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ABSTRACT

Within the scope of this study, while questioning the relations between technology and architecture, their effects on human life has also been analyzed with all due aspects pertaining to the formation of the architectural end-product. Its role in the process of architectural design is parallel to this relationship.

In this study, the idea which is aimed to achieve is that technology which was once a part of an artisanal production, has been taken up as a problem of modernization in the development of industrialization. The study which aims at demonstrating this alterations, tries to question the ways of seeking a tectonically sensitive dimension in architecture in the age of information including a series of comparative analysis. Within the scope of this study, while putting forward the spatial characteristics of high-tech architecture as a follower of a constructive tradition, building technology of the last decade in Turkey has been included in the discussion.

The discussion has been enriched by conceptual definitions in order to determine the terminology of the subject. In addition to the retrospective overviews, architectural concepts of the eras have been presented.

The findings of the study has been approved that the technical knowledge today is not limited as the knowledge of classical crafts technique, but it should be the rationalization of both the technical and the traditional. Most of the high-tech designs today use a kind of craft technique based on the machine production. In addition, the structural elements accomplished for the sake of visual impact are not "technological", but "scenographic" and "representational" as a matter of tectonic expression.

Keywords: philosophy of technology, modern age, tectonics, information age, high-tech, architectural design approaches.

ÖZ

Bu çalışmada, teknoloji ve mimarlık arasındaki ilişki sorgulanırken, öncelikle teknolojinin, mimarlığın temelini oluşturan insan yaşamı içinde kurduğu anlam ve gösterdiği değişim analiz edilmeye çalışılmıştır. Mimari tasarım sürecindeki rolü ise bu ilişki ile paralellik gösterir.

Çalışmada varılmak istenen nokta, teknolojinin sanatsal bir eylem olarak ortaya çıktığı ancak endüstrileşmenin gelişmesiyle bunun bir modernleşme sorunu olarak ele alındığıdır. Bu değişimin ortaya konmasını amaçlayan çalışma, karşılaştırmalı bir analizi içermektedir. İnşa etme geleneğinin devamı olarak görülen günümüz yüksek teknoloji mimarlığının mekansal özelliklerinin de ortaya konmasını amaçlayan çalışmada, Türkiye'deki son dönem yapı teknolojisi de örneklerle analiz edilmeye çalışılmıştır.

Yöntem olarak öncelikle, çalışmanın terminolojisini oluşturan kavramsal tanımlamalar yapılmıştır. Tarihsel perspektif sunmanın yanında dönemlere ait mimari kavramlar da tanımlanmış ve tartışılmıştır.

Sonuç olarak, bugünkü teknik bilgi birikiminin klasik zanaatların pragmatik olarak kazanılmış teknik bilgileriyle sınırlı olmadığı, ancak uygulamaların teknik araç ve geleneksel normların rasyonalizasyonuna dayalı olması gerektiği söylenmiştir. Bugün birçok yüksek teknoloji ürünü tasarımlarda görülen, zanaatçılığın makina üretimi ile gerçekleştirilmesidir. Bunun yanında, strüktürel olmayan, ancak görsel etkinin abartılması adına kullanılan elemanlar "teknolojik" olmak yerine "görüntüsel" ifadeler içermektedir.

Anahtar kelimeler: teknoloji felsefesi, modern çağ, tektonik, enformasyon çağı, yüksek teknoloji, mimari tasarım yaklaşımları.

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INTRODUCTION

1.1. The aim of the study

The aim of this study is to determine the role of technology as a manner of expression in architecture.

Technique, beyond its meaning as a method of construction, is related to social and scientific paradigms which determine the values of the era. In this study, while the role of technology is analyzed, its basis are ascertained as the economic, social and scientific backgrounds, production types, materials of construction, architectural space organization, and also the aesthetic judgments of the time.

In this point of view, changing paradigms, have always cause the technology to acquire new meanings. Technology, while it was "to craft something" by "revealing" or by "letting a thing to disclose itself", it appeared to mean "to produce or to manufacture an object", later in the technological age.

The study has concentrated on this transition in the essence of technology which has pointed out a differentiation from an **"ontological thinking"** process towards a **"technological thinking"**. This is in line with the domination of positivist world view as the cause of scientific improvements. Thus, a comparative analysis has been developed according to these changing definitions and the hints of a new concept has been sought.

The objectives of this thesis has been determined by critical approaches taking today place in the field of architecture. The following discussions concluded the point of departure of the study as follows:

- Today, a single paradigm does not dominate the scope of the discussions in the field of architecture, like for instance in 1920s and 1930s. Many paradigms determine the milieu of architecture the sciences and social sciences as well. In the same way, the tectonics of space goes beyond the pure and simple constructional discourses. The concepts like transparency, flexibility and mobility are the concepts symbolizing this century, but they are carried to their limits today. Buildings loose their sense of belonging to their environmental contexts. It is becoming difficult to analyze the architectural determinants in the classical sense; like material and constructional methods and joints. By means of the disconnection of the building with its context, emphasis on the "immaterial" in order to the "material", it grows difficult to define the "being" of building.

In this study, especially the rereadings about the tectonics of architecture by Kenneth Frampton, including the ideas that architecture, today, is reduced to a stage of visual insight, has been considered importantly. A similar approach has also been revealed by Hartoonian, in his book, "Ontology of Construction".

Within the scope of this study, these "re-readings" are enlarged by means of relevant analysis including examples from today's architecture

- The milieu today, including many paradigms against the purist, modernist discourses, involves assortment, richness, covertness, togetherness and complexity in expression. In this way, technology becomes "scenographic" or "representational" in order to be "tectonic". In a milieu like this, what is "tectonic" and what belongs to the body of the building in the real sense is debatable.

1.2. The domain of the study

In the veryoutset, it is necessary to analyze how economic, social and political circumstances formed the basis for the world of design and the rise of technological progress in the age of industrialization.

The basic phenomenon of the modern world has been the exhaustion of the empire, and the birth of industrial and scientific powers in 19th century. In this way, as human power decreased with the help of the machines, the efficiency was increased. Scientific innovations, industrialization which transformed the scientific knowledge to technology, demographic disorderliness, urbanization, social movements and capitalist world trade can be summarized as the sources which supported the modern world.

In 1860s, when Marx has remarked that "all that is solid melts into air", he meant that everything sacred became worldly, human beings faced with their own reality (Berman 1994, p.111). Production, consumption and human needs gained international characteristics. The new production method has developed and this led to the establishment of industrialized factories. Gradually, it engendered the class consciousness in the society. This process still continues in nowadays world. The common principle for freedom is directed towards the free marketing. With these conditions, any kind of human behavior has become a matter of awareness and economically legitimate.

In addition to the social and economic factors mentioned in the above and in line with the idea of urbanization, a technocratic model of national development has initiated in the cities of Europe. Between 1850 and 1860, the governor of province, Eugéne Haussmann was charged by Napoléon the III rd to construct new boulevards, drainage and metro systems in the old Medieval city of Paris (Benevolo 1989 V.1., p.67-68). These images which have become familiar today, were revolutionary progresses of the time. The fringe districts of the city were cleared and became healthy. While people were becoming homeless in these parts, the city was gaining a homogenous character. The boulevards of Haussmann's Paris were the steps of modernization, developing the productive forces and social relations of bourgeoisie as well as military for reasons.

The commercial structure of capitalism has produced new architectural forms. In contrast with the overcrowding visions of nineteenth century, the new urban scheme of early twentieth century have reflected light, green, hygienic and transparent atmosphere as well as the character of its building forms. Glazed sheds, fabricated with standard components, were the leitmotif of the industrial city. Some of these architectural forms were exhibition structures, market halls, railway stations, shopping galleries and museums.

In his book "Notes from Underground", Crystal Palace was described by Dostoyevski as a building completely calculated and designed with certain mathematical rules (Berman 1994, p.300). That was a true statement, because the design of the building has been achieved by engineers only. The building has a cast-iron structure so slim that it was nearly impossible to be noticable. The transparency of the building reflected the color of the sky, the water and the sun. It did not disturb the nature, in contrary included it. It has not been designed as a permanent structure, but as a temporary and demountable one. Actually, it has been disassembled after three months and rebuilt in a different location in the city. It was the symbol of the western rationalization and philosophy of the mechanical life. The importance of the building lied not only in its architecture and construction, but also in its symbolic character which was the new spirit of the era.

G. Semper, an architectural theorist of the time, proposed an enormous portable glass roof over the "Jardin des Plantes" in Paris referring to Crystal Palace and in his essay "Science, Industry and Art" accepted an idea of design in the age of machine (Wigginton 1996, p.45).

With the transition taken place in 19th century and the beginnings of 20th century, mobility and dynamic aspects have become respected values of the time. The period between the two world wars is the time for full mechanization. Mechanization changed the city pattern and caused the industrial production to take place in the surrounding areas of the city center. The sizes and the shapes of the buildings have changed. Machines have been interpreted, primarily, as tools of progress which shaped the culture based on science and rationality, and secondarily as destroyers of the nature.

The assembly line was one of the effective tools of mechanization. By organizing and integrating various types of production, an uninterrupted production process has been achieved where man has become an essential part of it. The time factor has played an important role in the regulation of machines with one another. Recently, the assembly line has been brought under a broader heading, called the *line production* (Giedion, 1969, p.77). The fully automatic production has not been achieved until 1920. During the transition phase, man still acts as a lever of the machine. Connected with the assembly line a problem has grown since 1900; that is the scientific management. The scientific management's investigation has been a performed way of human work.

Hausmann has been the forerunner of Le Corbusier's and Tony Garnier's ideas of the modern city. Mechanization and engineering requirements have been taken into consideration in city planning. Writings of Le Corbusier in the beginning of twentieth century has projected the new pattern of modern city reflecting the idea of mechanical life. If the boulevards are the distinctive features of nineteenth century, the high-ways have the same connotation for the twentieth century's. Le Corbusier, in his manifestation "Towards a New Architecture" in 1924, after describing the bewilderness of the modern men in the mid of the violent traffic, which was also a new concept for the modern world; observed that they have at first sight refused, but then identified themselves with the powers of this new city. The modern man needed "factories that produced traffic", and also a new type of street. The world of skyscrapers, surrounded by wide green areas, connected with the highways, completed with the underground parking and shopping areas has always been the description of the new city by Le Corbusier. It was a world which was regular and under control. As a solution, the new cities were to be designed as perfect machines as hygienic as an organism.

The pioneers of the time like Marinetti, Mayakovski, Le Corbusier, B. Fuller and Marshall McLuhan have proposed solutions to the problems of the modern life with the technological and administrative tools, because tools have been served for human needs. On the other hand, according to the people like Ortega y Gasset, J.Ellul, Foucoult and H.Marcuse the modern world was full of emptiness, it was one-dimensional and deprived of humanistic possibilities. What was seen as freedom and comfort was nothing more than just another kind of slavery, because, to free and increase the productive powers was percepted as the freedom of humanbeings (Berman 1994, p.26).

The picture drawn above, is a summary of the transition to the modernization. In the modern world where the scientific powers are autonomous, architecture, urbanism and other branches which are getting industrialized, give emphasis to the "progressive" character of technology and show it as a "power" which will carry the society to future. Today, the problem is to define the dialectical relation among new materials, techniques and the interaction between human and architectural space where the use of material and technique is still a problem of a "search for essence" in natural and man-made contexts which are gradually lacking of authenticity.

Changing production methods carry the architecture to the digital mediums. In order to find out the boundaries of the ultra-modern world, the conceptions like mobility, dynamic aspects and transparency are extended to the limits. "Immateriality" and "spaces with non-limits" has been put on the agenda. This is in line with the production process which has been considered as the utilization of high technology.

Therefore, **the study concentrates on the thresholds determined by the technological improvements**. The so-called thresholds are concerning the classical, modern and post-modern ages. The basic transition beginning with the industrialization in the modern age and as an extenuation of it, the post-modern era, points out the second threshold consisting of different modifications of technological understanding. Thus, the subject is studied within a comparative understanding of these eras arguing the identification of "technology" in "architecture".

1.3. The method of the study

So as to achieve the scope of the study, **a comparative analysis** is being proposed in order to emphasize the thresholds mentioned in the above. The parts ascertaining the so-called eras have been analyzed according to the following criteria:

- **Conceptual definitions** has been put forward in order to determine the **terminology** of the subject. In this part, the theories of technology have been transferred.

- The thresholds have been examined with a **retrospective overview** attempting to elucidate the architectonic quality of the era.

- Each threshold involves its own **architectural concepts** to comment in details according to the properties of tectonics of space. Firstly, material and the related construction methods, secondly, the tectonic dimension of architectural space, and thirdly the aesthetic dimensions have been analyzed by the re-readings of the samples and the critics of the theorists.

The organization of the chapters has been set up according to the following order:

The **introduction** aims to put forward the idea of industrialization in the beginning of nineteenth century in order to develop a modern world dominated by the industrial and scientific powers. Technology is treated as one of these powers through the process of modernization.

The **second chapter** examines the definitions of technology from the point of view of technologists, anthropologists and philosophers. In the first part of the chapter, the essence of technology has been discussed generally concentrating on the statements of Heidegger. Second part of it, determining the first threshold, includes a retrospective analysis of building technology and material in nineteenth and twentieth century to show the influence of technological progress in the field of architecture with an elaboration of space in the basis of "tectonics".

The **third chapter** focuses on the second threshold ascertained by the information technology. Changes in the production process and the computerized technology taking place after 1960s has been examined in the first part. As a product of computerized technology, environmentally controlled and intelligent buildings are introduced. Second part concentrates on the concept of "high-tech" as a design approach and it is aimed to be considered with in the scope of the tectonics of space. Although the technological needs and the organic forms are combined in "Future Systems", this experimental approach which carries a "science-fiction aesthetic", is not included in the scope of the study because of differing from the constructional attitudes of the so-called high-tech architecture.

At the end of the third chapter, the comparative analysis between the first and the second machine ages has been formulated with a table.

Chapter four concentrates on an analysis of building technology in Turkey to evaluate the position of the country among the others that develops and utilizes "high-technology".

A number of sample situations are proposed visually and literally in this comparative study. Thus, a wide range of current literal investigation has been required.

Chapter 2

TECHNOLOGICAL EXPRESSION IN THE AGE OF MODERNISM

2.1. Definitions of technology in the age of modernism

In order to recognize technology as a philosophical issue, it is imperative to have insight on its nature and meaning. James Feibleman, in his essay "Pure Science, Applied Science and Technology", accepts that ***technology is the modus operandi level of construction, the actual way of operating***, or in another essay, he maintains the view that, ***technology is skills (skills of operating).*** According to the above, technologists are nearer to practice and dealt with skilled approaches derived from concrete experiences (Mitcham 1983, p.2).

Henryk Skolimowski, agrees with Feibleman and states that the general aim of all technical activity is ***efficiency***. Nevertheless, the path leading to efficiency is different in various branches of technology. For example, the history of architecture can be seen as the development of architectural forms and the combination of materials that increase durability as well as the aesthetic and utilitarian aspects. The technical categories, such as accuracy and durability are the technological constants, whereas the aesthetic satisfaction and comfort are variables. For Nervi, Niemeyer and Wright, the element of a construction is at the same time a component of an aesthetic pattern. When beauty and utility are the ingredients of the technological product, it is more difficult to make an analysis about the concept of efficiency.

As an anthropological approach, in contrast with the idea of man as a tool-using animal, ***homo faber*** (tool maker), Lewis Mumford presents the idea of man as ***homo sapiens*** (mind maker). He suggests that there was nothing uniquely human in early technology until it was modified by linguistic symbols, social organization, and aesthetic design. The primitive techniques were life-centered, not work-centered (production-centered or power-centered). He also points out that the Classic Greek understanding of technique makes no distinction between industrial production and art (Mitcham 1983, p.78-82).

Jacques Ellul, in his controversial book on 'The Technological Society', begins with the definition of technique, as **'the totality of methods rationally arrived at and having absolute efficiency (for a given stage of development) in every field of human activity".** He points out 'the characteristics of the relation between the technical phenomenon and society'. If we discuss about the technological society in his point of view, we should consider technique as the central component. The technical activity, or technique, as the most primitive human activity originates in the phenomenon of invention. Jacques Ellul splits the evolution of technique into two parts; man as the maker -homo faber- and the magician. Ellul's technique is the whole of instrumentality either by hand or by magic. He describes magic as the first expression of technique, through rites or ceremonies. At the same time, when magical techniques become rigid, systems and inventions occur.

Jose Ortega y Gasset's definition of technology as **"the system of activities through which man endeavors to realize the extranatural program that is himself"** is a statement in which technology is understood as an activity grounded in human nature and is the adaptation of the environment to the individual (Mitcham 1983, p.20). As the primitive man is not aware of his technology, the artisan in Greece and Rome, does not yet know that there is technology, but he knows that there are technicians who perform a set of activities which are not natural (Mitcham 1983, p.306). On the other hand, the present-day man is surrounded by technical objects which form an artificial environment around him. These three stages are described as**; the stage of chance, the stage of artisan** and **the stage of technician**. Differing from Ellul's statement that the invention is a part of manual technique, Ortega y Gasset thinks that invention does not yet exist because technology is not yet separated from the man who practices it. According to him, until the development of machine, artisan was not liberated from the tool. Then, when the invention occurs, the stage of technician appears in the scene. Third stage, in which the mechanical production takes place, suggests that technology is situated between human and nature.

Ortega y Gasset warns that this mediation of technology creates a "supernature" that conceals the previous nature. After then, the artificial environment takes place, within which we find it as our real nature.

In "Critical Theory of Technology", Andrew Feenberg argues that the real issue is not the technology or the progress per se, but the variety of possible technologies and paths of progress among which we must choose" (Feenberg 1991, p.5). Modern technology is no more neutral, because it conducts the values of the industrial civilization. He presents three major types of theories of technology:

- **instrumental theory of technology;** in which technology is a subservient to other social spheres. By this way, the pure instrumentalism offers a neutrality of technology, and the tools are useful in any social context. Its neutrality attributes its "rational character" and "universality". The "universality" also means that some standards of measurement can be applied to different settings.

- **substantive theory of technology;** which generally includes the inclination of Jacques Ellul and M. Heidegger. They deny the neutrality of technology and argue that it establishes a new type of cultural system that restructures the world as an object of control. A link is drawn between "the technical phenomenon" and "the characteristics of modern society". In Heidegger's words, technique becomes autonomous. This theory makes us to interrogate the cultural character of the problem. When it does not simply imply a means, but a way of life, then the "substantive" impact takes place. **THE ISSUE IS NOT THAT MACHINES HAVE TAKEN OVER, BUT THAT IN CHOOSING TO USE THEM WE MAKE MANY UNWITTING CULTURAL CHOICES** (Feenberg 1991, p.8).

and proposes a critical theory of technology:

- **critical theory of technology;** rejects the neutrality of technology. By refusing its imperialism, it is regarded as relative to other dimensions of human existence (Feenberg 1991, p.8). Critical theory has its roots at the school started in Frankfurt in 1929, also known as Frankfurt School. The school owed a considerable depth to Heidegger, but also concerned with Marxism - his theory of telling the history in terms of types of production (Coyne 1995, p.68). Critical theory is so named, because it has an open-ended and self-critical approach to social transformation. As a worthy representative of Frankfurt School, **Herbert Marcuse** defined the technological thinking parallel to

Heidegger. According to **Marcuse**, it isolates and marginalizes "the ethical" and trades in domination. "History is the history of domination" (Coyne 1995, p.73). And where the productive forces support a domination over man, technology itself may reproduce and embody this domination. Major perpetrators of domination is the mode of technological production itself and the mass culture it produces.

Consequently, both the instrumental and substantive theories of technology share a "take it or leave it" attitude towards technology (Feenberg 1991, p.8), but in both cases technology seems like a destiny. The problem is how to define its domain and proposing an alternative technical determination. It is achieved by conceptualizing a new understanding of modernity and adapting it to the needs of a freer society. Despite these points of disagreements, critical theory argues that technology is an "ambivalent" process of development and its ambivalence is distinguished from its neutrality. According to this point of view, it is a "social battlefield" (Feenberg 1991, p.14) whose alternatives according to the civilizations should be discussed.

In our times, the theory of technology is represented as an integration of object with context. Technology with environmental concerns, respect to human freedom, designs that create humane living spaces, production methods that protect human life are all demands to reconstruct the modern technology. In this way, wider range of contexts has been gathered. Heidegger considered modern technology separate from society as a contextless force. **In contrast with the Heideggerian approach, the problem is expressing technology not as a power, but as a meaning in modern forms which we identify as ours.**

2.1.1. The essence of technology

Heidegger identified the world we live in as the 'scientific world'. As Nietzsche mentioned what distinguished the 19th century was not the victory of 'science', but the victory of 'scientific method' over 'science' (Nalbantoğlu 1997a, p.18). Differing from the scientific understanding of Greek and Middle Ages, modern science (the positivist science) means "research". 'Method' is proposed as the type of research of the objects between the limits of objective research areas. When the method of researching the world is discussed, something which is **reachable, testable and countable** by experiments is meant. If it is possible to test and count anything, then it is certain that the world is put under the command and use of human beings. Today, method of research enlarges its limits as 'cybernetics' which is the science of control by communication.

Heidegger, in his essay 'The Question Concerning Technology' (1954), opposes the instrumental rationalism of modern industrial society, and against the threat of modern technological civilization proposes 'art' as the savior force. He perceives **'art'** not as the fine arts, nor as an activity of proficient, but **as the technique and aesthetics of life**, a connection between human and universe (Nalbantoğlu 1997b, p.27). While technology is supposed as a tool for a certain aim used by a human activity, Heidegger interrogated the process which set up the relation of aim and tool. In his essay, he holds that human beings were still able to present themselves in the original ***'techné'*** of the Greeks. Techné, indicated in the work of craftsmen, was a form of ***'poiesis'***, which means 'bringing forth, produce, create, etc'. 'Techné' allowed things to 'be', by bringing forth what is hidden inside, which is - the truth - ***'aletheia'*** (Megill 1985, p.138). In fact, aletheia was not exactly something hidden inside, but it has engendered during the process of bringing forth. Here, Heidegger states four basic factors which were also mentioned by Aristoteles **[causa materialis (material), causa formalis (form), causa finalis (reason), causa efficiens (process)]** (Nalbantoğlu 1997a, p.40) that were combined in poiesis. Therefore, the notion of 'techné' (knowing how to do) has been described as the human activities and abilities acting on the process formed by these factors.

In the real sense, the process of bringing forth by 'poiesis' has changed completely in the age of modern technology. It is replaced by "producing". Today, the truth comes out in a commanding challenge. Feeling oneself as a part of nature is reduced to an unfamiliar state. The nature is turned into a mere resource- what Heidegger calls a **'standing-reserve'** (Bestand). The humans who are the creators of this process are also accepted as the 'standing-reserves'. Thus, according to Heidegger what is called 'dangerous' is not the technology or the science itself, but this point of view of **'framing'** (gestell). The world is totally reduced to technological terms. In the age we live in, when everything is framed, the human -as the master of all- remains at the center of the universe surrounded by the 'things'.

Aristotle conceived that the natural form of something is intrinsic to that thing. For him, the end of technology is equated with use. On the other hand, man does not stand in some external relation to technology apart from his being from the Heideggerian approach. According to Heidegger, any account of technology must include the following five essential features: **techniques** (tools, implements, apparatus, machines), **products** (consumer and nonconsumer goods), **nature** (material and power), **theory** (the role of science) and **intersubjectivity** (the social organization of labor). To emphasize the spatial function of techniques; the context, in which the techniques (tools, machines, materials, energies, science and persons) are included, is called the "contextual totality" (whether it is a house, a carpenter's workshop or a factory) (Mitcham 1983, p.357).

Heidegger makes us return "to the phenomenological presence of things in themselves" as a follower of Husserl's doctrine (Frampton 1995, p.22). The presence of things is identified with its matter. And, he continues that what is constant in a thing is that it stands together with a form. Thing is a formed matter. At this point, according to him, architecture stands between "human self realization and the maximizing thrust of technology", which consists of durability of the "thing", the instrumentality of the equipment and human institutions taking place in it (Frampton 1995, p.23).

The word "techne" was represented in time when an ontological bound between art and science was present. As the tools for working did not have the state of today's machines of production, producing something, mentally, did not perceived as a continuos way of development. Towards the end of seventeenth century, "techne" was replaced by "technique" when the technical elements were used by the artisan. The advent of mechanization in late eighteenth century, the ontological relationship had disappeared between art and science. Parallel to these developments, in the mid-nineteenth century of architectural discourse, the positivistic rationality took over "the logos of making", "techne". The "productionist understanding" of making and manipulating dominates the world of thought which is the domination of scientific, philosophical and therefore the **technological thinking**.

By the invention of the telescope, by Galileo, perception of the world was transformed to an interest of the process of physical life. The basic character of the modern age is the interest in the logic and analytical approach to natural and cultural phenomenon. In this way, nature becomes something measurable. **A major break is the shift from object to process; process which based on fabrication. From this point of view, the process which projects the final product, denotes the transition from techne to technology.**

In Classical discourse, work is a unity of thinking and doing, which is the combination of both theory and practice. In the age of mechanization, the unity of work is replaced by the process of production. It is a break between modern thinking and archaic.

Discovery of nature as a "power" of source in eighteenth century, remarks the domination of man over nature. This indicates a break between subject and the nature which has been objected. Production on one hand, reduces man and nature to economical factors of production, on the other, to mere rational terms (Baudrillard 1998, p.48-49).

Reading Heidegger in light of Walter Benjamin, the major break is called the disintegration of the **"aura"**[1] in the context of mechanization. "Aura", implies the

[1] Walter Benjamin in his article , " The Work of Art in the Age of Mechanical Reproduction" states that, "even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be" (Benjamin 1993, p.49). He later refers to this element as the **"aura"** of the original, that all reproductions lack. According to him the technical reproduction can put the copy of the original when it is out of reach. As the work of art had lost its effect of sacredness, it gains a new and political function. When the observer is faced with **"aura"** or the mystery of the traditional forms, he is effected with it and finds

presence in time and space, its unique existence at the place where it happens to be. For Benjamin, **destruction of the "aura"** has taken place by industrial production, needing not only different tools, but also a new perception of nature and object. In other words, what Arts and Crafts movement had concerned was the loss of "aura", the distance introduced by mechanization between tradition and the reproduced artifact. Today, during the transmission of information, "aura", "uniqueness" and "the sense of place" remain as the "**untransmitted**" concepts of artistic and architectural products (Çağlar, Dinç, Uludağ, 1996, p.15)

2.1.2. Social bases of technology

The spread of the concept of industrial society has been accompanied by recognition of the two major developments of modern times - democracy and industrialism. The concept of industrial society begins with the intellectual roots in nineteenth century. The society becomes scientific by the application of science to production and the scientific organization to scientific and technological progress. In accordance with this process, the instruments and organization of work are renewed (Aron 1974, p.17).

"The technical phenomenon" taking place in "modern society" conducts the values of the industrial civilization. When technique becomes autonomous, the cultural character of the problem of technology is detected. Two different kinds of classifications of "technological society" are given below. First, by Jacques Ellul, according to the technological properties. And second, by Neil Postman, according to the types of cultures with in their technological context.

