s, and establish whether this kind of architecture, which I will describe as Neo-metabolism, can help us to shape our 21st century megacities.



RESEARCH METHODS

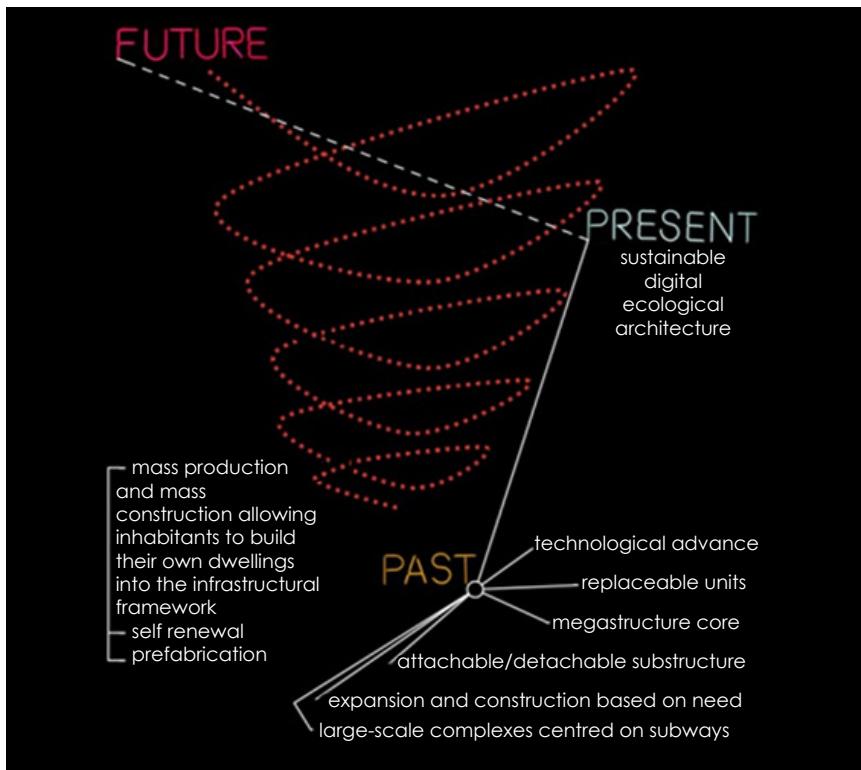
The chosen research methods and methodologies for this thesis are literature search, comparative analyses of the chosen case-studies, visually-based studies' methodology, which mean that drawings will be used as a research and producing of own drawings as a test of my ideas.

In order for this thesis to be understood, it is necessary to begin with the etymology of the word 'metabolism' and the meaning which it had for the Japanese architects. Metabolism – 'is the biological process by which life is maintained through the continuous cycle of producing and destroying protoplasm' (Ross, 1978: 7). For the metabolist architects it meant creating an environment that can live and grow, reproduce and transform, renew itself in response to demands of use or of the times.

The research will begin with a literature search on the ideas and principles of Metabolism Architecture analysing how different members of the original Metabolist group of five developed their ideas in different ways. Ideas of Kenzo Tange, who had never belonged to the Metabolist group, but who unquestionably influenced on the emergence of the metabolism ideas, will also be studied. The research will be based on literature search and reviews and visual representation. Besides, the identified Metabolist principles will find a reflection in my own drawings and design.

Metabolism as a movement did not exist in the West; however, we can see some similarities in the shapes of Brutalism movement – mostly concrete materials, repetitive geometries, existence of blocks etc..The significant difference is absence of the biological component in the second one. Brutalism did not have a goal to create building as living organism. On the contrary, a contemporary movement in architecture named biomimetic architecture creates architecture which is based on rules and forms of nature. So, is Neo-Metabolism a kind of Brutalism mixed with Biomimicry? On this stage I will compare and contrast these three movements and then give a set of principles and tactics which will help to create Neo-Metabolism architecture. Comparison will be based on literature search.

Thereafter, the second part of this thesis will explain the challenges



for Megacities. Modern tendencies for cities with expanding population will be studied, analyzed, compared and contrasted. According to the Organization for Economic Co-operation and Development (OECD) during the next twenty five years the urbanization processes will increase dramatically, it follows that the problems of megalopolises, big cities and expanding cities remains a pressing issue. Some of these problems are the lack of space, difficulties in preservation of green areas and clean air, chaotic expansion of the cities without any scenario of development.

Faced with similar problems in 1960s Metabolist architects proposed aerial and floating metropolises as a solution. Some of them - Kiyonori Kikutake's Ocean city project, Kenzo Tange's Tokyo Bay Plan, Arata Isizaki's City in the sky, Kisho Kurokawa's Helix City, will be chosen as case studies to be analyzed and compared. Doing these studies will lead me to the challenges to create Neo-Metabolism in the West and, in particular, in London, which will be my case study and a site. Again, principles of these case-studies will be incorporated in

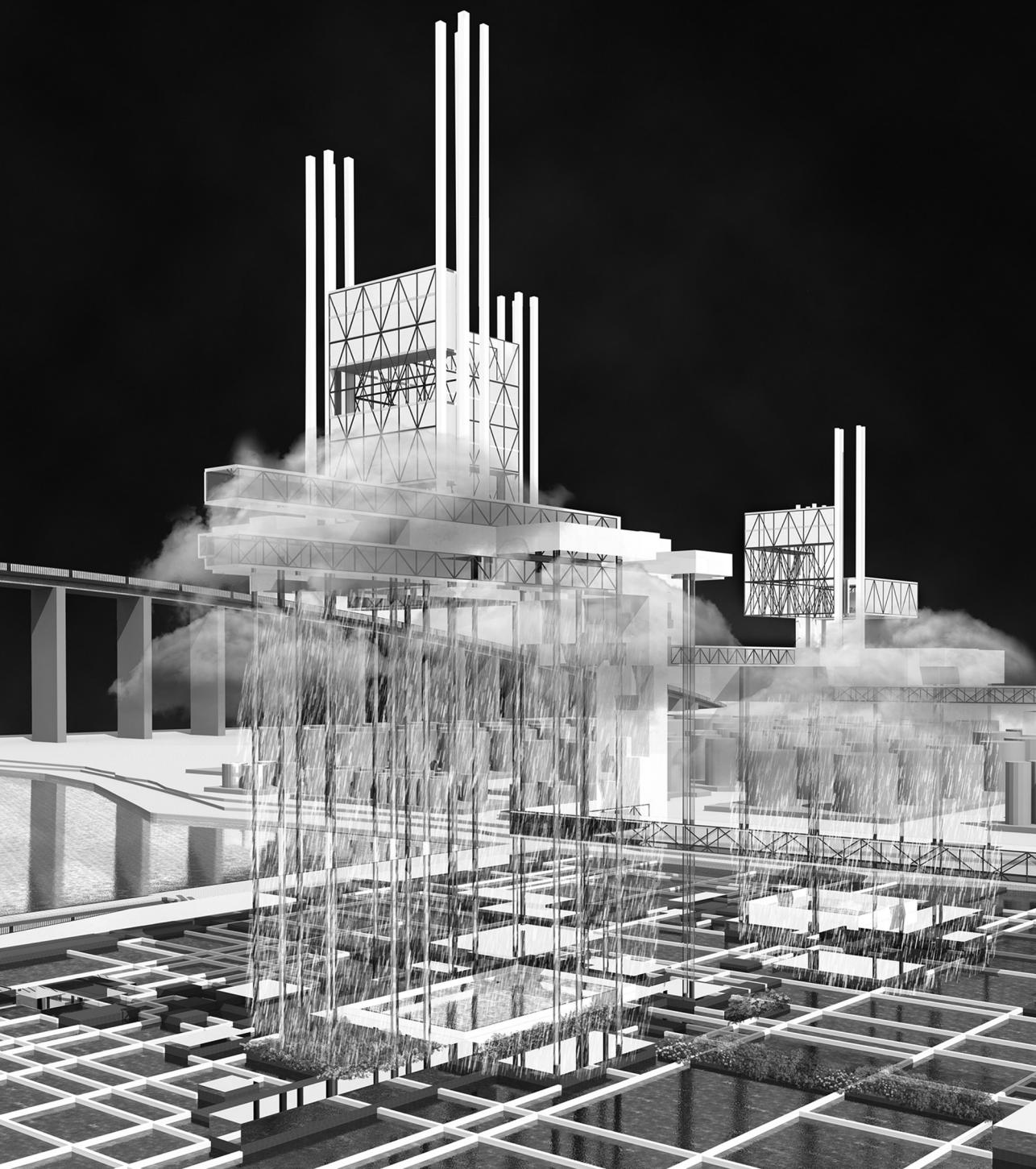
my proposal of a floating city.

Equally important are the case studies of Megastructures, which were proposed not only in Japan, but in many European countries, too. Megastructures were proposed to be capable of unlimited extension, designed as a framework to support small units which could be 'plugged-in'. The most valuable case studies, such as Plug-In City project (Peter Cook of Archigram), Bridge towns and Ville Spatiale (Yona Friedman) will be chosen to be studied as well as the previous ones through the visually-based studies' methodology and supported with literature reviews.

When the historical overview and research, which is also based on visional representation, is completed, it might be concluded from that stage and speculated what ideas are still actual and useful, and can be borrowed from Metabolism and Megastructures movements and be applied for modern cities and the cities of the Future, and which one become pointless after 50 years. This diagram is a draft that represents what characteristics of metabolism architecture can be useful for present, and probably, for the future, and which do not work. In addition, as a summary of the historical overview I will make a map of Metabolism and Megastructural proposals which will be a key map to all my case-studies, placing them in time and location.

Finally, the principles and strategies of sustainable eco-tech architecture should also been incorporated with the Neo-Metabolism movement of the future.

After gathering all the information above, I will have a set of principles for the Neo-Metabolism architecture which will find a reflection in my proposed design through drawings. As a conclusion I will also have an architectural game for my chosen site.



INTRODUCTION

Metabolism was an avant-garde movement in architecture and urban planning which flourished in Japan during the 1960s and sought to overcome the crisis of expanding modern cities after the Second World War. The members of the original Metabolist Group (Kisho Kurokawa, Fumihiko Maki, Masato Otaka, Kiyonori Kikutake, Noboru Kawazoe) proposed the principles of a dynamic city which were based on the ideas of constant renewal of human society. Metabolists offered a combination of two structures – stable core, such a tree trunk, and a system of cells, which could be moved and replaced, like the foliage. Metabolists named them different “metabolic cycles”, so-called “permanent” and “transient” elements. Urban infrastructures such as highways, harbours, and dams they defined as a “permanent”, while houses, shops and other small-scale constructions were defined as “transient” elements (Lin, 2010:102).

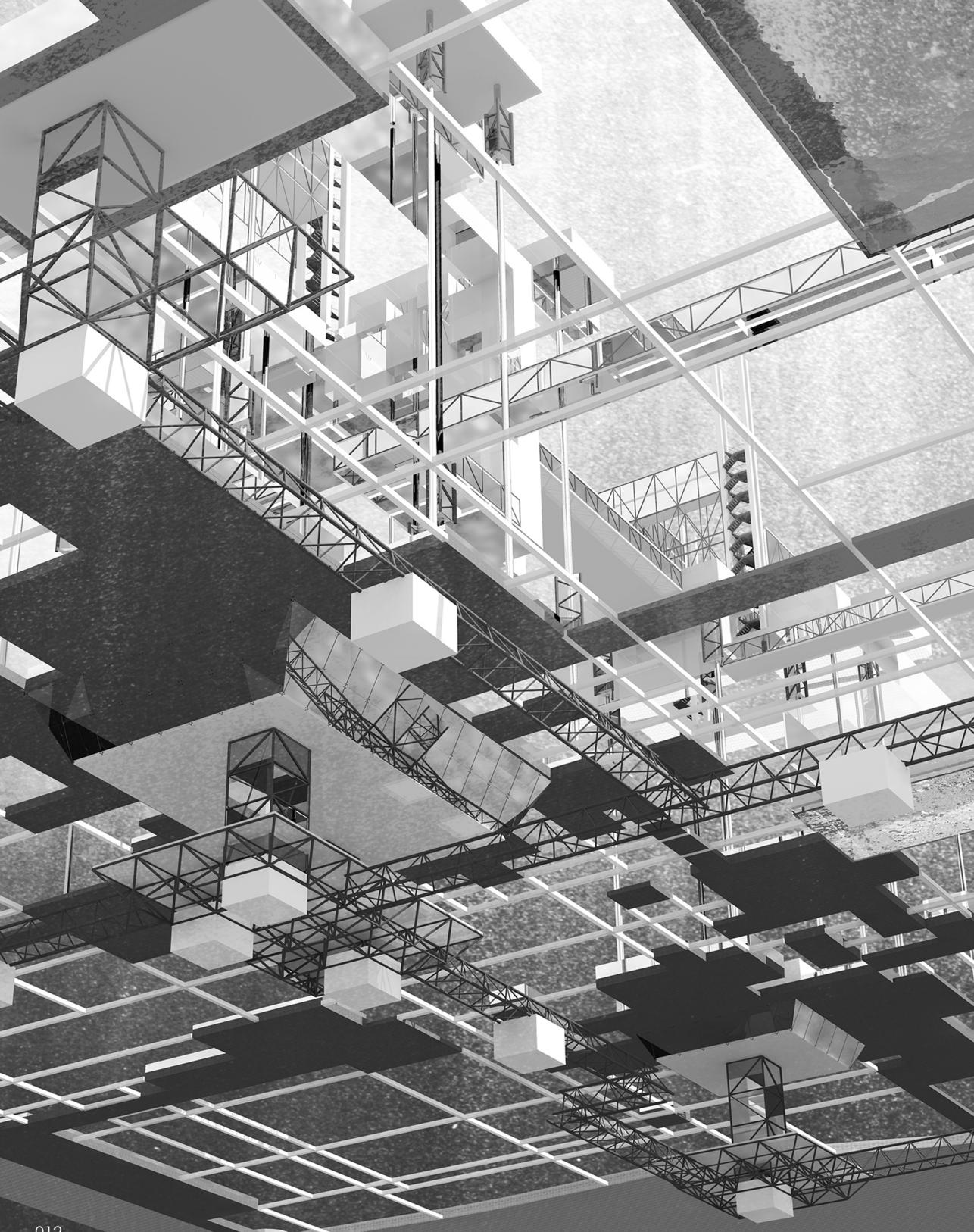
Metabolist proposals are primarily urban planning proposals, which presumed radical conversion of an urban environment. The key principle is the development of new urban spatial structures and the possibility of their transformation. Metabolist projects contributed to the expansion of a different point of view on the issues of spatial organization of the city, the logic of its emergence and development.

Metabolists were idealists and visionaries who proposed that future cities could be constructed using the modern technologies which at the time offered seemingly unlimited possibilities.

Their aim was to create a utopian vision through architecture that would create a better life and improve everyday reality (Lin, 2010: 26).

Japanese architecture and culture share a different worldview to western culture. This paper is an opportunity and attempt for me to understand better Japanese architectural tradition by exploring similarities and differences with Western tradition, such as in the way the concepts of the soul and nature are understood.

Metabolism has a strong historical and theoretical background. As described by Kenzo Tange and Noboru Kawazoe in publication



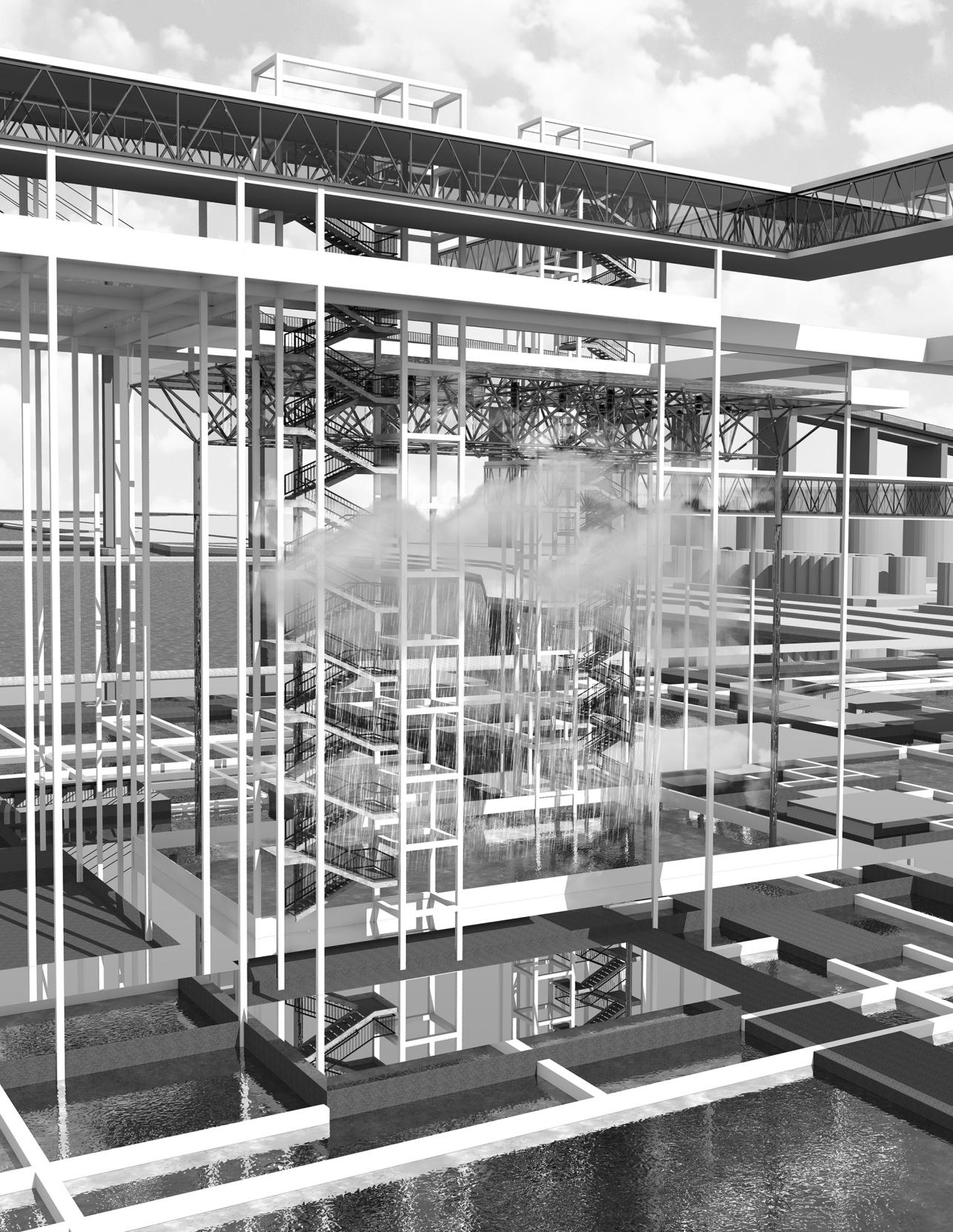
"Ise: Prototype of Japanese Architecture" all the subsequent architecture of Japan have its roots in Shinto Shrines architecture, and Metabolism is not an exception.

So, what is the city of the Future? The question that Metabolists were fascinated by and an issue that concerns science fiction writers, architects and engineers throughout the 20th century. However, projects for the cities of the future which were proposed during 20th century in the schemes of Metabolist architects or other avant-garde architects' schemes such as Megastuctures etc. with their utopian, futuristic spatial structures hovering over the cities, or expanding floating cities were much more enthusiastic in comparison to the vision of the future cities today. And I find it quite paradoxically – they did not have the technologies and materials that we have now and in spite of this proposed so revolutionary projects. Today we changed from modernist vision to the vision of "green cities" and "smart cities".

Now, in the 21st century, we have all the advanced building technologies and materials, and have strong reasons for finding new solutions for expanding cities and overpopulation issues, the variety of proposed ideas and architectural concepts do not provide a vision for a better life in the cities of the future. In my opinion, most of the modern visions of the future of our megacities look just like digital shots from a science-fiction film or a computer game rather than a manifesto or a new proposal for the city of the future. Metabolist architects and architects of movements with Megastuctural urban vision were obsessed and united with their common ideas about future. Today we do not have such a global movement which cares about future of our megacities, but we do have lots of issues to solve. Architecture can become boring, a strong feature of that is a loss of interest to the architecture among society. Today it is hard to find someone (not specialist in architecture or design), who can identify modern architectural movements; normally it is seen only as "concrete" or "glass" architecture. That is why I suggest rethinking and reinterpreting Metabolists and Megastucturs ideas by incorporating them with modern issues such as sustainability and ecology. Together this can be seen as Neo-metabolism.

Thesis in brief

Chapter one starts with a literature search on the roots of modern

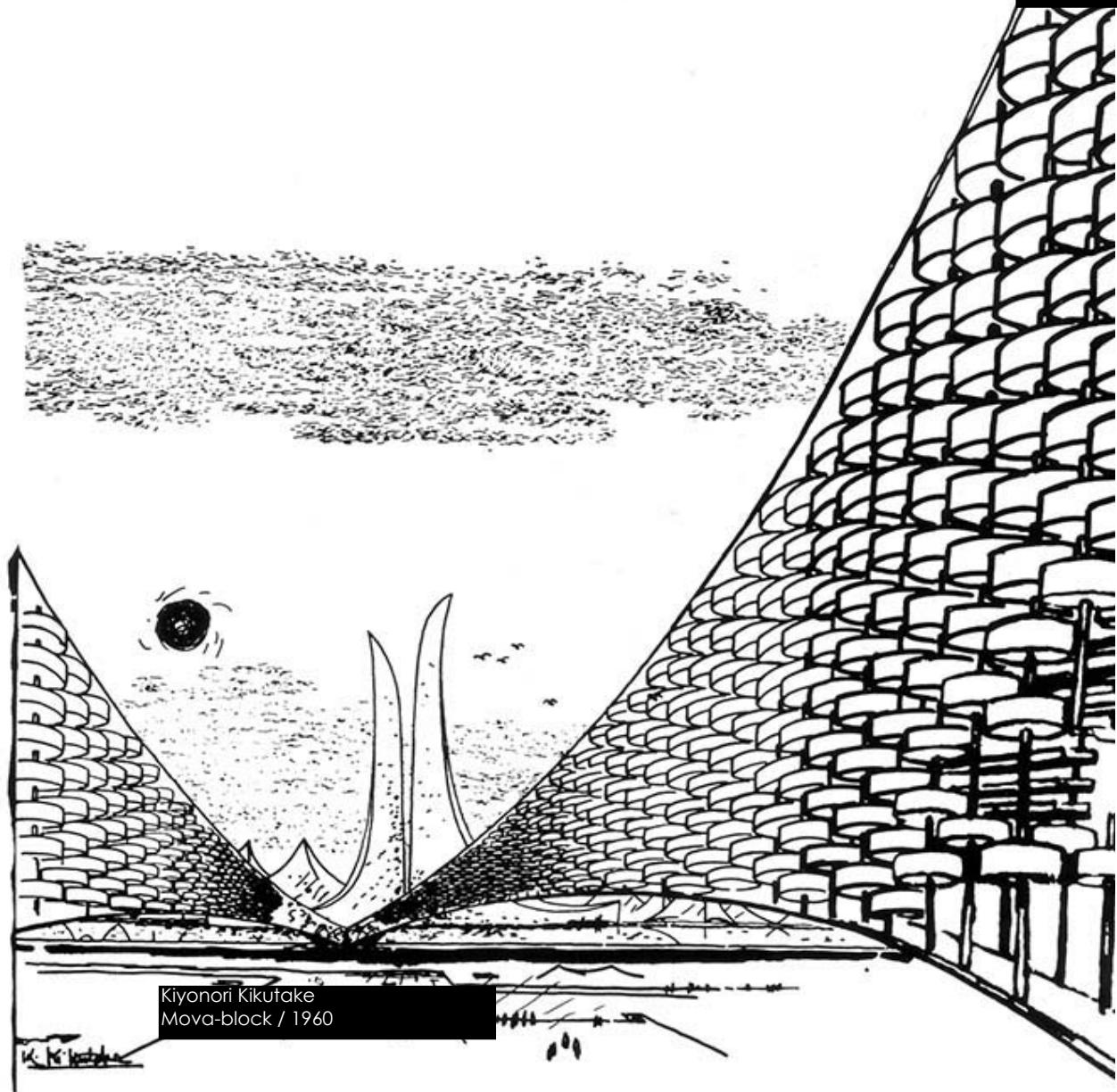
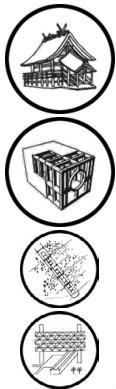


Japanese architectural tradition that shows the connection between traditional Shinto shrines architecture and avant-garde Japanese architecture. It continues with analysis of the proposals which were presented in the main Metabolism publication (manifesto) – “Metabolism/1960: The proposals for new urbanism”. These studies are necessary for identification of metabolic elements and dividing them into elements of “current interest” and “obsolete”. Further I compare Metabolism with Brutalism and Biomimicry to define ideological and visual similarities with western movements. Besides, Biomimicry is a contemporary movement, but it is used only in architecture. As a summary, I give my first vision of Neo-metabolism urban design principles which is a combination of “old” metabolism principles with “new” biomimetic principles.