Technology exercises an influence upon society, the social power and authority. Referring to his book "The Technological Society", Jacques Ellul confines the characteristics of society :

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some connections with his identity, but the defamiliarization as a cause of the technical possibilities pushes the observer to a situation of more critical and active attitude. As a result, there is a big difference between a "unique", "original" and the work of art reproduced as a reason of technique (Benjamin 1993, p.45-76)

- technique becomes the new and specific milieu in which man is required to exist

- the technical milieu has the following characteristics:
    1. it is artificial
    2. it is autonomous with respect to the values, ideas and the state
    3. it is self-determinative independently of all human intervention
    4. it grows according to a process which is casual
    5. it is formed by an accumulation of means which have established primacy over ends
    6. all its parts are implicated to such a degree that it is impossible to separate them

- since technique has become the new milieu, all social phenomena are situated in it, such as economics, politics and culture.

- technique comprises organizational and psycho-sociological techniques (adaptation of human beings to the technical milieu).

- choices and ends of modern man are dominated by the technical values (Mitcham 1983, p.86).

On the other hand, Neil Postman, in his book "Technopoly: The Surrender of Culture to Technology", has classified the cultures into three types:

- the tool-using
- the technocracies
- the technopolies

According to Postman, although the **tool-using** is rapidly disappearing, they are not the intruders in society, but they are integrated into the culture. In a **technocracy**, the tools play a central role in the thought-world of the culture. Organization and management are directed by the technical experts. It is a social form in which the peak of its organizational integration has been reached. Tools attack the culture rather than integrate it. Technocracy which gave the idea of progress, speeded up the world, and accomplished more in a shorter time. It did not entirely destroy the "social" and "symbolic" worlds. This does not mean the vanishment of traditional world, but these two opposing world views - the technological and the traditional - coexist in an uneasy tension, where the technological seems stronger. With the rise of **technopoly**, which is defined as the totalitarian technocracy, one of those thought world views - mostly the traditional - disappears (Postman 1993, p.23).

Society is always in need of renewing itself and as a matter of fact, producing new strategies. The factor of technological development, especially as a political problem, will always keep its place in these strategies. However, inventions like "alternative futures", are acertained in a way which they correspond to sociological backgrounds.

2.2. A retrospective view on the impacts of technology over the organization of architectural space in the age of modernism

Industrial Revolution has always been one of the major forces of the modern architecture. The problems and construction methods of production have changed as well as the patrons of it. The new life pattern has demanded new forms by the industrialization. According to Leonardo Benevolo, the industrial revolution was characterized by certain basic changes from the mid 18th century: increase in population, increase in industrial production and mechanization of productive systems (Benevolo 1989, p.xix). Increase meant more types of products and more processes to produce them. Changes in the building technique can be summarized in three basic issues:

- The traditional materials such as stone, brick and timber were utilized in an efficient way and the new materials like cast iron, glass and later concrete were added. With the help of advanced equipment of machinery and developments in geometry, nearly all sorts of complicated plans were made realizable (stereotomic roots). (will be examined in sections 2.2.1.1.1. and 2.2.1.2.1.)

- Increase in population resulted in new needs for habitation. Factories, stores, warehouses, housing, etc. which referred to the public functions had to be built economically in a short time. (will be examined in sections 2.2.1.1.2. and 2.2.1.2.2.)

- Development of specialized schools and new ways of creating knowledge. (will be examined in sections 2.2.1.1.3. and 2.2.1.2.3.)

Geometrical ways of handling shape and form of products brought a certainty to the application of design. The scientific developments at 17th century were generally based on the problem of "stability". The influence of these scientific developments to building technology was seen in two different ways. The widespread **of descriptive geometry** and **metric system.** Descriptive geometry was based on the idea of two-dimensional drawings of three-dimensional objects on paper. In this way, the means for overcoming the limitations of building technology was provided. **Stereotomy** (Fig.2.1) refers to the application of geometric projections in determining the shape and dimensions of stone or wooden elements in arches, vaults, trusses, stairs and domes (Perez-Gomez 1992, p.227). (Stereotomy : the art or the technique of cutting solids, stonecutting). This technique provided a certain solution to the form and the combination of the architectural elements on plain paper.

Sainte-Geneviéve (1754) (Fig.2.2), constructed by Soufflot was fined successful for the structural components which are governed by certain static functions with minimum use of material. On one hand, it fulfilled the rationalistic Greco-Gothic ideal by combining vaulted and trabeated structural forms in a new spatial unity, on the other it stretched the art of reinforced masonry construction to its technological limits (Frampton 1995, p.32).

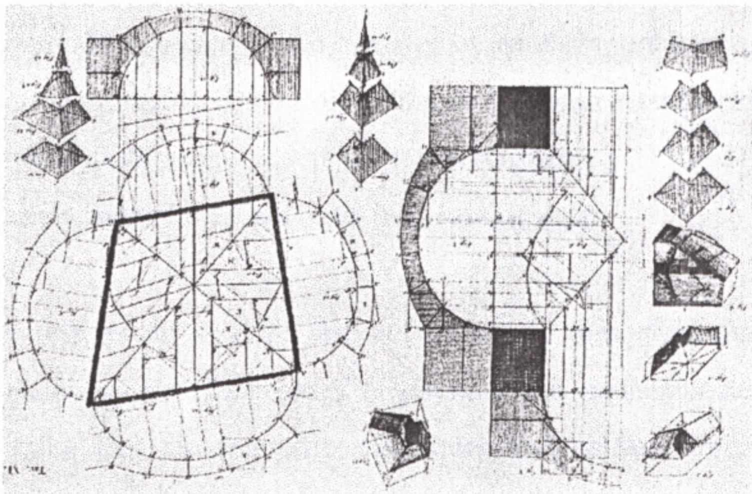

Fig. 2.1. Stereotomy, stonecutting; (source: Benevolo 1989, V.1)

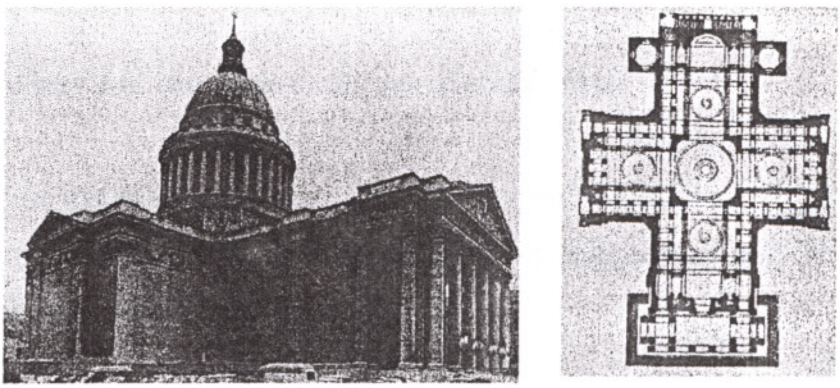

Fig.2.2. Soufflot's Sainte-Geneviéve, 1754; (source: Gomez 1992)

Before the architectural education was related to Academie d'Architecture, the practitioners of architecture have been trained in the guilds or learned design and construction through practical experiences. Much of the actual design took place at the site or in the stoneworker's shop. Many engravings were done after the completion of the building (Doremus 1994, p.67). Ecole des Beaux-Arts (1671) which was established as an academy to train architects, had constituted the elites of the profession. Techniques of drafting (two-dimensional drawings) have been taught at Ecole des Beaux-Arts. **This transition from crafsmen to architect identifies the early distinction between art and science of architecture** (Balamir 1996, p.102). After then, the engineering schools based on the knowledge of scientific principles, such as Ecole des Ponts et Chaussées and Ecole Polytechnique has been established pointing out the schism between architecture and construction (Giedion, p.211-212). The scientific innovations had increased the field of activity for engineers.

Ecole Polytechnique which was set up in 1794, had a function of combining the science and life, practical activities and discoveries of physical and mathematical sciences. The theorists insisted that the scientific techniques and constructional methods should be considered deeply in architecture. J.L.N. Durand at Paris Polytechnique has brought up his method as the identification of the components (components that gain a form according to their materials growing up from its own nature), combination of each material which form the whole, and finally the search for the building techniques.

2.2.1. Building technology and materials in the age of modernism

Building technology and materials in the age of modernism can be examined in two basic sections based on iron and glass constructions in nineteenth century and the concrete constructions of the twentieth.

2.2.1.1.The use of iron and glass as materials of construction in the nineteenth century

Iron and glass materials in the nineteenth century are studied according to the following criteria:

- Constructional properties and methods of construction in lieu with the architectonic qualities and the semiotic dimension

- architectural typologies
- theories of construction

In preindustrial societies, the natural materials and the technical qualities had great importance in determining the style and scale of building. By Industrial Revolution, in addition to these factors, new materials and constructional systems have also acted on design.

Traditionally, three versions of iron have existed: **cast iron, wrought iron** and **steel**. While the cast iron was the crudest form, wrought iron was comparatively soft because of having almost no carbon. Cast iron column was the first structural member *'produced with the new industrial methods'* used in building. Cast iron was a material which could *'be shaped easily'*. It was the symbol of 19th century and was followed by the use of iron beams combined by these iron columns (hollow cast iron pillars).

At first, **'iron was used for secondary purposes'** to join up the hewn stone in freestone buildings. It was melted traditionally, the product was resmelted and poured into moulds to obtain **cast iron** (Curtis 1995, p.3).

At the beginning of 19th century, large numbers of new bridges were needed, thus the engineers of Ecole des Ponts et Chaussées constructed them with freestone as the symbol of kingdom. The **first structural use of cast-iron,** after the experiences in steam engines, was the bridge over the Severn at Coalbrookdale in 1779 (Fig.2.3). It was designed as *semicircular arches* with a span of 30.5m. by joining two *half-arches* made in a single piece (Benevolo 1989 V.1., p.19). Cast iron frame structures were used in warehouses at St Catherine Dock in London with a brick encase based on a system of fire-proof multistory mill construction (Frampton 1980, p.29).

After then, suspension bridges with ***'chain cables'*** were designed in order to suit bridges with large spans and less resistant to dynamic stresses.

French architect and theorist Eugene Viollet-le-Duc formulated a link between architectural history and the 'expression of building construction and materials', **the**

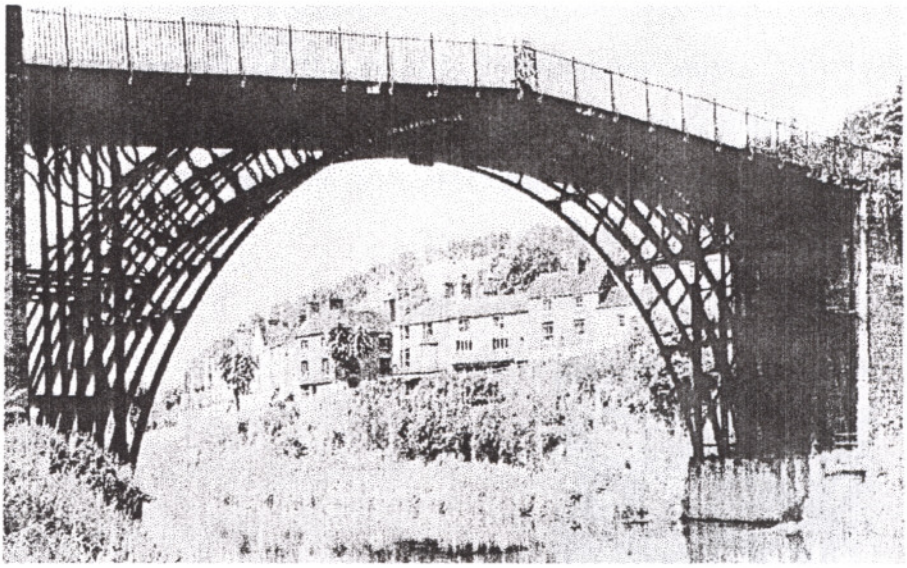

Fig. 2.3. Coalbrookdale Bridge, 1777-81; (source: Benevolo 1989, V.1)

architectonic qualities (Fig.2.4). What he wanted to express was to release from the eclectic historicism of 19th century by the principles derived from the construction of the building. This tendency has a point of departure both combining '*the idea of finding new forms with new technologies and making a construction with what is logical for all the decades*' (Bilgin 1987, p.58). Viollet-le-Duc defined the new material of the century as iron, which, in his words, permitted **wider spans, with less weight and greater reliability**. It was the coming system of the future which was '*structurally superior*' to the systems of antiquity (Frampton 1995, p.83). He demanded that all kinds of materials should appear as they are. As he mentioned "the best architecture is that whose ornamentation can not be divorced from the structure". Viollet-le-Duc's discourse is important because he implied the idea of tectonic in addition to his belief that architecture is not imitative.

Another building for the Paris Exhibition of 1889 was Galerie des Machines (Fig.2.5) expressing the new aesthetic language with its light and cellular structure. The point where the designers and the constructors have been trapped was the Gothic or Baroque style used in these buildings. The technique and the material were new, but the stylistic approach carried the hints of the past. Galerie des Machines was too big in scale, thus it was not easy to wander in the building for the visitors. For that reason, two big trolleys were installed for carrying the spectators above the exhibition area. In this way, not only the circulation problem was solved, but also the interior space was brought down to the human scale. *'The tectonic potential of the whole'* was derived from the order of the components and the articulation of the joints.

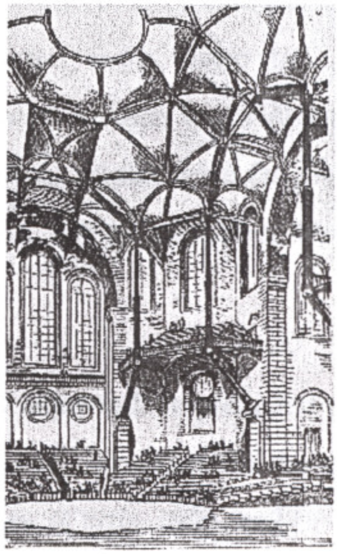

Fig. 2.4. Concert Hall, Viollet-le-Duc, 1872; (source: Curtis 1996)

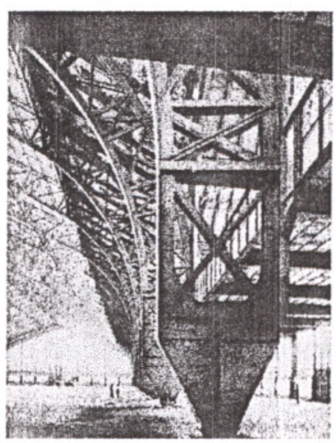

Fig. 2.5. Galerie des Machine, Contamin and Dutert, 1889; (source: Pevsner 1968)

To emphasize the **semiotic dimension** of the iron constructions, it is certain to remark the triumph of technology and the prefabrication processes as the products of the modern life and the images of the consuming society. The new concepts in the social formations determined by the modernist culture were "eternal development", "continuous reproduction" and "renewal". Therefore, the iron constructions acted as the symbols of these ideals.

The 19th century exhibition halls expressed the technological power as an instrument of national progress and compete for prestige in the new world of international trade. At first, the iron and glass constructions for utilitarian needs, were built as **warehouses, workshops, factories, covered marketplaces, bridges and railroads**. The **iron halls** suited the need of *'unbroken spaces'* both in spatial sense (as places of transit) and *'temporal'* one (expositions torn down after they closed) (Buck-Morss 1989, p.130).

In his studies after 1860, **the French theorist Eugéne Viollet-le-Duc** predicted that the new style of 19th century would consist of the *'honest expression'* of the new building construction and materials like iron and glass (Curtis 1995, p.27). He detailed the principles of construction of medieval age by using structural members out of iron. He also compared the constructional characteristics of the past with the emerging technologies of his time and showed that the technological innovations in each epoch drew some theoretical conclusions (Crowe 1995, p.147).

The architect-constructor Henri-Labrouste, predicted that the construction itself is a reasoned ornamentation. As he explained *'the solidity of a building does not depend on the solidity of the material, but the way it is put together'*. He was commissioned to built the **Bibliotheque Ste. Geneviéve** (Fig.2.6) in Paris. Except from the outer masonry outer walls, all the structural members were made of iron, but the elegant iron construction was balanced in itself, thus it did not need to put stress on the walls.

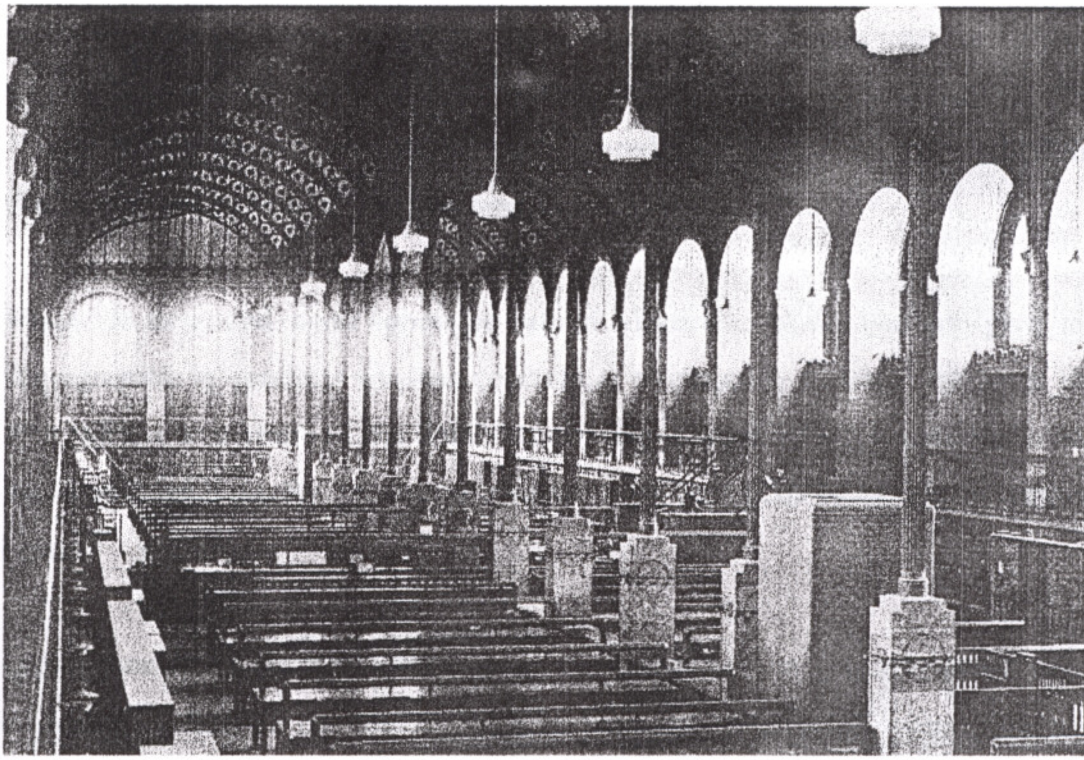

Fig. 2.6. Bibliotheque Ste. Geneviéve,1843-50; (source: Pevsner 1968)

During the last decades of the 19th century the iron buildings nearly reached to the limits of their constructional possibilities. Sooner, the reinforced concrete became important in ordinary buildings because of the economical advantages of the material. It was the engineers of 19th century who advanced the building techniques and prepared them for the use of modern movement.

2.2.1.2. Use of concrete as a constructional material in the twentieth century

The building technology based on concrete material in the beginning of twentieth century is studied according to the following criteria:

- Constructional properties of concrete and methods of utilization in lieu with the architectonic qualities and the semiotic dimension
- architectural typologies
- theories of construction

Concrete was not new as a building material in the history of building technology, because before its use in the end of 19th century betonarmé technique, the Romans and early Christians had used it without strengthening, as a material called "caementum". The use of material has explored again in the second half of the nineteenth century usually for cheapness and fireproofing character.

While the stone and wood appear as natural substances, brick, iron and glass are homogeneous by-products whereas concrete is a composite material. Although the 19th century was aware of the durability and the strength of the material, it never manifested itself as the innovative structures of iron (Coalbrookdale or Crystal Palace).

Mies's concrete skeleton constructions in Weissenhofsiedlung (Fig.2.7) gave chance to develop a flexible planimetry. With its white cubic volumes, open plans and machine age details the housing exhibited the character of what was later called "The International Style". A purist rationalist consideration indeed was a combination of economic, technical and aesthetic factors. In the event of allowing functional variables inside, an abstract outer form can also be accepted as functional. This is what Mies has supported in opposition to a complete formal attitude.

Corbusier's "Domino" concrete housing system (1914-15) (Fig.2.8) designed to serve the needs of modern society in harmony with the mass production. The concrete skeleton of cantilevered slabs has been supported with six columns. The idea was to arrange modern dwellings which were simple, rectangular and easily produced with mass-produced components. Corbusier was in need of defining the elements of a new architectural language. The Domino system allowed new freedoms in the positioning of partitions and generated the principles like - free plan, free facade and flat roof terrace. As the elements of the structure, the columns, floors and roofs have been expressed in their ideal and pure form (Curtis 1996, p.85). This design concept, evolving the abstract modulation schemes, has freed the modern man from the dependence to traditional conditions and let him to transform the environment adapted to his way of life.

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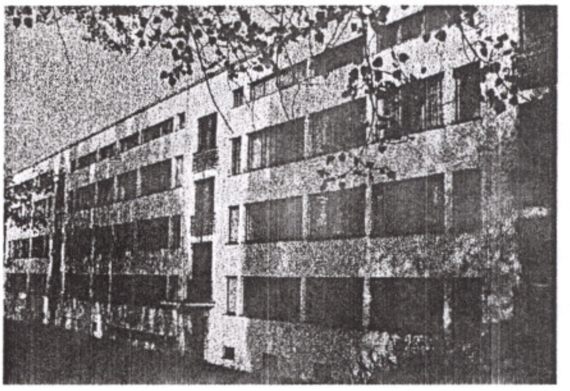


Fig.2.7. Weissenhofsiedlung, Mies, 1927; (source: Curtis 1996)

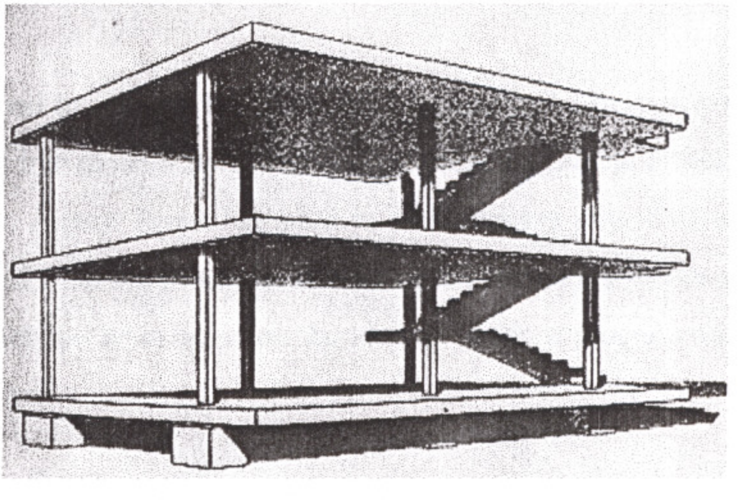


Fig.2.8. Domino Housing, Le Corbusier, 1914-15; (source: Curtis 1996)

After the two World Wars, concrete became the material of hygienic building, social mass production and the industrial economy. Above the functional qualities, all the materials have semiotic qualities as well. For this reason, concrete has a connotation of industrial prefabrication for satellite towns and precast panel housing. It recommended itself for the design of wide-span factories. The assembly lines were easily threaded in the factory which required cheapness, standardization, fireproofing and unobstructed span (Curtis, 1996, p.81).

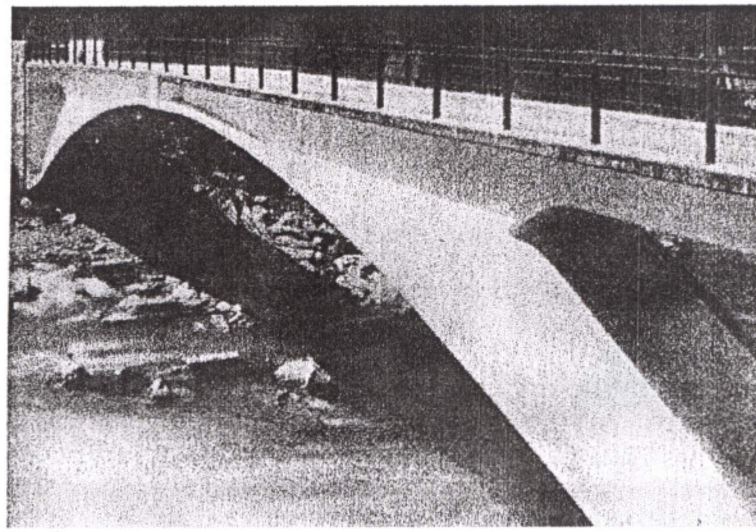


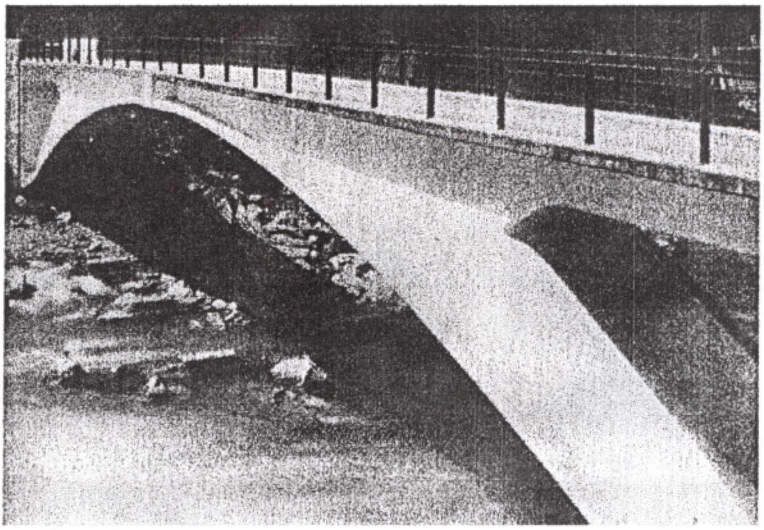
Fig.2.10. Maillart's bridge over the Reine at Switzerland, 1910; (source: Pevsner 1968)

Perret has decided that the right forms for reinforced concrete were rectangular ones because of the simplicity of making with standard sections and aesthetic expectations of the material. Differing from Perret's system, Corbusier has introduced the idea of separation of fill and frame. Based on this idea, he has presented the concept of open plan, open space and open facade.

2.2.2. Tectonic dimension of architectural space

Technology as "techné" in the Greek sense of reasoned intelligence, followed a system of rules, related to some kind of an artisanal production. For Greeks architecture was defined as the form giving capacity of the material since the material is limited in scale, the knowledge of "joining" and "fixing" is needed. Thus, "tectonics" was a combination: the material, procedure of joining and form. In short, the tectonic potential derives from the poetic articulation of the substance.

The question of the origin of architecture (Fig.2.11) and its relation to construction is illustrated in Laugier's book "An Essay on Architecture", Paris 1755. The primitive hut (Fig.2.12) was described as a form composed of four tree-columns and a simple gable-end roof with branches showed by a female figure. The clearness of structure



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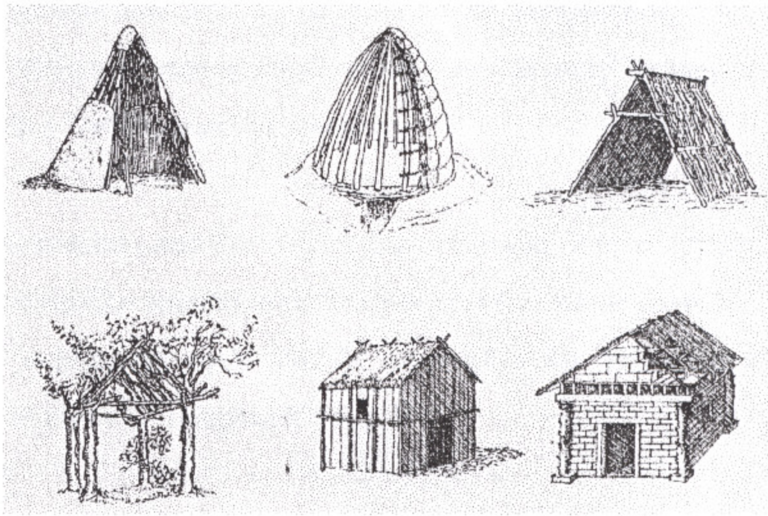

Fig. 2.11. Origins of hut; (source: Crowe 1995)

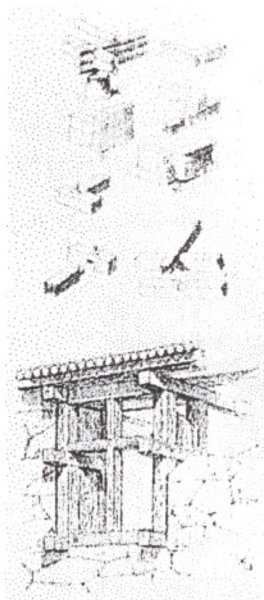

Fig. 2.12. Laugier's primitive hut, an illustration by Laugier, 1755; (source: Lambert 1993)

Fig. 2.13. Joints in Classical architecture, Porphyrios; (source: Porphyrios 1991)

As D. Porphyrios says, "building is not a construction for necessity, but the ontological experience of tectonics, revealing the ontology of constructing" (Fig.2.13). For instance, the tectonic expression of Paxton's Crystal Palace is derived from the order of the parts and the articulation of the joints. The eclecticist approach in post-modern architecture uses attachments on the construction, which are decisive in this sense. They are "scenographic" rather than "tectonic" or they are "representational" rather than "ontological" in character.

In 1973, in "Structure, Construction and Tectonics", Eduard Sekler defined tectonic as: **"expressivity arising from the statical resistance of constructional form in a way that the resultant expression could not be accounted for in terms of structure and construction alone"** (Frampton 1995, p.19).

Cited by Frampton, what Norberg-Schulz has observed as a connection between the compositional order and tectonic assembly is, "Spatial organization (composition) may be described without referring to a particular technical solution, but **character can not possibly be separated from the process of making**" (Balamir 1996, p.195).

In his book "Studies in Tectonic Culture", Frampton mentions about the tectonic and tactile dimension of architecture. With his terms, **"tectonic is defined as the art of joinings"**. He puts forward the distinction between "tectonic" and "atectonic" which was proposed by Sekler, and what is referred by "atectonic" is the construction whose tectonic elements are hidden. As an example, Frampton makes remark of Peter Behren's AEG turbine factory where the tectonic and atectonic clearly coexist. On one hand, there remains the tectonic pin-jointed steel frames and on the other, the atectonic corner bastions, failing to carry the cantilever of the roof (Frampton 1995, p.21). He says that although tectonic meant construction, it is a poetic construction, the construction which interprets. Similarly, for some post-modern architects, like Graves, Venturi or R.Bofill, the reveal of the structure or the joints of the construction is not a part of their discourse, in other words, what is interpreted is not the construction itself.

2.2.2.1. Material / Joint / Detailing

Taking up 'the whole' as the building and 'the parts' as the integral components, the problem is how to assemble the latter so as to come up with the whole which possesses architectonic qualities. In other words, the expectation of the architectural academia is to come up with more than the some of the parts. Consequently, the material and construction gains a narrative role. Both in modernist and postmodernist discourses, this way of revealing is identified as a poetic act.

In the writings of Marco Frascari[2] and Vittorio Gregotti[3], the architectural detailing was accepted as an initial point and a concept. First, opposing to the abstract perception of detailing in modernist tradition in post-war years, they emphasized **the importance of construction and detailing in architecture**; secondly, they pointed out **the expressive value of material and joining in relation to the physical and historical environment**.

This reminds us the return of ontological presence of things, as Heidegger mentions, the natural integrity of human life and the act of constructing. In this way, the combination of the spirit of material and the act of constructing meant an integration with the spirit of place. The act of constructing, mentioned above, involves a tradition. For this reason, Gregotti did not approve the integration of different industrial fields with architecture, because this brings the end of tradition of constructing which excludes a cultural heritage.

In Classical architecture, **constructional detailing** and **decorative detailing** (Fig.2.14) were linked and the making of detailing was given back to the craftsman. As Frampton mentioned, the tectonic dimension of construction does not deny 'ornament' and adds that "all forms of joining are potentially forms of ornamentation". Any kind of joint serves as an ornament (Akcan, 1997/11, p.43). An important aspect of classical thought was its 'ontological understanding' and the

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[2] "The Exercise of Detailing" by Vittorio Gregotti, (Nesbitt 1996, p.494-497)
[3] "The Tell-the-Tale Detail" by Marco Frascari, (Nesbitt 1996, p.498-514)

ontological relation between man, tool and nature. For example, Scarpa supports the idea of crafts production in building and rejects the computerized technology which becomes dominant in the industrial age. These approaches are part of individual statements after the doctrinal modernist approaches of the post-war years.

Scarpa, as mentioned in the above, is distinguished by being a part of a tradition. He can be related with the way Wright reconstituted the whole with conceivable joints. It is said that his discussions with the manual workers about the constructive craft and elements are the products of site context. He carried the soul of local artistic tradition and the feeling for material through the combination of different materials. Details are the celebrations of craftswork (Fig.2.15). His truth to the manual construction was emphasized is his designs. While the hinges and the joints between the double columns were technologically clever, they did not reflect directly the mechanical production. Also, the zigzag outlines are the examples of carpentry of the classical architecture, but not historicist in style (Fig.2.16) (Los 1994, p.8-26).

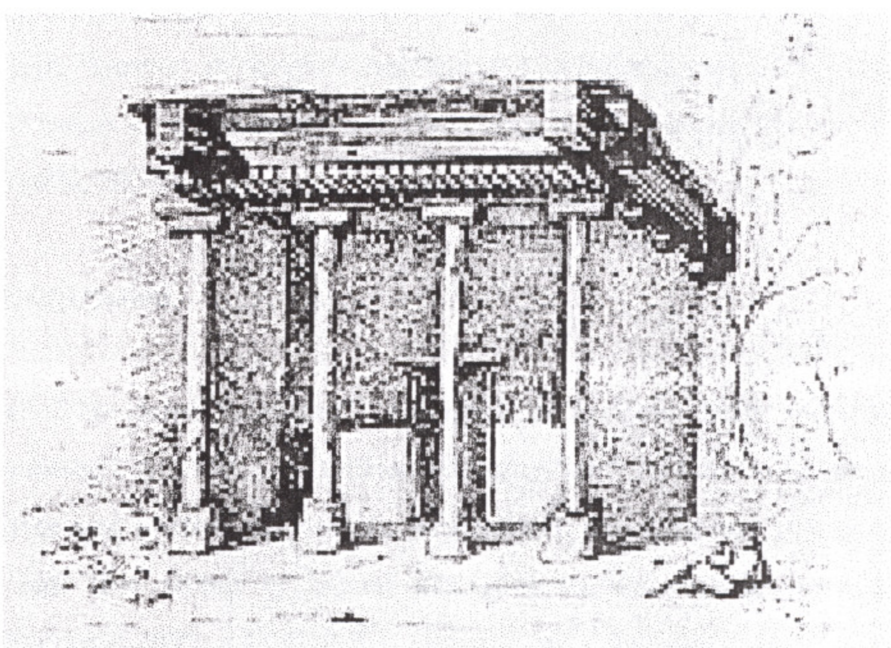

Fig.2.14. Classical Architecture (the unity of construction and decoration); (source: Frampton 1995)

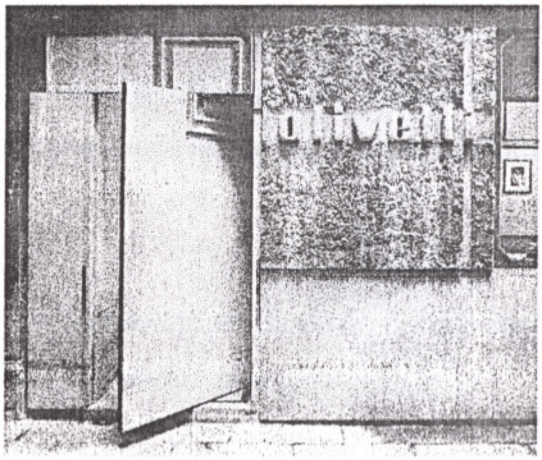

Fig. 2.15. Scarpa (detail showing the utilization of different materials) (source: Los 1994)

The tectonic nature of Scarpa's work has been displayed by Frascari, showing the double-faced presence of technology as **"techné of logos"** and **"logos of techné".** This dimension has been characterized by a reciprocity of "construing" and "constructing". With his words "At the time of the Enlightenment the rhetorical *techné of logos* was replaced by *logos of techné*. Construing becomes the manner of production of signs that are the details, while constructing is a counterpart in the generation of details However, in Scarpa's architecture this replacement did not take place. There is a union of construction and construing in the making and use of details" (Nesbitt 1996, 500-514).

2.2.2.2. Tectonic expression

The earliest use of the term **"tectonic"** in English dates from 1656, meaning **"belonging to building".** In 1850, Karl Otfried Müller defined the term as **'a series of arts which form and perfect the vessels, implements, dwelling and places of assembly. We call this string of mixed activities tectonic; their peak is architecture.'** (Frampton 1995, p.4). But, first elaboration in the modern sense is by **Karl Bottischer**'s with his book "The Tectonic of the Hellenes" in 1844 (Quantrill 1991, p.6). Botticher distinguishes the core (Kern-form) form of the timber rafters in Greek Temple and the artistic representations (Kunst-form) of the same elements.

His interpretation of tectonic as a whole includes the framed presence and the relief sculpture (Frampton 1995, p.4). As Mitchell Schwarzer has written, Botticher has proposed that the beauty of architecture has derived from the explanation of mechanical concepts related to the constructive demands as well as the artistic considerations[4] (Frampton 1995, p.82).

The tectonic can not be separated from the technological, because it is formed both by the technical and the symbolic dimension of the object.

By the influence of Müller (Frampton 1995, p.4), Semper put forward the four basic elements of architecture based on the Caribbean hut (Fig.2.17) that he saw in the

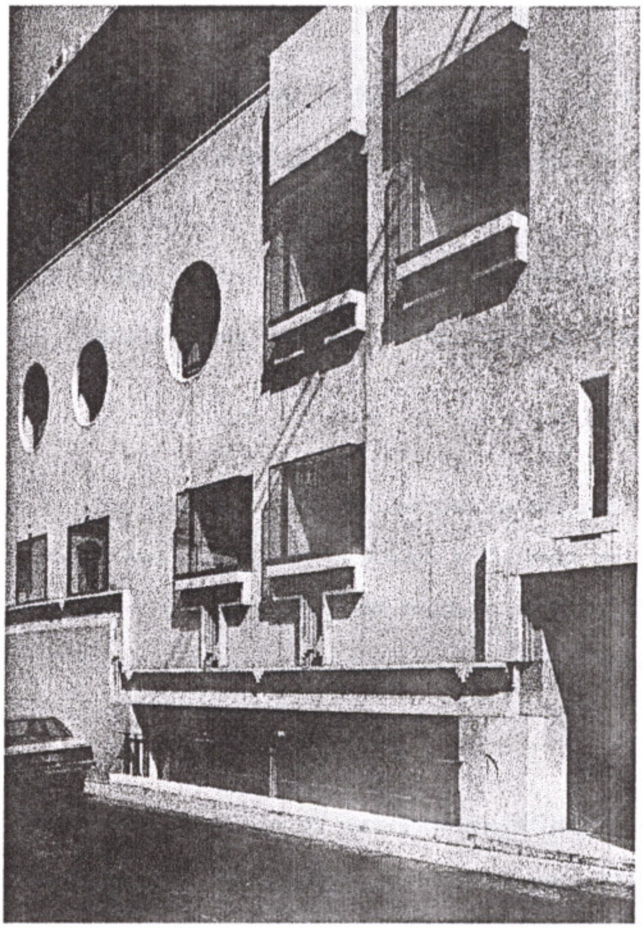

Fig.2.16. Scarpa (facade, zigzag motif); (source: Los 1994)

[4] Schwarzer, Mitchell, "Ontology and Representation in Karl Böttlicher's Theory of Tectonics", Journel of the Society of Architectural Historians, 1993.

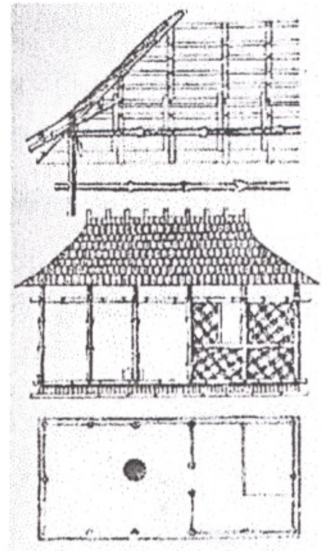

Fig. 2.17. Semper's Caribbean hut, 1851; (source: Frampton 1995)

Great Exhibition of 1851: 1.the earthwork, 2.the hearth, 3.the framework, and 4.the enclosure (membrane). In broad terms, he classified the building craft in two fundamental procedures:

- tectonics of frame, with lightweight linear components (tends towards the sky).
- stereotomics of earthwork, with repetitive, heavyweight elements; load bearing masonry (tends towards earth).

> "Architecture, like its great teacher, nature, should choose and apply its material according to the laws conditioned by nature. If the most suitable material is selected for the embodiment, the ideal expression of a building will of course gain in beauty and meaning by the material's appearance as a natural symbol" (Semper 1989, p.102).

What has been defined by Semper are two principles of forms of construction: the post-and-beam, or trabeation and bearing wall construction. Series of constructions are arranged according to the evolution of building practice. An argument has been made by Porphyrios that architecture constitutes a poetic expression of constructional priority arising from its natural evolution. On one hand there remains Semper's earthwork, and on the other dematerialized Crystal Palace of Paxton's .

As Semper has emphasized, ceramics, carpentry, masonry and weaving were the four industrial arts which correspond to the four elements of architecture. The hearth, or the center, has derived its form from ceramics and metalwork. The roof, terrace and enclosure were related to the skills derived from carpentry, masonry and weaving. The hearth and the roof were the essential parts of these elements.

Semper maintained that the earliest tectonic element/structural artifact is "knot" referring to the primary building culture of the tent (Fig.2.18). According to him, perhaps the oldest technical symbol. In architecture, in ceramics and generally in all the arts, the net was used for the decoration of surfaces and applied in a structural-symbolic way. The beginning of building construction coincided with the beginning of textiles. Knot referring to joint, is implied by Semper when such a transition is expressed from the stereotomic base of a building to the tectonic frame (Frampton 1995, p.86).

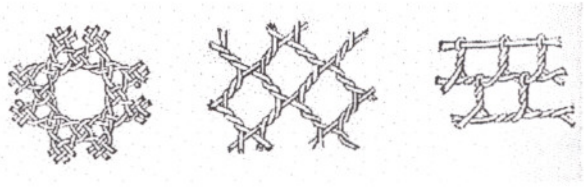

Fig. 2.18. Semper's (knot, joint) ; (source: Frampton 1995)

The importance of "montage" as "jointing" or "assembly" also stems from Semper's thought. As Hartoonian mentions, montage is not only a mode of making shared by a production process, it also embodies an experience of fragmentation (Hartoonian 1994, p.26-27). This fragmentation denotes the absence of transferring tradition, including the craft of architecture.

Semper has marked that both decoration and dressing, apart from the tectonic frame, are so closely bound together that it is impossible to separate them. It is opposite of the positivistic understanding of construction and interpretation of ornament in Viollet-le-Duc's point of view. **For Violet -le- Duc, form is the realization of**

construction and material. For Semper, the tectonic evolves out of the metamorphosis of material and the skills that are already at work.

In architectural discourse, Heidegger's understanding of techne is defined as tectonic. The meaning of tectonic goes beyond construction. **While construction is simply putting together the architectonic elements such as columns, beams, walls and roofs with respect to gravity; tectonic is the reveal of meaning of these architectonic elements beyond their structural rationality.** Between the structural utility and the analogical representation, there remains the tectonic. **Physical properties and methods of construction should not be regarded as the functional and technical concerns of building, but should be considered as the components of the architectural form with a potentiality of symbolic, aesthetic and cultural content.**

2.2.2.3. Tectonic qualities in modern architecture

To analyze the tectonic qualities in modern architecture, some pioneers of the era will be exemplified below. Although they differ in expression, they share the same tectonic sensitivity.

August Perret's achievement was using his facade to express both his material and reinforced concrete structure. He used ferro concrete in the way Henri-Labrouste had used iron. As an example, to catch the sight view of the Seine and the Eiffel Tower, large windows were used with a u-fronted plan in apartment blocks at rue Franklin (Curtis 1996, p.76) (Fig.2.19). The difference between the frame and the infill is distinguished, although the concrete posts and beams were clad in terra-cotta and Art Nouveau tiles. This is why Perret is so much interested in the expression of both the skeleton and the carpentry which evokes the carpenter of tekton of the Greeks.

Everything seemed to grow lighter in the beginning of 20th century, thus the very thin structural elements seemed to connect the building to the ground. For instance, with Garage Rue Ponthieu (Fig.2.20) of 1905 by the exposed structural concrete, the betonarmé aesthetic was utilized by Perret. Variations in the depth of beams, exposed main columns, the beams joining them and the industrial sash glazing was rarely used in those times. Indeed, the flexibility of planning with a grid of concrete columns was needed for the circulation and parking of the cars.

An architectural language has been formed by letting the construction to be perceivable. For him, the visual expression of material is important as well as the constructional system. In his main theoretical statement, published in 1952, he writes:

> "**Architecture is of all the artistic expressions the one most subject to material conditions**... Construction is the mother tongue of architect. The architect is a poet who thinks and speaks in terms of construction. The large buildings of our time presuppose a framework, a framework rendered in steel or reinforced concrete. The framework is to a building what a skeleton is to an animal...Just as the skeleton of an animal, the framework of a building must be composed, rhythmic, balanced and very symmetrical" (Frampton 1995, p.153).

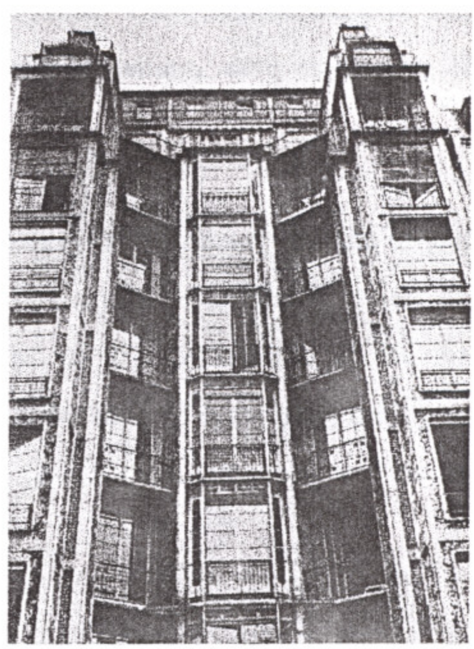

Fig. 2.19. Apartment block at Rue Franklin, Auguste Perret, 1902; (source: Pevsner 1968)

Fig. 2.20. Garage Ponthieu, Auguste Perret; (source: Benevolo 1989, V.1)

In his early domestic architecture, Wright had visited Japan and influenced by the repetitive order of Japanese architecture. On the other hand, smooth shaping of machine technology directed his design approach. In his designs, the same idea of modular grid and order is varied on the basis of the local circumstances and it was an "economic, democratic, mechanized" expression of labor saving in construction as well as his architectural concept. In Allice Millard House in California (1923) (Fig.2.21), Wright, who called himself as a "weaver", used double walls formed of textured light weight blocks, knitted with steel joints. These double walls of solid reinforced slabs, inspired from the textured trees in nature, were supporting the climatic control. (Frampton 1995, p.109).

At Johnson Wax Administration Building (Fig.2.22) (1936), we see how the concept of "organic" is applied to his architecture. The concrete cantilevered tree-like columns were used (axis mundi or the tree of Enlightenment in Buddhist philosophy). These columns are fastened with a membrane of pyrex glass tubing and let him to develop a curved corner profile which Frampton calls a "modern streamlined aura".

Beginning with the stereotomics of brick constructions, Mies exercised the tectonic expression of glass and steel in 1927 in a Semperian sense. In his designs like Crown

Hall, IIT, Seagram Building and Nationalgalerie in Berlin he goes into a monumentalism of technology. The importance of his brick houses lies in their material expressivity. Quality of the material itself and the expression of detailing projects his aphorism that "God is in details". Glass is demanded in a skeleton frame tectonic system which sustains a spatial freedom and free plan. Similarly, the tectonic value of Barcelona Pavilion is gained by the free-standing cruciform columns and the planes which are set alone.

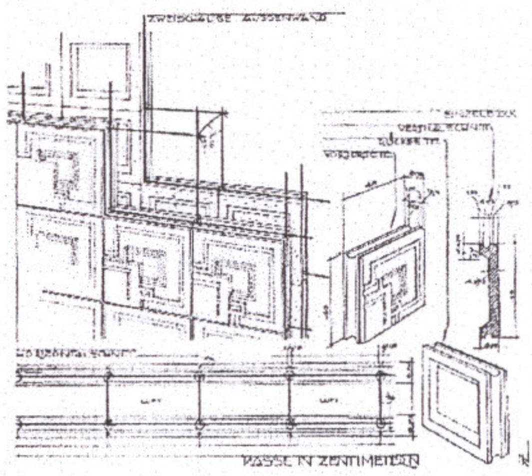

Fig. 2.21. Wall detailing of Allice Maillard House, Wright, 1923; (source: Frampton 1995)

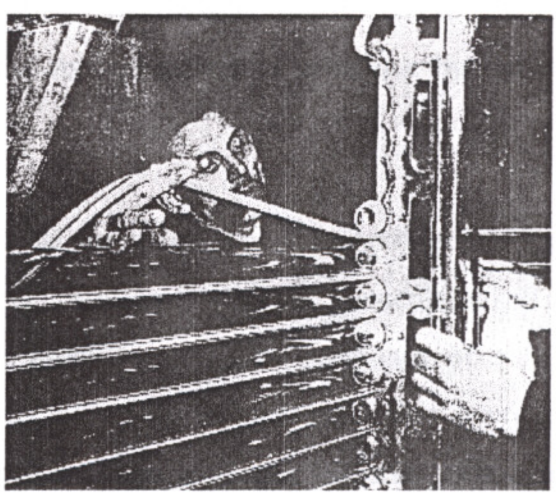

Fig. 2.22. Johnson Wax, Wright, 1936; (source: Frampton 1995)

According to Mies, "each material has its specific characteristics which we must understand if we want to use". In his steel constructions the structural details are reduced to a minimal expression, even the steel column is reduced into a single icon. As the columns are not connected with beams which are perceived, they do not appear as an element of the whole construction. The columns and beams do not define the frame of construction, and do not let the columns to gain a tectonic character. On the other hand, their material and section implies their constructional function (Bilgin 1998, p.72-75). With an avant-garde understanding of space, in Nationalgalerie in Berlin, frame appears as an infinite plane in space with its cruciform vertical supports. Mies's architectonic syntax lies in the discourse of column and wall. The column as a formative structural element is strongly emphasized in Barcelona Pavilion, and Tugendhat House (Fig.2.23). In these houses, any kind of excessive element is removed from the plan and the walls are reduced to a state of partition (Hartoonian 1994, p.72). The walls are liberated from the state of being load bearing elements, and their separation from the column resides a dialectical relationship. As a result, the wall and column acquire new meanings, a tectonic expression.

As Mies indicates, the triumph of universal technology has concentrated on "how" of technique. Like the others of his generation, he recognized technology both as a destroyer and provider. He admitted it as the "inescapable matrix" of the new era. The art of technique for him, meant the spiritualization of technique by tectonic form.

In recent studies of Kahn, just to get rid of the ugliness (as he identified) of joint construction, he designed continuos tubular structures with the elements united by welding (Fig.2.24). Another point, this utopic project was composed of a light structure in order to show the industrial nature of the material. This continuos tubular structures allowed a continuos flow of force in one material. (Frampton 1995, p.212).

Furthermore, he advocated the idea of hierarchic space as well. The separation of served (primary) and service (elevators, service cores, lavatories,etc.) spaces included the idea of giving a tectonic status, a hierarchical importance to services, as the structural frame. According to Kahn, just like the artist, the architect may also want to reveal how his work came out.

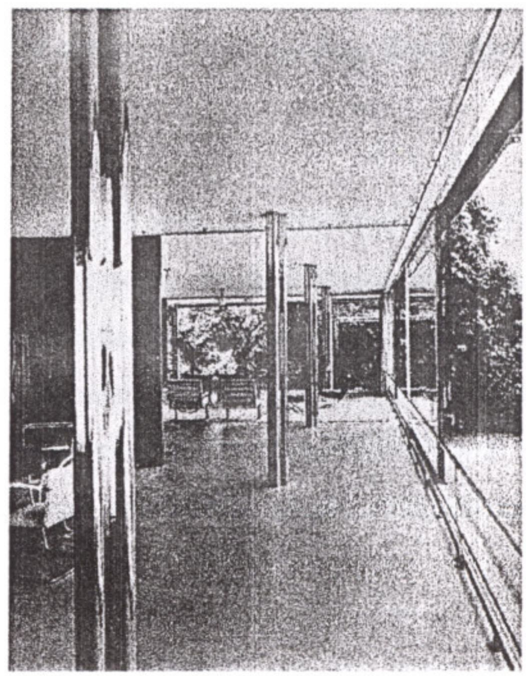

Fig. 2.23. Tugendhat House, Mies, 1928-30; (source: Curtis 1996)

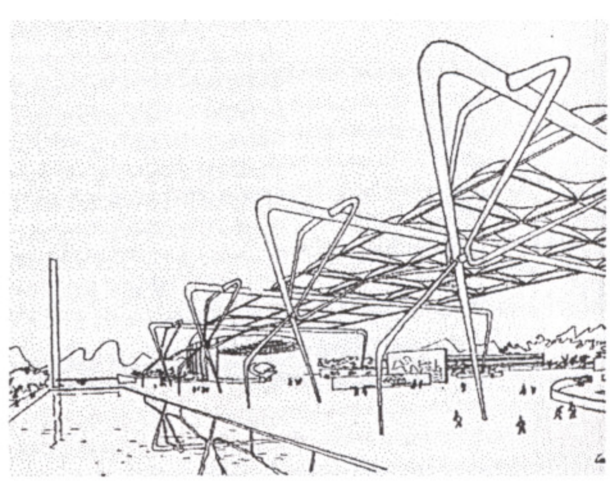

Fig. 2.24. Tubular structure, Kahn; (source: Frampton 1995)

Richard's Medical Research Laboratory (Fig.2.25) showed various aspects of tectonic expression:

- the use of hollow structure (air exhaust and intake towers)
- articulation of served and service spaces
- the full integration of mechanical services
- gravitational / levitational expression of static weight

With a brutalist approach, Kahn had considered that the building itself should express its own manifestation.