Chapter two describes challenges for megacities which are mainly connected with rapid growth of world population and urbanization, in particular. Among number of issues the ones connected with urban planning and transportation structures are obviously the most disturbing for architects. As a consequence, I go back to literature search on Metabolism schemes, but this time I analyse specifically the ones which were proposed as a result and solution for the challenge of overpopulation and poor transportation system. These analyses lead me to the second iteration of what Neo-metabolism in the west is and how it is presented in contemporary utopian proposals for London.

Chapter three gives a literature search on another avant-garde vision concerned on the urban design – Megastuctures. As well as Metabolism Megastuctural vision emerged in 1960s but in the West. After analysing several case-studies in the same way as in chapter one I conclude with dividing megastructural elements into elements of “current interest” and “obsolete”. Also, this chapter describes modern technologies and options for constructing contemporary megastuctures.

In my conclusion I give a full vision to Neo-metabolism making it a new modernism movement which is constructed with demand in new infrastructure and combination with biomimetic principles, and it also uses the latest technologies to make the architecture and urban design of our megacities be sustainable and environmentally friendly.





CHAPTER 1

LITERATURE SEARCH

Japanese tradition of impermanence in architecture

Japanese modern architecture as a phenomenon in the history of the world architecture emerged quite recently - after the Second World War. Before, it was absolutely isolated traditional architecture, which did not have any relations and links to the Western tradition. However, modernization of architecture in Japan had never occurred in the same way as it occurred in Western countries, where the ideas of International style simply replaced cultural traditions of each country. Apparently, one of the reasons can be the aspiration to save the national dignity and identity, despite the fact of defeat in the war and the collapse of the empire. This aspiration to the national identity had a reflection in the whole culture and architecture as well. Instead of copying and imitation of the Western modern architecture, Japanese architects found a unique way in which they combined the adopted advanced building technologies of the West with secular traditions in designing traditional spaces, and with the interaction of the architecture and nature, and all the above they did with a reverent attitude to the historical and cultural heritage. In fact, Japanese architects borrowed

"only the techniques and external forms of the industrial civilization of the West, without understanding its spiritual background."

(Kawazoe, 1973:19)

The year 1960 was the most important in the developing of Japanese Modern Architecture. It was both the year when the Tokyo Bay plan by Kenzo Tange was proposed and the year when five young architects published avant-garde manifesto entitled Metabolism 1960 (Ross, 1978:23), which is the main subject of my research. But if the Modern Japanese architecture is also based on traditions, where are the roots of Metabolism in traditional Japanese architecture?

Probably, ideas of Shinto Shrines architecture and, in particular, unity of artificial and natural environment, architectural openness for further development and transformations - these are the characteristics which become primary in formation of Metabolism



Kenzo Tange
"Tokyo Bay Plan"

Arata Isozaki
"Clusters in the Air"

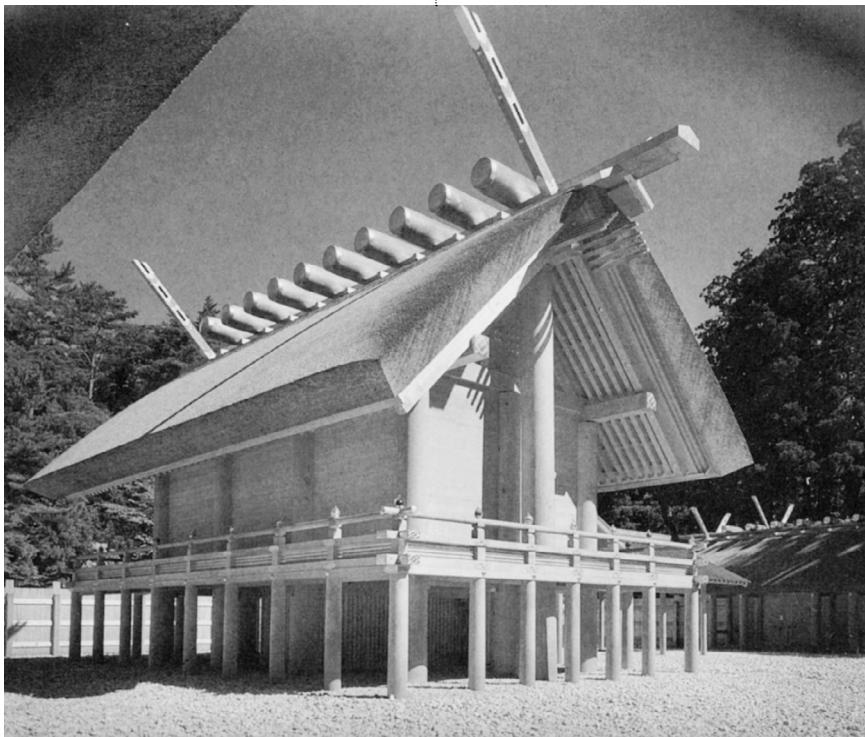
The Metabolist Group

Noriaki Kurokawa
"Space City"

Kiyonori Kikutake
"Space City"

Masato Otaka/Fumiko Maki
"Toward group form"

Noboru Kawazoe
"Material and man"



Shinto Shrine at Ise

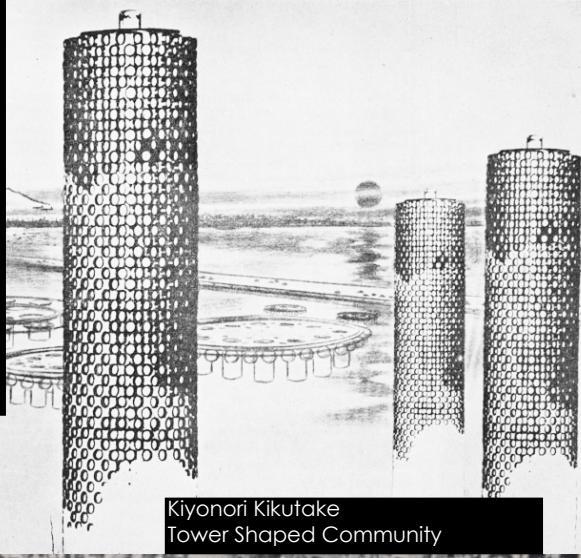
architecture. Among other shrines Shinto shrines at Ise had a special influence on the Metabolism architecture. What make them different and well known worldwide is the fact that they are rebuilt every 20 years since 690 CE and up to date as a part of the Shinto belief of the death and renewal of nature and the impermanence of all things, so that these shrines can be at the same time forever new and forever ancient. The history of this tradition is connected with the emperor Sujin who determined that the sun goddess was too powerful to be set just in one place, and that it should be moved (Reynolds, 2008: 316). In 1965 Kenzo Tange and Kawazoe Noboru in their publication "Ise: Prototype of Japanese Architecture" talked about the significant role of Ise shrines on the formation of all the subsequent Japanese architecture.

"The entire later course of Japanese architecture starts at Ise. The use of natural materials in a natural way, the sensitivity to structural proportion, the feeling for space arrangement, especially the tradition of harmony between architecture and nature, all originated here"

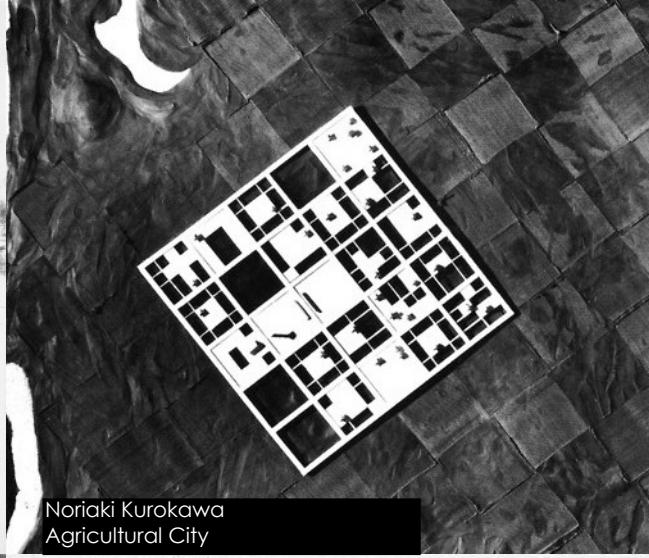
Kenzo Tange (Reynolds, 2008: 328)

As Kawazoe noticed, Ise was an example of Japanese tradition to monumentalize the building without preservation of its original form (Reynolds, 2008: 331). Perhaps, the principle of impermanence in Metabolism architecture which is one of the key principles is also borrowed from Ise architecture.





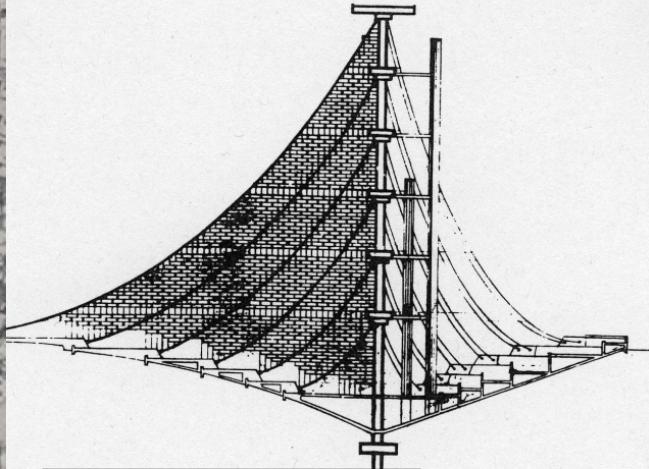
Kiyonori Kikutake
Tower Shaped Community



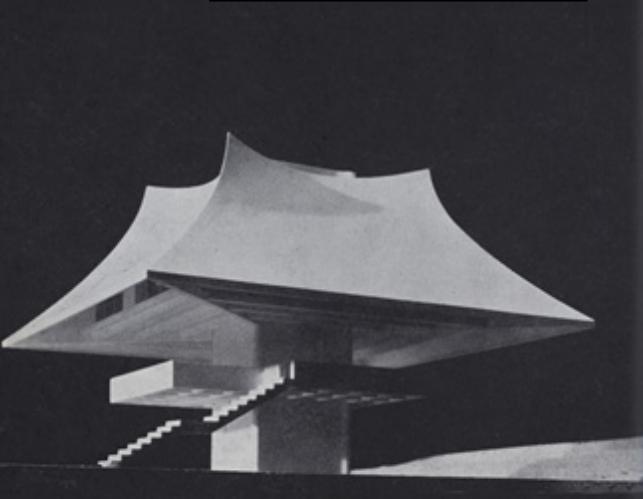
Noriaki Kurokawa
Agricultural City



Noriaki Kurokawa
Shopping town



Kiyonori Kikutake
Project Unabara



Noriaki Kurokawa
Mushroom-shaped house



Kiyonori Kikutake
Sky house

First Metabolist group members' proposals

The Metabolism movement originated with the manifesto "Metabolism/1960: The Proposals for new urbanism" which started with the words:

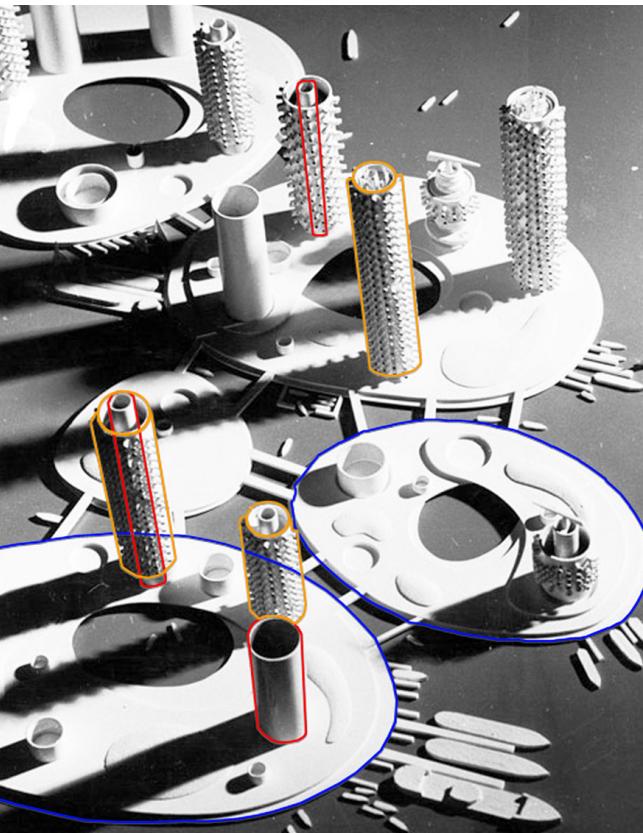
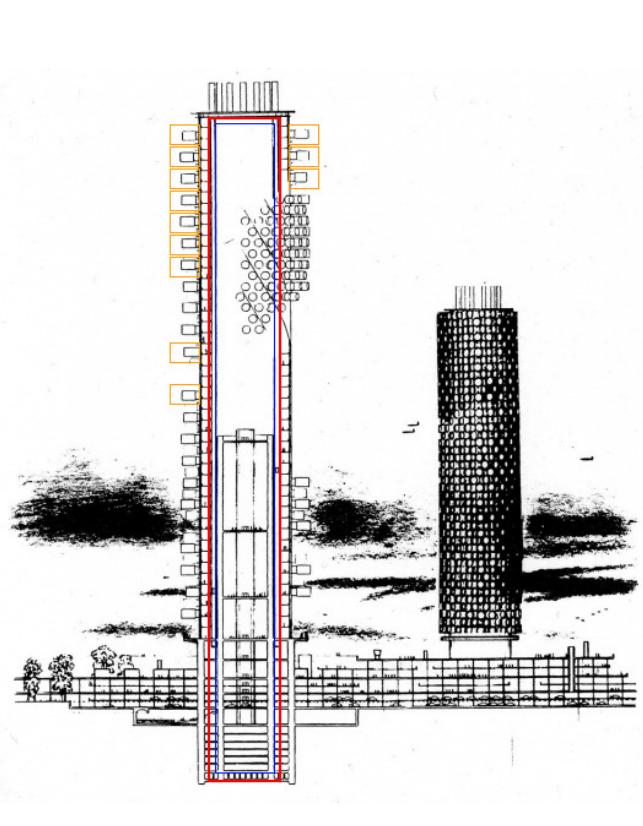
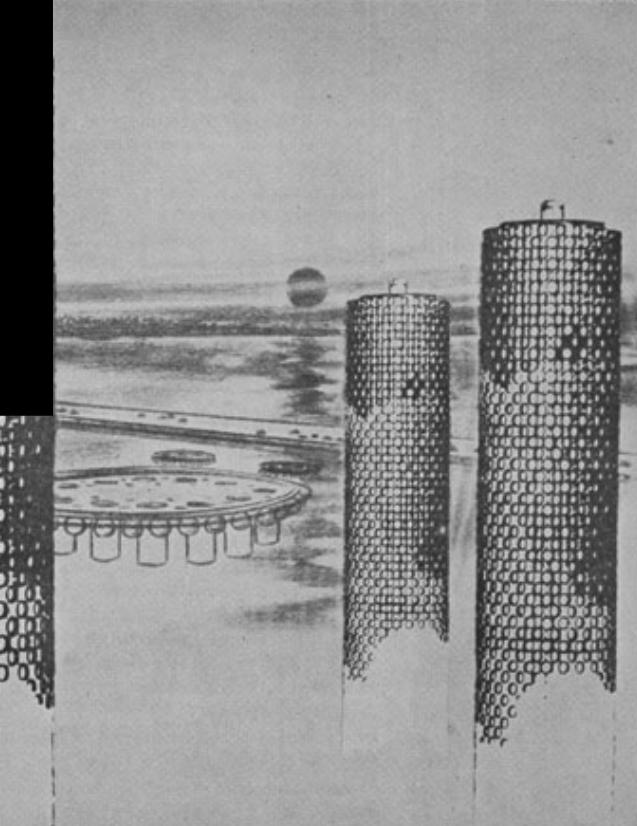
"'Metabolism' is the name of the group, in which each member proposes future designs of our coming world through his concrete designs and illustrations. We regard human society as a vital process – a continuous development from atom to nebula. The reason why we use such a biological word, metabolism, is that we believe design and technology should be a denotation of human vitality..."

Noboru Kawazoe

The manifesto consisted of four parts:

1. Kiyonori Kikutake – Ocean City (combination of "Tower-shaped City" and "Marine City")
2. Noboru Kawazoe – Material and man
3. Fumihiko Maki, Masato Otaka – Toward group form
4. Noriaki Kurokawa – Space city ("Agricultural City", "Mushroom-shaped house", "Urban design for New Tokyo", "Wall City").





Tower-shaped City / 1958
Marine City / Ocean City / 1959

Kiyonori Kikutake

“Tower-shaped City”

Key facts

Year: 1958

Location: Japan, no certain location

Number of units: 1 250

Number of residents: 5 000

The “major structure” was presented as a 300 meter tall concrete cylinder, which Kikutake named vertical artificial “land”. The “land” was meant to be attached with individual dwellings (“minor structure”) (Lin, 2010: 25-26). So, the main Metabolist elements for this project were: joint core (red on the images), capsules (yellow) and artificial ground (blue).

“Marine City”

Key facts

Year: 1959

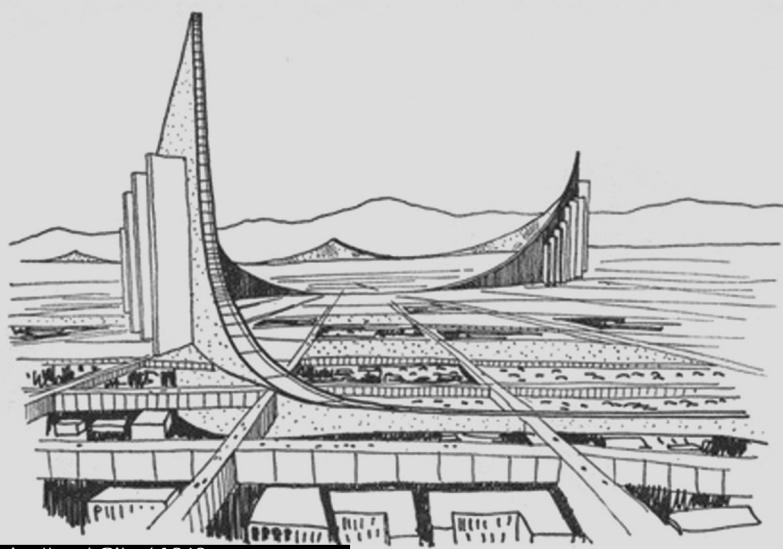
Location: Japan's Pacific coast

Number of residents: 500 000

Had the form of a floating city. It was designed to overcome the problem of overpopulation on the land. It has its own life cycle and when it became unsuitable for living it could move away and sink itself (Koolhaas, Obrist, 2011: 354, 356). The main Metabolist elements for the project were: artificial ground (blue) and floating city.

Combining and developing these two projects Kikutake proposed a new scheme “Ocean City”, where he connected all the Metabolist elements: floating city, artificial land, joint core and capsules.





Agricultural City / 1960
Wall City / 1959

Noriaki Kurokawa

“Agricultural City”

Key facts

Year: 1960

Location: Japan, no certain location

Area: 250 000 sqm.

Number of residents: 2 000

Was based on the ideas that agriculture as a means of production should be integrated with the structure of a modern city. It was raised four meters above the ground, so that the natural land was reserved for agricultural production (Lin, 2010: 30). Besides, raised land allowed life to exist safely even during the floods (Koolhaas, Obrist, 2011: 341). The main Metabolist element here is the artificial land (blue on the images). The city is designed as a megastructure.