In modern sense, tectonic has not only concerned with the structural form. The tectonic articulation linking from Perret to Kahn has the similar character of tectonic expression where the **constructional articulation** has maintained the **spatial articulation**. Problem arises in the concept of space, but what is distinguished in the examples given above, is that the modern architecture did not present itself with an immoderate articulations of space, but with pure and honest language emphasizing its tectonic quality.

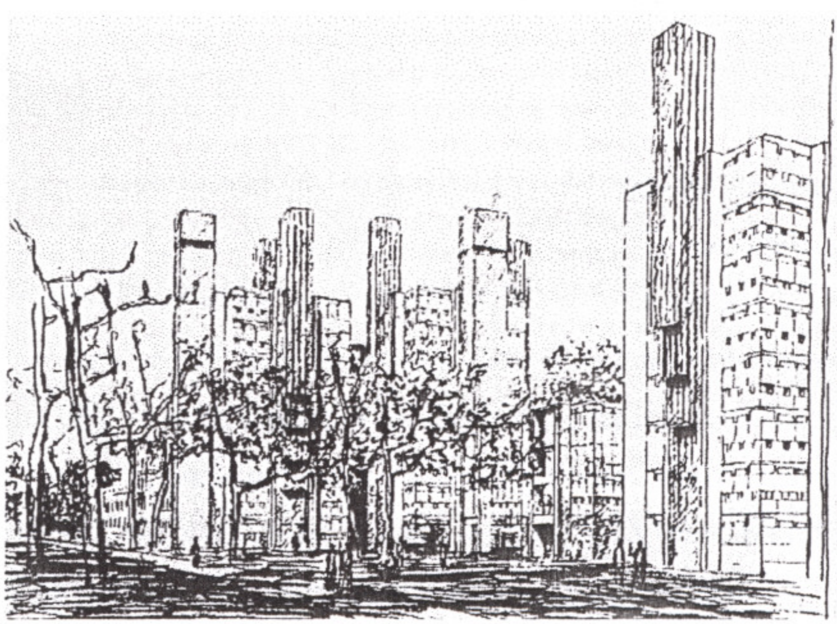

Fig. 2.25. Richard's Medical, Kahn; (source: Frampton 1995)

2.2.3. Machine aesthetics and mechanization in architecture

In Germany the problem of mechanism was a process beginning with the factory hall constructed with mechanical methods of engineering construction to the aesthetics of the final product. Platonic idealization of beauty of geometric forms leaded towards a machine aesthetics.

2.2.3.1. Standard types of production leading to a style

According to the rationalists like Muthesius, the aim of the German nation should be advancing with the possibilities of the industry and awaken the power of designers and craftsmen. Industrialization was displayed as a government policy. In the Werkbund Congress in 1911, the aesthetics independent of material quality, the idea of standardization and the abstract form were introduced as the bases of the aesthetics of product design (Bahnam 1992, p.72). As an opposition of the individualistic approach, Muthesius proposed the concept of "typical". The 'standard types' of homogenous style spread out both in architecture and in other artistic disciplines in Germany, which carried the traces of the military discipline. At first, a specific aesthetic direction was not determined though it was not the point of departure.

In the early 20th century as the **theories of Taylorism**[5]; F. Taylor was the originator of the scientific management; and **Fordism**[6] were set forth, the standards of efficiency adjusted for the functioning parts of the machines were applied to the movements of the workers in the new large-scale factory system. This system required a mechanism detailed in all aspects of product and the process removed the coincidences of any kind of personal initiatives. In Taylor's system, which included "time and motion studies", the workers are equaled with the laws, principles and rules of the "science" of their job. The system included four basic principles:

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[5] Taylor's "The principles of Scientific Management" has been published in 1911 (Harvey 1996, p.147).

1. production was standardized; the products were original in the artisanal sense of producing, but by standardization they became 'copies',
2. production was mechanized, as the product was standardized. Specialized machines were used for each component or special production,
3. instead of the worker, the production line has moved,
4. according to the theories of Taylor and his 'time and motion studies' the way of organization was determined. Defamiliarization (fragmentation) has begun by the separation between the labor and mental.

The Ford Motor Company in 1903, stated their commitment on standardization:

> "The way to make automobiles is to make one automobile like another automobile, to make them all alike, just like one pin is another when it comes from a pin factory" (Lambert 1993, p.48).

Fordist production model beginning with the automotive industry has spread over the other industries by time (Harvey 1996, p.150-163).

In 1930, Gropius' building blocks in Berlin, near Genossenschaftsstadt (Fig.2.26) were metaphorically designed like the assembly lines, the differentiated auto and the pedestrian roads like the roads which separated the assembly line and the product, and finally the parking area like the stores. The character of the building block provided the equal conditions for each house and rationalized the production process which predicted a site organization similar to the factory system (Bilgin 1994, p.79). For Gropius, the machine and accordance with industrial production was a necessity. The idea was to form a new guild of craftsmen, referring to the seventieth century's

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[6] The first Fordist production has begun in 1913 after two years that Taylor has manifested his ideas (Harvey 1996, p.43). Fordism, which has developed slowly in ABD before 1939, spread out in Europe and Japan after 1940 (Harvey 1996, p.159).

traditional guilds, but without a class distinction which made a boundary between craftsmen and artist. The process elevated a secularization in architectural production.

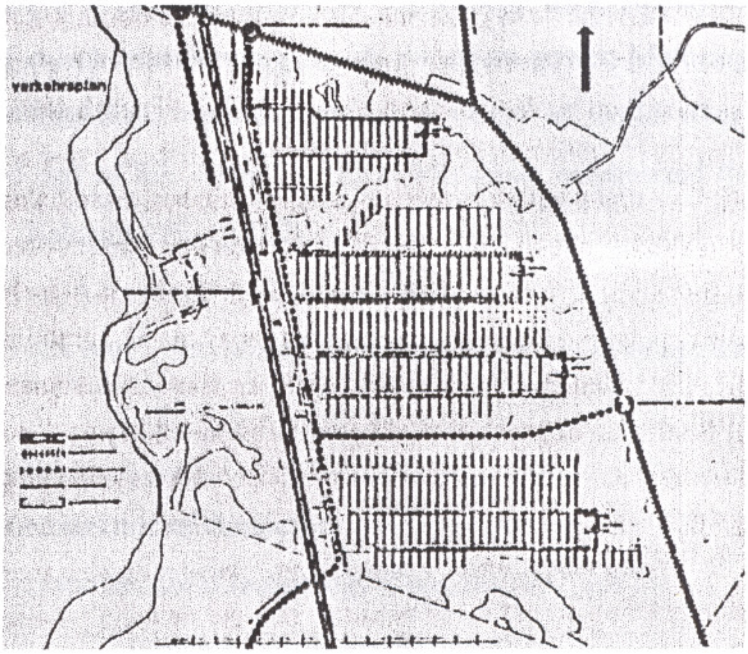


Fig. 2.26. Building blocks at Genossenschaftsstadt, Gropius; (source: Bilgin 1994)

Gropius maintained that a new conception of beauty has occurred with progress in thought and technique. In this way, machine with its perfect utility, economy and simplicity, became an ideal model for artistic creation.

On the other hand, the influence of machines was not only concerned with constructional and aesthetic qualities. Machines, hence the mass-production was valued by designers for ideological reasons, particularly the left-wing side. According to Moholy-Nagy:

> "There is no tradition in technology, no consciousness of class or standing. Everyone can be the machine's master or its slave...This is our century - technology, machines, socialism...it is our task to carry the revolution towards reformation, to fight for a new spirit to fill the forms stamped out by the monstrous machine". (Lambert 1993, p.22).

In the beginnings of 20th century, Italy was still a country whose economy has depended on primarily on agriculture. The technological developments had also effected Italy and the expectations of the industrial city were began to be realized. A change was observed from a society depended on agriculture to a society of technology. The process of industrialization began with the steam power. Motoring, rapid transmission and automobilism were brought up a vision of world where machinery was an accepted part of life. "The Technical Manifesto emphasized the dynamic against the static" (Bahnam 1992, p.107).

Marinetti, in his book "Le Futurisme", introduced three themes for the development of modern design:

- opposition to handicraft,
- the un-monumental architecture of democracy,
- the power station as an apotheosis of technology (Bahnam 1992, p.124).

The Futurists opposed to the antique with the Futuristic aesthetics of giant locomotives, tunnels, ironclads and racing cars. The image of the technological society and architecture were visioned in Le Futurisme with an orientation towards the world of machinery and technology.

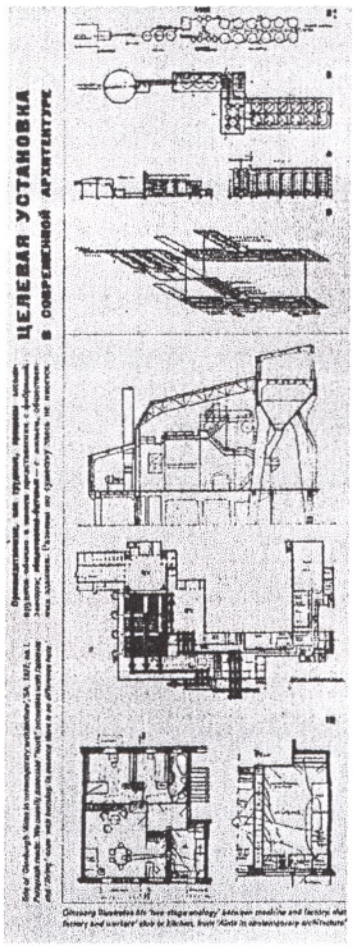
> "...live in high tension chambers where a hundred thousand volts flicker through great bays of glass. They sit at control panels with meters, switches, rheostats and commutator at right and left, and everywhere the rich gleam of polished levers. These men enjoy, in short, a life of power between walls of iron and crystal; they have furniture of steel, twenty times lighter and cheaper than ours. They are free at last from the examples of fragility and softness offered by wood and fabrics with their rural ornaments... Heat, humidity and ventilation regulated by a brief pass of the hand, they feel the fullness and solidity of their own will..." (Bahnam 1992, p.125) .

The most important feature of the Futurist architecture was being temporary and growing old, so that every generation would be in need of building its own city and environment. Recognizing the problems of planning of the industrial city, Sant'Elia drew the sketches of Citta Nuova, the three dimensional city joining the buildings and the communication net, the railways under and below the streets at various levels. Most of the sketches were in the form of perspective drawings, not the plans, but the importance of futurism laid in the celebration of new materials, progressive attitudes and mechanical analogies.

After the Revolution of 1917, the necessity of national construction occurred as the beginning of modernist tradition in Soviet Union. In 1920s, there was a distinction like modernism and a synthesis of cultural heritage as a result of questioning the architecture of the nation, as it was seen in 1980s in the West - modernism versus postmodernism (Powell 1991, p.7-9).

"The ideology of production or the image of the ideology of highly mechanized work became, the authentic manifesto of the Constructivists." (Tafuri 1995, p.148) The movement dedicated itself through the unity of science, industry and art. Ginzburg, in his book of 1924, he pointed to the machine as a model of spatial organization of building types. "With two stage analogy between the machine and the factory, the factory and the civil building, he formulated the practical steps of future model" (Cooke 1995, p.89). The importance of Ginzburg's two stage analogy (Fig.2.27) laid in its spatial solutions, because neither the engineering structure nor the machine itself gave an expressive spatial solution. The idea was composed of the connotation of spatial organization with the collective parts of the machine. The essence of machine came from the naked constructiveness of its components.

Chernikov, in "The Construction of Architectural and Machine Forms", stated that a construction was consisted of various possible combinations of elements (Fig.2.28). These possible combinations were summarized as a)Insertion, b)Clamping, c)Twisting, d)Embracing, e)Mounting, f)Bending, g)Coupling, h)Piercing and so on (Cooke 1995, p.113). These variations in the combination of elements were connoted to the organization of architectural fictions. Constructivists had deep respect for Le Corbusier and adopted his ideas as principles.



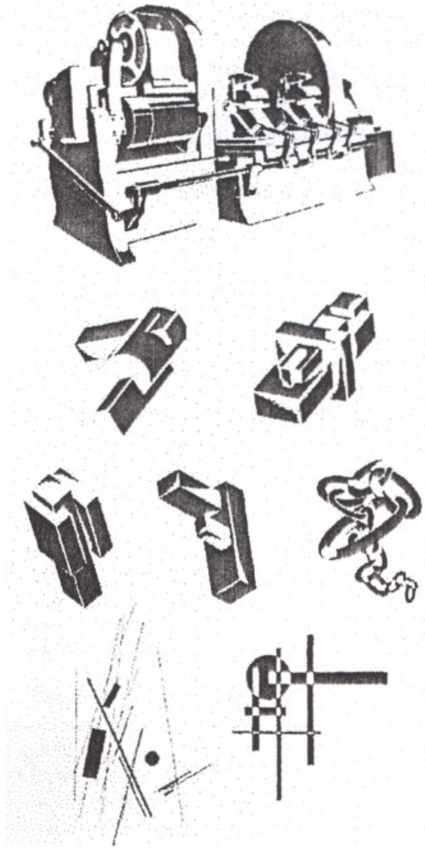


Fig. 2.27. Two stage analogy, Ginzburg, 1924; (source: Cooke 1995)

Fig. 2.28. Possible combinations of elements, Chernikov; (source: Cooke 1995)

2.2.3.2. A Corbusien approach to the machine aesthetics

When Le Corbusier has first published "Vers une architecture" in 1923, he made comparisons between engineering constructions and architectonics. He admired the harmony of designs of grain silos, factories, ships, airplanes and cars. "Engineers produce architecture for they employ a mathematical calculation, which derives from natural law, and their works give us the feeling of harmony" (Le Corbusier 1946, p.9). Silos and factories were praised for the clear distinction of spaces, and parallel to this, the forms and surfaces. Ships and airplanes were praised for the clear expression of their functions.

In his book, the temple of Paestum, Parthenon and automobiles were placed side by side to emphasize the idea of "standards" (Fig.2.29). The basic parts of temple - the columns, the frontal; and the basic parts of the automobile - the wheels, the chassis, the lights were defined as "standard types" in a system. The idea of standard units in a car led to the idea of mass-produced dwellings to solve the housing problem of the post-war years. His analogy between the Classical Architecture and machine design was represented as "selection applied to a standard". He had spoken of the new dwelling as a "machine for living in". In this way, he meant not a mechanistic "machine aesthetic", but rather a rationality in plan and serial production of architectural components which served a complete functionality, like in Maison Citrohan (Fig.2.30).

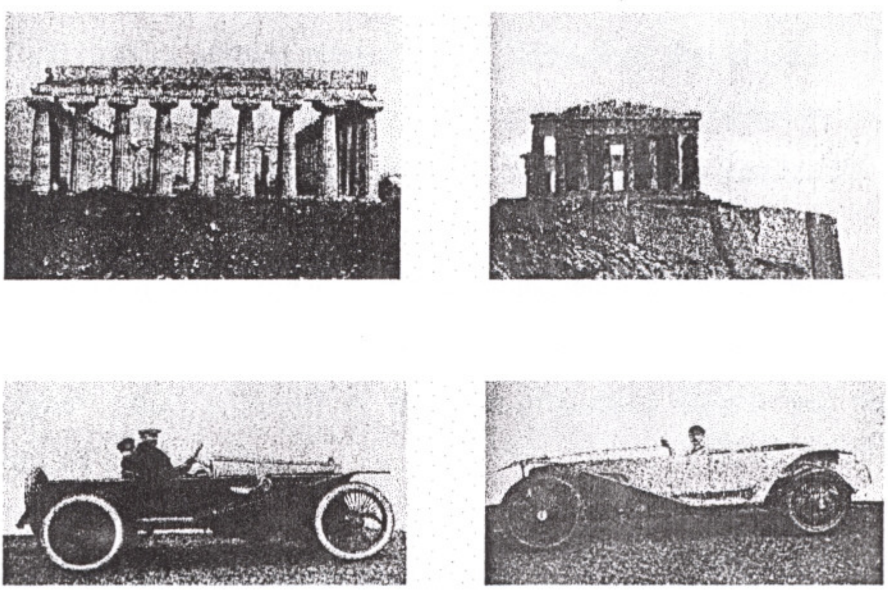


Fig. 2.29. Standards, Le Corbusier; (source: Le Corbusier 1946)

The new type of dwelling proposed by Le Corbusier was freed from the excesses of the customary dwellings and claimed to gain more light, greenery and useful spaces, for example by factory windows or industrial skylights. Dom-i-no houses with frame system of reinforced concrete construction points out the major aspects of Le Corbusier's architecture : break with the classical language and its self-referential capacity as an aesthetic object (Hartoonian 1994, p.36). Dom- i-no houses were a

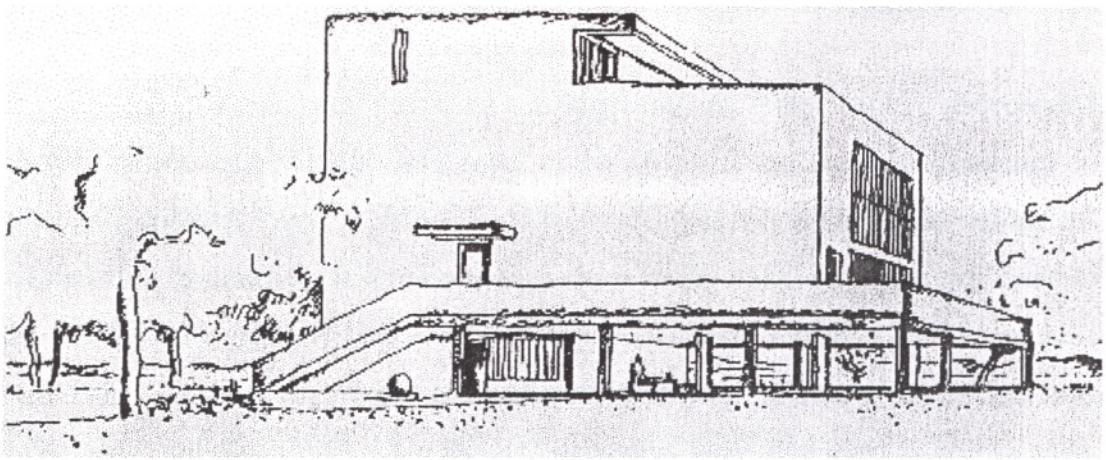


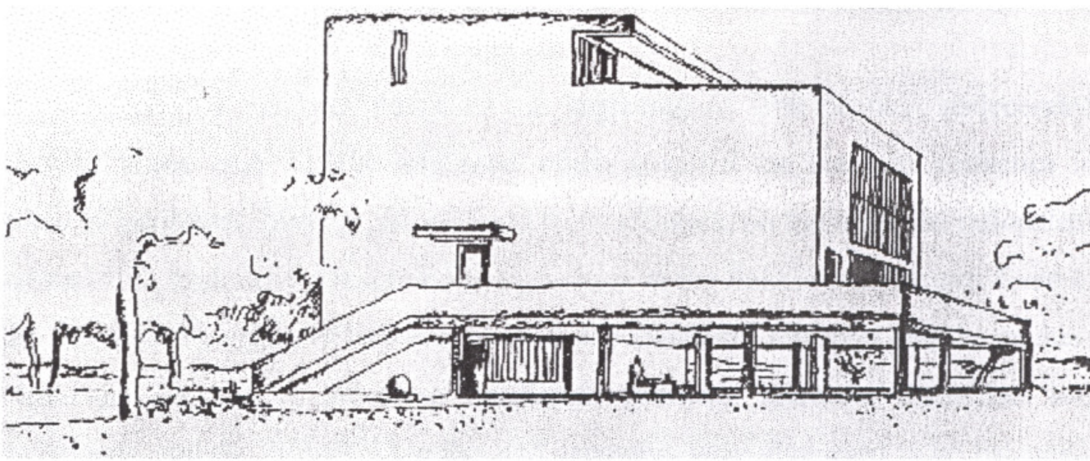
Fig. 2.30. Maison Citrohan, Le Corbusier, 1922; (source: Curtis 1996)

manifestation of the modern attitude toward nature, technology and cultural life. Although he praised the materials and techniques of engineering, he emphasized that architecture must go beyond such works and create its own language and aesthetics.

Le Corbusier described buildings produced of "all components of a piece made by machine tools in a factory, assembled as Ford assembles cars". However , the house built like an airplane which appeared as the mass-production houses was the realization of Sant'Elia's architecture.

2.3. Technological Progress in the Age of Modernism

While questioning the relationship between technology and architecture up until the information age, the technological tools were mechanically used devices. Beginning with the 18th century, with the introduction of new technologies and related for example by factory windows or industrial skylights. Dom-i-no houses with frame system of reinforced concrete construction points out the major aspects of Le Corbusier's architecture : break with the classical language and its self-referential capacity as an aesthetic object (Hartoonian 1994, p.36). Dom- i-no houses were a



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materials into building technology, relevance of the true nature of technology was seen in the structures of engineering. While all kinds of idealist thoughts were directed towards the coming future, to the scientific reality, engineering with its direct images, materials and concrete solutions took charge of the present day.
The craft of building has been transformed in lieu with the dissemination of the building knowledge. The craft of building changed from an apprentice system to a mathematically defined process (Doremus 1994, p.34).

By the effect of industrialization in the beginning of 20th century, undecorated abstract forms were significantly used which glorified the machine aesthetics in place of handwork. Even so, in one hand the craftswork, on the other the rationalist-technologist tendencies constituted an opposition in the field of architecture. Even in the foundation program of Bauhaus in 1919, the architects, sculptors and the painters supported the idea of return to handicraft. Extrinsic scientific researches and techniques, and the intrinsic thoughts and behaviors were attempted to be balanced. Gradually, designing and producing prototypes for the industry was considered.

Architecture, in a sense, is a phenomenon which determines its being by certain technical potentialities. After the expressionist or cubist aesthetic discourses which gave birth to twentieth century modern architecture, an architecture of a strong and functionalist type have occurred. Either by hand or by machine, architecture governs the role of having a symbolic character. Thus, modern architecture embodies a dilemma, the mass production and the uniqueness. For this reason, the examples selected in the previous chapter included both the ones which are totally produced by industrial methods and materials and the ones which materialize its unique character.

In one of his arguments, Le Corbusier explains that Metal Houses Project in Lagny are modularly designed for to be repeated in different places, but the components embody a plastic and expressionist enthusiasm, and yet, the symbolic manifestation of architecture remains. This is like a car design, just how a model is multiplied for thousands of time, but still preserves its uniqueness.

Chapter 3

TECHNOLOGICAL EXPRESSION IN THE AGE OF INFORMATION

3.1. Theories of technology in the age information

In 20th century , all aspects of life are housed on oppositions like technological production / craft production; function / expression; aesthetic necessities / social necessities. The paradigms which we face in post-modern condition are "electronic communication technology", "post-capitalist consuming society" and "simulation". It is agreed that under the influence of technological development, industrial society which is actually dated from the beginning of nineteenth century enters a period of transition equal in importance to the transition between pre-industrial and industrial society.

The information technology opens up a possibility of being everywhere through our hyper-textual web-links. An understanding leading to **a non-place oriented space** takes command. In a world where it is impossible to be tied to a certain, concrete space, spaces are interactively effected by the other spaces that are physically so far. Relations which are not physically observed may effect the identity of the space morphology. While the communicative space is enlarging itself, the physical space is limited with its boundaries (Akcan 1994, p.39-51). In addition to that, mass production and mass availability is extended to the idea of ubiquity (predominance) (Coyne 1995, p.79).

Bahnam characterizes the 2nd machine age with highly developed mass-production which distributed the electronic devices to wider parts of society. In the information age, technology is increasingly becoming electronic, less mechanical. And as a production type, countries which are excessively industrialized attain to a condition that is called post-industrialization. From many aspects, although there seems similarities with the 1st one, its character is new according to the type of production.

Advantages of many natural and synthetic sources, light metals, new alloys and plastics are being used.

On the other hand, machines, devices and developments in computer technology engendered the full automatic factories. Although, industry was mechanized in 19th century, automation system was lately occurred in the second half of 20th century with the introduction of assembly line. A system which completely removes the hand labor, finds solutions depending on the technical tools. Man only governs the role of an applicator.

In “Beyond Mechanization”, Hirschhorn determines the post-industrial work by the development of modern production technology. He argues that the old mechanical production technology was rigid which employed built-in mechanical controls. He continues that, the new post-industrial technology employs electronic controls that can be operated separately from the machines they govern (Feenberg 1991, p.94).

Information technology is distinguished from the earlier machine technologies according to the application of machines in a certain process. Although the information technology is used to reproduce the process of replacing machines for human needs, it is quite different from the previous ones. The process is based on the idea of the translation of an information by an automated device to an automated action. Also, the automated devices register data for these activities. For example, computer-based, numerically controlled machine tools or microprocessor-based sensing devices. By this way not the information is translated into product, but also the product into data. It introduces a dimension of reflexivity, an apparent process sharable in two ways.

According to Shoshana Zuboff, information technology is characterized by two fundamental duality; “On one hand, the technology can be applied to automating operations on the basis of a logic that hardly differs from that of nineteenth-century machine system-replace the human body with a technology that enables the same processes to be performed with more continuity and control. On the other hand, the

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In a milieu like this, taking part in the discipline of architecture and expressing the tectonic value of a construction in the traditional sense constitutes one side of the problem, because what is mostly expressed today is the new production process, the material and the detailing which belong to these concepts.

3.1.1. Social background of the society in the age of information

The characteristics of an information technology oriented society are considered as the followings:

- a technological advance developed by computers and information technology
- changes in the workplace has effects on the nature of the society
- reorganization of material world by new technologies
- technological transformation engendering new organizational behaviors and collaborative relationships

Daniel Bell proclaims that, indicating the post-industrial society, the "new class" is not constituted by the industrialists, but the scientists, engineers and mathematicians of the new intellectual technology. The institutional base is no longer the factory, but the university. It is still admitted that society is structured by its technology and run by its practitioners (Kumar, 1974, p.131-132).

As Bell mentions, understanding of nature as the reality of human life has been transformed to a new understanding of reality of post-industrial society which are techniques, tools and the world defined with the technological terms.

Mass media becomes the image creator in the post-industrial society by using the powers of electronic devices. The "pop culture" erected by the post-industrial society reinforces the representative power of image not only in everyday culture, but also in architecture.

3.1.2. Interrelations among human / technology / nature

It is the age of information when the energy crisis and the relation between human, technology and nature has been mostly questioned. Thus, the section will be examined according to the energy consumption, climatic and environmental factors acting on design and the intelligent buildings.

3.1.2.1. Energy consumption in construction

According to an adjustable and continuous relation of human beings and nature, humanistic and safe technology is required. The crisis with which the contemporary world of modern technology is faced, are the destruction of the living environment, insufficient natural sources, inhuman technological systems (orders), etc. Is it possible to develop a humanistic technology to solve all these problems? The technological improvements must be directed towards the real needs of humans.

Although the modern technology is a product of human being, it shows a progress depending on its own laws and principles and this is different from the laws and principles of the development of living nature. According to its dimension, speed and intensity nature stops when it is needed, on the other hand the modern technology never sets a limit to its own.

As E.F. Schumacher stated, the primary function of technology is to decrease the work power of human being which he is bounded to carry for surviving. The types of work with which the work power is decreased successfully by technology, are the productive ones that need proficiency. Through this process of adjustable and continuous relation of human beings and nature, what is required from the scientists and technologists are:

- available and cheap enough to reach,
- suitable for small scales,
- methods and instruments which get along well with the creativity of humans (Schumacher 1979, p.39).

It was the project of Yona Friedman, in 1960s, which included the criteria mentioned above. It was an utopian urbanistic project, dissecting the city into two structures primary -infrastructure- and the secondary -changeable-. The secondary infill elements were inserted in a primary, spatial structure and involved the user in the shaping of the space. What Friedman has suggested was the ordinary people making use of new technologies by designing their own homes. A kind of "user oriented architecture".

Especially after the energy crisis of 1973, the idea of more-for-less was developed and studies were intended to produce the basis for future energy rationing. Major recommendations were made for reducing the energy consumption. *The first* recommendation was the substitution of components and structural assemblies which require less energy for their embodiment. *Second*, energy conservation in the manufacturing process. *The third* one was particularly concerned with design and included the production of **more efficient buildings consuming less building material** (Pawley 1990, p.97). By the integration of mechanical systems and the design of the buildings, efficiency has been obtained, and this let the development of a new kind of profession called "building technology".

In architecture, the crisis brought forward the concepts of **solar design and alternative energy**. Intelligent and highly sophisticated ways of building allowed for the economic use. Fuller's 1960 utopian project for a two-miles diameter geodesic dome created a controlled environment which corroborated technological 'ephemeralization' for the benefit of future life. **Energy and architecture related thinking** of Fuller encouraged him to design megastructure projects all over the world. In his Dymaxian design - combination of the words 'dynamic' and 'maximum' - **maximum functional potential with minimum material and energy input** is tried to be realized (Fig.3.1). This is what "designing science" as Fuller called. To advance an efficient man-made environment, Archigram and Japanese metabolists worked on projects as well as J.Friedman and Fuller. American architect Roy Manson wrote in 1977 that:

> "Neither the smallest cottage nor the largest metropolis can ever be completely isolated or cut off from nature. What we should do is building upon this fact instead of fighting against it. Instead of expanding great quantities of energy and material resources to create and maintain an artificial environment, biological architects follow two approaches : first they seek to use nature as a model and design buildings that apply the structural principles found in nature, and second they try to develop ways in which nature itself can do the construction work. We shall call the first approach 'biomorphic' and the second 'biostructural' " (Pawley 1990, p.106).

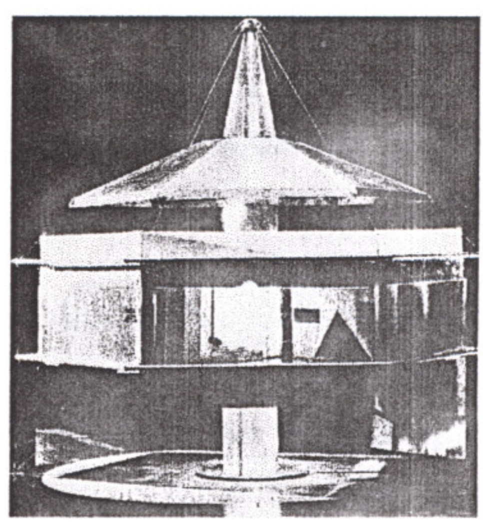


Fig. 3.1. Dymaxian House, Fuller, 1929; (source: Curtis 1996)

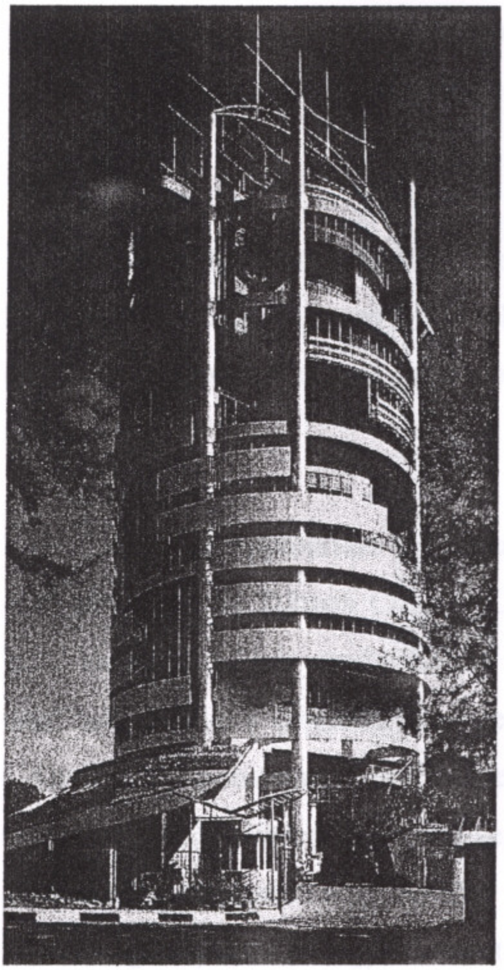
3.1.2.2. Climatic and environmental factors acting on design

Considering the energy input mentioned in the previous section, the skyscrapers today taking place in big cities, should not be regarded in the conventional sense, because they require special systems as a cause of their dense uses. These systems are demanded both for their structural rigidity and for the mechanical and electrical systems. Two basis are considered for their design; first, **the spatial configuration**, second, **the climatic and environmental factors**. The approach to climate oriented design is known as the "bioclimatic" approach or design related to the climate of the place. These buildings can be analyzed that they serve to the compatibility between the building and the nature by using high technology in their formation. High level of environmental innovation is succeeded in these technically sophisticated buildings and it is rather used as a prototype in most of their design strategy.

In Mesiniaga Tower, in Malaysia, planting starts from the bottom of the building and spirals it in the terraces (Fig.3.2). The solids and voids formed by both the glass and aluminum claddings and the terraces provide a distinguished and smart views. Solar shadings and natural ventilation is used successfully on the facade (Yeang, Hamzah 1997, p.15-21).

Similar to this building, Shanghai Armoury Tower (Fig.3.3) is also designed both to represent an urban icon, and to be a low-energy building. The landscaped terraces are placed at different points to act as buffer zones between inside and outside. The curved screens on the facade act as multi-functional filters against the weather conditions (Yeang, Hamzah 1997, p.37).

Triangular planned Commerzbank headquarters building has also sky gardens (Fig.3.4). The garden level rotates in every fourth floor of the building. It is demanded that the building should be transparent to radar, thus the cladding is constructed as glass.



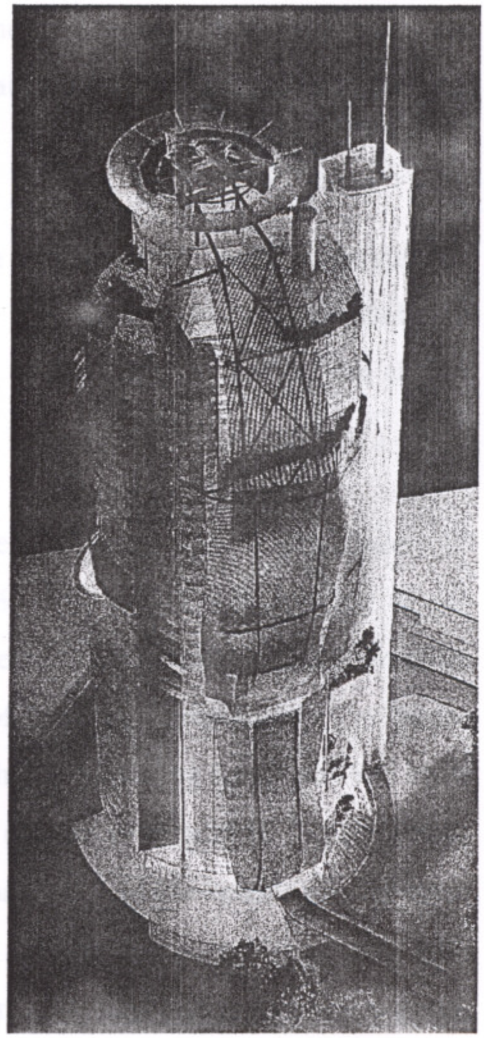


Fig. 3.2. Mesiniaga Tower in Malaysia, Ken Yeang and T.R.Hamzah, 1992; (source: Yeang, Hamzah 1997)

Fig. 3.3. Shanghai Armory Tower, Ken Yeang and T.R.Hamzah, 1997; (source: Yeang, Hamzah 1997)

One of the most important properties of Commerzbank is its climatization suggesting energy consumption. The 14m. high screens that protect the gardens can be opened at the top, to control the micro-climate and balance the fresh air intake under the appropriate circumstances (Fig.3.5). Like the ventilation of the atrium, the offices which are nearer to the periphery of the building have the advantage of utilizing natural ventilation. The balance between the manually and automatically controlled parts, are generated by both people and machines (Davey 1997, p.26-39). The building's skin is covered of two overlapping layers with a naturally ventilated cavity between them. The first layer acts as a sunscreen and filter controlling the flow of sunshine, air pressure and the effect of snow and rain; while the internal layers are motorized by a system which open up and allow the air to circulate (Fontana 1997,p.37).

In order to reduce the chimney effect in the atrium, it has been separated by horizontal glasses in every twelfth floor. The electro-mechanical and the architectural problems have been coordinated in the early stages of the design process.

By adapting an appropriate technology to the traditional and tested models of environment, J M Tjibaou Cultural Centre (1991-97), by R.Piano, has one of the latest examples of this approach. The wooden-semicircular enclosures supported by steel cables have a connotation of reed huts of the local environment. As Steele identifies, it is a sustainable practice reflecting the "pre-existing typologies and local materials with a reliance on natural ventilation" (Steele 1997, p.291). Piano's works are generally connected with the idea of sustainability, but his handling is different from using only solar energy. He treats it as an intelligent approach beginning with the settlement of the building at the site. Sustainability involves a series of criteria, such as, ventilation, mass, material, breeze, etc.

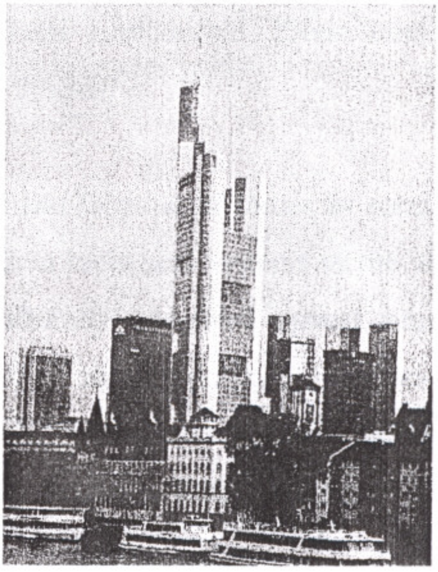


Fig. 3.4. Commerzbank, Foster, 1992-1997; (source: Davey 1997)

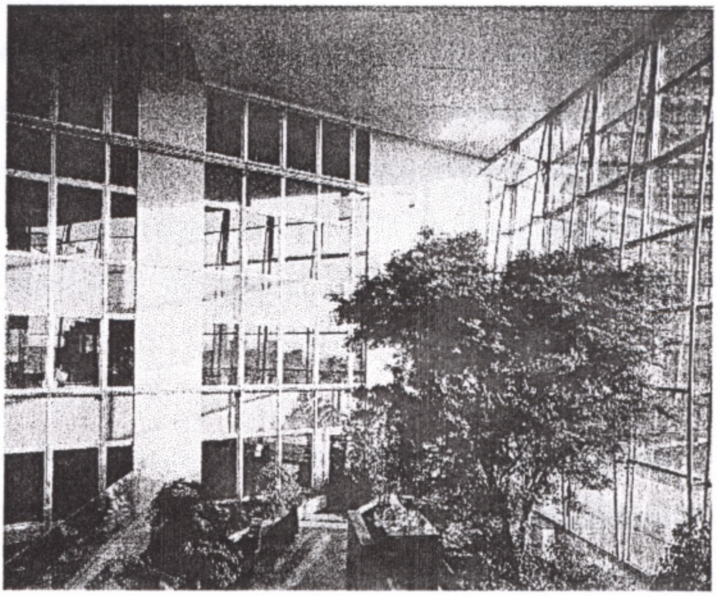


Fig. 3.5. Commerzbank, high-screens, Foster, 1992-1997; (source: Davey 1997)

3.1.2.3. Intelligent buildings / Interactive materials

The intelligent structures refer to the works in the field of mobile robotics. Investigations on different fields beyond the scope of architecture, such as aerospace and defense industry basically have common technical interests. Of the fact that the aircraft and space technologies utilize more sophisticated sensing and control technologies; like embedding sensors in structural components. Environmental conditions are cautiously checked with fiber optic strands.

Optical fiber is used to determine the magnitude and location of forces by sensing applications. These sensing systems are modeled on biological systems in the way the signals circulate in the human body. "Structurally integrated optical neuro-systems" have been developed which are capable of sensing position, orientation, rotation, displacement, deformation, temperature, pressure, structural damage, frequency, vibration, acoustic waves, voltage and magnetic fields (Krueger 1996, p.29).

At the university of Vermont, Huston and Fuhr, the optical fiber sensors are installed in concrete and on steel substrates, and the reaction of the component during its use is observed. Further applications of sensor technologies in architectural applications are the thermal sensors, motion detectors and photosensors. In intelligent buildings, sensors play the key role. Sensors automatically allow various pieces of equipment in building to stay within their optimum range. All the process is supported by the computer technology. The control of the system requires a complex flow of information (Ohba 1992, p.128).

Despite of the modeling of the biological systems sensor technology has a distinguishing character, that is **adaptability**. Adaptation is applied to structural, mechanical, circulation and communication systems. It provides a change in the environmental conditions of a building. Intelligence in this case, is related with the economy of building construction, operation and management which let us to discuss about with the terms subsume efficiency, optimization and control. Fiber optic networks and active materials mentioned above supply the building with "a measure of self awareness and reactivity".

Krueger suggests that architecture may acquire elements of adaptability and interactivity through the implementation of techniques under development in a variety of fields - among them artificial intelligence, robotics, and intelligent materials and structures, and these capabilities enable the architectural organism (Krueger 1996, p.29).

The depth of knowledge in different study areas is professionalized that a team work is required. Especially, for the buildings which require large and complicated systems, the architects, experts of building technology, engineers and maybe the manufacturers need a collaboration. The science of materials, transportation, quality of techniques should be all carefully considered. Ove-Arup recalls designs taking place after this production technology as **"science-guided designs".** Arup's statement reflects the mental thinking of post-war society concerning with the efficiency of industrial production. The origins of this computer based science, called cybernetics has its origins in 1950s. Invisible systems of electronic communication and production changes the way to conceive architecture.

This process, developed by the adaptive machines changes the relation of human with nature and natural environment. Instead of a fixed purpose of machines deviating nature, machines adapt themselves to the organic process of nature. With the same purpose, the buildings which are designed as a totality, composed of these adaptable machines gain a neutral character in the relation of human and nature. This neutrality may cause a reductionist approach in the tectonic sensitivity corroborating with the **instrumental theory** in architecture.

3.2. The impacts of technology on the organization of architectural space in the age of information

Building technology and material, the tectonic dimension of space and the aesthetic concerns of information age will be examined in this section.

3.2.1. Building technology and material in the age of information

According to the architects who utilized high technology in their designs, today's design process should include the following criteria :

- Mobility and the rapid change. The rapidly changing social and technological pattern requires spaces becoming smaller and highly mechanized. It means multi-functional use so far as design is concerned.
- New engineering techniques. Examples of these are new materials, structures, total energy concepts and feedback of ideas from other sources such as electronic and aerospace industry. The production engineering becomes an integral part of design approach. A contribution with the structural engineer is required.
- New techniques of management, skilled programming and briefing techniques (Foster V.1, 1991, p. 107).

3.2.1.1. New techniques of construction

Techniques of building change with the introduction of each new material and method of construction. Design approaches change also with new design tools. Traditionally, in architectural practice the computer is viewed as a sophisticated tool to mechanize manual processes.

In industrially produced process, traditionally side-based techniques are replaced by the factory-controlled components to achieve a higher standard, speed and economy. The components are adapted to specific requirements. A technological shift is marked from using ready-made to custom-made components with the introduction of computer controlled robotics tools in the factory. This design development is closer to product design than to conventional building design and has its own flourishing craft tradition. Advanced CAD technologies allow concepts to be examined in three-dimensional plasticity. Laser-cutting and other techniques enable to transform design into model or final product. By CAD systems the integration of database from conceptual design through to construction and beyond is aimed.

With the help of specialized tasks, the architect, the chief-builder, constructs by drawing an architectural design, an imaginary construction of a future building (Ellis 1997, p.37).

3.2.1.2. New materials in building technology

J.Baudrillard wrote about the authentic quality of synthetic materials and emphasized that what is needed for the assimilation of new materials into culture is time and experience. Steel, glass and reinforced concrete were the revolutionary materials in the beginning of 20th century. On the other hand, they were the forerunners of high-strength alloys and composites. For instance, most products with high-performance of structural properties are manufactured out of carbon fiber: racing cars, sailing boats, and even aircraft and aerospace industries.

The basic idea is to exploit two different materials to create a compound with superior properties to the individual components. Hybrid material components, mostly the recycled or recomposed materials, has shifted the emphasis from "truth to materials" to "truth to program and process" (Walker 1997, p.66-68). The composite materials open up the way to unpredictable constructional developments not only for the industries mentioned above, but also for architecture and other branches of design.

3.2.1.3. Technology transfer in architecture

Technology transfer is a term, used by Charles Kimball in 1967, who was the president of the Midwest Research Institute, referring to "a process whereby techniques and materials developed in one creative field, industry or culture are adapted to serve in other creative fields, industries or cultures".

Adaptation of an industry from one creative field to another is not a new concept. Romans had used lightweight marine technologies for the constructions of the roof of Collosuem or the dome of San Vitale, A.D. 547, was constructed with thousands of earthenware pods for lightness (Pawley 1990, p.145).

There are many well-known examples of technology transfer in the field of applied science. "Glass fiber was first demonstrated in 1893 as a dress fabric in combination with silk, before it was combined with resins. Polyethylene sheeting, like polyvinyl chloride, was originally used for wiring insulation in the 1940s; then after the war, both were used for packaging, and then including flexible impermeable membranes for building construction. Teflon was originally used in the purification of uranium for the first atomic bombs; only later did it become a 'non-stick' coating for pots and pans, and eventually a self-cleaning finish for architectural fabric roofs as big as the 5.5 million-square foot Haj terminal at Jeddah airport in Saudi Arabia, designed by SOM.

Polyesters, combined with glass fibers, showed such strength, flexibility that they were used in the manufacture of military radio aerials, then begun to be used on a larger scale for hand-laid up boat hulls; then hand-laid up car bodies, baths, washbasins, toilets and showers. Epoxy-ceramic coating was used to provide resistance to the exposed steel work in Sainsbury superstore by N. Grimshaw" (Pawley 1990, p.141).

The Wichita Houses designed by Fuller recalled the metallic sleekness of an airplane using the light-weight alloys developed in aircraft industry (Fig. 3.6).

In most of Foster's designs ideas, materials and techniques were borrowed from other technologically advanced sources like aircraft and automobile industry where it is appropriate. This is also why he calls his design approach as 'appropriate', but not 'high-tech'. PVC roofing originally from automobile industry, plastic aluminum panels from aerospace, raised floor systems from jetliners, photochromic glazing from jet bombers - connected with the theory of Fuller (Pawley 1990, p.152).

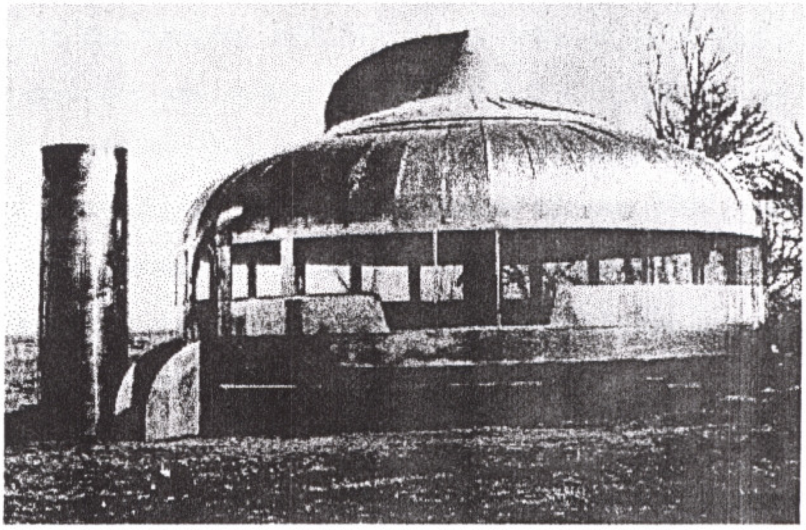


Fig. 3.6. Wichita House, Fuller, 1946; (source: Pawley 1990)

It is a way of pushing the boundaries of building technology. For instance, in Sainsbury Center (1978), superplastic aluminum cladding panels were one of the first uses of this material in building industry. It is easy to form and stretch the malleable materials like lightweight composite materials when heated which are developed for aircraft industry. Also, the technique used for giving form to these materials need compressed air presses and low-cost tools (Foster V.3, 1989, p.14). The removable panels for raised floor system are made from lightweight honey-comb sandwich material used in the floor system of Boeing aircraft.

Neoprene jointing system provided a weatherproof connection between adjacent panels. To prove the integrated design approach this system formed an archetypal product for Foster.

One of the latest examples for the technology transfer is exemplified by F.O.Gehry at the art gallery in Bilbao, Spain. Form of the building is based on the fractured planes and contorted curves, thus it exceeded the conventional building construction methods. The CATIA software, developed by the French aeronautical firm Dassault, translated the hand-built models of Gehry to the on-screen models by digitizing the certain points on the edges and the surfaces of them (Slessor 1997, p.43) (Fig.3.7). By this way, the transformed numeric data was transcribed back into a model to recorrect the surfaces and the volumes. BOCAD, a new software developed for bridge and highway construction was used to generate the 3-D structural computer models and translate the model into 2-D drawings or CNC (computer numerically controlled) data for the configuration of the steel members (Slessor 1997, p.44). Each structural component is marked and bar coded in order to reveal its coordinates in CATIA modeling. Each piece is placed in its position as defined by the computer with a method used in aerospace industry.

The mostly indicated subject here is also the capabilities reached by the electronic industry in the post-industrial age. The computer is used to rationalize the intuitive concept of Gehry and generate the structural concept with its constructional components. Having greater advantages like being lighter, warmer and cheaper at that time sheets of titanium were used instead of stainless steel (Leclerc 1997, p.73).

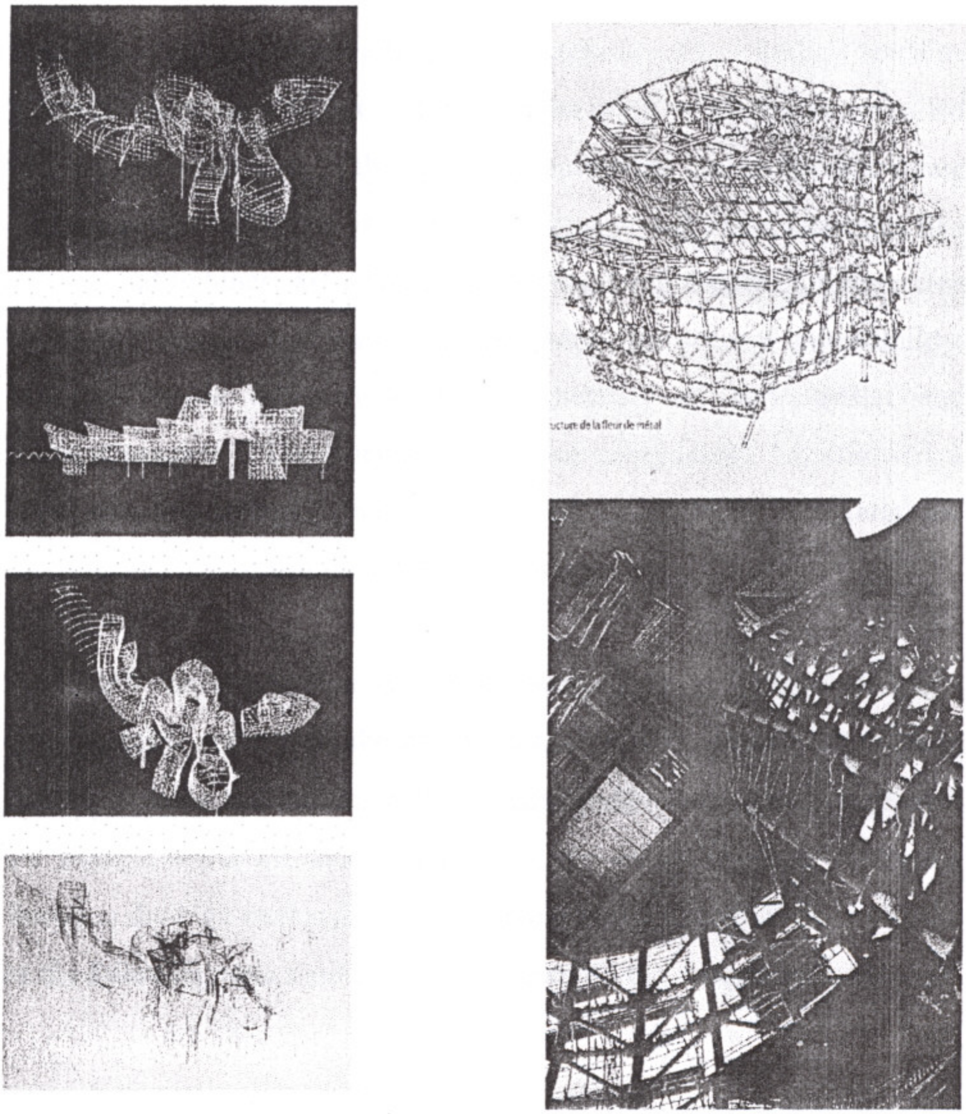


Fig. 3.7. Bilbao, screen modellings, Gehry, 1997; (source: Leclerc 1997)

3.2.2. Tectonic dimension of space in the age of information

High-tech architecture has been selected to exemplify the tectonic dimension of space in the age of information.