“Wall City”

Key facts

Year: 1959

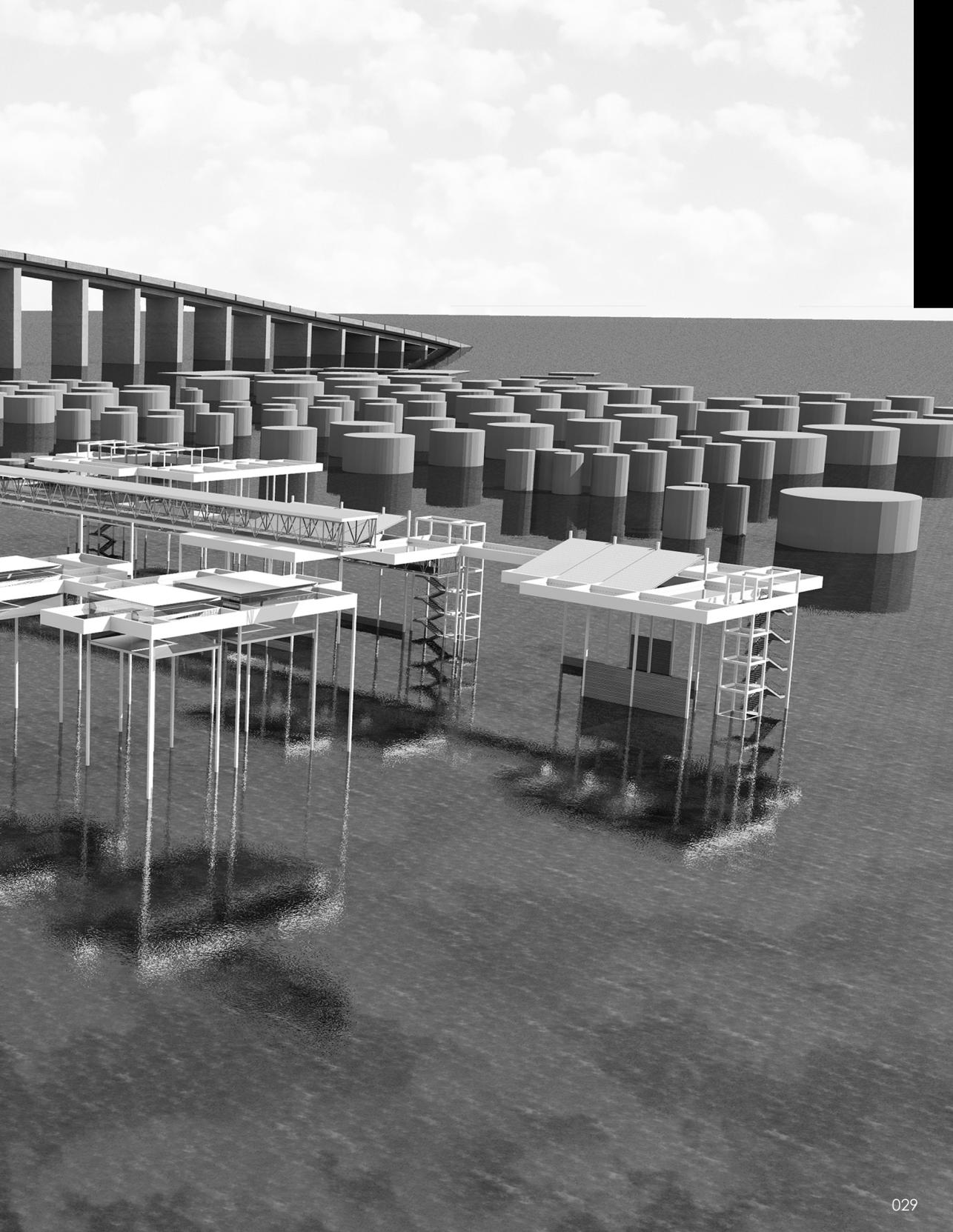
Location: Japan, no certain location

Was based on Le Corbusier theory of four spaces – a place to live, a place to work, a place for recreation and transportation. In his “Wall City” Kurokawa used the wall to divide living units, which will be plugged on the one side of the wall, from the factories and offices on the other side (Metabolism: Proposals for a new urbanism, 1960: 54). In this scheme Metabolism elements are: artificial ground, joint core (which is the wall in this project), capsules/units. It is designed as a megastructure.

“Agricultural city” with its idea of raising the city to protect it from flood leads me to this vision of a flooded city (pp.28-29)









Kiyonori Kikutake
Sofitel Tokio / 1994



Noriaki Kurokawa
Sony Tower in Osaka / 1976



Noriaki Kurokawa
Nakagin Capsule Tower / 1972



Summary

The listed projects from their first manifesto were more just speculation utopias rather than projects which were meant to be realized. But the metabolism elements from these urban theories later influenced on the design and construction of metabolism buildings. For instance, both the Sofitel Tokyo (1994) by Kiyonori Kikutake and the Sony Tower in Osaka (1976) by Kisho Kurokawa were demolished in 2007 and 2006 respectively. It shows that the concept of movable units which can be replaced with the times did not work. Another example is the Nakagin Capsule Tower (Kurokawa), as it was the clearest example of all the metabolism urban theories ideas which were applied on one single building. And even this building "is scheduled to be demolished" (Lin, 2010: 233).

Consequently, no one of these three building had used its ability to renew itself, it means that the metabolism elements which are the core and the units with different lifespans (for instance for the Nakagin Capsule Tower the core were designed to last sixty years and the units - for twenty-five years), in fact, lasted for the same period of time. This fact makes me to identify replaceable units as "obsolete" and not relevant to contemporary Neo-metabolism theory. But the fact that they did not work within the scale of a single building does not mean that the idea will fail on an urban scale, where core is seen as an infrastructure and individual buildings are the transient elements.

To sum up – from the very first metabolism proposals such elements as artificial ground, floating cities are in the category of "current interest" for Neo-metabolism, as they did not lose their topicality and are relevant for our expanding cities due to lack of space, while the concept of a joint core with prefabricated units is "obsolete", as it was tested and the idea failed.

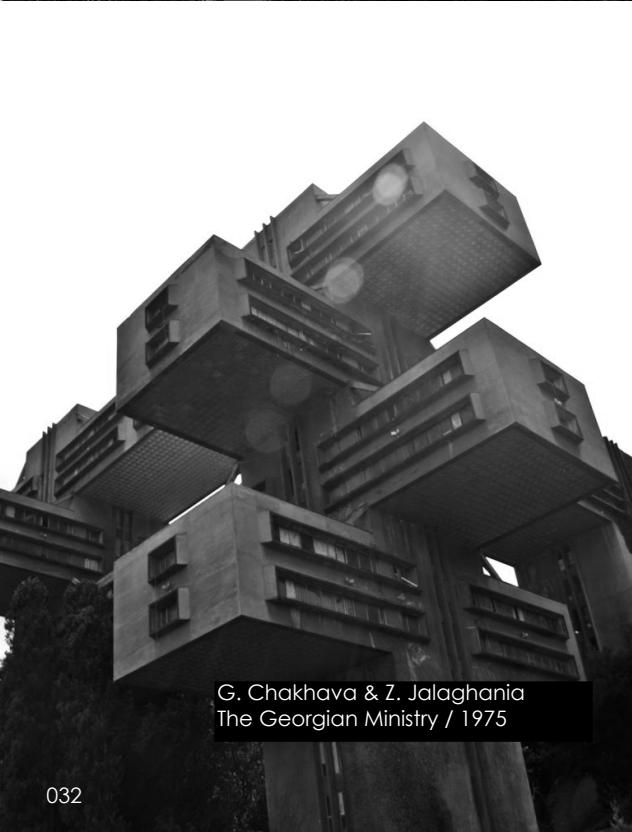




Ernő Goldfinger
Trellick Tower / 1972



P. Brívio
Mixed Use Building / 1960



G. Chakhava & Z. Jalaghania
The Georgian Ministry / 1975



Hayward Gallery, South Bank /
1961-67

NEO-METABOLISM – IS IT A KIND OF BRUTALISM WITH BIOLOGICAL COMPONENT? COMPARISON BETWEEN METABOLISM, BRUTALISM AND BIOMIMETIC ARCHITECTURE

To understand better whether metabolism has any similarities with Western modernism movements and contemporary architectural movements, I compare metabolism with brutalism and biomimicry.

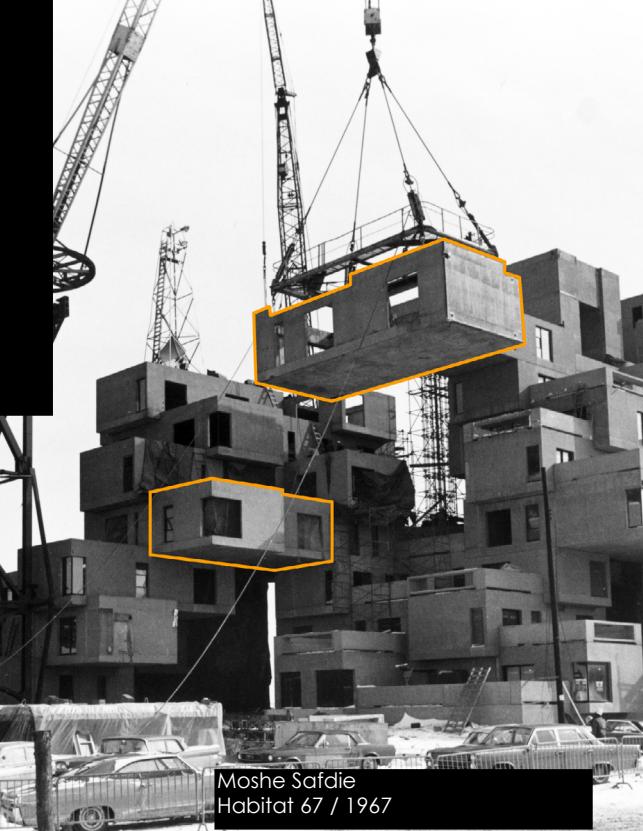
Metabolism and Brutalism

Metabolism as a movement did not extend to the West; however, we can see some similarities in the shapes of Brutalism movement. Emergence of Brutalism is connected with the names of Alison and Peter Smithson who first used the term in 1953 to describe the architecture which was designed to be unadorned (Clement, 2011: 18).

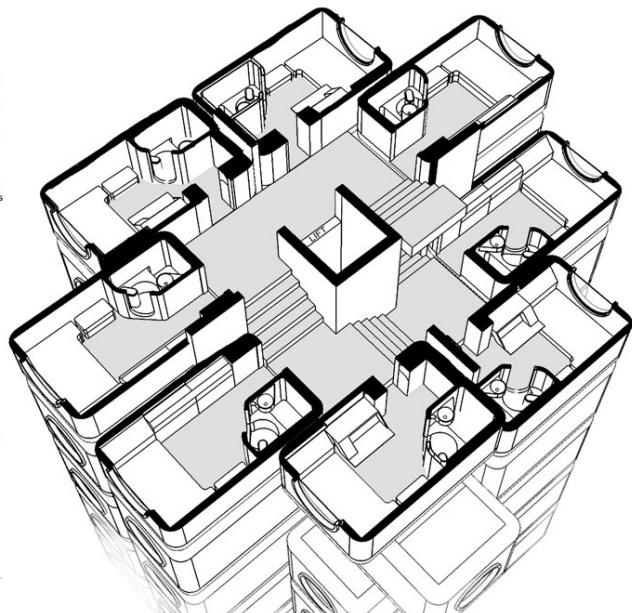
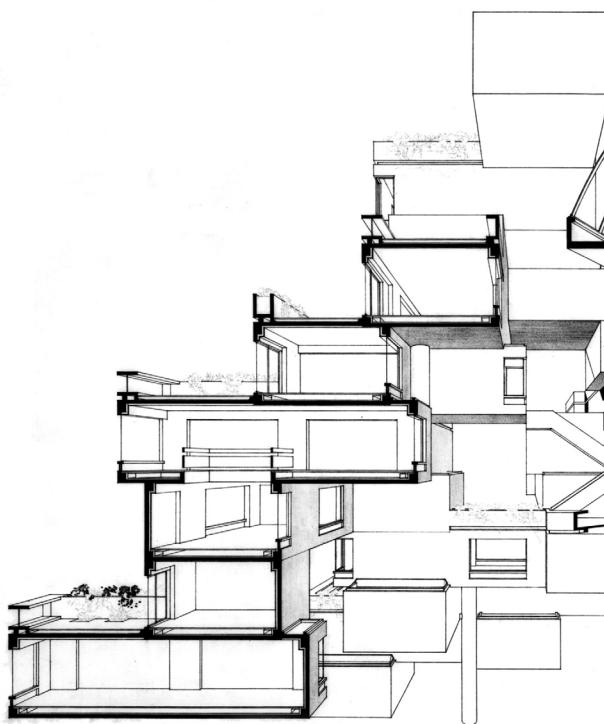
As well as the Metabolism movement in Japan Brutalism in the West was born in the age of dramatic contradictions as a post-war Modernism movement which aimed to developed mass social housing needed after the war.

Brutalism is characterised with repetitive angular geometries, formed mostly from concrete and usually have a rough, blocky appearance (*Brutalism architecture* [Online], Available: <http://goo.gl/KRIOhU>).





Moshe Safdie
Habitat 67 / 1967



Noriaki Kurokawa
Nakagin Capsule Tower / 1972



Brutalism and Metabolism visual comparison

1. Habitat 67 and Nakagin Capsule Tower

Habitat 67

Key facts

Architect: Moshe Safdie

Year: 1967

Location: Montreal, Canada

Number of modules: 354

Number of residential units: 158

Nakagin Capsule Tower

Key facts

Architect: Kisho Kurokawa

Year: 1972

Location: Tokyo, Japan

Number of residential units: 140

From an overall perspective, they seem to be very similar - both of the residential buildings were designed as experimental solutions for high-quality housing for a better life in the dense urban areas approximately in the same time (1967 and 1972), both were constructed with prefabricated modular units for a lower cost (*Habitat 67* [Online], Available: <http://goo.gl/YaE7NY>). However, the significant difference is in philosophy - the first one of Brutalism style was not meant to be a living organism, it did not follow the main Metabolist principle of impermanence and was not designed with a "transient" and "permanent" structure.





Denys Lasdun
University of East Anglia / 1962-68

2. University of East Anglia

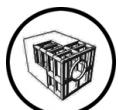
Key facts

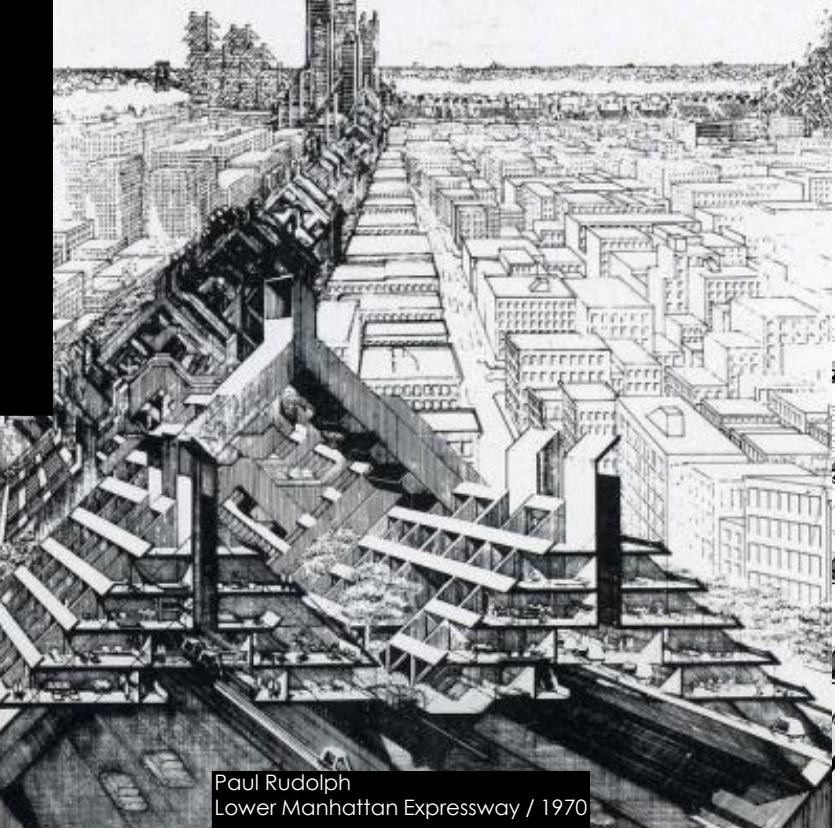
Architect: Denys Lasdun

Year: 1962-68

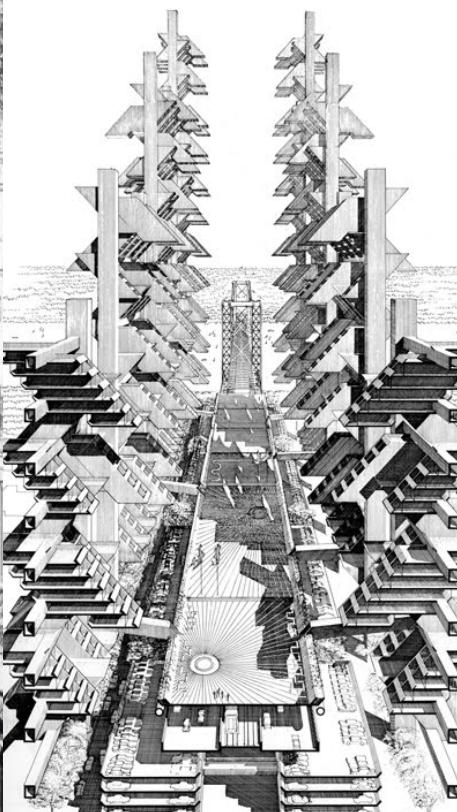
Location: Norwich, UK

Another example of Brutalism architecture where the building not only has similarities with Metabolism in shapes, but it follows the Metabolism concept of "transient" and "permanent". Megastructural university building was built with "permanent" teaching and administrative facilities in the centre of the composition (red on the image), and with "transient" student housings in a zig-zag form (yellow) (Banham, 1976: 131, 132).





Paul Rudolph
Lower Manhattan Expressway / 1970



Kiyonori Kikutake
Stratiform structural module / 1977



3. Lower Manhattan Expressway project and Stratiform structural module

Lower Manhattan Expressway project

Key facts

Architect: Paul Rudolph

Year: 1970

Location: New-York, USA

Stratiform structural module

Key facts

Architects: Kiyonori Kikutake

Year: 1977

Location: Japan, no certain location

Brutalist Paul Rudolph and Metabolism Kiyonori Kikutake have designed visually and ideologically very similar megastructural projects. The first one (Lower Manhattan Expressway project) was designed as a project of integration of the transportation system with a residential above (*Paul Rudolph's Lower Manhattan Expressway* [Online], Available: <http://goo.gl/vTqrTH>). Kikutake's Stratiform structural module was also designed as a megastructure supporting artificial ground platform on which individual residential houses could be plugged-in. The modules were possible to build over the existing railways, roads, and dense urban areas. With the rules of biological cycle Stratiform structural module was flexible and easy dismantles, besides, all the materials could be reused (Koolhaas, Obrist, 2011: 345, 669).

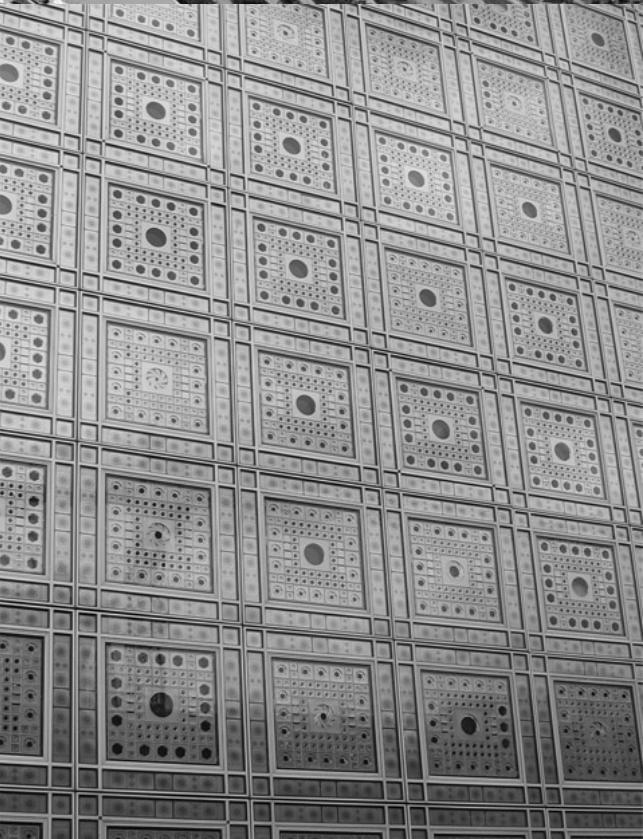




Grimshaw Architects
The Eden project / 2000



Jean Nouvel
Institut du Monde Arabe / 1981-87



Biomimicry and Metabolism comparison

Biomimicry is a living architecture, main principle is sustainability, and forms are inspired by nature. As Gruber speculates (2011: 17), for biomimetic architecture plants are extremely important as a prototype models since they have some common problems like staying at one place. The same vision had the architects of Metabolism constructing the permanent structure of a building as a tree trunk.

"Without any doubt plants construct using the same principles as engineers, but their technologies are much finer and more perfect."

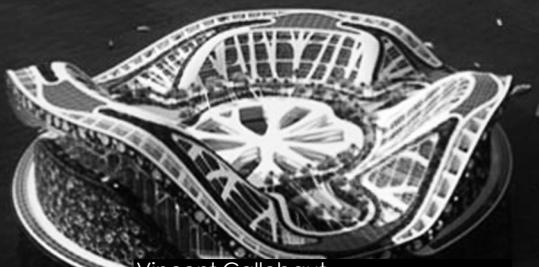
S. Schwendener (Gruber, 2011: 21)

Biomimicry in its philosophy applies to architecture all the principles and features which are common for nature – it imitates growth, evolution, openness, homeostasis and metabolism (Gruber, 2011: 124, 125, 156, 181).

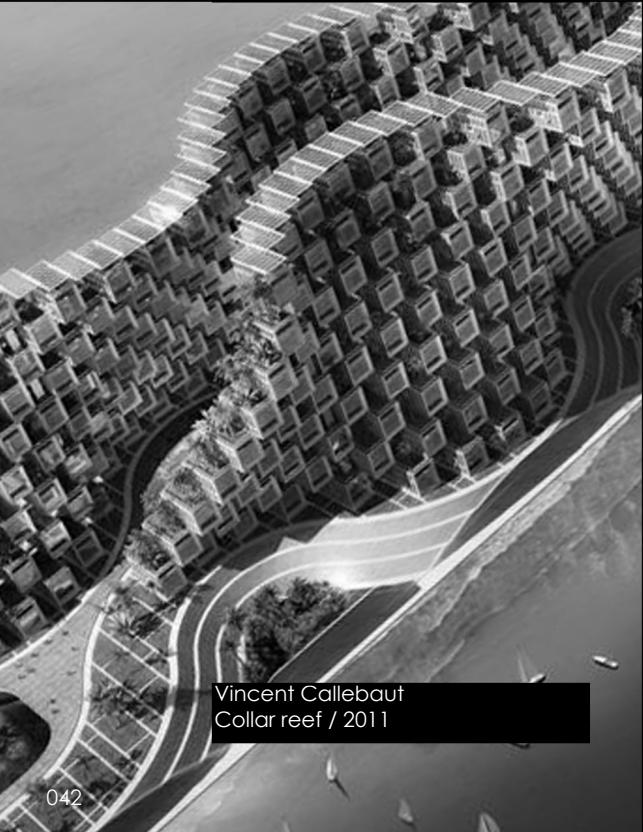
As well as plants in nature buildings should adapt to the natural forces, and adaptability and changeability is another principle of biomimetic architectures. Metabolists talking about changeability and flexibility meant only the opportunity of the cities and buildings to develop and be upgraded with the generation change and new human demands, on the contrary, biomimetic architecture talks about openness, changing and adaptation to everyday natural changes, such as the temperature or light to help save the energy (Gruber, 2011: 128). Jean Nouvel's Institut du Monde Arabe is an example of architecture which is open to everyday weather and light changes.