3.2.2.1. High-Tech architecture

If the modernist era beginning with the twentieth century is called "the first machine age", in terms of Bahnam, then the age which gains the profit of electronics is called "the second", "the post-industrial", "the age of ephemeralization" or the age where "highly developed mass production" is taken as the dominating force. Concepts like flexibility, change and lightness are advanced and considered deeply. A further step of flexibility in the spatial articulation is the three dimensional extendibility. Flexibility in building is regarded as the adaptability of both spatial and constructional components. "The integrated building component" has allowed a multi-functional use. In addition to that, lightness and transparency in material are the other distinguishing features of the high-tech space.

The term "high-tech" in architecture symbolizes technology as well as using it - differing from the other industries like electronics, computer, robots, etc. This is because architecture has a stylistic character in each epoch. Although the high-tech architects are anxious about the label "high-tech", the critics continue to draw a distinction between the high-tech styles of USA and Britain (Davies 1988, p.6). The examples for the following topics are generally focused on the designs of "high-tech" architects.

Much of the high-tech architect's work has been equaled with low energy consuming designs. As the followers of modern architecture, they differ in the way they relate themselves with nature. Instead of seeking a dominance over nature, they try to organize a harmonious relation with the environment and the natural way of living.

The architectural practice takes participation with computer technology. One of these reasons is the building industry which has been organized in this direction. The computerized technology provides a flexibility in product design rather than mass production, which is called the "rationalization of building" by high-tech architects.

In this regard, a tectonic sensitivity can be achieved by the technology used in the information age.

3.2.2.1.1. Influential precedents of high-tech

The constructors of nineteenth century influenced the high-tech designers of today with the poetics of structure, technology and transparency in their designs. Such as, Maison d'Alsace - known as "Maison de Verre" (1928-1932) (Fig.3.8) a steel and glass structure comprised of demountable components, built in Paris by Pierre Chareau and Bernard Bijvoet (Mezgeroğlu 1992, p.64) or the projects of Jean Prouvé who adapted the industrialized systems and methods of production to his philosophy of architecture (Steele 1997, p.18).

The steel and glass concept of Mies and the "dymaxian" principle of design by Fuller had great influences. The system designer, Ezra Ehrenkrantz has concentrated on school building systems called SCSD (Schools Construction System Development) in 1964 (Fig.3.9). The system only concerned with the environmental servicing (involving the structural roofdeck, air-conditioning, lightning and partitions) and left the architect or the builder free to finish off the appearance of the building (Jencks 1985, p.75). In most of Foster's school design, this system let him to put the following criteria: deep plan, aerodynamic building skin, kit grid of construction, visible integration of service and structure, free planning (Foster V.1, 1991, p.182).

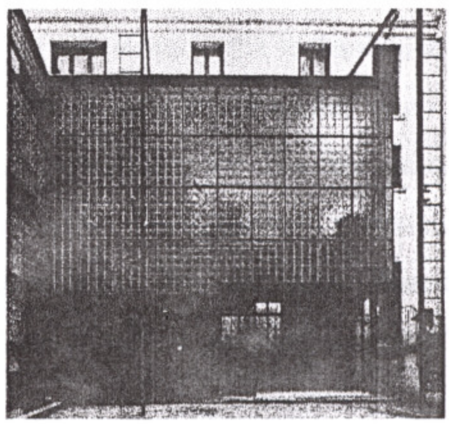


Fig. 3.8. Maison de Verre, Pierre Chareau and Bernard Bijvoet,1928-31; (source: Curtis 1996)

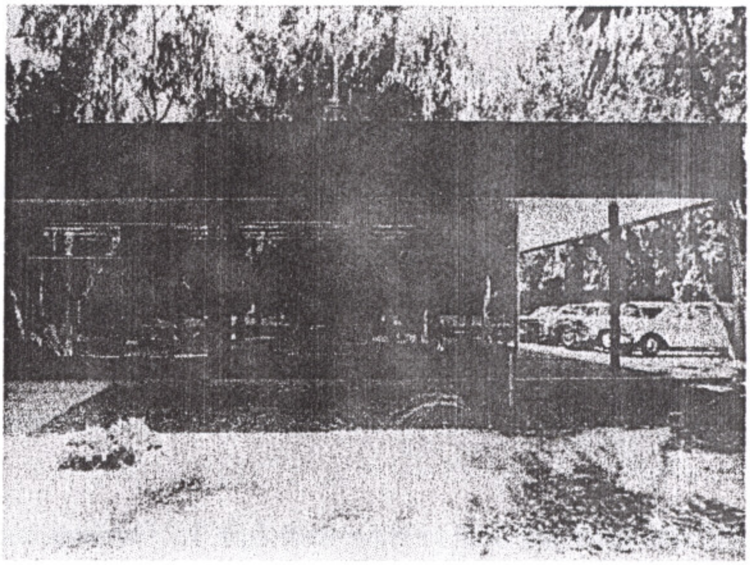


Fig. 3.9. School systems, Ehrenkrantz,1964; (source: Foster V.1 1991)

3.2.2.1.2. Constructional properties acting on design

A common method developed by the high-tech architects is industrial production. Following stages are distinguished: program, concept, design, model testing, technical drawing and development of prototypes. After this, the production begins. For high-tech architects like Foster, Rogers, Hopkins or Grimshaw building is always the built. It gains its character from the constructional characteristics (Foster V.2, 1989, p.158). **A custom-made production preferred by these architects allows them to imitate a craft technique to the machine production**. By this way, conservative building industry is caught by the other industries in the technological era. **"Hand-made by robots"** as Foster calls. In spite of their industrialized origin, the following examples are mostly one-off structures confirming the idea that mass-production is not necessary to get a successful solution out of industrialized materials and detailing. This proves that, although high-tech involves an industrialized process, the high-tech architects are called as "custom-tailors working in metal" (Rosenberg 1976, p.159).

3.2.2.1.3. The building typologies of high-tech architecture

More typical example of high-tech buildings are the industrial ones. This is because, the industrial buildings are in need of being constructed in a short time with maximum efficiency, thus they increasingly force the limits of building technology and strive for better solutions. Buildings with long spans, airports, offices, markets, the leisure centers are the following typologies which generally share the same characteristics with the industrial buildings.

3.2.2.2. Spatial and architectonic qualities in High-tech

The spatial and architectonic qualities of high-tech architecture has been studied according to the concepts like flexibility/change/adaptability, integrated building component and transparency/lightness.

3.2.2.2.1. Flexibility / Change / Adaptability

The early modernists produced a machine age architecture in a sense that their monuments were built in a machine age, as Bahnam mentioned. The buildings of the second machine age are intentionally incomplete, because in the real sense they give permission for flexibility and change. The adaptation of buildings to other uses over time is a requirement of **"the age of ephemeralization"**, because the modern society is in need of changing itself according to the quick consumption.

Especially, the industrial buildings needed a fast and mechanized construction. A lightweight shed enclosing a simple space is required. Depending on the circumstances of the company for future needs, flexible and movable partitions which have the ability to change the space organization are preferred. Elements like flexible partitions, seating elements, demountable steel partitions, horizontal or vertical sliding doors or panels are used. The common knowledge for factory buildings was almost, the office at the front and a production area at the back. After the widespread of clean industry, this hierarchical spatial organization has been replaced by a different approach to conventional industrial building with one roof umbrella over a more democratic working environment. Since the industries are clean industries, few problems are created by the integration of separate functions.

Foster's Reliance Control Building, the first industrial building that was constructed by Team 4, has a simple description for this concept. The cross-head detailing above the corner stanchions projected that an extension in an east-west direction is possible (Fig.3.10). At the same time, these elements have exhibited an aesthetic feature.

Different from the industrial buildings, an early example, a seminal for a "lightweight flexible house" was generated by Eames in 1960s (Fig.3.11). However, Eames was one of those architects who was taken as a model by high-tech architects like Foster, Rogers, etc. stood between the two eras - the 1st and the 2nd. Design of a house as a basic unit for living developed by the possibilities of industrial technologies. Everything was mobile in the house except the basic frame, the structural system.

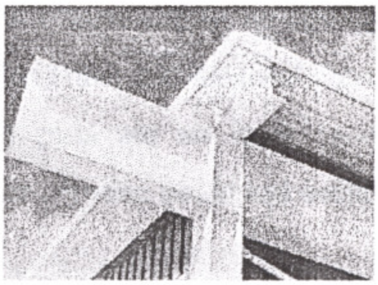


Fig. 3.10. Reliance Control, stanchion's detailing, Foster 1965-66; (source: Foster V.1 1991)

In the same way, differing from the two-dimensional flexibility of Miesian or Corbusian design approach, a concept of three-dimensional flexibility was supposed to be realized in Pompidou Center Project. In this building a change between floors and different layers is considered when it was first designed, on the other hand it was never achieved because it needed an expensive construction system. Anyway, the problem is to take flexibility a stage further and introducing the idea of flexibility not only in the partitions, but also in the permanent elements. These buildings are incomplete in their form, ready to be enlargeable or demountable.

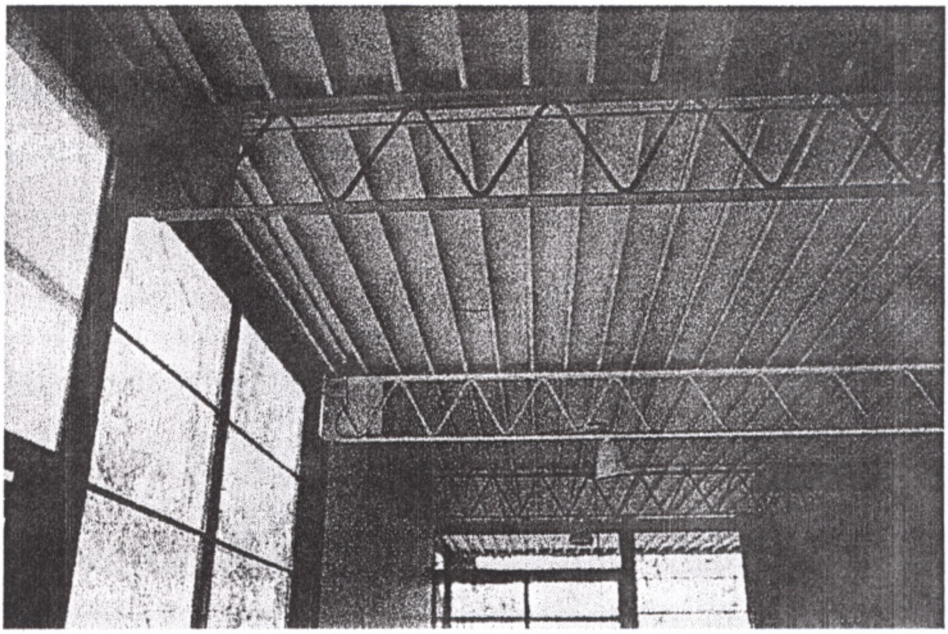


Fig. 3.11. Eames House, 1960; (source: J.Neuhart, M.Neuhart, R.Eames 1989)

"As there is no building without water and electric power, there will be no building without the climate-control in the future". This was what Fuller had dreamed about. In a climate-controlled environment the component parts are no more called buildings. A total flexibility is obtained, because division between inside and outside is vanished.

Served and servant spaces is a planning strategy and also important for technical concerns. As the main structure lasts for 50 years, the technical equipment have life span of 10 or 15 years. While maximum flexibility is achieved in served spaces, arrangement of the equipment becomes easier. The idea is first advocated by Kahn in the Medical Research Building where the service spaces are subordinate to the served laboratory spaces. Distinction of spaces which means that different functions should be designed in different spaces was an attitude of modernist tradition.

Contrary to the traditional high-rise buildings, in Hong Kong Shanghai Bank, Foster placed the services, the structure and the elevators, not in the center of the building which would consist of a heavy structural core, but at the external surfaces as modules which let an open plan. Modules containing the toilet facilities and air-conditioning plants have been manufactured in Japan (Fig.3.12). A mobility and a flexible office planning have been achieved with the exposed escalators and structure indicating the spatial partition.

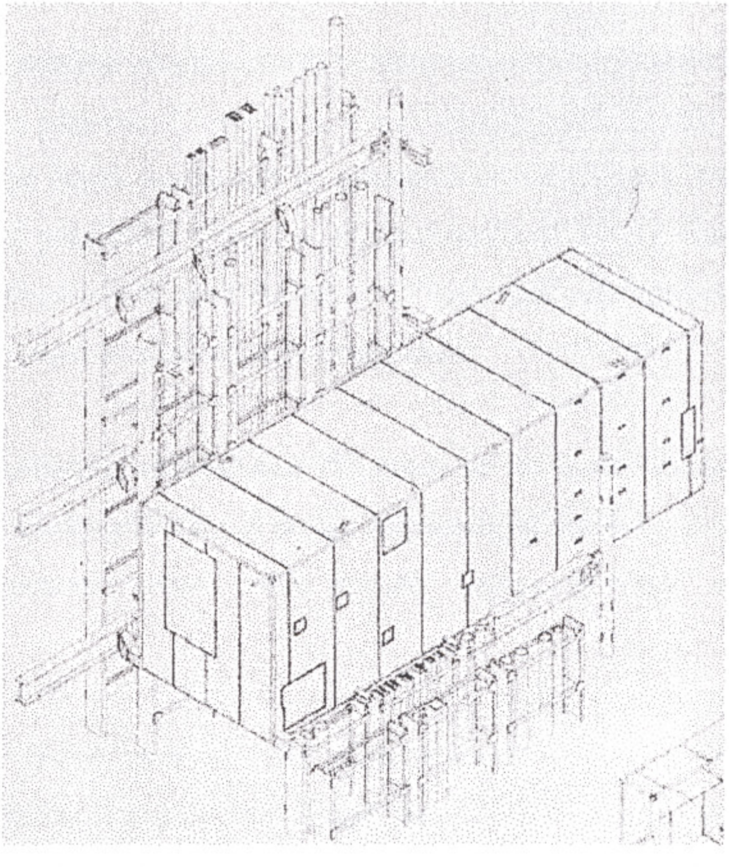


Fig. 3.12. Hong Kong Bank, modules, Foster, 1979-85 (source: Foster V.3, 1989)

Module structures for mechanical and electrical services is not indeed a problem of engineering, because the idea of module is an architectural idea. There are two basic approaches to the use of modules:

- attaching the modules into a fixed infrastructure of services like ‘living pods’ (dwelling capsules) as it is represented in Kurokawa’s Capsule Tower,

- taking the served space as a fixed element and the services as the 'plug-in' modules like the service modules of Hong Kong Shanghai Bank. The modules which have been assembled on the building site structured the service towers on the periphery of the building.

The module concept consists of both flexibility, demountability and mass production as well. Grimshaw has also designed toilet modules out of stainless steel and used in his industrial buildings (Davies 1988, p.11). The advantages to use plug-in-pods is, first speeding up the work on building site, and second high quality of production.

The concept of flexibility is possible with the idea of mobility of components and the whole of the building. In the projects of Archigram, it was already predicted that a new vision of the city of the future world will be generated of the plug-ins. The primordial way of industrial production offered a standardization of factory-made products. Most of the buildings which carry the label of "high-tech", are custom-made. This is accepted as a further step in industrial production.

As part of a spatial differentiation, **the exposed structure** or the constructional components became a distinguishing feature of design approach. At the same time, the exposition of a structural system with primary colors provides an ornamentational character.

Technically, the exposure of the structure may cause some difficulties when protection is concerned. Whether it is concrete or steel frame, if it is a multistory building, its structure should be encased. If it is steel framed, like in Center Pompidou, water-cooling for columns, dry-insulation for trusses or the spray-on-fireproofing for the joints maybe required (Davies 1988, p.9). The steel framed structure of Hong Kong Bank was proposed to be protected by a thin ceramic fiber blanket fixed onto it. This cementious coating was developed for that project. Later, because of the thickness and heaviness of concrete which nearly required 50mm. thickness, "a reinforced aluminum foil cement-based coating" with a thickness of 12mm. is applied (Foster V.3, 1989, p.219) (Fig.3.13).

A British high-tech architect Nicholas Grimshaw is distinguished by his organic approach of expressing the skin and bones of his buildings. A transition towards a more organic expression is observed between his press buildings; from Financial Times Print Works, London 1988, to the Western Morning News Building, Plymouth 1993. Plymouth building (Fig.3.14) with its ship-like form has a connotation of Plymouth's naval tradition. It was not only a symbolic relation, but also a reflection of practical thinking and detailing of naval engineering. The glazing has been hung on the great curved columns spaced outside the building which also support the roof structure (Fig.3.15). The curvaceous facade affirming a total transparency like the Financial Times Print Works, presenting what has taken place inside the building. In the search of a connection among organic skeleton, structural design and its way of expression Grimshaw and Calatrava have similar tendencies. This tendency is exemplified in Grimshaw's railway station as one of the most important architectural typologies. Apart from a symmetrical railway shed, the section of the building changes on the longitudinal direction according to the site lines. The eastern side of the shed has covered in stainless steel and the western side in glass leaving the structure conversely (Fig.3.16). The glass shed taking place under the structure joined with accordion gaskets in response to the thermal expansion (Steele 1997, p.90).

Demystification of technology, in terms of exposing the structure and the components and determining a distinction between the served and service spaces help to reveal the technological character of the building. The distinction between the structure and the cladding, the glass enclosure of working parts of the building are disclosed in order to inform the observer how the building works. The distribution of structural, mechanical and spatial components decentralize technology. By **decentralization** men's control over technology is increased. By this way, neither giving an autonomous character nor looking at it just as a tool, but demystifying technology and decentralizing its control, a self-possessed relation both liberating ourselves occurs (Bonavia 1986).

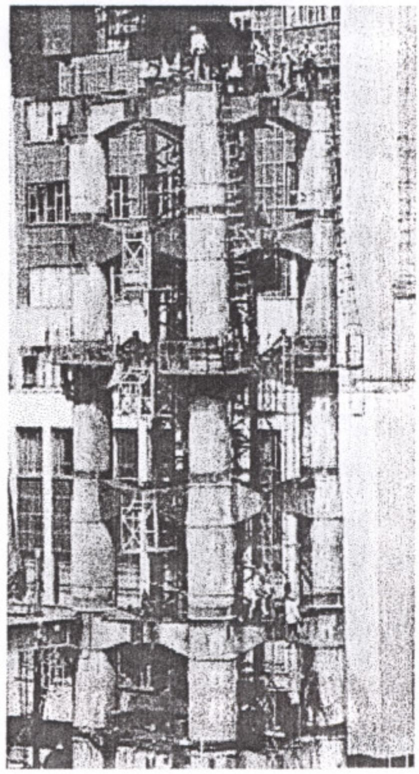
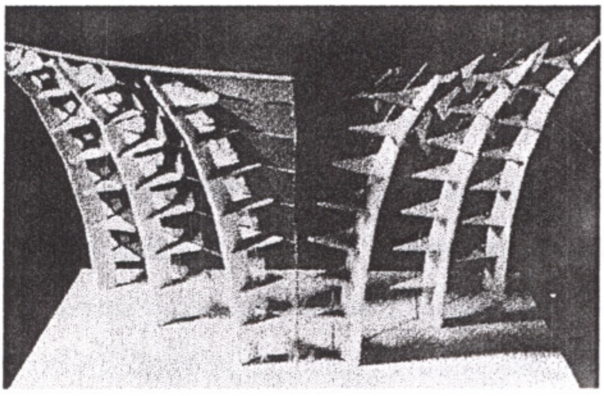


Fig. 3.13. Hong Kong Bank, cement covered structure, Foster, 1979-85 (source: Foster V.3, 1989)



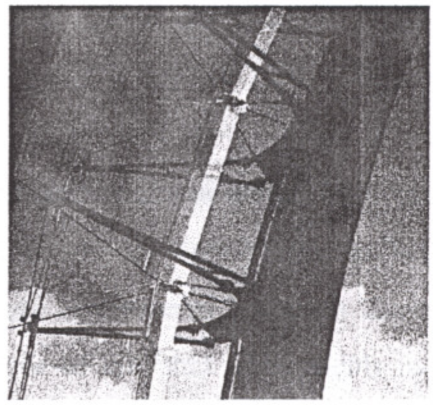


Fig. 3.14. Plymouth Building, Grimshaw, 1993, (source: Grimshaw 1993)

Fig. 3.15. Plymouth Building, glazing detail, Grimshaw, 1993, (source: Grimshaw 1993)

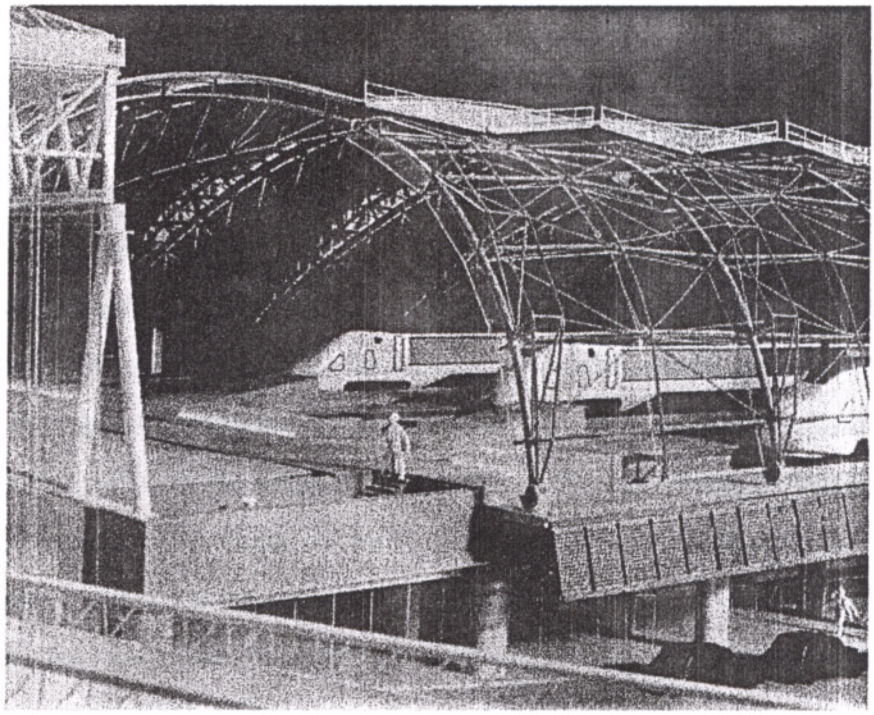


Fig. 3.16. Waterloo International Terminal, Grimshaw, 1993; (source: Grimshaw 1993)

3.2.2.2.2. Integrated building component

The main idea which is carried out with the integrated building component is the full variety of activities with minimum constraints. Integrating the components takes place as a decision of design. By using multi-functional components a simplicity in detailing is also achieved.

As Martin Pawley has marked, "the most highly evolved creatures are actually the masterpieces of component specialization and multi-functional (what Fuller called 'synergetic') assembly, which means that specialized components perform more than one function and thus optimize the performance of all other components by reducing their load" (Pawley 1991, p.29).

A very simple example for this concept was observed in Reliance Control Building. The fluorescent lighting has been used in the rescesses of the roof decking as a reflector and the secondary beams were replaced in order to allow these tubes to fit exactly. It was a simple idea, but at the end formed a unified whole (Foster V.1, 1991, p.81).

The thematic concept for Sainsbury Center is open and clear space for the main areas, thus the truss structure contained the distribution of services within its depth (Fig.3.17). The same depth is also used to contain for small facilities. The structure has been replaced between an inner skin of perforated louvres and an outer system of interchangeable panels. At ground level the lobbies, lavatories, stores, small kitchen and photographic studios; and above mechanical and electrical plant are positioned inside the structure (Fig. 3.18) (Foster V.2, 1989, p.82). Economy is achieved through making components which do more than one job. The computer of the building, reading the density of the clouds in the changing sky, has driven the louvres all day long and an interaction between architecture, environment and technology has been offered (Steele 1997, p.79).

As one of the successful examples, the essence of Stansted Airport (Fig.3.19) lies in its strategy of positioning the services. In order to realize a light shed over a total space, the roof has been purified from the installation system. For this reason, the structural trees included the service pods like air conditioning, fire protectors, TV screens, emergency lightning, information charts and communication. Hot smoke, absorbed by the installation modules, has been thrown out by passing through the building (the adequacy of the solution has been discussed) (Okutan 1998, p.136). The steel trees are spaced at 36-meters intervals in a grid system and at the same time they spanned the half of the distance economically. The objective was to create a large space where function and use are primary requirements (Foster V.3, 1989, p.67).