Generally speaking, comparison of Brutalism and Biomimicry shows that Brutalism is very similar to Metabolism visually and in its social and political aspects (which were the reasons for emergence of these two Modernist movements), while the philosophy is different. And conversely, Biomimetic architecture does not seem to have any visual similarities with Metabolism, but the research identified lots of common principles and the main is the vision of living architecture.





Vincent Callebaut
Lilypad / 2008



Vincent Callebaut
Collar reef / 2011



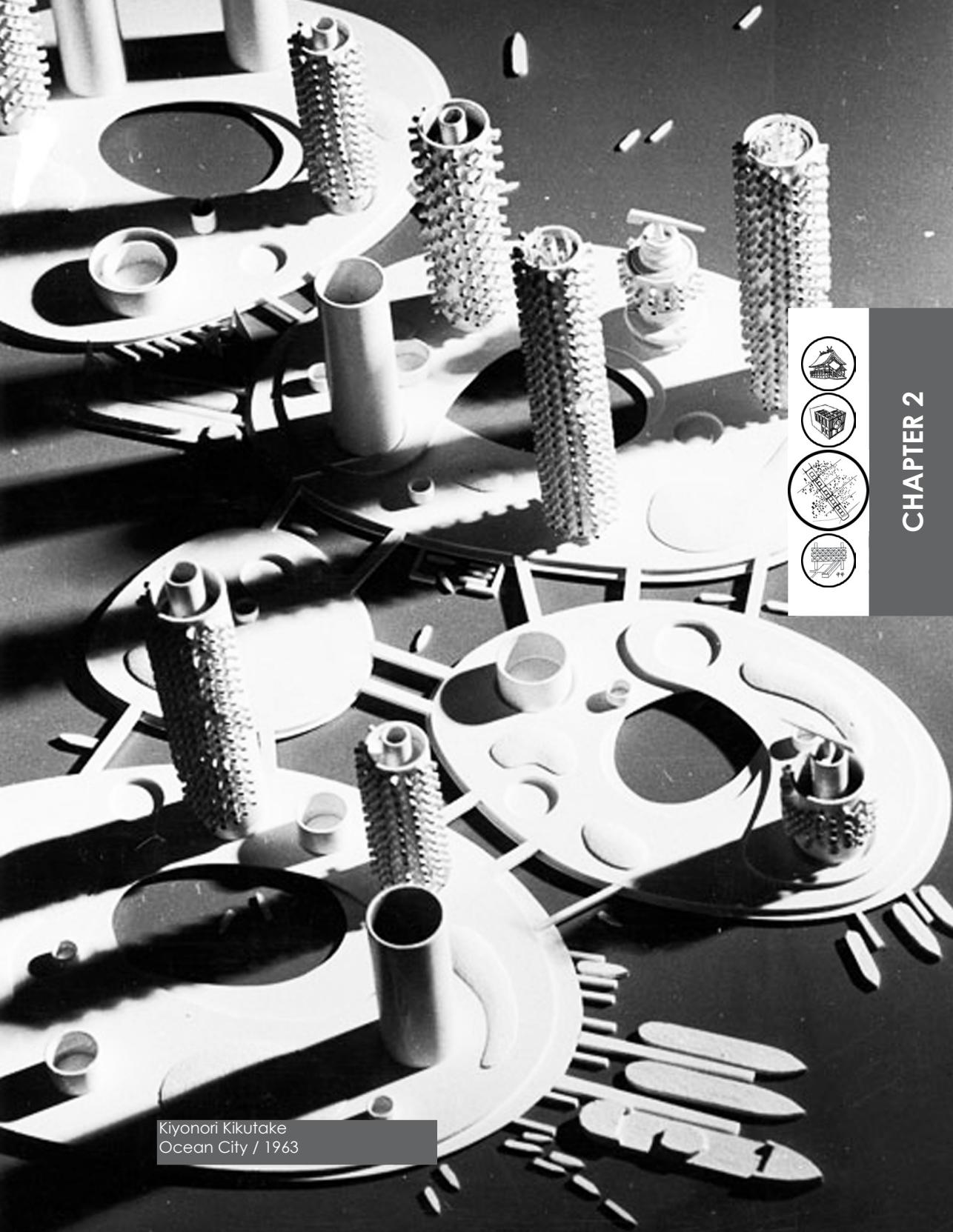
Vincent Callebaut
Dragonfly / 2009

Summary

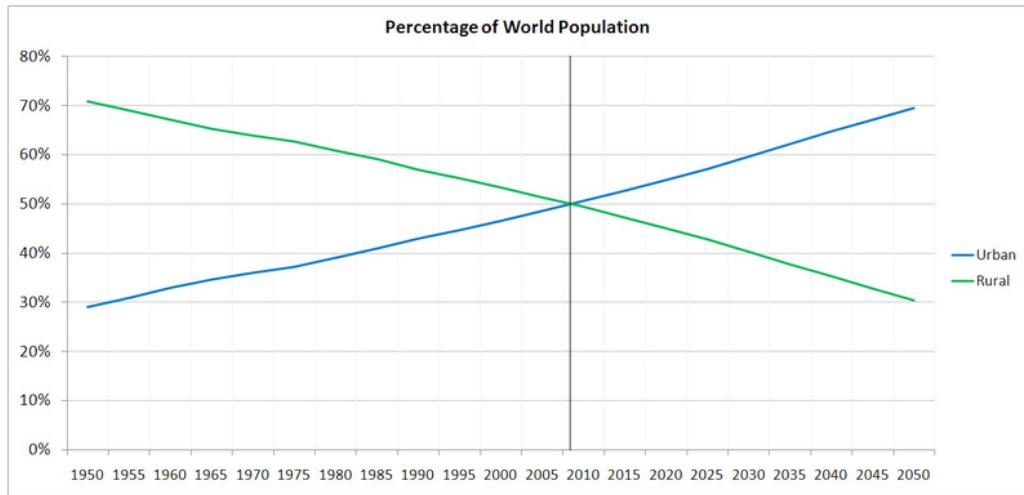
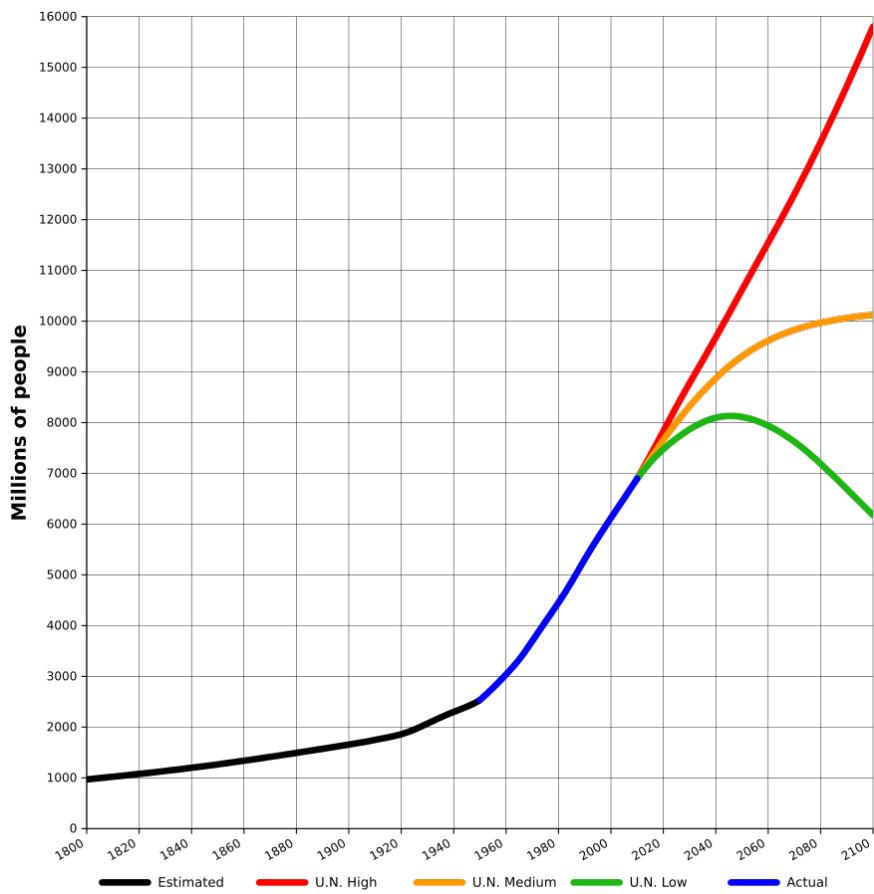
To summarize, my first vision of Neo-metabolism is integration of Metabolism principles with biomimetic principles and ideas. In biomimicry architects get inspiration from the nature and all the natural principles. For instance, the main source of energy used by nature is solar energy – architects tries to do the same, making buildings self-sufficient, or the form – in nature the form is always subordinated to its function, same are doing architects. So, I can assume that Neo-metabolism cities of the future, which combine for the first stage biomimicry and metabolism, can be seen as a complex self-sufficient ecological system. And as it is fully or partly self-sufficient there is no need to be tied to the ground, consequently, it can float. As an example, to my mind, some urban utopias by Vincent Callebaut (<http://goo.gl/Kulki6>) can be named contemporary Neo-metabolism, as they are proposed with all the biomimetic sustainable principles and with the idea to solve problems of predicted urban growth.



CHAPTER 2



Kiyonori Kikutake
Ocean City / 1963



CHAPTER 2

CHALLENGES FOR MEGACITIES

From 1804 to 2011 the world population grew from 1 billion to 7 billion and according to the most recent United Nations estimates, the highest - the world population may rise to 16 billion by 2100; according to the lowest estimate, it may decline to 6 billion. But the medium and more likely to happen is that the human population of the world is expected to reach 8 billion people in the spring of 2024, and 9 billion in 2040 ([Online], Available: <http://goo.gl/zPM8nF>).

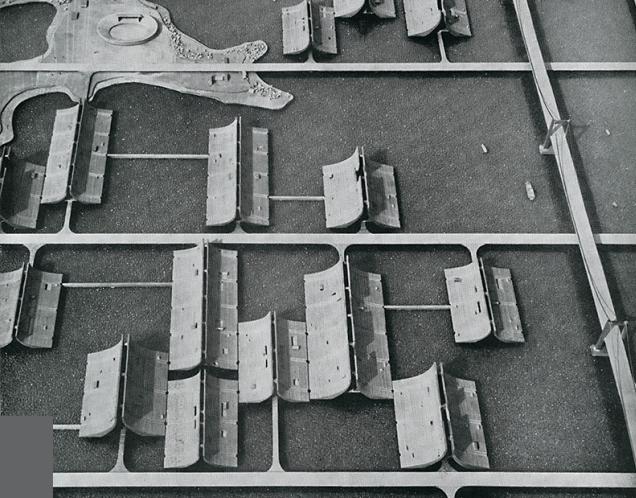
Identically, will increase urbanization, again, it is estimated by the United Nations Department of Economic and Social Affairs that the number of people living in cities will reach 4.6 billion by the year 2025 and 5.6 billion by 2040. For the United Kingdom the number of people living in urban areas will increase from 49 million in 2010 to 60 million in 2040 ([Online], Available: <http://goo.gl/wC401F>). It follows that the problems of megacities, big cities and expanding cities are now a pressing issue. Would we be able to provide accommodation for the future generations with the current structures of the cities?

It is obvious that the number of megacities' challenges is countless – here are economic problems and unemployment, social challenges, as with population increase living conditions will become poor, environmental challenges as the cities with larger number of inhabitants have bigger environmental impact, overpopulation, air and water pollution, decrease of green areas, infrastructural issues, etc. (*Megacity Challenges* [Online], Available: <http://goo.gl/RUFKF1>).

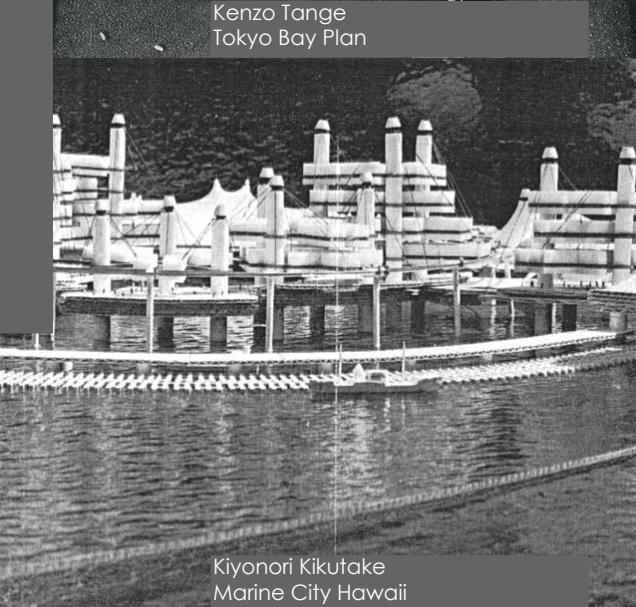
But as an architect I am most interested in the urban planning structure and transportation challenges. The population and city growth demand more mobility, for this reason transportation between cities and between outskirts of the cities and city centres should become faster.

In the research article “Megacity Challenges” megacities are divided into three major archetypes – emerging cities, transitional cities and mature cities. Emerging cities are least affected by the planning and transportation issues, while transitional and mature cities are affected with urban planning issues a lot

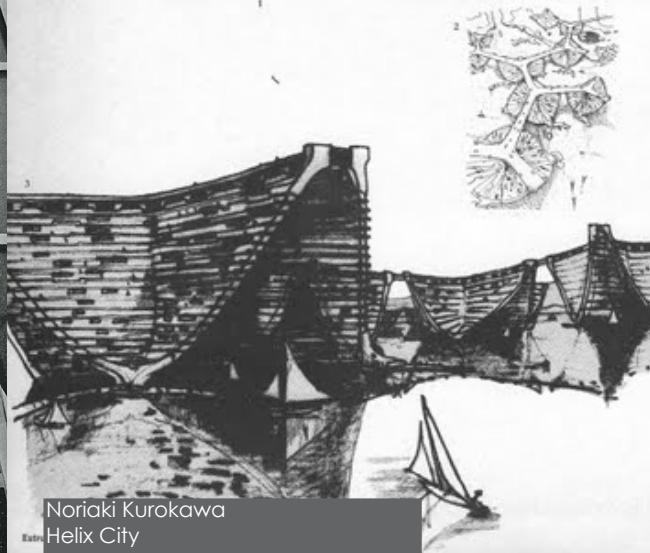




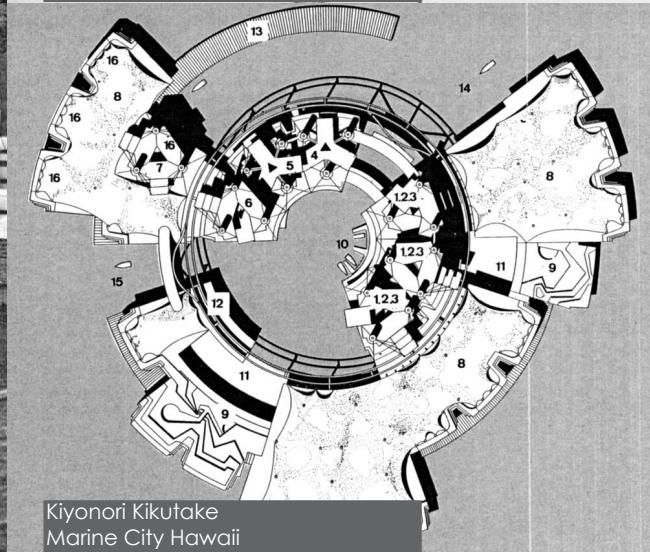
Kenzo Tange
Tokyo Bay Plan



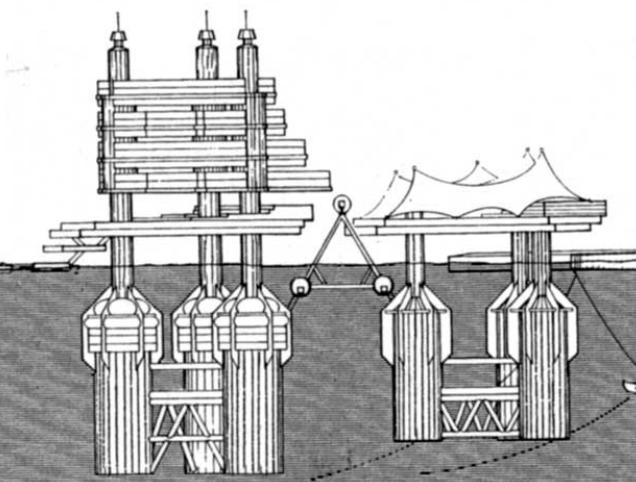
Kiyonori Kikutake
Marine City Hawaii



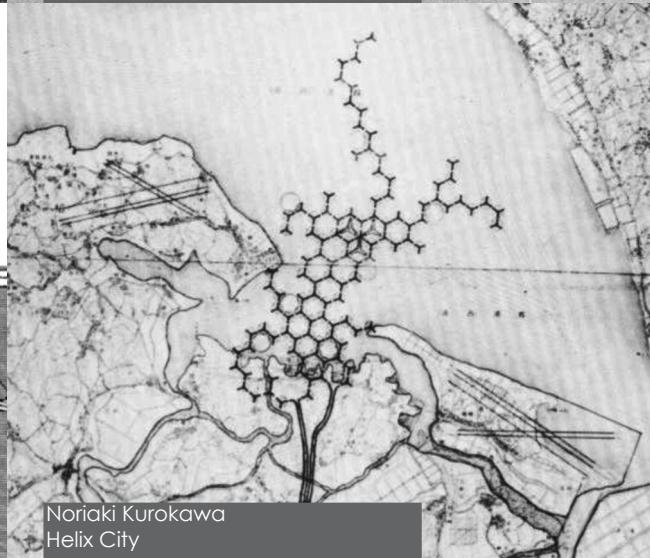
Noriaki Kurokawa
Helix City



Kiyonori Kikutake
Marine City Hawaii



Kiyonori Kikutake
Marine City Hawaii



Noriaki Kurokawa
Helix City

(Megacity Challenges [Online], Available: <http://goo.gl/RUFKF1>. Fast expansion of these cities demand new territories and upgraded transportation systems.

Faced with similar problems of a rapid population growth in 1960s in Japan (from 5.4 million in 1950 to 10 million in 1960) which caused lack of space and inefficient transportation system, Japanese architects proposed floating cities on artificial land and cities in the sky. The same principles with the capacity for renewal and "transient" and "permanent" elements were applied on an urban scale.

"Tokyo is expanding but there is no more land so we shall expand into the sea"
Kenzo Tange (Banham, 1976: 47)

FLOATING / AERIAL METROPOLISES

Case studies:

1. Tokyo Bay Plan (Kenzo Tange)
2. Helix city, Floating city, Floating factory (Kisho Kurokawa)
3. Floating cities (Kiyonori Kikutake)
4. Clusters in the Air (Arata Isozaki)





— Central spine - carries an elevated highway system,
spanned 30 kilometres over the sea

— Loops



New civic centre and port



Offices and public buildings



Residential

Kenzo Tange

Tokyo Bay Plan

Key facts:

Year: 1960

Location: Tokyo Bay, Japan

Number of residents: 5 million people

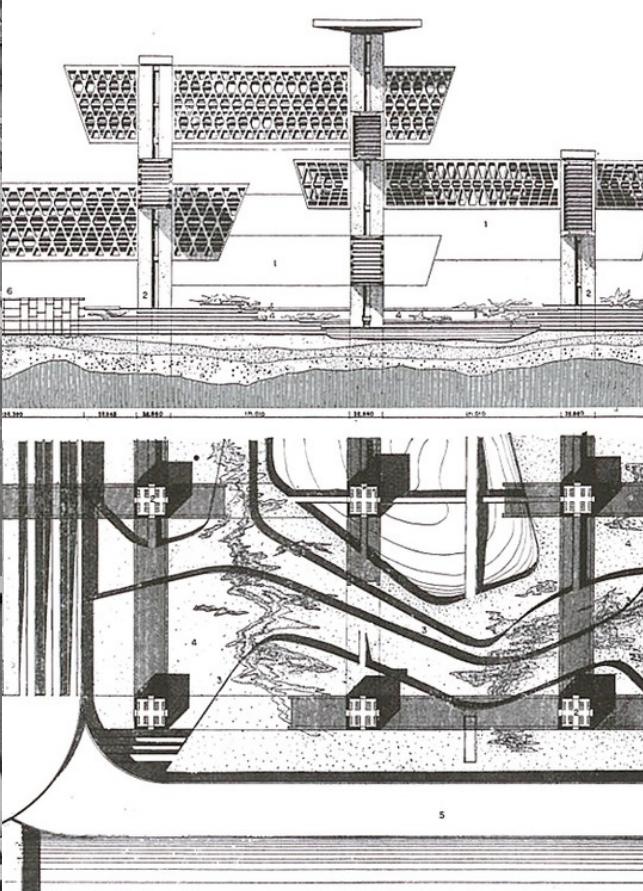
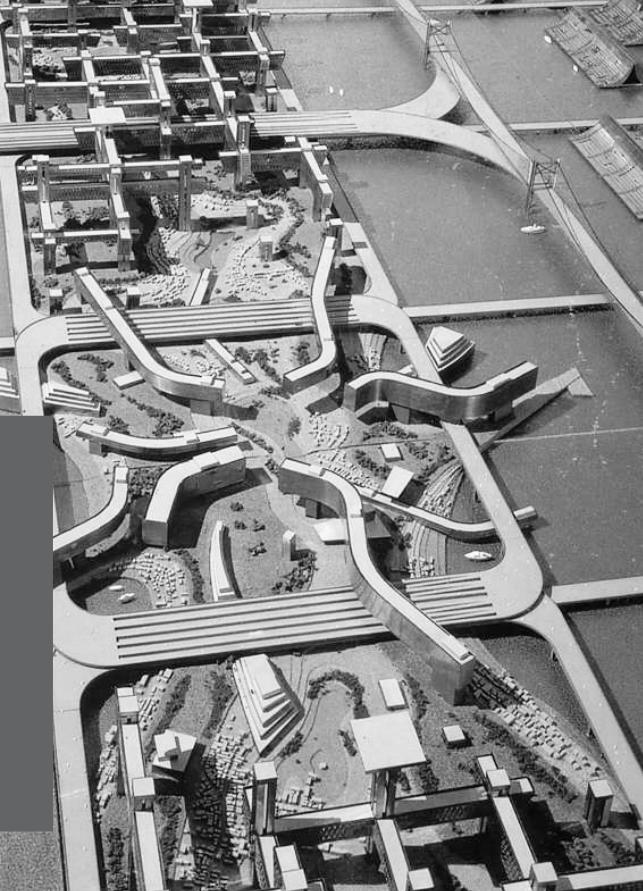
Number of people working along the central axis: 2.5 million people

Kenzo Tange was the first architect who proposed a new vision for expanding contemporary megacities, in his Tokyo Bay Plan 1960 he showed the necessity for big expanding megacities with the population more than 10 million to move from the traditional radial structure of the city with its fixed functions and objects, which are "closed" and not ready to grow, to linear structure of a city which is flexible and changeable. In Tokyo Bay Plan 1960 explaining the new concept of "structure" Tange emphasized:

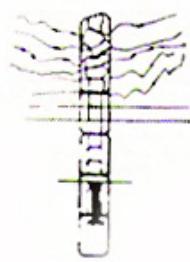
"The proposal for structural reorganization in the Tokyo Plan- 1960 was our first turning point away from a functional approach and toward a structural approach. In this plan we attempted to grasp all the structure of Tokyo in terms of mobility and communication taking place in it."

Kenzo Tange (1980: 187)

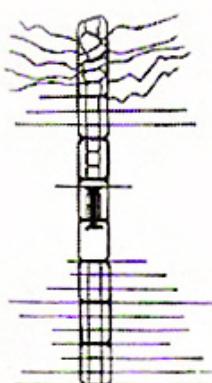




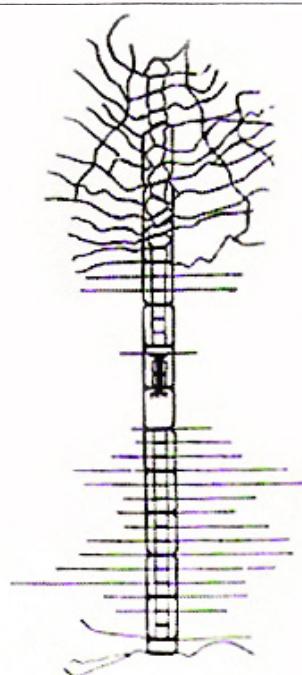
1st five-year plan



2nd five-year plan



3rd five-year plan



4th five-year plan

Kenzo Tange
Tokyo Bay plan / 1960

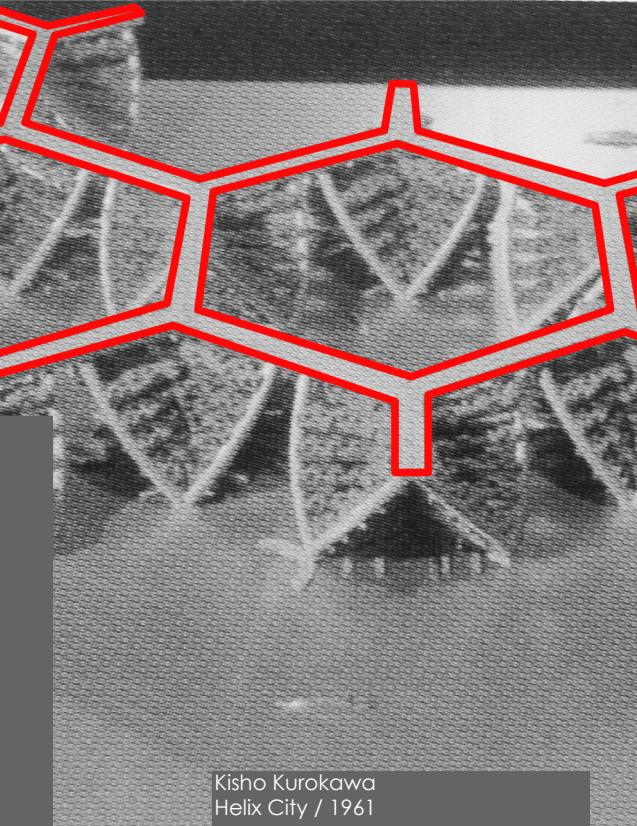
It was designed with Tange's idea of a "city as a process" and radically transformed the traditional vision of a city. The main characteristic of the new urban organization of Tokyo was the denial of the radial system and replacement of it with a linear model which developed across the whole Tokyo Bay. Tange changes the concept of a metropolitan civic centre with all the public facilities buildings to a "civic axis" which starts in Tokyo centre and extend outwards (Lin, 24:2, Summer 2007: 112, 114). The conception of a metabolic cycle with external growth and internal regeneration was applied to the scheme: external growth meant that the city structure is "open" and can develop with the times; internal regeneration meant that all the architectural components were flexible (Lin, 24:2, Summer 2007: 117). It was a huge transportation network with gigantic motorways and residential blocks constructed as megastructures and all the structures followed a biological model of growth (Pernice, 2007: 93).

Own proposed masterplan inspired by Tokyo Bay plan (pp. 54-55)

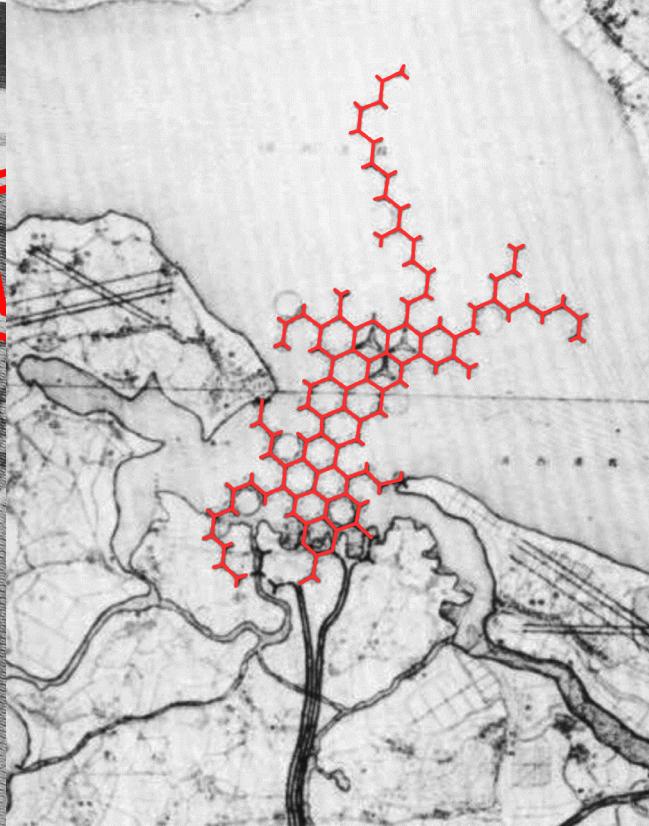








Kisho Kurokawa
Helix City / 1961



Kisho Kurokawa
Metabonat / 1969



Kisho Kurokawa

Kurokawa had several proposed schemes of floating metropolises – “Helix city”, which was later developed to “Floating city Kasumigaura”, Floating factory “Metabonat”.

“Helix city”

Key facts

Year: 1961

Location: Japan

Number of residents: 10 000/ per spiral

Was his first megastructural project. The proposal was inspired by the biological discoveries in the structure of chromosomes (DNA). Kurokawa used the spiral structure of DNA to create a city which was able to develop three-dimensionally (Pernice, 2007: 111). Later the originally designed Helix city was transformed to be a floating city on the lake Kasumigaura. The transportation system for this scheme was situated on the roof (red on the images).

“Metabonat 1969”

Key facts

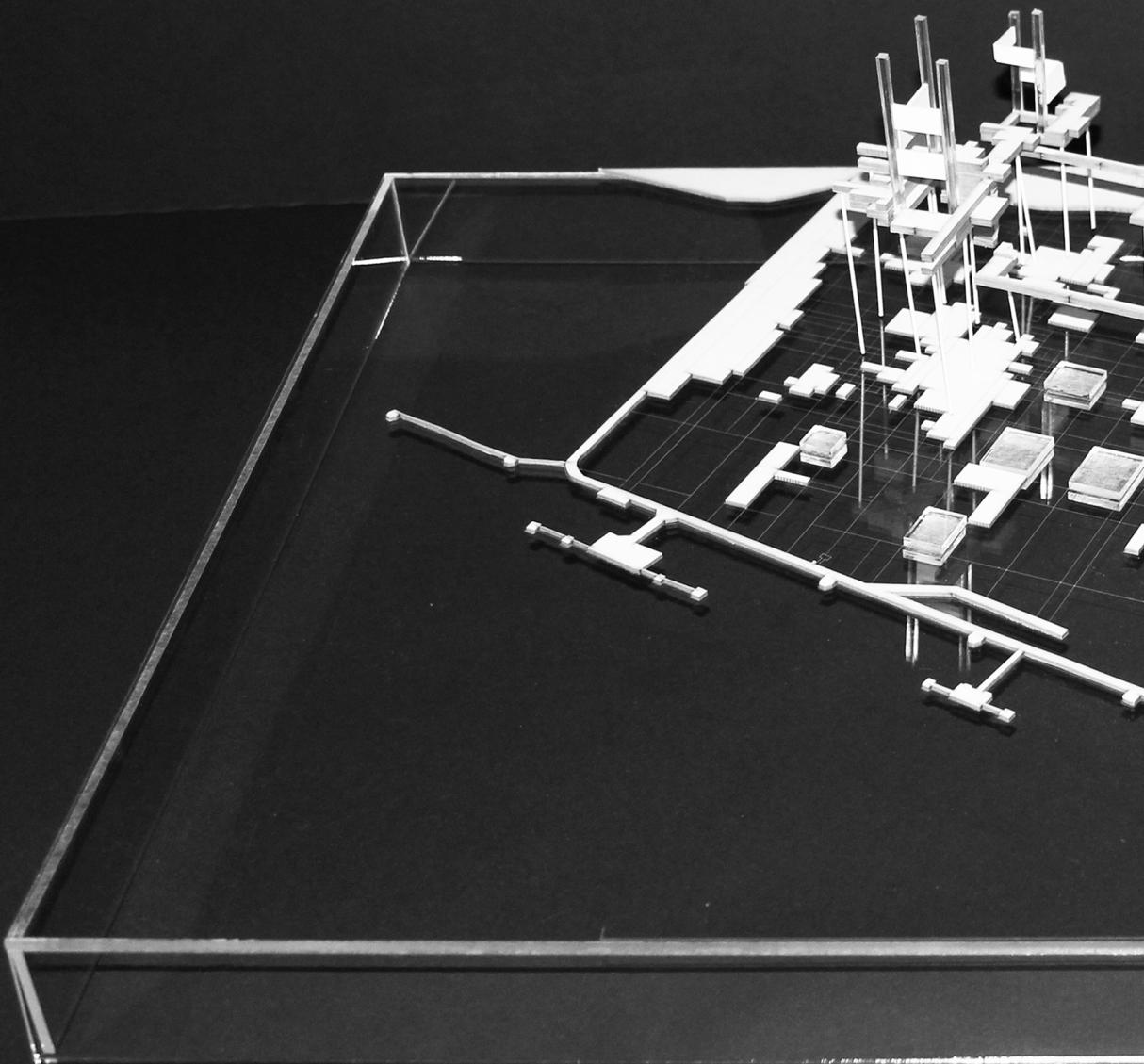
Year: 1969

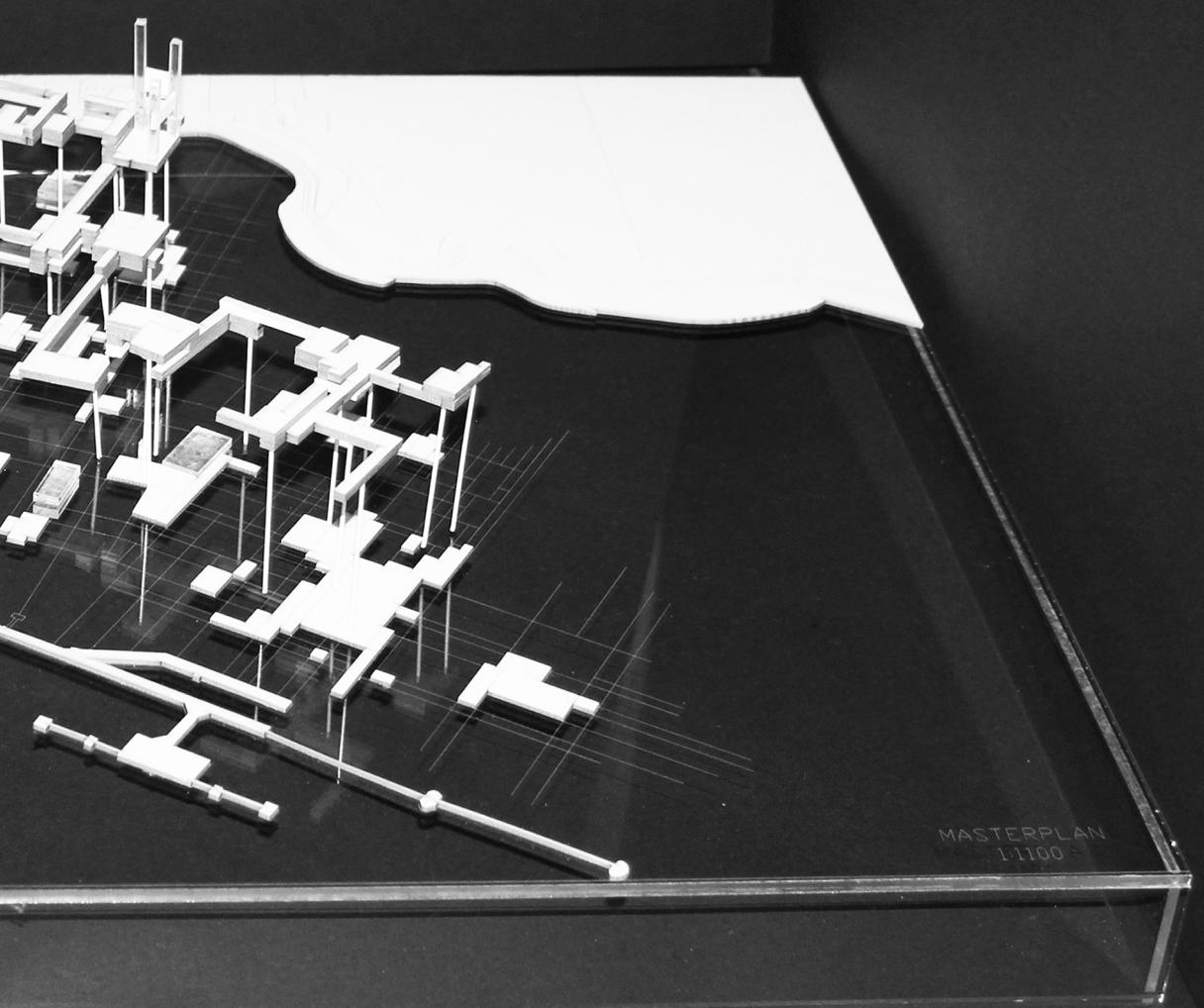
Location: Japan

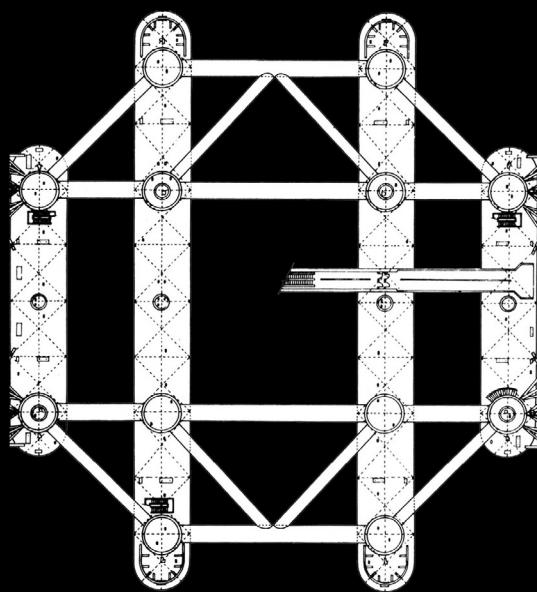
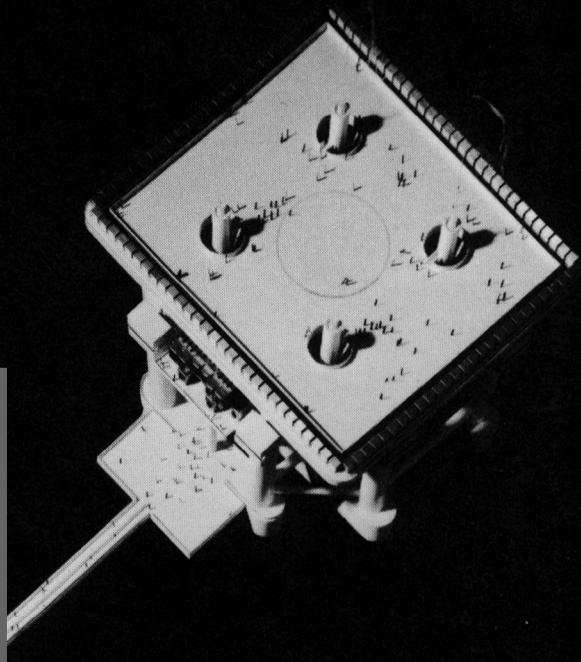
Metabonat was another floating city which was also been proposed as a solution for lack of space in Tokyo. It was a combination of a floating city and a factory. According to Kurokawa putting industry out to the sea will have a positive effect on the protection of the environment of the coasts. What was different about Kurokawa's proposal in comparison to other Metabolist town planning approaches, is that his cities were designed without any infrastructure (transportation system), conversely, they consisted of repetitive modular components with all the infrastructure inside, and the city could further expand by adding new modular components (Pernice, 2007: 112, 113).

My physical model of an oil research centre in London inspired by Metabonat model (pp.58-59)

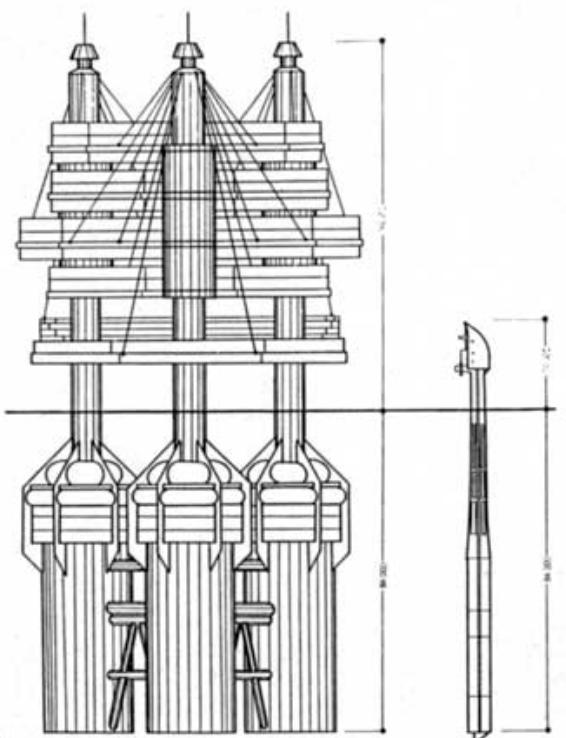
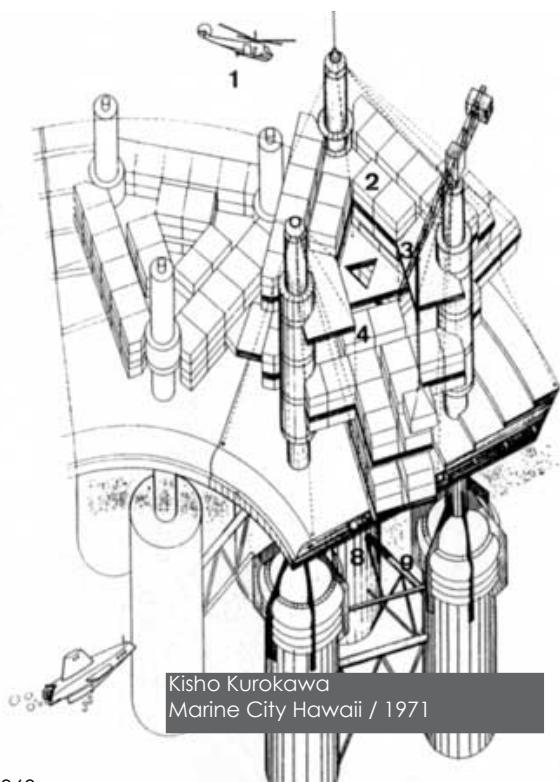








Kiyonori Kikutake
Aquapolis / 1975



Kisho Kurokawa
Marine City Hawaii / 1971

Kiyonori Kikutake

Kikutake was the one who probably proposed the biggest number of different marine cities and the only one who had a realized built floating artificial ground. "His research in the field of marine city technologies lasted several years and gave a fundamental contribution in the spread of metabolist urban landscape vision worldwide" (Pernice, 2007: 103).

Starting with the very first two visions of "Marine city" and "Ocean city", published in Metabolist 1960 proposal, Kikutake had at least another 3 marine city projects. Different in shapes they were all about new living spaces outside of the land, some on artificial floating platforms, and some without ground at all.

Finally, in 1975 Kikutake had the opportunity to realize a small marine city "Aquapolis" for the Okinawa Marine exposition.