Like most of the buildings of Foster, in Hong Kong Bank, design has constituted of the integration of spatial organization, structure and mechanical servicing. For this reason, the floor components are conceived as complete modules incorporating not just the service void, but also the services themselves (Foster V.3, 1989, p.152). The slab acts as a structural diaphragm and provides the necessary fire protection

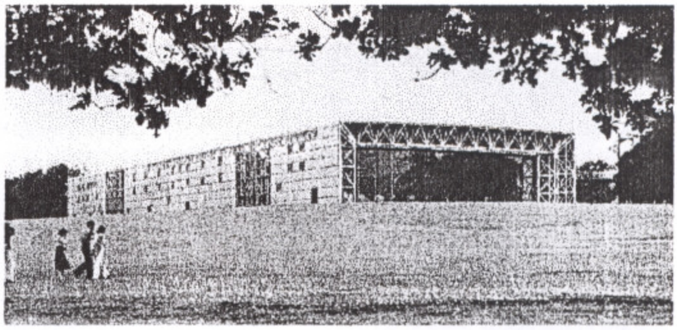


Fig. 3.17. Sainsbury Centre, Foster, 1978; (source: Foster V.3, 1989)

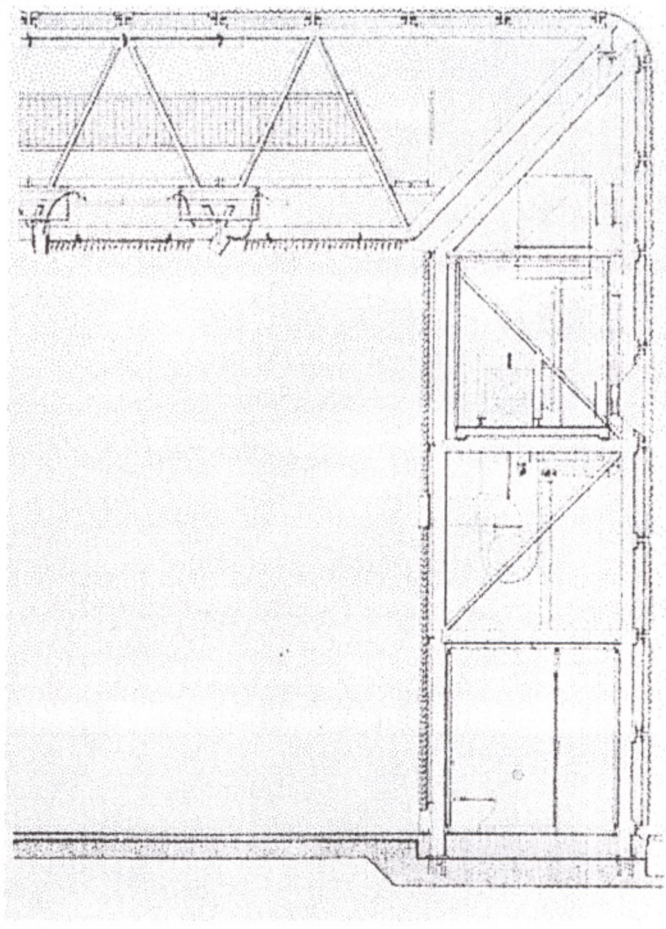


Fig. 3.18. Sainsbury Center, integrated building component, Foster, 1978; (source: Foster V.3, 1989)

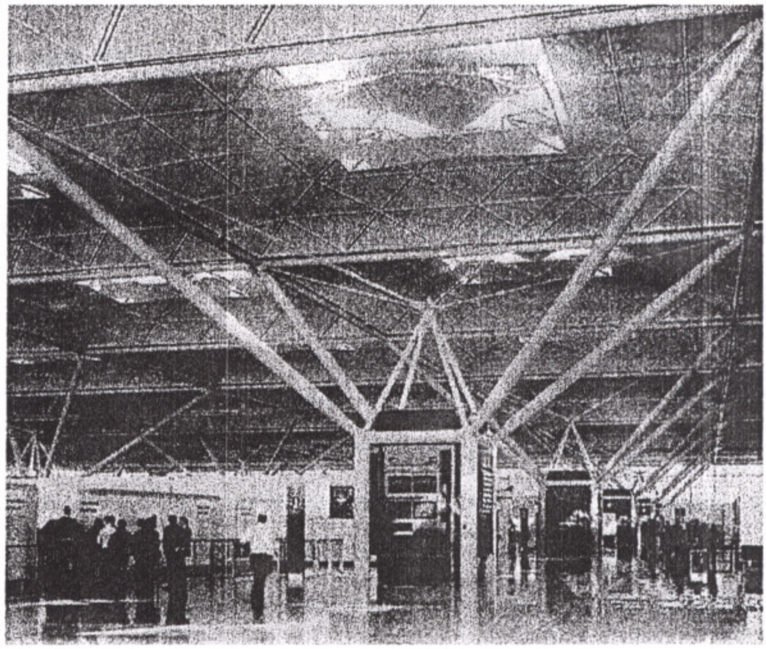


Fig. 3.19. Stansted Airport, integrated building component, Foster, 1978; (source: Foster V.3, 1989)

between floors. Combining ducts, trunking a floor structure in an integrated factory-assembled component is an idea which is in lieu with Foster's concept of kit of prefabricated parts (Fig.3.20). Thus, the structure and the services are separated into distribution zones in the floor void to let a flexible planning. The floor panels in a standard grid were constructed in laminated honeycomb which is light and strong and mostly used in the construction of aircraft (Foster V.3, 1989, p.232-235).

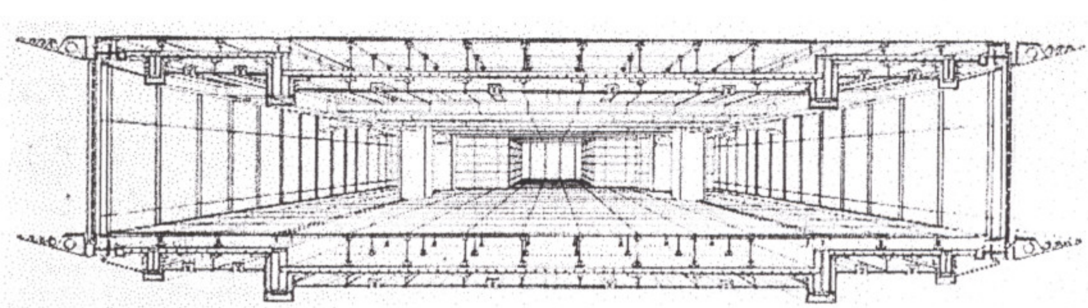


Fig. 3.20. Hong Kong Bank, floor detail, Foster, 1979-85 (source: Foster V.3, 1989)

3.2.2.2.3. Transparency and Lightness

Lightness is evaluated in two ways, both by being weightless and provision of daylight for inner space. Although it seems that they both imply two different dimensions of "lightness", they are interrelated subjects. Letting the daylight to flow through the interior, necessitates a fragile transparency gained by the material. As Otl Aicher has commented:

> "At the beginning of the century there was a cry for light. A cult of sun-worshipping had arisen. Today, we have enlarged the program into a controlled interdependence of light and shade. Such an architecture can not be realized from a merely static beauty. It needs an architecture able to react and to change. This should be achieved by machines or manual control".(Thomsen 1996, p.107).

According to Virilio, the importance given to glass and transparency today is a metaphor for the disappearance of reality. Transparency is a matter for the loss of material quality in architecture (Thomsen 1996, p.108). It implies a transition from an aesthetics of materiality to immateriality.

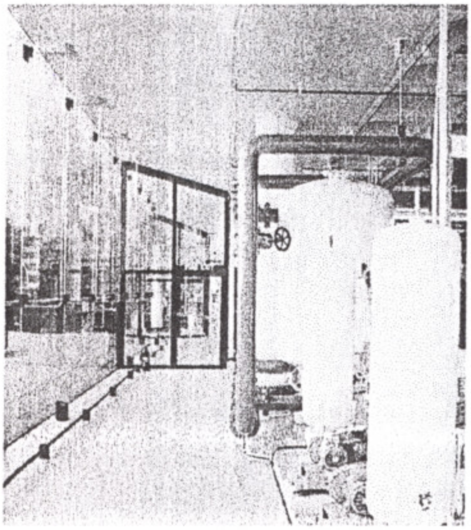
Transparency is a concept which is developed with the new building morphology in the beginning of twentieth century. Transparency of the material is associated mostly with the transparency of a democratic society.

The concept of transparency taking place in the modern movement began with the **flow of space between inside and outside**. This concept supports the idea of taking more light and heat inside as well as exhibiting the interior space. From the beginning of cubist movement, the open space dictated a space formed of horizontal and vertical planes. Instead of using holes on the solid walls, fragments on these planes defined the voids. Today, a spatial and visual integration is easier with the help of technical innovations. The inner space is allowed to be independent from the

outer space even in functionally more complex buildings which are totally glazed with the help of structurally used glass.
Technically, for the skyscrapers in 1950s, the tinted glasses in buildings were used to reduce the transmission of solar heat. The need for light has to be balanced with the concern of heat loss. With the invention of coated glasses, which look like mirrors from the outside, unwanted solar energy is reflected away. Although the material transparency is often achieved by glass, glasses are not the only transparent solids; such as the transparent plastics.

Willis Faber (1971-5) of Foster Ass. is a wholly transparent building whose concept is to show how a building works. Inside the building the partitions are out of glass as well, even the cleanness of plant room is clearly perceived (Fig.3.21). The transparency of the building reflected the working philosophy of the company. The character of the building is derived from the way the glass wall is put together. The whole wall is suspended from the top of the three-story structure (Fig.3.22), but the half-story glass fins (elements) provide the wind resistance which are fixed to the glazing with sliding patch fittings. These fittings are adapted to the fractured surface of the facade. The visual continuity is insured by the glass-to-glass silicon joints from the outside. (Wigginton 1996, p.110). As the design is manipulated as a deep-plan, in addition to the transparent facade, an atrium has been used to provide day-light to the central parts of the building. In Hong Kong Bank, the sun-scoops were also used in atrium for collecting more light.

The architects like Ian Ritchie and Martin Francis who worked for the structural glazing at Willis Faber & Dumas experienced the capacity of glass while adapting it to a structure considering its deformation. The enclosures in Les Serres at Parc de la Villette were decided to be as transparent as possible, it was supported by a reduced structure like cable trusses (Fig.3.23). It was formed of 2mX2m panels of toughened glass assembled into 8mX8m composites. As the panels were joined with waterproofing silicone, the composite panel acted as one sheet. The weight of the panel was shared between the support points and a spring mechanism is inserted into the support brackets. It both spread the load and acted as a shock absorber for any sudden breakage (Fig.3.24). With the innovative fixing details providing a smooth exterior surface. Depending on the angle, the glass walls were sometimes reflective and sometimes transparent.



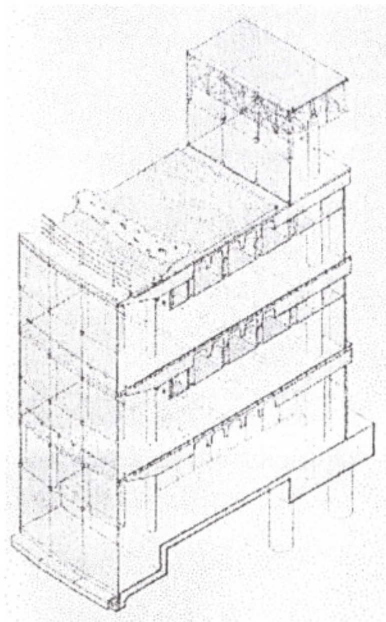
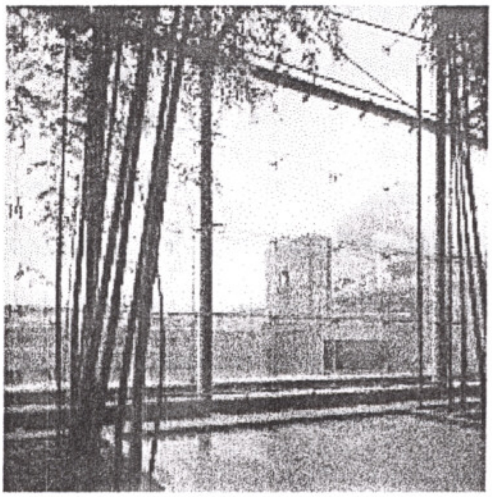


Fig. 3.21. Willis Faber, plant room, Foster, 1971-75 (source: Foster V.2, 1989)
Fig. 3.22. Willis Faber, axonometric section, Foster, 1971-75 (source: Foster V.2, 1989)



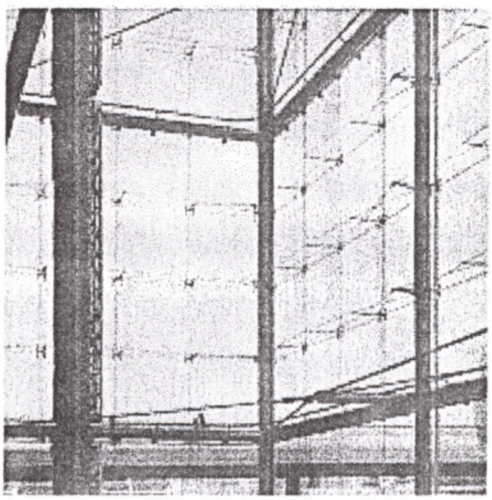


Fig. 3.23. Les Serres at Parc de la Villette, Ian Ritchie & Martin Francis, 1986;(source: Editions de la Cité des Sciences at de L'industrie)

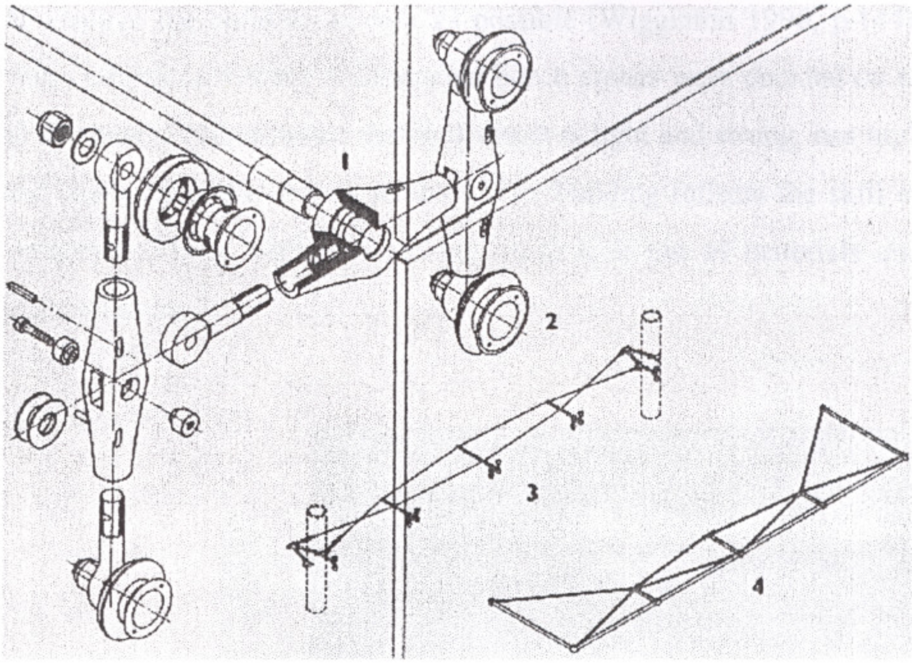


Fig. 3.24. Les Serres, glazing detail, Ian Ritchie & Martin Francis, 1986; (source: Editions de la Cité des Sciences at de L'industrie)

The works of British high-tech architect Michael Hopkins have been characterized with the utilization of tensile structures. The Schlumberger Research Center and Lord's Cricket Ground (Fig.3.25) were his most successful practices. Teflon-coated fabric roof has been dominated as the primary cladding system. After the successes of these projects, the teflon fabric has been adopted. The system is thermally reflective, fire-protected (incombustible) and **structurally light** (Steele 1997, p.87). Symbolically, the membrane coating is not characterized as high-tech, but the tensile structure is. The first use of teflon fabric was the Jeddah Airport of 1980. To provide a low-cost durable shelter SOM has designed a tensile shelter for the Muslim pilgrims. The Terminal structure has pushed the limits of building technology and demonstrated that such a massive structure can still be light and airy.

The IBM Traveling Pavilion (1982-6) of Piano is required to be a building in which information and computer technology could be exhibited as a traveling building especially for young people (Fig.3.26). Therefore the concept is focused on transparency, demountability and lightness. It was required to be transparent, so that the exhibition would always be seen in the surrounding; demountability and lightness was required to remove the building as easy as possible (Wigginton 1996, p.144). According to these criteria, a system of laminated beech arches were decided on to produce a rigid structure. Polycarbonate material which is light and strong, has high transparency and easily takes shape was selected. The building reflects the skill of Piano which creates buildings with high-technological look out of materials and forms which awaken nature.

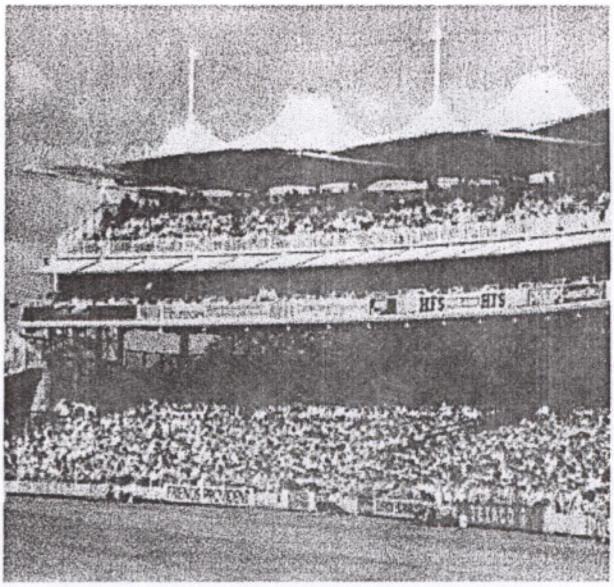


Fig. 3.25. Lord's Cricket Ground, M.Hopkins, 1987; (sorce: Jenkins 1991)

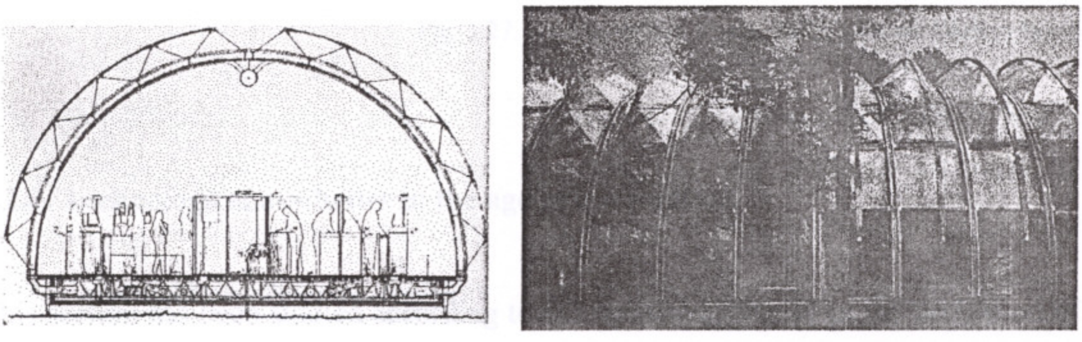


Fig. 3.26. IBM Travelling, Piano; (source: Wigginton 1996)

Piano's Kansai Terminal which settled on island in Osaka Bay (1988-1994) (Curtis 1995, p.3) was a linear and transparent building (Fig.3.27). Concentrating on the craftsmanship of architecture, the architect has also achieved a "soft" geometry rather than a "rigid" one. The building took its aerodynamic form from the air blown out of the outlets. By this way, a micro-climate has been controlled under a huge 82,8m. long cavity (Castello 1994, p.3-5). In spite of its complex curved form, the roof, which has been built out of 82.000 standard-size stainless steel panels suggested uninterrupted and dynamic spaces both responding to the external forces like wind, light and gravity.

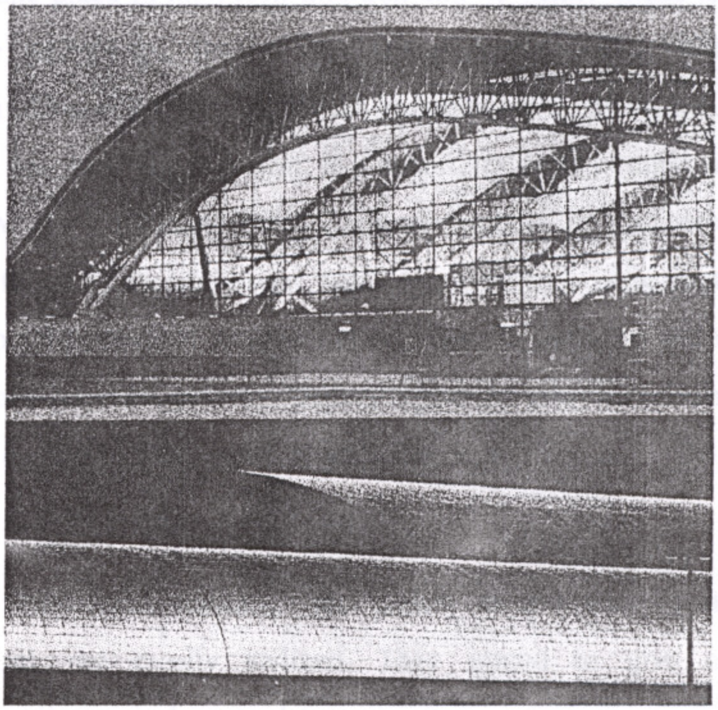


Fig. 3.27. Kansai Airport, Piano, 1988; (source: Okutan 1998)

3.2.3. Technological aesthetics in the age of information

This section has been studied according to the stylistic approach in the utilization of technology and the immoderate use of it called as "the technological illusions".

3.2.3.1. Technological style

Technology is used to create distinctive architectural forms with its own aesthetic character. Structure is one of the most important tool for this concept. Mobile structures, buildings assembled from mass-produced components possess a mechanistic character and a machine analogy just like the mass-produced, portable machines out of synthetic materials. They may not be mobile, but they seem to hover above the ground and move one day.

The works of Jean Nouvel take place in high-tech tradition and he firmly sticks to the use of the avant-garde technology. Institut du Monde Arabe, Paris 1988 (Fig.3.28) carries the mission of being a courtyard for the communication of culture. Thus, it is a symbolic bridge between east and west, and according to its context, a bridge between old and new. As a result of these basis, throughout its southern facade technological interpretation of the traditional wooden screens in Middle East have been used. These computer-controlled screens out of titanium and steel have both decreased the day light and provided privacy. Depending on the position of sun the camera-like lenses create an interplay of openness and closeness.

The exposed structures of "high-tech" buildings are honest in the sense that they are genuinely structural, are mostly stylized. They intend to give a message of technological excellence and up-to-dateness.

The spatial and structural quality of the Hong Kong Bank expresses itself with a Gothic like impression. With the flying buttresses, the exposed structure, the proportions of the atrium and the translucent eastern window the building is characterized as a "cathedral of commerce" in the age of high technology (Fig.3.29).

As a related example, in Renault Sales Headquarters (Fig.3.30) by N.Foster Ass., the structure was used as a part of the stylistic program to create a striking

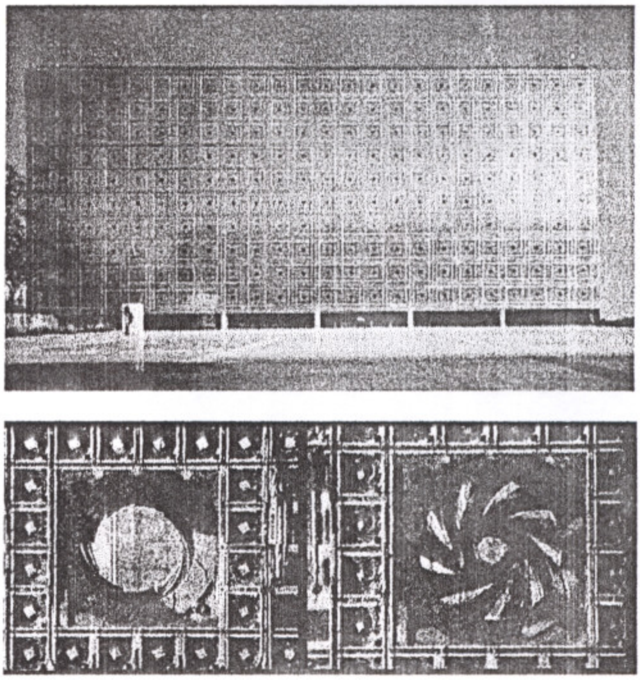


Fig. 3.28. Arab Institute, Nouvel, 198788; (source: Papadakis 1991)

visual image which is symbolic of technological excellence. The single-story building has a steel-frame structure supporting a non-structural cladding envelope. The basic form of the structure is of multi-bay portal frames running in two principle directions. The longitudinal profile of each frame is matched to the bending moment diagram for the principal load; the structure is trussed, the compressive elements have some resistance to bending. These features improve the efficiency of the structure, but the structure is unnecessarily complicated. Maybe a conventional portal frame would be more economic but in that case it would not provide an appropriate image for the company. It is series of architectural, but not structural decisions, putting forward the structural symbolism. Meanwhile, the point was appreciated by the structural engineers who worked with the architects on high-tech buildings :

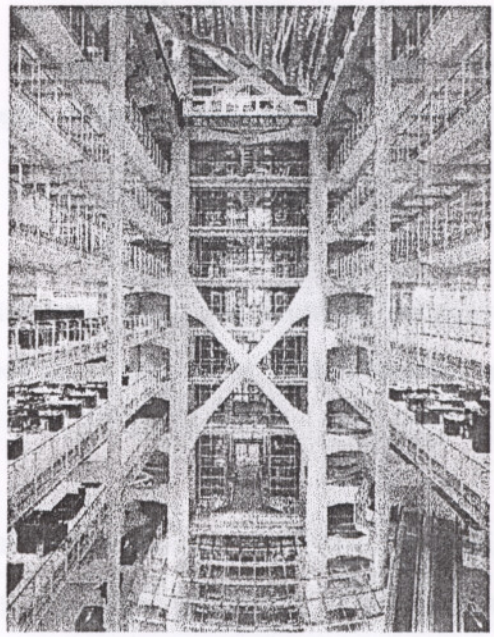


Fig. 3.29. Hong Kong Bank, flying butresses, Foster, 1979-85 (source: Foster V.3, 1989)

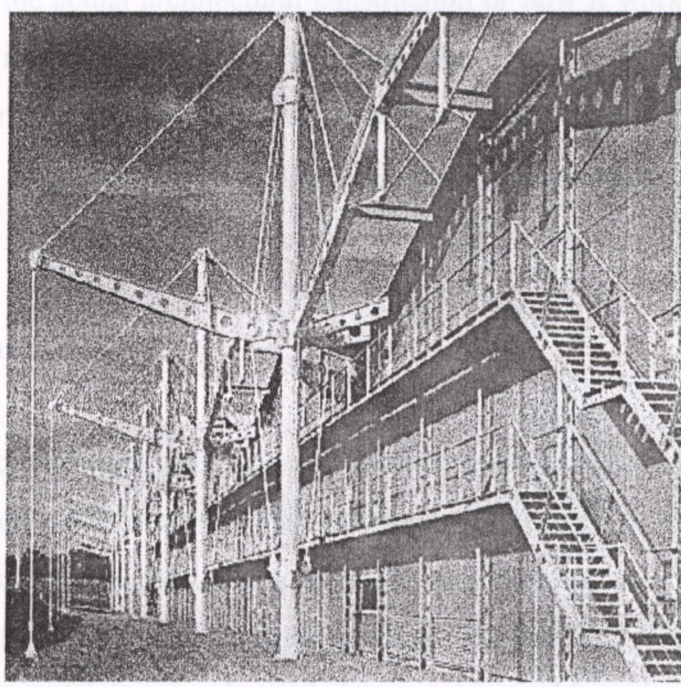


Fig. 3.30. Renault Center, Foster, 1980-82; (source: Foster V.2, 1989)

> "The use of structure as an exposed element is almost an architectural decision, part of an architectural philosophy that requires a degree of dialogue between engineer and architect" (Macdonald 1994, p.84).

Without a tectonic process, revealing the tectonic form, the tectonic becomes "scenographic". A tectonic process, or technological process of design requires a relationship between design and construction.

As an immoderate example to technological expressionism, Japanese architect, Takamatsu, after 1980s (Papadakis 1992, p.18), took the image of high-tech machines full of carefully crafted details in his buildings (Fig.3.31). They were different from the rational and functional machine of Le Corbusier. Most of the details in his buildings : the heavy metallic parts, steel plates, highly polished surfaces, hinges, rods and the large rivets are technological in nature. Yet, these details are partially related to the actual architectural construction or how it works. Such details and elements are images of a pseudo-technology (Fig. 3.32). B. Bognar defines it as "pop-tech". An urban fiction is produced by way of "technology". The work of Hasegawa and Ito seem to continue such high-tech phenomenalism (Papadakis 1992, p.18).

3.2.3.2. Technological illusions

The electronic paradigm, which effected architecture, redefines reality in terms of media and simulation. Appearance is valued more than existence. In big cities, where every fundamental thing is introduced by media, large or small, each building tries to be a unique expression and detail. "The medium is the message", is what McLuhan has expressed. Any understanding of cultural and social change is impossible without a knowledge of the way media works as environments. The characteristic and content of media belongs to another media. Thus, the content becomes the message.