Aquapolis

Key facts

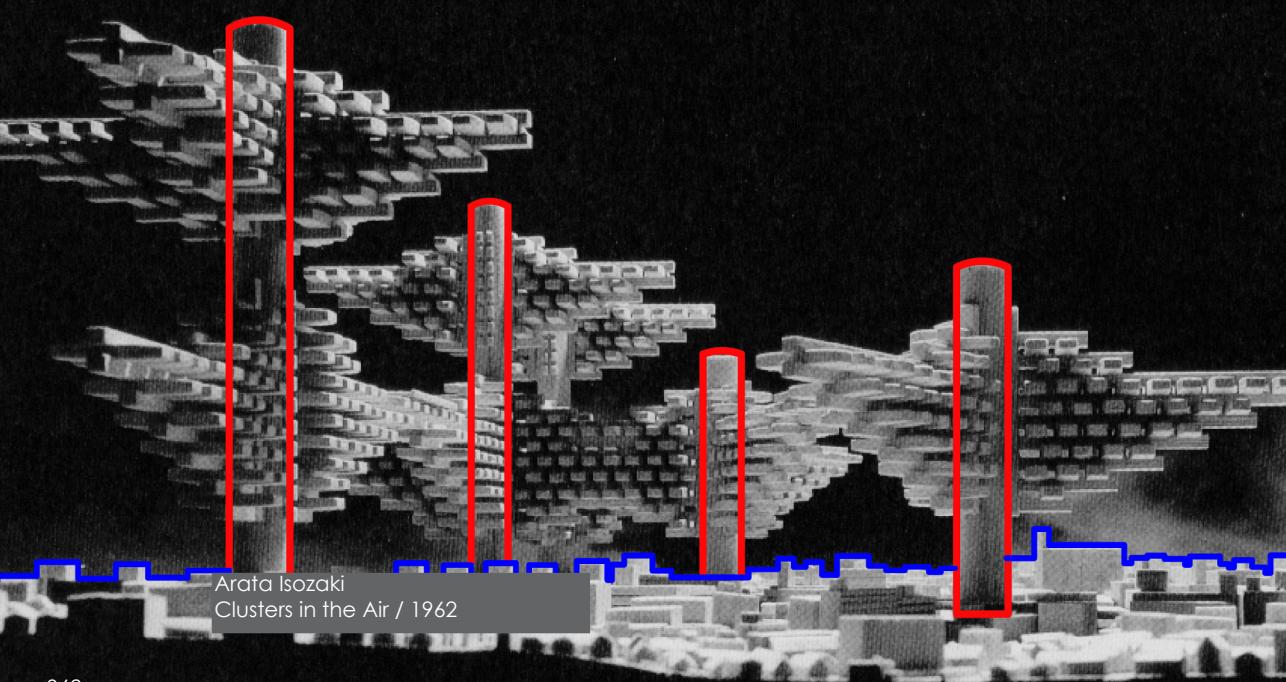
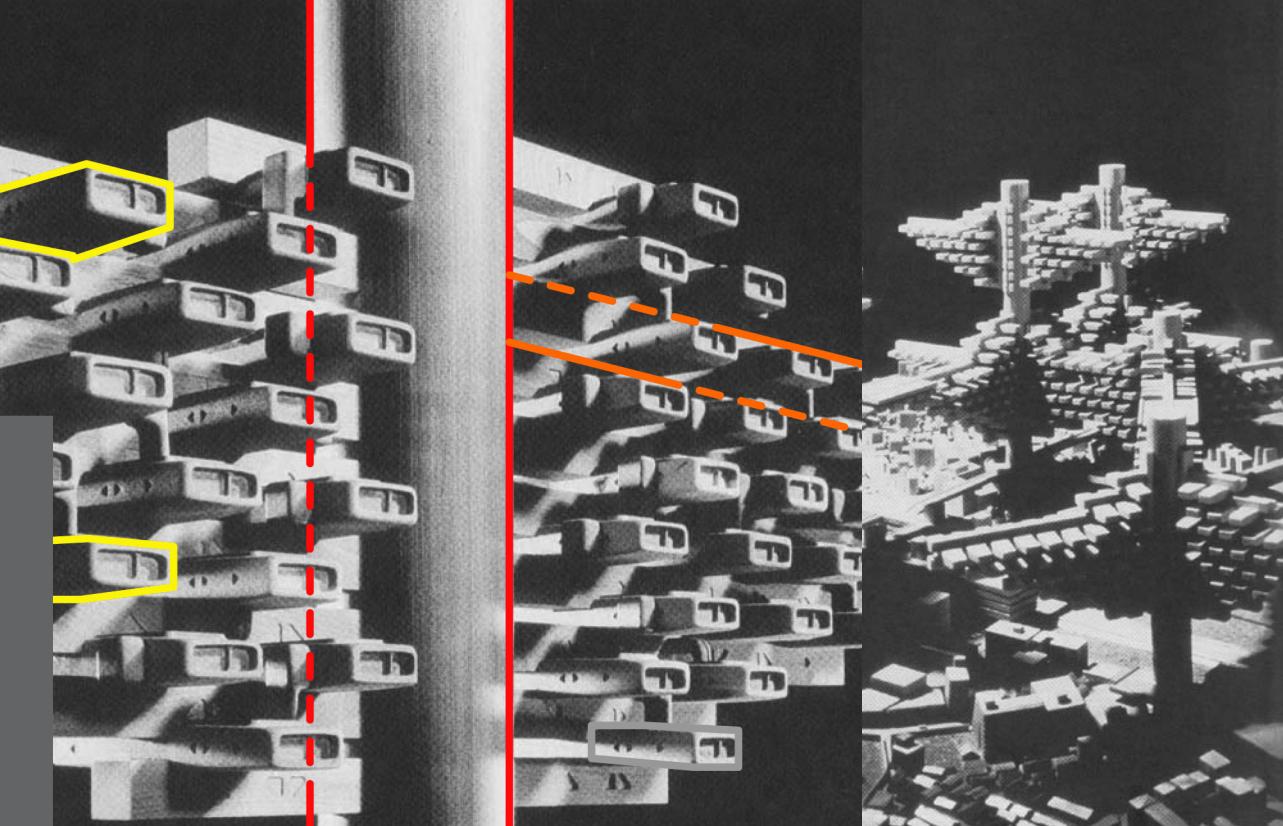
Year: 1975

Location: Okinawa, Japan

Area: 10 000 sqm.

This small built floating artificial piece of ground proved that the current technologies could be used to build self-supported environment on water and translate Metabolist utopian projects into reality.





Arata Isozaki

While most of Metabolist utopian city projects were proposed as floating cities in the seas, Arata Isozaki developed a different vision for expanding Tokyo named “Clusters in the Air”.

“Tokyo is hopeless. I am no longer going to consider architecture that is below 30-meters. ... I am leaving everything below 30 meters to others. If they think they can unravel the mess in this city, let them try. I will think about architecture and the city in the air above 30 meters. An empty lot of about 10 square meters is all I need on the ground.”

Arata Isozaki

And he put this idea into the project “Cluster in the Air”.

“Cluster in the Air”

Key facts

Year: 1962

Location: Tokyo, Japan

His proposal was based on a joint core system. Several cores which occupied that 10 square meters of the ground contained the house circulation. Tokyo skyline at that time was 31 meters (blue on the image), so at the level where core reached 31 meters cantilevered horizontal spaces grew from the core (Lin, 2010: 72). Core was the “trunk” (red), cantilevers – the “brunches” (orange) and the living units – “leaves” (yellow) (Koolhaas, Obrist, 2011: 367).

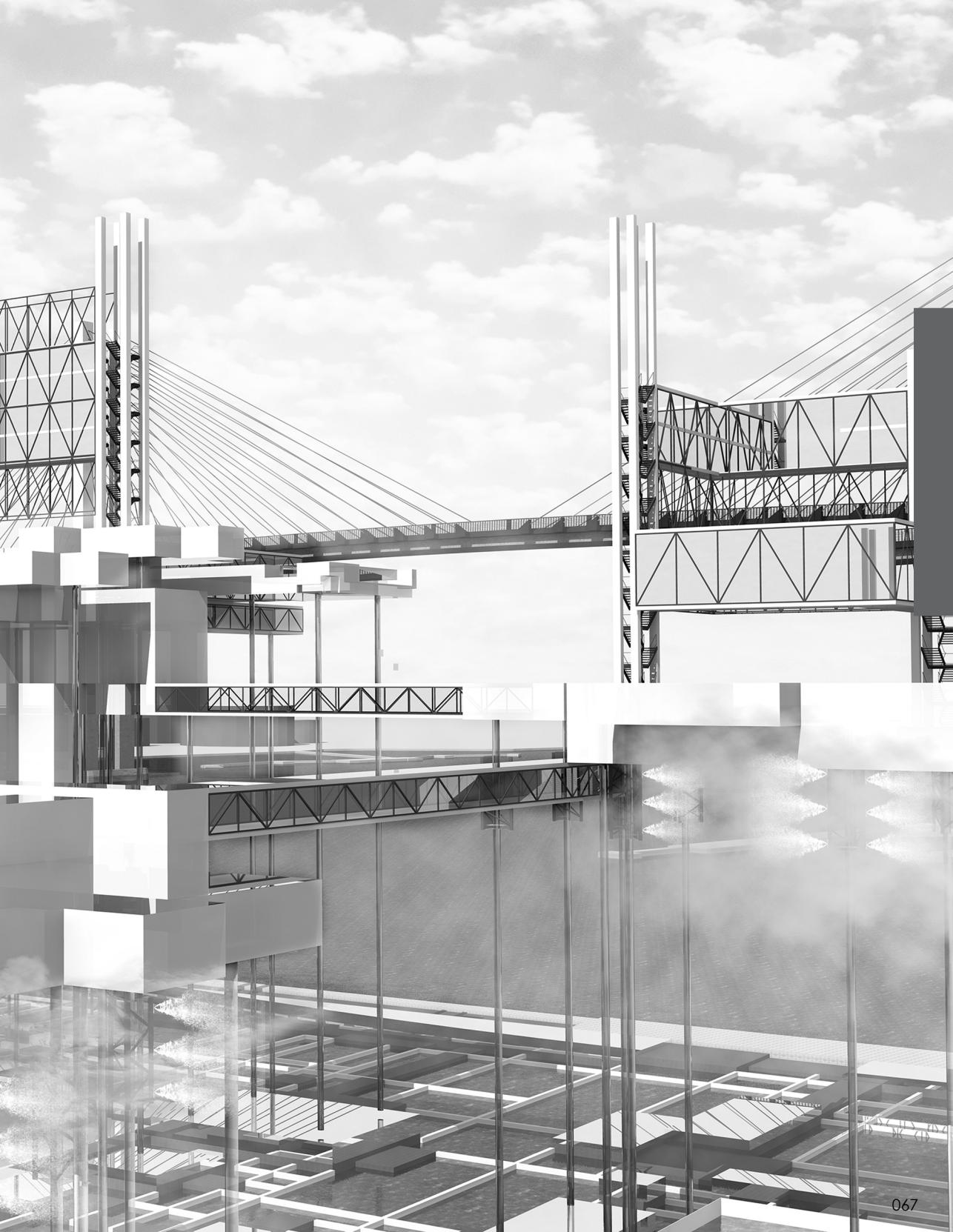
Own drawings influenced by Metabolist's aerial and marine urban utopias and put into design of an oil research centre in London (pp.64-67).





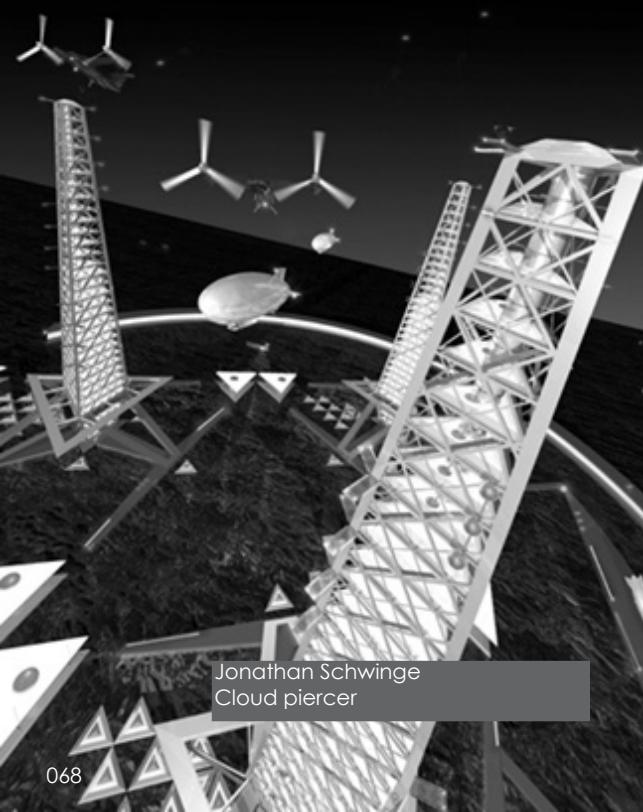
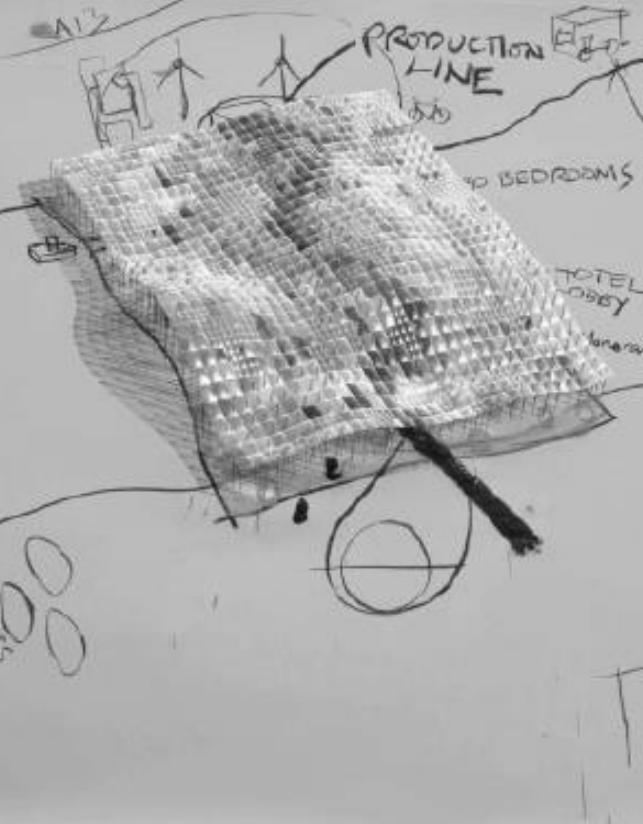








Will Alsop
Megasucture over the Thames



Jonathan Schwinge
Cloud piercer



CHALLENGES IN CREATING NEO-METABOLISM IN THE WEST (LONDON AS A CASE-STUDY)

Metabolism in Japan was conceived as a solution to the issues of fast growing population and necessity to accommodate them. But the proposals which depended mostly on the advanced technologies and materials were not available for that time. As a result, all of the urban planning Metabolist's schemes remained only on paper, being too revolutionary and too utopian.

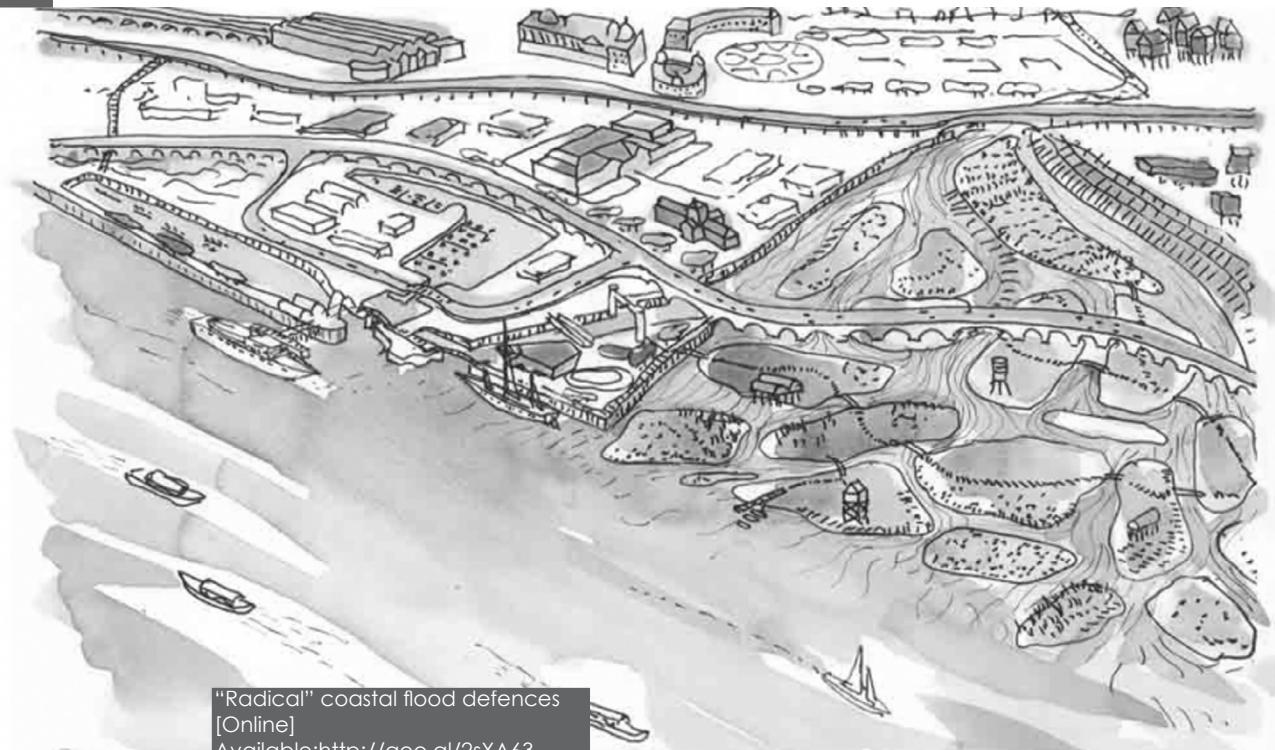
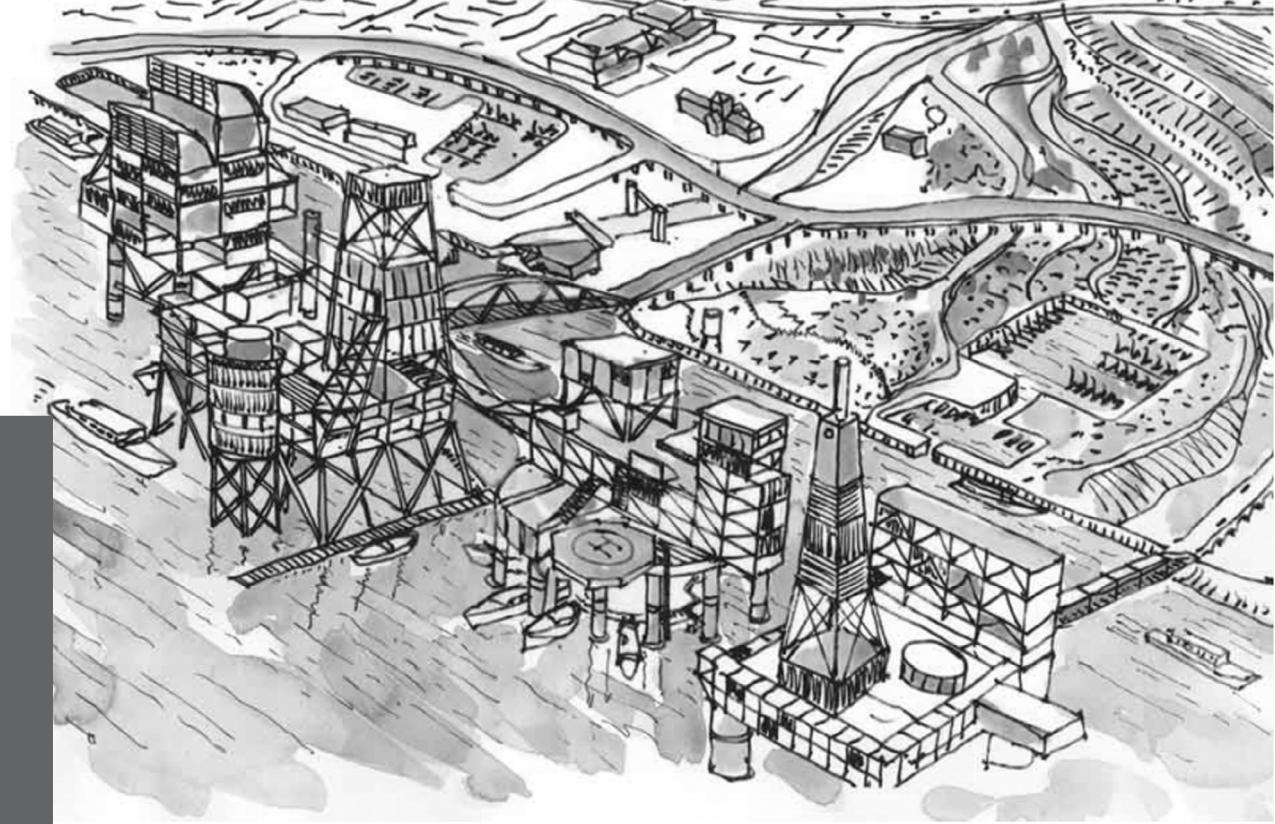
Today, more than 50 years later, our contemporary cities suffer from the same issues – overcrowded cities, traffic, and in the nearest future increase of the urbanization processes can become a reason for land shortage and poor infrastructure of expanding cities. And primarily this is an issue of concern to architects. If we look at modern urban proposals for the future, in many of them we can see the deep impact of Metabolist project and their megastructures as a way of creating more land.

London is my case-study, and site for my own design proposal which together with the following research explore strategies for solving London urban planning issues. Abley and Schwinge in "Manmade modular megastructures" suggested looking seriously at Thames Gateway as a future site for doubling Greater London from 7 to 14 million inhabitants. They speculate:

"What if the Thames Gateway were all done at once and in quick time to pay for the transportation, services and infrastructure needed to double London?"

and imagine that realization of this idea will allow connecting the estuary and central London enlarging its transportation system with all kinds of fast transit systems, such as increases in road network and even magnetic levitation trains (2006: 24-25). As examples they cited inhabited bridge between Thamsemead and Dagenham – megastructure over the Thames, which is a sketch by Will Alsop, and another project "Cloud piercer" by the architect Jonathan Schwinge. His project is the tallest and largest megastructure in the world located on the Thames Estuary as a new living space in case of the predicted economic and population growth. It consists of 3 steel lattice towers 1610 metres tall each, and is surrounded with a huge inhabited wave breakers and floating accommodation structures. In the traditions of Metabolist architects, the city is made as a self-supported structure and has all the functions of a city





"Radical" coastal flood defences
[Online]
Available:<http://goo.gl/2sXA63>

providing an expansion for London (Abley, Schwinge, 2006: 33).

Infrastructure

According to the classification given above on three major archetypes of cities, London relates to the mature cities.

"For Mature cities, the primary problem is old or obsolete systems (40%), then system capacity (35%). With its ageing rail and underground systems, London is a prime example. In a metropolitan area where an estimated 30 million journeys take place every day, transport investment over the past two decades has barely been sufficient to maintain the system, let alone to increase capacity to cope with soaring demand. As a result, congestion and overcrowding is already acute on all of London's transport networks, according to a recent report from Transport for London"

(Megacity Challenges [Online], Available: <http://goo.gl/RUFKF1>)

As the population increase there is a demand not only to create new living spaces, but also to improve mobility increasing travel speed and the system (Abley, Schwinge, 2006: 32).

So, if we imagine Thames Gateway as a future site for doubling London to the East and as a future site for constructing Neo-metabolism, then what can we borrow from Metabolism aerial and marine cities and what can we add specifically for this site?

First of all, the most significant change proposed by Tange in Tokyo Bay plan and supported by other metabolists was the necessity for the expanding cities to move from radial to linear structure of the cities. And this is still in "current interest" for most of the old megacities, and for London, in particular. But what is specific about London and Thames Gateway – it is the challenge to design with the flood risk. And Neo-metabolism can be seen as an opportunity to protect the region from the flood by creating inhabitable megastructures, as "attacking" the sea and creating firstly, new living spaces which are not in danger of being flooded, and secondly, providing a protection from rising sea level being simultaneously a new living space and a flood defence – is a possible solution to flood risk design.

To summarize, second iteration of Neo-Metabolism, which in the beginning I characterized as a combination of metabolism of 1960 with biomimetic principles of self-sufficient biological system, is now more specified for London and other coastal cities. Research of



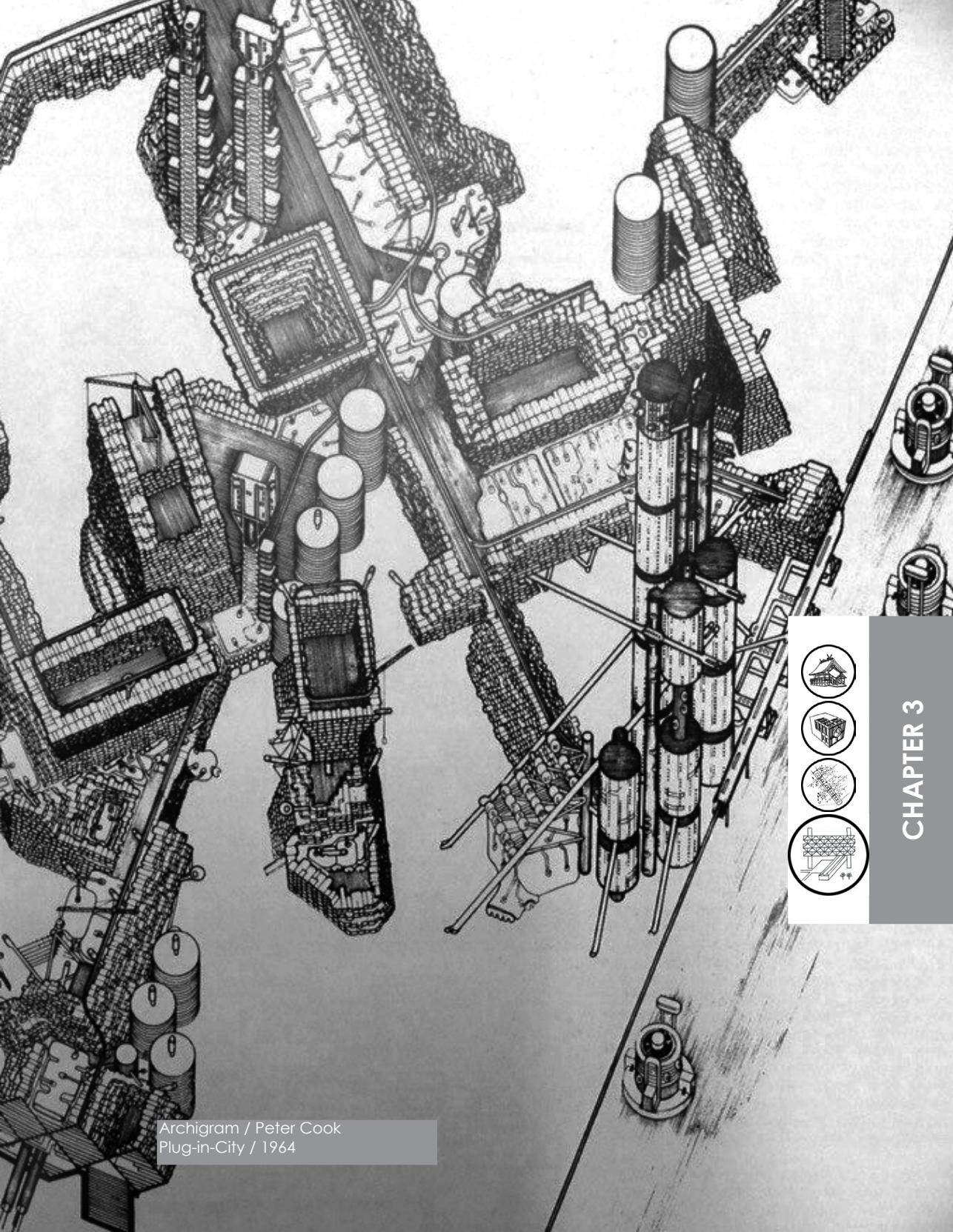


Megacities challenges shows that marine and aerial cities are still relevant for megacities firstly because of population and urban growth and secondly because of climate change. So, on this stage Neo-Metabolism is edited by adding the principles of necessarily flood-resistant design and the principle of occupation and search for new living spaces in the land, air and water. And the next chapter will explain technologies and ways of building in the water and air.

CHAPTER 3



Archigram / Peter Cook
Plug-in-City / 1964



Kenzo Tange
"Tokyo Bay Plan"

Arata Isozaki
"Clusters in the Air"

The Metabolist Group

Noriaki Kurokawa
"Space City"

Kiyonori Kikutake
"Space City"

Masato Otaka/Fumiko Maki
"Toward group form"

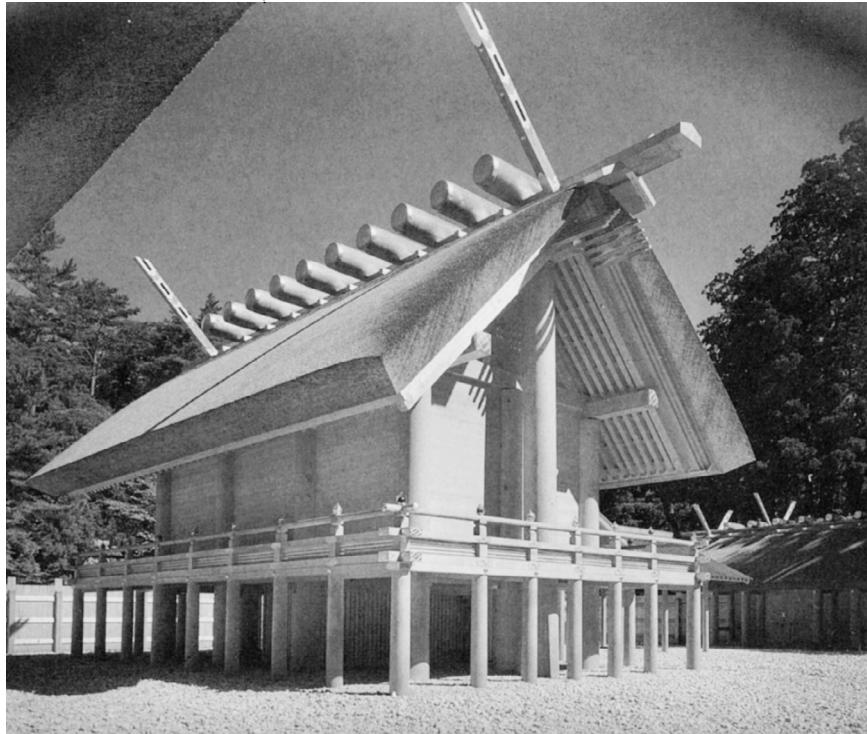
Noboru Kawazoe
"Material and man"

Megastructures

Archigram/Peter Cook
"Plug-in City"

Yona Friedman
Bridge Towns, Ville Spatiale

Constant Nieuwenhuys
"New Babylon"



CHAPTER 3

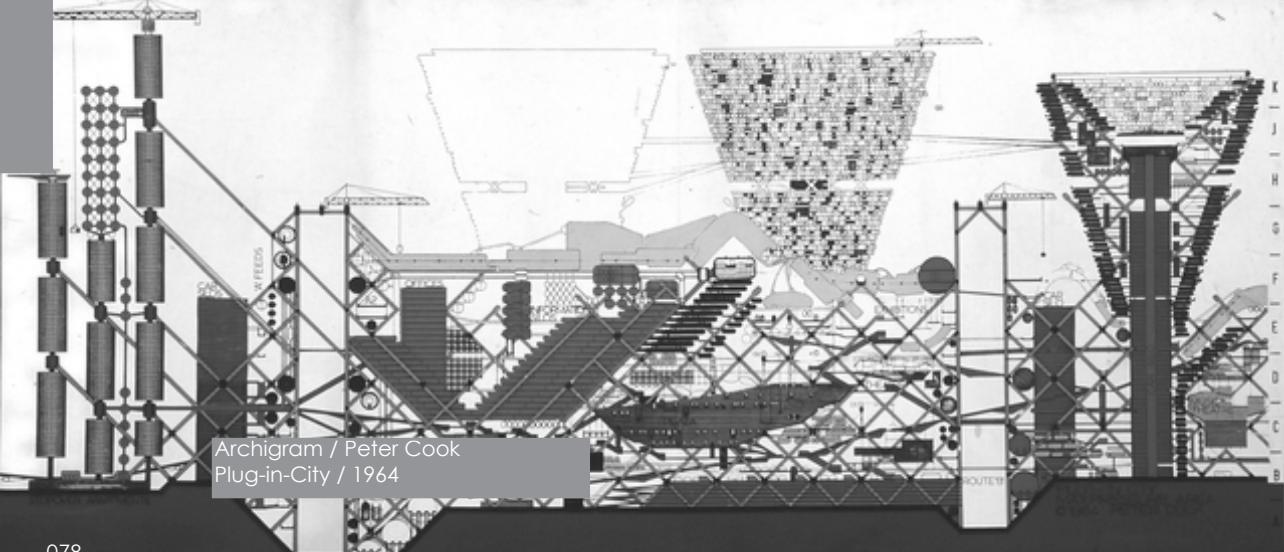
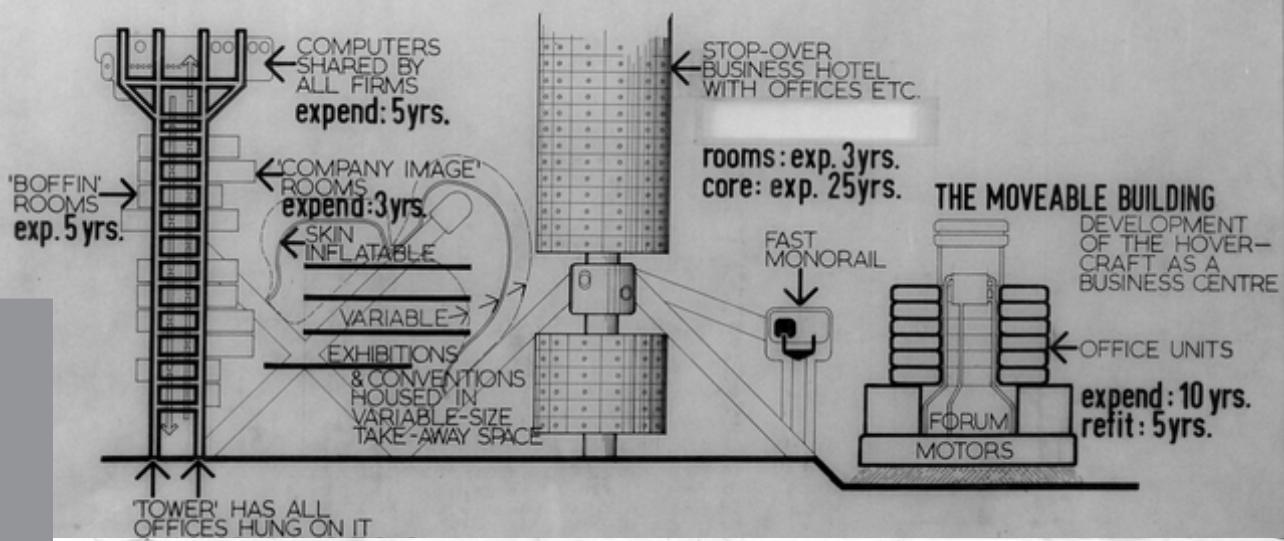
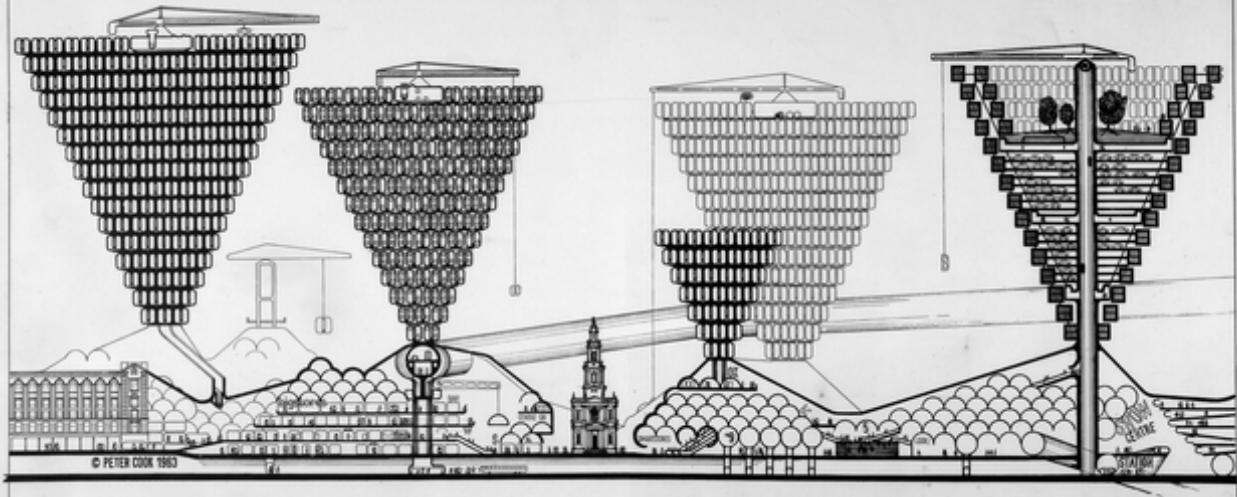
MEGASTRUCTURES IN MEGACITIES

In the same period of time when Metabolism flourished in Japan, Europe and the West were developing another utopian architectural concept named Megastuctures. Generally, the both had strong connections and similarities in their ideas, and in fact, the word "megastucture" was first used by a Metabolist Fumihiko Maki. The most important characteristics of megastuctures were: application of a special framework integrated with infrastructure and use of individual massified units. (Lin, 2010: 9, 10). And, as discussed above, the most Metabolist's urban planning utopias were characterized with the same.

Case studies

1. Archigram/ Peter Cook – Plug-in-City
2. Yona Friedman – Bridge Towns, Ville Spatiale





Archigram

Archigram was a British avant-garde movement which was often compared to Metabolism. The issues the group was trying to overcome with their proposals were common both for megastructural movements and Metabolism:

"This was the early 1960s (...), a time of great social and cultural change. We were concerned about the way that cities were being developed in the United Kingdom. The population of London (and the southeast of the United Kingdom) was predicted to expand at a tremendous rate for a variety of reasons"

Dennis Crompton (Máčel, Schaik, 2005: 88)

Plug-in-City

Key facts:

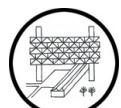
Architect: Peter Cook

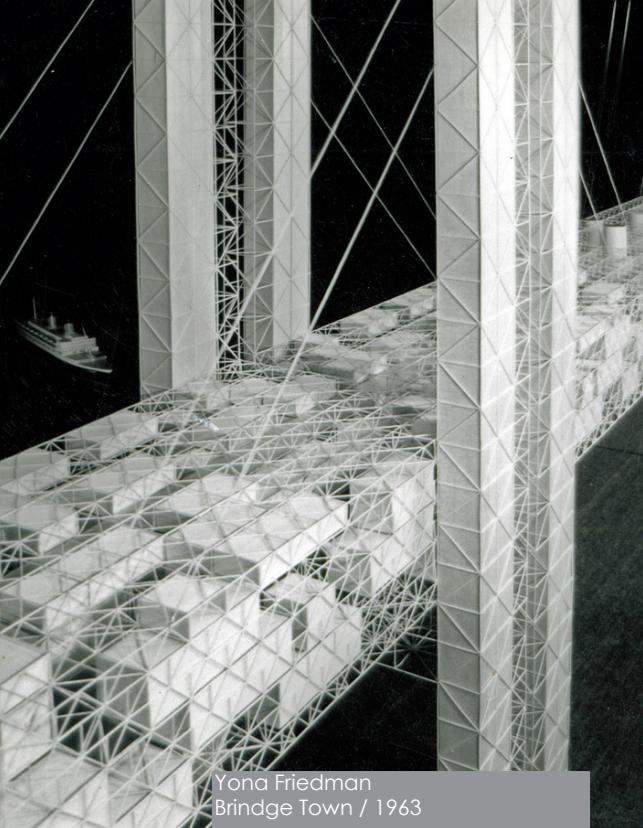
Year: 1964

Location: UK

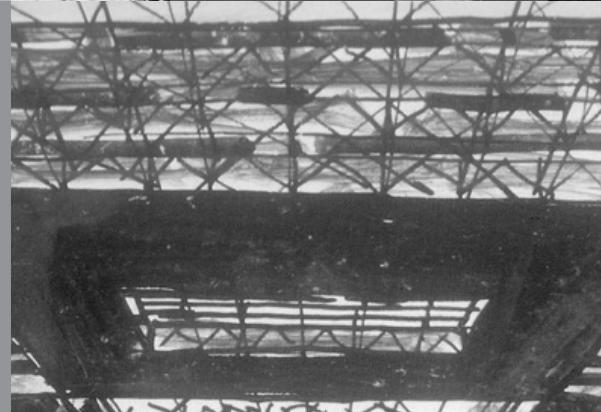
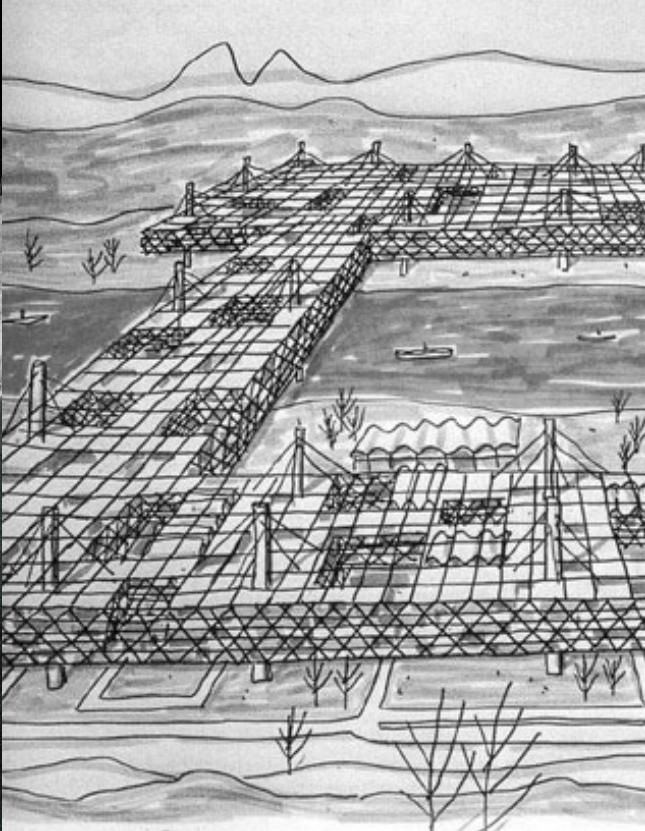
Plug-in city, in fact, was not a city; it was a combination of previous utopian projects of the group – concrete constantly evolving megastructure that incorporates removable metal cabin housing and other units of all needs with transportation services. The units were moved by giant cranes (Cook, 1999:36-39).

In the same way as Metabolist elements were designed with a different lifespans, units and all the elements of Plug-in-City were "planned for obsolescence" (Cook, 1999: 39). Similarities between Archigram and Metabolism can be seen both visually and in design strategies. However, the proposals were based on different ideas – for Archigram it was mechanisms and for Metabolists – biological processes.

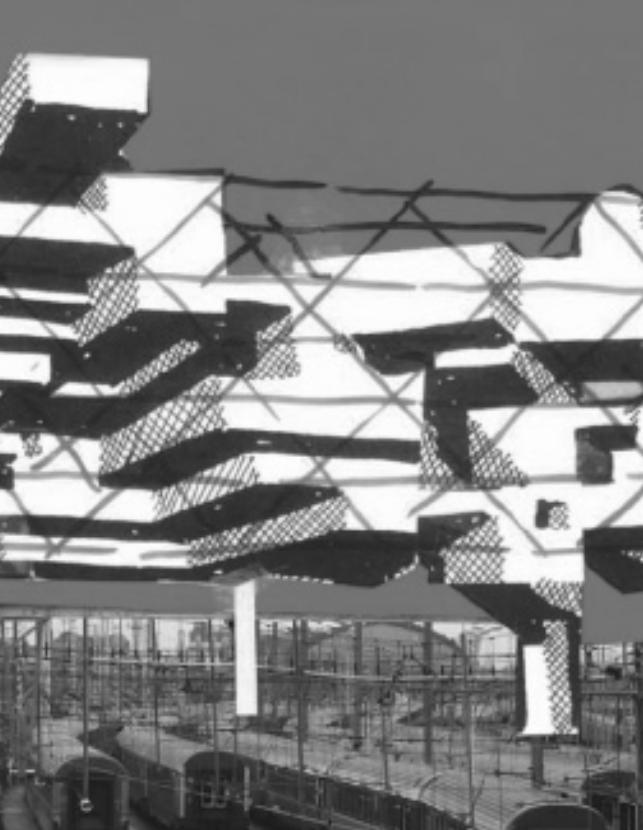




Yona Friedman
Brindge Town / 1963



Yona Friedman
Ville Spatiale



Yona Friedman

Bridge Towns

Bridge towns were a series of megastructural projects over rivers and channels with the goal to connect banks and shores and at the same time make the bridge structures to be useful combining the function of the bridge with commerce, housing or leisure function (*Bridge Towns* [Online], Available: <http://goo.gl/6GZuga>)

Bridge Town over the Channel

Key facts

Year: 1963

Location: English Channel (connects the UK and France)

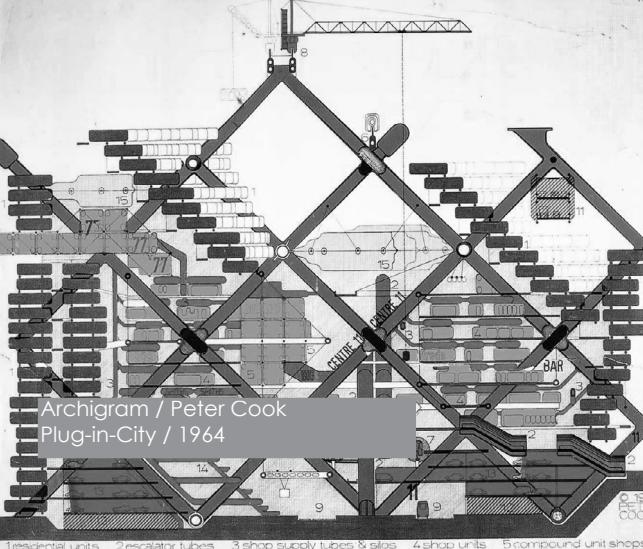
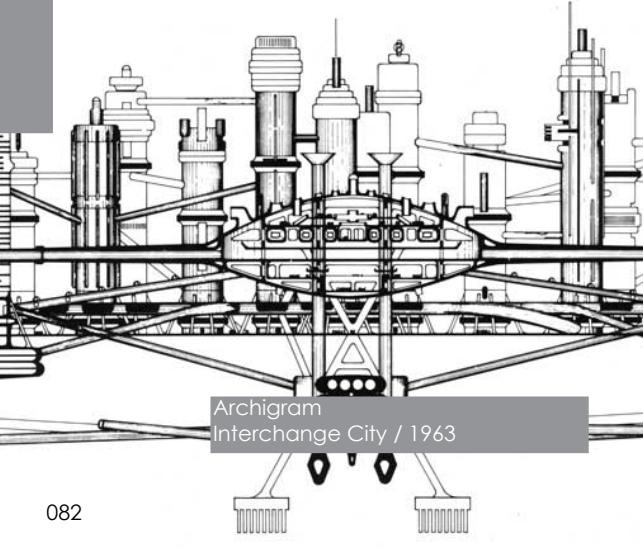
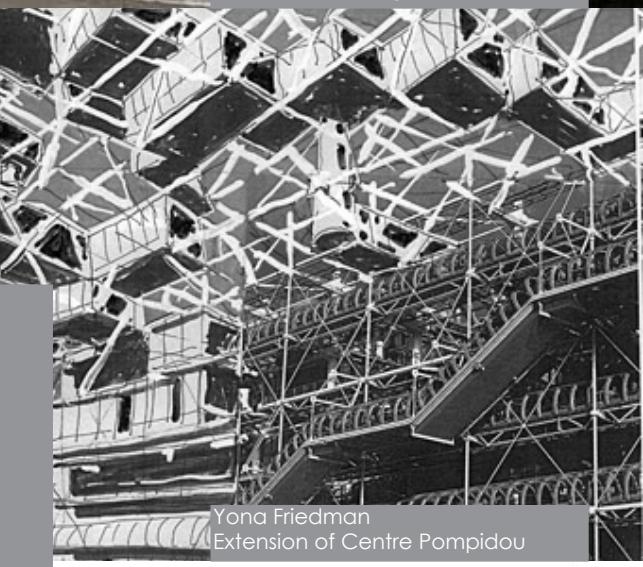
As Banham said (1976: 61) the English Channel bridge town project was very close ideologically to Kenzo Tange's Tokyo Bay project. But Tokyo Bay project with its bridging system connected only different parts of Tokyo, while Friedman's scheme was more global and was seen as a way of connecting Britain with the European community and if fact, the scheme was discussed a lot in the UK press as it could have become an alternative solution instead of the plan for a future tunnel (*Bridge Town over the Channel* [Online], Available: <http://goo.gl/suqlzc>).

Ville Spatiale

Ville Spatiale was a manifesto of spatial urbanism where Friedman gave his principles and vision of the future of big cities. The basic principle explained that for creating new housing there was no need to demolish the old one, as the new city could be built above the existing city, especially over less used areas in a city, for example railways (*Principles Ville Spatiale* [Online], Available: <http://goo.gl/AuQn7o>).

Besides, he incorporated into spatial city his earlier principles of Mobile architecture, where citizens were free to decide how their individual dwellings will look and what is more these dwellings were capable for change of location within the urban framework. At this point he highlighted the importance of play in people's lives, so his architecture was an attempt of involving citizens to "let's make a city" game (Banham, 1976: 60).





Summary

Research of the listed megastructural projects shows their connection to Metabolism and relevance to Neo-Metabolism. As I have noticed earlier Archigram was frequently compared to Metabolism in the way both movements designed their proposals in response to the population growth. Yona Friedman's Bridge Town and Kenzo Tange's Tokyo Bay projects similarities are also obvious. Moreover, in my vision, there is a similar approach in design between Isozaki's Clusters in the Air and Friedman's Ville Spatiale, as both of them had the strong vision of leaving the old city architecture below the new city. So, Friedman's spatial cities can also be identified as aerial metropolises, which I earlier put in the category of "current interest" for Neo-Metabolism.

In summary, I think that Friedmans's proposals are "in current interest" for Neo-Metabolism due to my definition of Neo-Metabolism as the movement which reassess the way we occupy the land, water and air with increasing threat from climate change and overpopulation.

Own megastucture drawing (pp.84-85)







Options for moveability

Self-propelled city



Towed city



Semi-submersible ship



Disassembled

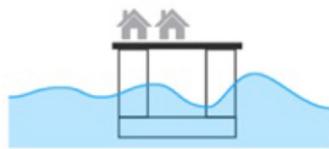


Options for seakeeping

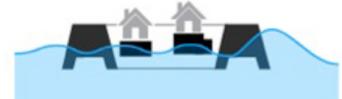
Cities on the ships



Cities on raised platforms



Construction of breakwater

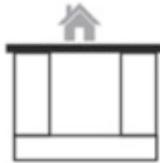


Options for growth

Cities on the ships



Cities on raised platforms



Construction of breakwater



[Online]
Available: <http://goo.gl/I0Ltvq>

NEW TECHNOLOGIES FOR CONSTRUCTING MEGASTRUCTURES IN THE FUTURE

As it said before in the time when Metabolists and Megastructural schemes were proposed with the ambitions to overcome the crisis of megacities, the schemes were too utopian and too revolutionary, so, the only realized floating piece of land was Kikutake's Aquapolis.

But can they be built today, and if yes – then how? To understand that better I looked at a report of the Seasteading implementation

plan published by The Seasteading Institute (*Seasteading Implementation Plan Final Concept Report* [Online], Available: <http://goo.gl/I0LtVq>). The report said that even today with increasing number of proposed floating cities the number of realized ones remains limited; so, its goal is to show first research in the way floating cities can become our future.

One of the primarily thing for the most projects of floating cities is the opportunity for city to move, and several options for that are given: first type is self-propelled city, which is the best option for often relocating cities; second option is towed city, which means that floating platforms are moved by a tugboat; third option is moving by a semi-submersible ship and finally, the forth variant is a city that is designed with the ability to be disassembled before moving to a new site. All of the options have their advantages and disadvantages, but if we are talking about Neo-Metabolism and its principle of self-sufficient system, then the first option with self-propelled system seems to be the most appropriate.

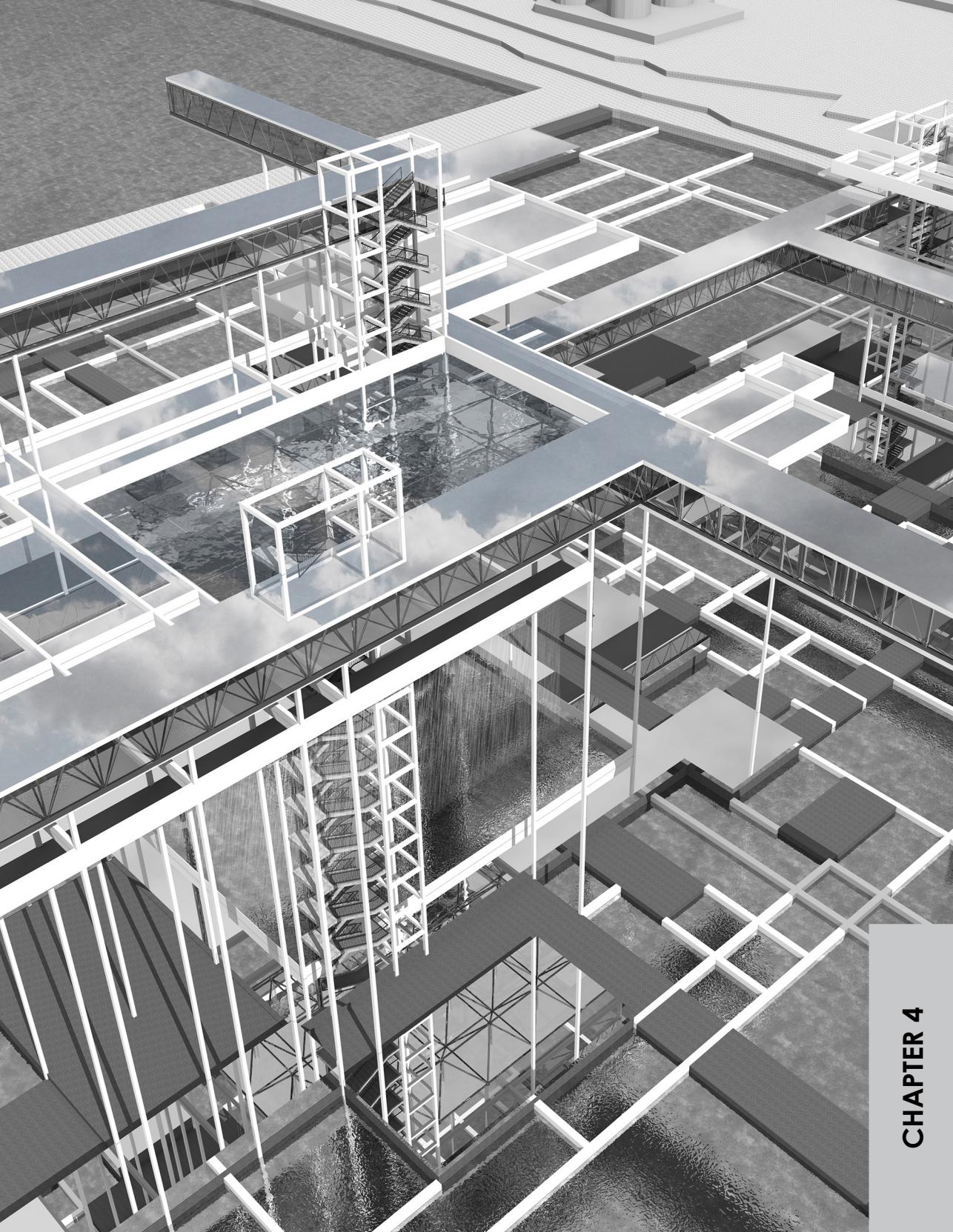
Safety of people – is the most important task of any project, and when the project is floating seakeeping is an extremely important part of safety. Described by the authors of the report it “consists of two levels: the ability to survive severe sea conditions in a protected bay and to be able to adapt for survival on the high seas” (*Seasteading Implementation Plan Final Concept Report* [Online], Available: <http://goo.gl/I0LtVq> :12).

There are several options for seakeeping: first - are cities designed on the ships; secondly it is raised platforms, which raise the housing thereby eliminating contact between water surfaces and floating city and minimizing waves impact; and the third way of protection is construction of an external structure of breakwater.

As well as the moveability options, seakeeping options have their pros and cons, but the one, which is in my vision, the most optimal for future floating cities is the option of raised platforms as it is at the same time a breakwater and the safest option in case of floods, and this is the option which were used in my own design of floating city. However, according to the same report, a feature of this option is that the structure cannot rise gradually; the platform itself constructed at once hardly can be expanded, but the smallest units on the platform are still capable to grow.



CHAPTER 4



CHAPTER 4

CONCLUSION

In this paper I aimed to identify how do principles of Metabolism and Megastructural proposals can help us to shape our 21st century megacities and propose set of principles for Neo-Metabolism in the West. To repeat, I think that with the estimated population growth and risks of climate change we need to reassess the way we occupy the land, sea and air, and in this thesis I explored how that can be done with the help of modernism architecture of 1960s.

Research and study of Metabolists and Megastructural ideas and analyses of their proposals helped me to identify the most significant principles and put some of them in my proposal for Neo-Metabolism. So, to sum up, after several iterations of Neo-Metabolism architecture which was first defined as a combination of Metabolism and Biomimicry, later specified for the West and, particularly, for London in respond to its challenges and at last upgraded by constructing technologies and megacity principles, I came up with the final one. The principles are the following:

- 1. Artificial land and floating city** (general principle for Neo-Metabolism)

This is the principle which remains from the very first metabolist proposals, as it is still in current interest. In point of reference, Jessa Gamble in her article "Has the time come for floating cities?" ([Online], Available: <http://goo.gl/o1TyXZ>) explains that the floating cities which may seem like science-fiction can become very common with the threat of global warming and sea levels rise. So, that is not surprisingly that architects and researchers of all over the world take seriously the approach of designing cities on the sea.

- 2. Integration of Metabolism with Biomimicry** (general principle for Neo-Metabolism)

For Neo-Metabolism this means following the principles of sustainability for creating a complex self-sufficient ecological system.

3. Linear structure of expanding cities (general principle for Neo-Metabolism + specific for London)

The principle that was first proposed by Kenzo Tange for Tokyo and still remains relevant for expanding cities. Talking specifically about London, this can be used for expanding London to the East (the Thames Gateway).

4. Flood-resistant design (specific principle for Neo-Metabolism in London)

As London is in a serious risk of being flooded, Neo-Metabolism here should be designed with the approach of flood-resistant design.

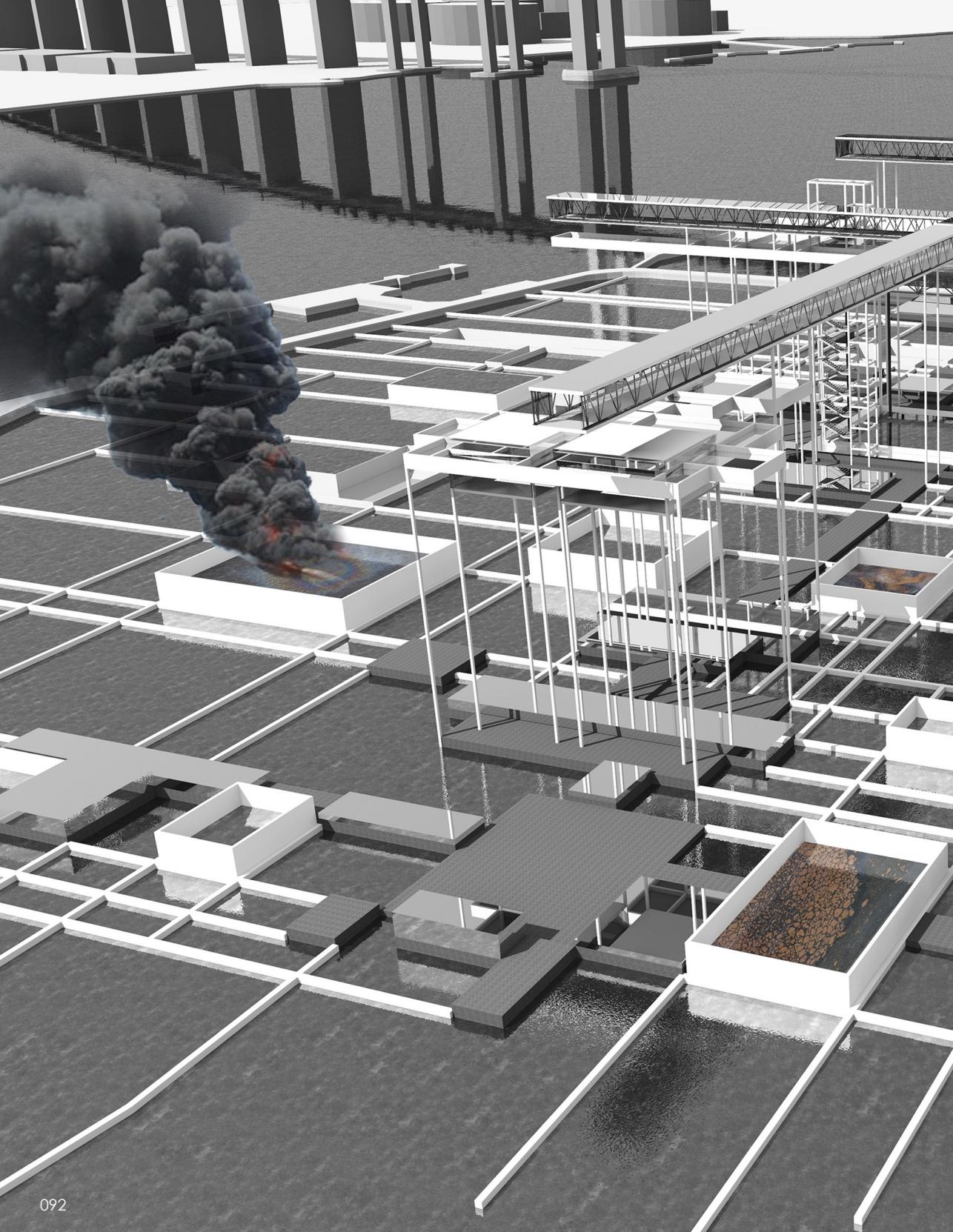
5. City in the air (general principle for Neo-Metabolism)

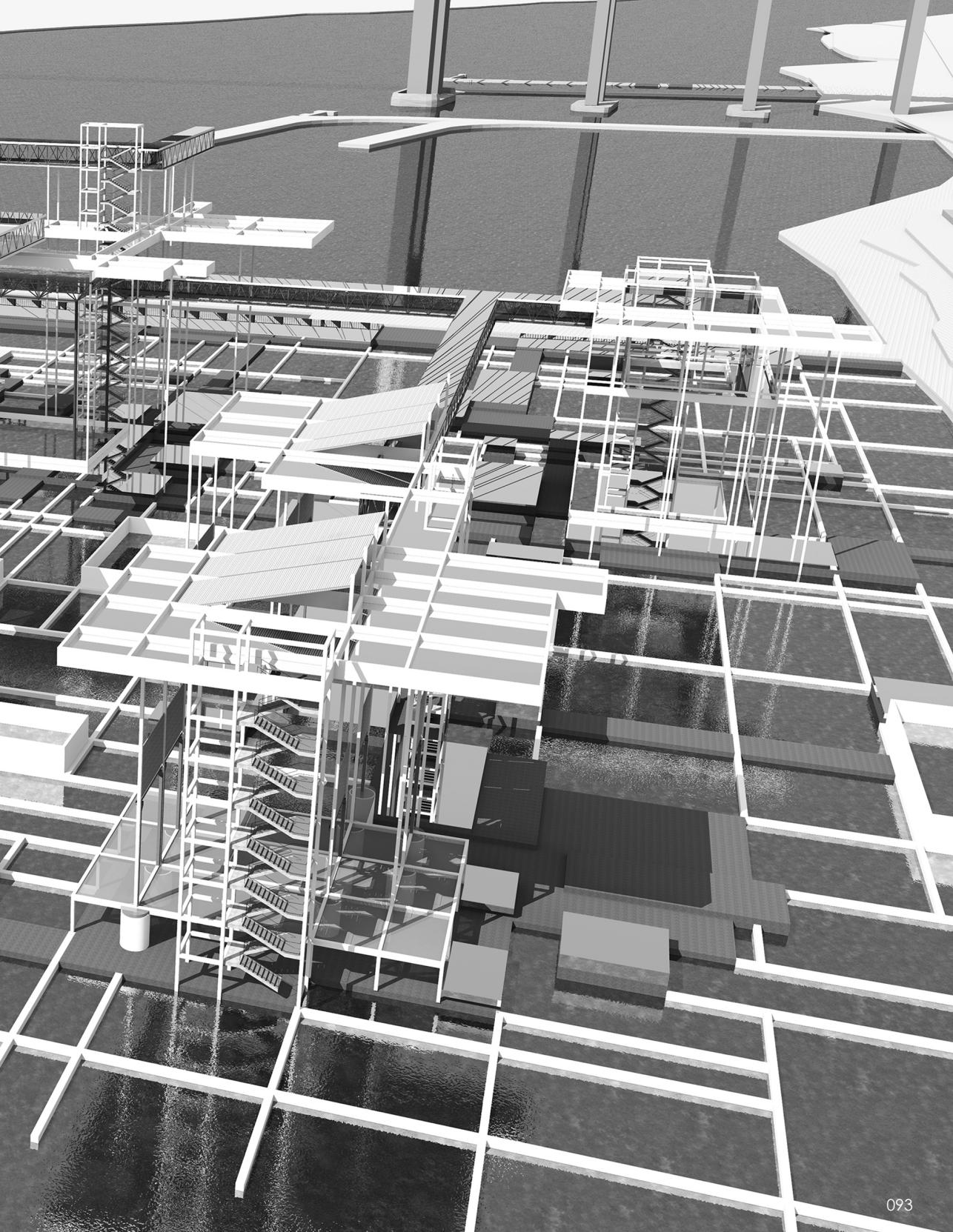
Principle which was common both for Metabolist and Megastructural schemes, and is still relevant today for creating hovering cities over the water or over the existing cities, like the ones which were proposed by Isozaki and Friedman.

Besides the Neo-Metabolism principles this paper comes with three other outputs. Firstly, as one of the focuses of the thesis was literature search on Metabolists and Megastructural proposals as a summary I came up with a "Metabolist map" which places the most significant urban proposals in time and location.

Secondly, inspired by Metabolists proposals and after setting out principles of Neo-Metabolism for London I proposed with my own drawings of design of a floating and at the same time aerial city for London.

And finally, Friedman's point of view on the playful architecture and the principle of "let's make a city" leads me to the idea of creating my own "let's make a city" architectural game. Game consists of a fragment of the Thames Gateway's map and schematic plans of some of the Metabolists and Megastructural schemes, my own proposal and some existing buildings (all of them are small separate elements), which can be put on the map, so that everyone can play and make his own "the Thames Gateway Neo-Metabolism".





INDEX OF TERMS

Artificial ground – solution for the problem of lack of space on the land by creating “structures that hover over the ground on platforms or pilotis” (Koolhaas, Obrist, 2010: 340).

Biomimicry - “coined by a US group around Janine Benyus, is about using the genius of nature to develop innovation. The holistic approach includes ecological design as well as interest in technological innovation.” (Gruber, 2011: 17)

Capsule - (or a unit) basic transient element of a metabolic cycle. “The capsule stands for an emancipation of the building in relation to the ground and heralds the era of moving architecture...” Noriaki Kurokawa (Koolhaas, Obrist, 2010: 336).

Floating cities - “plan to overlay artificial ground on water through a combination of reclamation, piers, platforms, floating megastructures, and floating islands.” (Koolhaas, Obrist, 2010: 340)

Joint core – a method of creating vertical land into which living units can be plugged in with the aim to expand housing to the air (Koolhaas, Obrist, 2010: 360)

Megacities – cities with the population more than ten million people

Megastructure - “a large frame in which all the functions of a city or part of a city are housed (...) a mass-human scale form which includes a Mega-form, and discrete, rapidly-changing functional units which fit within the larger framework.” Fumiko Maki (Banham, 1976: 8)

“not only a structure of great size, but (...) also a structure which is frequently:

1. constructed of modular units;
2. capable of great or even “unlimited” extension;
3. a structural framework into which smaller units (...) can be built – or even “plugged-in” or “clipped-on” after having been prefabricated elsewhere;
4. a structural framework expected to have a useful life much longer than that of the smaller units which it might support.” Ralph Wilcoxon (Banham, 1976: 8)

Metabolic cycles – a system of urban elements with long-term and short-term lifespans (Lin, 2010: 102)

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 and technology should be a denotation of human vitality. We are not going to accept metabolism as a natural historical process, but try to encourage active metabolic development of our society through our proposals." Noboru Kawazoe (1960)

Permanent element – elements of the metabolic cycle with long-term lifespans (large-scale urban infrastructure) (Lin, 2010: 102)

Spatial urbanism - "large-scale modular canopies that could be suspended above towns, cities, and landscapes (...) Spatial cities canopies to house capsules, habitable nodes nestled within the framework." (Koolhaas, Obrist, 2010: 20)

Sustainability - "describes economic cycles that do not harm the environment and do not consume more energy, raw materials etc. than are re-created in the natural cycle" (Daniels, 1998: 18)

Transient element – elements of metabolic cycle with short-term lifespans (small-scale constructions) (Lin, 2010: 102)

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