Whether it is a part of the culture or not, somehow the message is ready to be consumed .

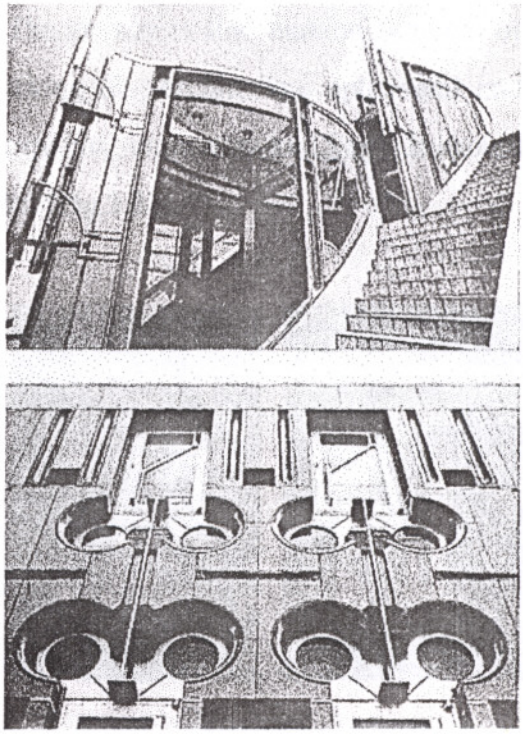


Fig. 3.31. Kirin Plaza Building, Shin Takamatsu,1987; (source: Papadakis 1992)

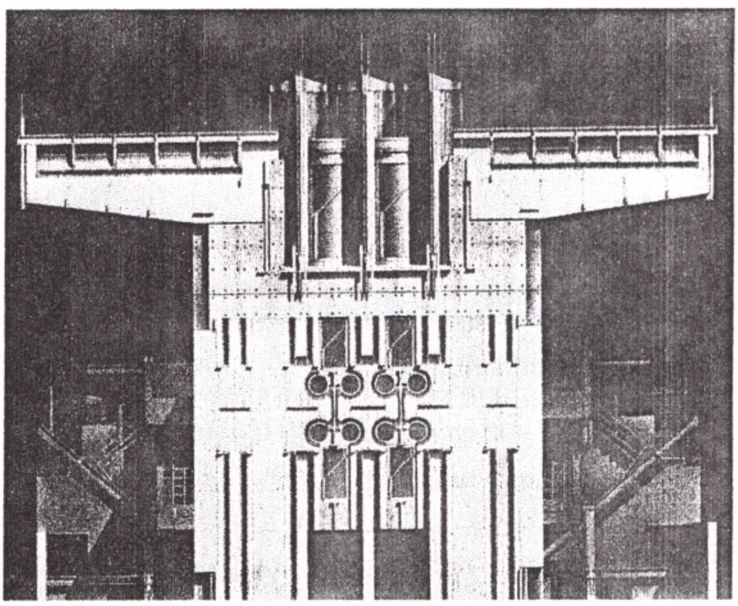


Fig. 3.32. Syntax Building, Shin Takamatsu, 1988; (source: Papadakis 1992)

Toyo Ito puts forward the problems of making architecture in a simulated city and seeks the answer of "creating a work of architecture with a physical presence that goods no longer possess" and "building architecture which endures while local communities are nullified" (Ito 1995, p.9). The answer is first making fictional or video-image-like architecture and second making that architecture ephemeral and temporary without replacing video images or making temporary buildings. It should be fictional and ephemeral as if it is permanent (Fig.3.33).

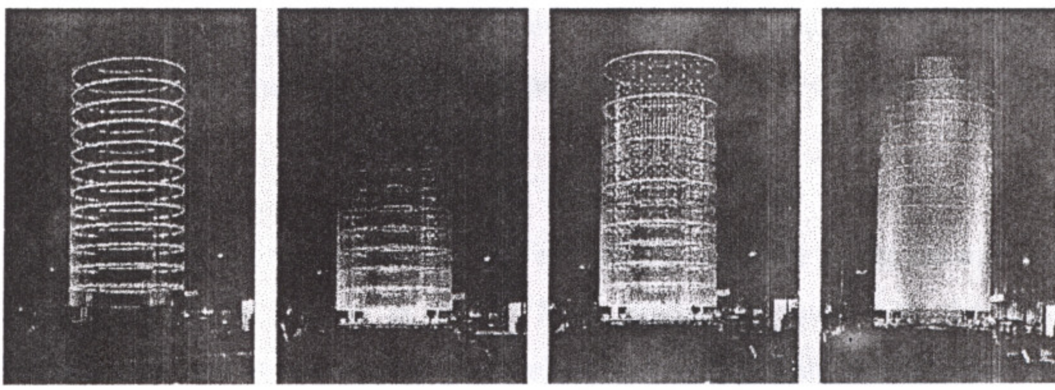


Fig. 3.33. Tower of the Wind, Toyo Ito, 1986; (souce: Ito 1995)

The hardware technologies which are product of the first machine age were preoccupied with rationalism, standardization, mass-production and industrial technology. On the other hand, the new software technologies are more intuitive, flexible and locally modulated. In most of the examples, tectonic considerations continue, but with an emphasis on appearance. The effect is apparent even more in the articulation of details, surfaces, etc.

What technological images are bound to serve is the authority or the power of the companies or the governments. "Image" as a keyword governs the function of reflecting the ideas like "estimable", "quality", "prestige", "reliable", "avant-garde". As a matter of fact, they become the symbol of commerce in a consumer society.

3.3. Conclusion of Chapter 3 and a comparison between the 1st and the 2nd Machine Ages

1st Machine Age involved the mechanical efficiency and quality as a factor of good design. What formed the bases of this idea are 19th century mechanical and engineering achievements. Second, the futurists who emphasized the mechanical speed in buildings. Third, the constructivists who focused on the pragmatic needs, materials and techniques. Werkbund and Bauhaus sought for achieving the new formation of art and architecture with new machinery of industrial production. Mostly the problem was how to get high performance in functional, structural and mechanical issues.

2nd Machine Age is characterized by the remarkable advances in technology and growing pluralism in society in 1960s. Mass production joins with the mass communication and production is more electronic rather than mechanical. The symbolic machines for the 2nd Machine Age are television and computer. Industrialization does no more mean "hard" machines, but also "soft" machines.

In the age that technology is said to be the dominating force on both architecture and the human life, the distinction between the artistic creativity and the engineered creativity is increasingly vanishing.

The utilization of advanced technology in architecture in the name of "high-tech" is based not only the building materials and construction systems, but also it reflected an integration between man and his environment as an architectural design. In other words, the technological improvements taking place at the end of twentieth century allowed us to evaluate the meaning of architecture within the scope of technical equipment, process and theories.

It is possible to categorize these two ages according to their basic properties in order to clarify their distinctions. These properties are defined in table 3.1:

Table 3.1. Comparative assessment of 1st and 2nd Machine Ages; (source: partly taken from David Harvey 1996, p.199-205).

Variables	1st Machine Age	2nd Machine Age
production type	mechanical	electrical, computerized
	mass-production	custom-made production
	with man & machine power	with information power
	authoritarian	participant
	reproduction	reproduction of the original
	with hard machines	with soft machines
	Fordist production	just-in-time production
economy	capitalist world trade	late-capitalist world trade
social ideology	industrialized	post-industrialized
	technical-scientific	pluralist
	modernist	post-modernist
	mass culture	individualist"yuppie" culture
	international	geopolitical
	defamiliarization	decentralization
	paranoia	schizophrenia
scientific understanding	industrial calculative sci.	communicative philosophical
	rationalist	assortment of knowledge
building material	steel, glass and reinforced concrete	high-strength alloys and hybrid materials (recycled or recomposed)
	technology versus environment	technology for environment

space morphology	permanent	temporal
	monumental	ephemeral
	functional	multi-functional
	spatial division	spatial integration
	materiality	immateriality
aesthetics	abstract	pluralist
	calm	immoderate
	machine aesthetics	computer aesthetics
	construction	deconstruction
	meaning	image

Chapter 4

AN ASSESSMENT OF THE BUILDING TECHNOLOGY IN TURKEY

Technique is a product of a certain culture. Thus, technology can not be treated apart from the cultural properties and develops with the guidance of inventive thoughts in that culture. The request for human power and labor organization change according to the type of technology whether it is high or low.

Today, the economies of the countries are defined with the level of quantity and quality of information which is produced, used and reserved. *'The countries which are socially and economically developed'* in the information age are also the ones which both **utilize** and **produce** their technology.

In '*countries within the development and industrialization process*', the **production, selection, transfer and adaptation of technology** occupies an important role. The type of production is determined on the basis of economy, production power, conditions and the knowledge constituted of these criteria. The question is which type of technology is suitable for any kind of development. At the beginning, these countries have to apply technology by transferring from countries which are more advanced. However, the transferred technology should be adapted to the resources of the country. For that reason, they should establish their own research and development units (Demirel 1994, p.33-34).

"The age of ephemeralization" belongs to a process which has already existed in western world. On the other hand, Turkey does not experience this process as it is experienced in the western world. As a country which is in the process of development, high-technology has not spread homogeneously as it is the case in the west. **In spite of this, there are examples which are not imitations and adapted to the conditions taking place in Turkey in order to develop the building**

technology. Following examples are selected according to the criteria mentioned above.

4.1. Industrial technologies acting on building construction

Industrial building methods are important for increasing the quality of materials, for the realization of the production appropriate to the standards under the umbrella of technical knowledge. The companies which utilize industrial methods produce 60% of the production with tailor made methods and %40 with standard components (Tezcan 1992, p.44). There are two sectors which are supported by industrial production. The industrial buildings and housing. However, the housing blocks are rarely successful in the basis of their design and architectural expressions. Moreover, generous organizations are needed for producing housing complexes with industrial methods. (Eyüce 1992, p.3).

In Turkey, like in many other countries, it is the industrial buildings which force the limits of building technology due to the requirements of a rapid and economic construction system. The image of the industrial buildings in the world of marketing is important for such aspects like the quality, the quantity and the ability of the employer. The industrial buildings have been constructed economically and poorly in the time of non-planned developments, but then it was understood that the correct solutions cost less than the poor ones. By choosing the appropriate technology the cost is decreased, quality is increased and quick production is realized. As an example, Cengiz Bektaş's İzmir Aliağa Steel Factory has been constructed by using 19kg. of steel per m2. The roof has been modeled like space frame, but with a simplest solution.

4.1.1. Industrial buildings

Industrial buildings of different construction dates and technologies are selected in order to exemplify the selected topic.

4.1.1.1. Lassa Tire Factory

The factory which was designed by Doğan Tekeli and Sami Sisa in 1975, has been located on the way from İzmit to Ankara (Fig.4.1). Planning of the factory has been determined according to the requirements of tire production. Generally, it was structured as a one-story building.

Like in most of the factory buildings, the primary principles in choosing the appropriate technology were **economy, easiness and quickness in construction.** Instead of a steel construction, reinforced concrete has been advanced for the following criteria:

- the steamy heat caused by the production process would require an expensive maintenance for steel
- steel constructions are less resistant in fire-proofing
- according to the experiences of the architects, the flat insulated roofing is more efficient for preventing leakage.
- Reinforced concrete construction is more economic than steel (Tekeli, Sisa, 1978, p.63).

The columns are situated in a grid of 12m.X16m. The span of 12m. has been connected with prefabricated reinforced concrete beams, while the double-T roof elements were spanning the other direction. Between the roof elements, **a composed material out of fiber glass and polyester has been used in order to take light indoors** (Fig.4.2). To get rid of the monotonous facade of the building and to catch a humanistic scale, the vertical paneling on the facade has been detailed by grooves on it. The fiber glass semi-circled slits on the roof are continued on facade and lowered up to the point where they catch **the human height**. In addition to that, circled windows on the eye level has been arranged on the prefabricated panels of facade (S.Sisa, D.Tekeli, 1994, p.143-149)

The building achieves the structural, functional and technological necessities as well as the aesthetic requirements.

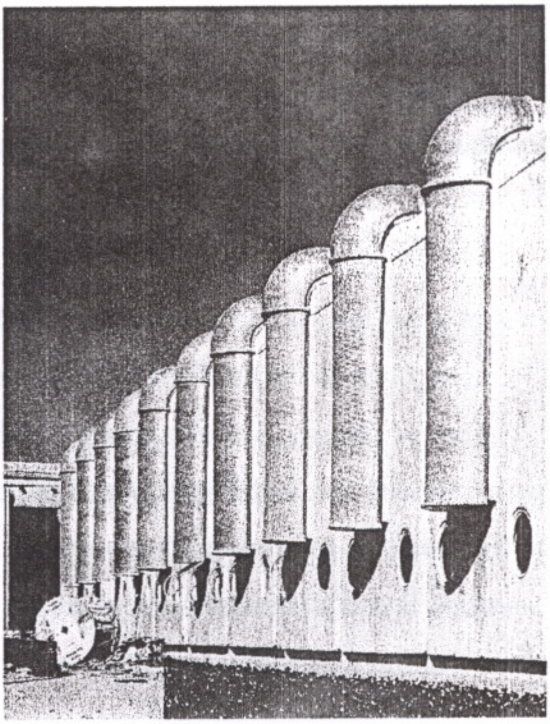


Fig. 4.1. Lassa Factory, Tekeli & Sisa, 1975; (source: Tekeli, Sisa 1994)

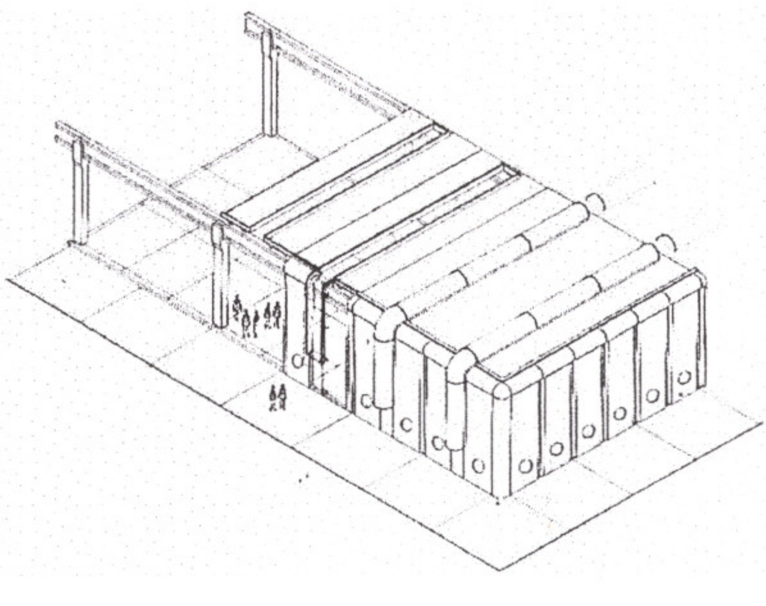


Fig. 4.2. Lassa Factory, detail, Tekeli & Sisa, 1975; (source: Tekeli, Sisa 1994)

4.1.1.2. Göveçlik Cotton Factory

Göveçlik, 1972, is one of the C.Bektaş's factories constructed in Denizli (Fig.4.3). After cooperating with an American institution for the mechanical planning, by reestablishing the spaces required for machines and decreasing the total amount of workers, and **efficient planning** has been accomplished.

The roof trusses spanning the width of 21m. have been connected by space trusses on the other direction. 2m. and 3.5m. spaces have been left at the top and bottom of the triangular sectioned space trusses. By the lightning elements spaced between 3.5m. suspended ceiling are both used to hide the connection detail and provide an equal spread of light (Bektaş 1979, p.14-16). This example constitutes **an integration of multi-functional uses of components** similar to the Reliance Control Building of Team 4. The detailing was simple in idea, but at the end it formed a unified whole in both buildings.

The rectangular sectioned vertical supports needed for the paneling system were kept inside the walls to decrease corrosion and maintenance expenses.

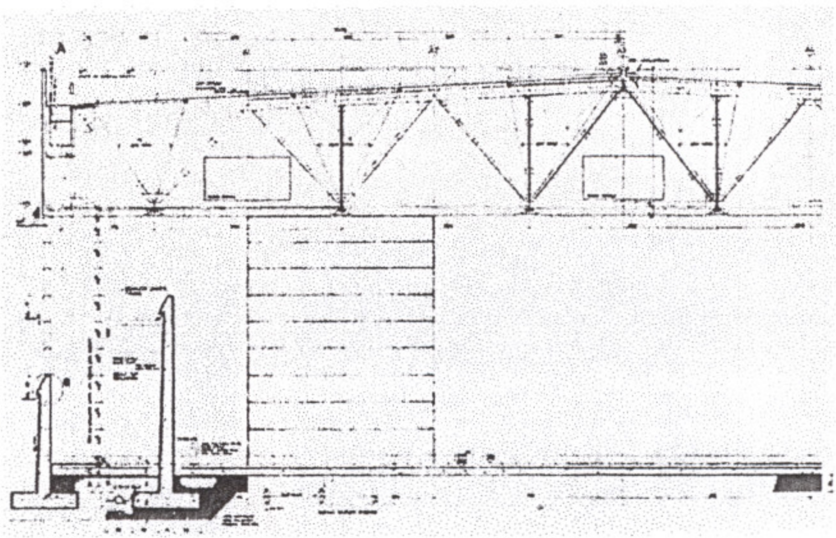


Fig. 4.3. Göveçlik Factory, Bektaş, 1972; (source: Bektaş 1979)

4.1.1.3. Administrative Building for Yalova Textile Factory

The work of architect, D.Avcıoğlu, is characterized by his approach incorporated with the contemporary art and technology. His “contemporary vocabulary” of architecture seeks to bring an intellectual point of view to the use of technology.

While considering the use of technology in his designs, he accepts that technology is international and belongs to everywhere on earth and people who appropriately uses it. Consequently, his belief to **the adaptation and interpretation of technologies** given birth in other places is reflected in his architectural discourse. This discourse lets us to draw an architectural perspective identified in an interdisciplinary approach, seeking the ways of transferring the appropriate technology to the discipline of architecture and taking up architecture as an act of constructing.

Building has been constructed in Yalova, 1996 (Fig.4.4). The industrial outlook of other complexes in the area effected the design of administration building which included offices and the rooms for meeting and education (Avcıoğlu 1997, p.57). The realization of the building has been limited in accordance with the existing constructional possibilities of market. **The light construction with its demountable paneling system** has allowed a quick construction. A technological process between design and construction carries the high-tech expression of the building beyond being “scenographic”.

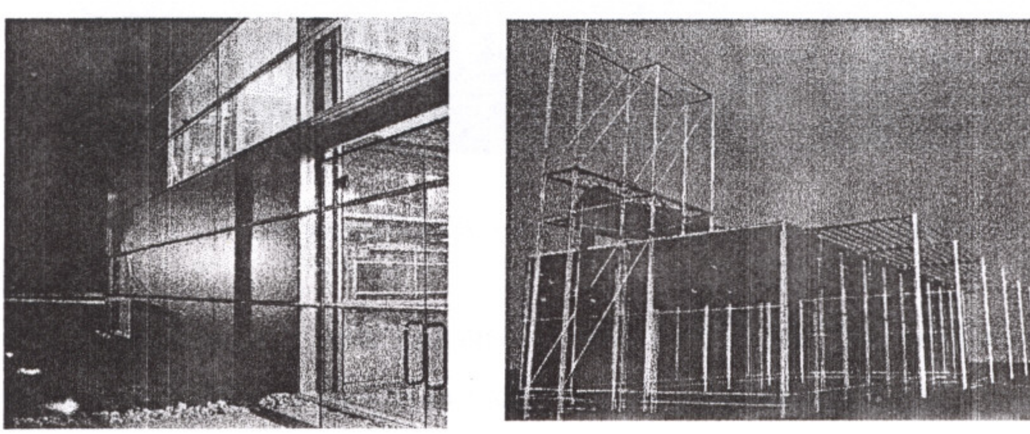


Fig. 4.4. Administrative Building for Yalova Textile Factory, D. Avcıoğlu; (source: Avcıoğlu 1997)

4.1.2. Commercial buildings with multi-functional use

Commercial buildings with wide spans have similar technologies like the industrial buildings.

4.1.2.1. A multi-purpose tourism center - Tatilya

The center designed by Oktay Nayman, 1996, has situated on the west side of İstanbul (Fig.4.5). It has been built on a land covering nearly 109.000m2. The tourist center would be the city's biggest commercial center and the built surface area is approximately 175.000m2 (Nayman 1996, p.51-57). Various functions like shopping mall, bowling alley, cinema, a hotel complex are included. Like the other commercial landmarks through the world, the center tries to be a key attraction.

The courtyard covered with steel and glass roof acts as the heart of the complex. The purpose of the **transparent roof** is to create a sense of a natural garden. It covered an area of 52X115m with a curved roof surface.

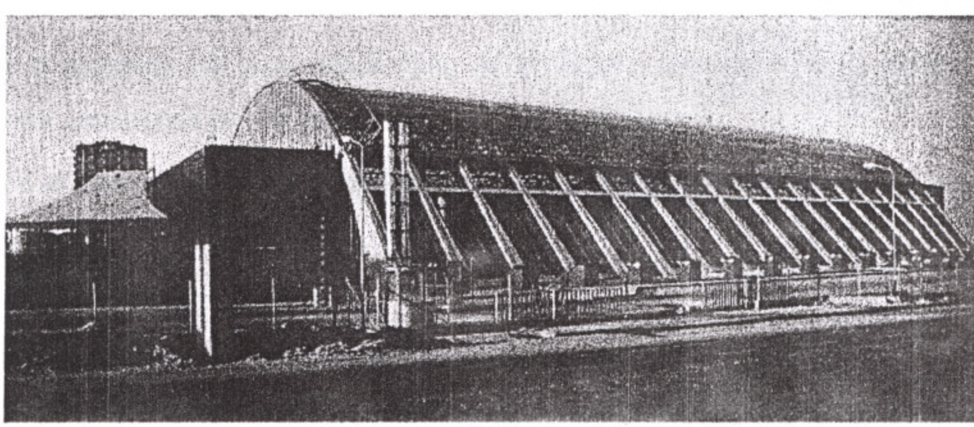


Fig. 4.5. A multi-purpose tourism centre-Tatilya, Oktay Nayman, 1996; (Nayman 1996)

Its main trusses diagonally cross each other at about right angles. "Top and bottom chords of these trusses are parallel to each other, but move in different helicoidal curves. Yet diversion between chords of each segment is a constant angle of 1.181°

which made it possible to mass produce all the segments". Consequently, the overall roof assembled out of 18 partial roofs raised and assembled on site. By using 36.5kg steel per m2, a light and rigid roof has been structured (Nayman 1996, p.36-43).
It was a problem to insulate such a transparent volume. So, the skin of the building has been made of insulated glass with a blue-green outside layer to reduce the infrared reflections.

In spite of the simple concept marking a rectangular courtyard in the middle, most of the detailing and technical solutions feature the characteristics of **high-tech detailing**.

4.1.2.2. A multi-purpose fair center - Glass pyramid

The center has been constructed by Yaşar Marulyalı and Levent Aksüt, 1997, in Antalya (Fig.4.6). It was the first application as a fair center in a pyramidal form enclosed totally with a steel and glass structure.

The building which has been constructed for being a prestigious one has multi-functional use, like congress hall, exhibition hall or concert. The structure has located on a mountanious area establishing an analogous relation with its context. Basic criteria considered by the architects acting on design are:

- in order to decrease the effect of its huge form, **designing a transparent and light enclosure**,
- **adaptable to the environment**,
- **a flexible space serving for the multi-functional use**.

The pyramidal 60m.X60m. enclosure has been designed as a space frame out of steel considering the economical factors and easiness in construction. 24 concrete columns have supported the system with a module of 2.60m.X3.00m. The pyramidal enclosure and walls were covered by a double glass paneling system. It was formed of 1.30m.X1.5m. toughened glass panels joined by laths (Marulyalı, Aksüt 1998).

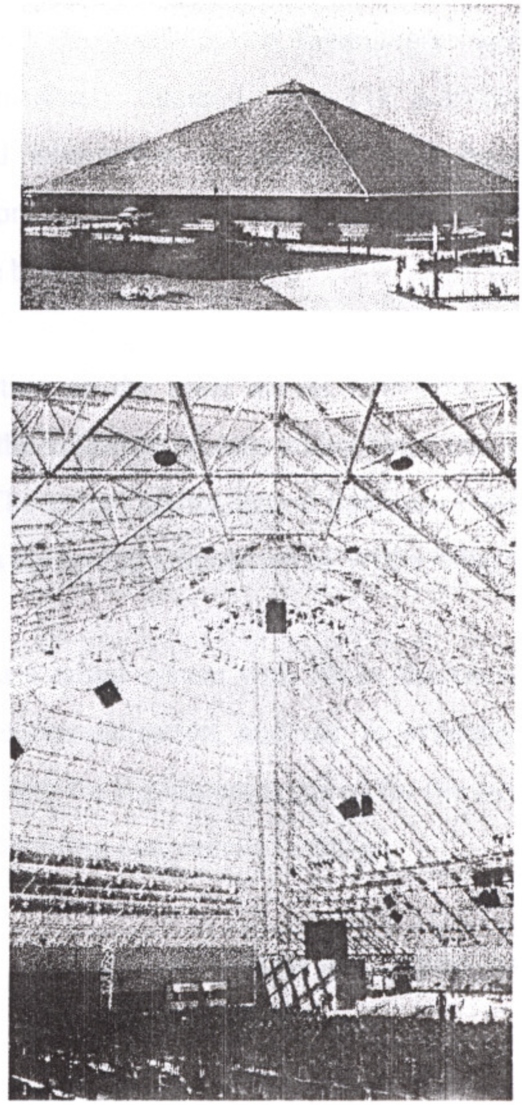


Fig. 4.6. A multi-purpose fair center-Glass pyramid, Marulyalı, Aksüt, 1997; (source: Marulyalı, Aksüt 1998)

4.1.3. Office Buildings

Some of the office buildings share the same characteristics with the so-called high-tech buildings, such as Doğan Madya Center.

4.1.3.1. Doğan Medya Center

The periodical publications headquarters, designed by H.Tabanlıoğlu and M.Tabanlıoğlu, has located on 40.000m2. of area in İstanbul (Yapı 149, p.50-58) (Fig.4.7). Industrial activities, offices and administrative functions have been included in the Center. The space articulation, the image and the expression of the building is not different from the other office buildings on the world.

The transparent roof with a steel construction on the main access road and the **transparent facade** of the building exposes the industrial process taking place inside the building and creates a high-tech image. The atrium taking natural light inside the open office spaces of the building reminds us the spatial articulation of Willis Faber.

The floors of the building are constructed as a raised system with 50cm. thickness whereby the connections for computer, telecommunication, and etc. is available from any point. In addition to these services with the equipment required for the air-conditioning, the floor acts as an **integrated building component** in design.

The building is cladded with **"structural glazing"** which does not expose its structural elements on the exterior for achieving an uninterrupted surface.

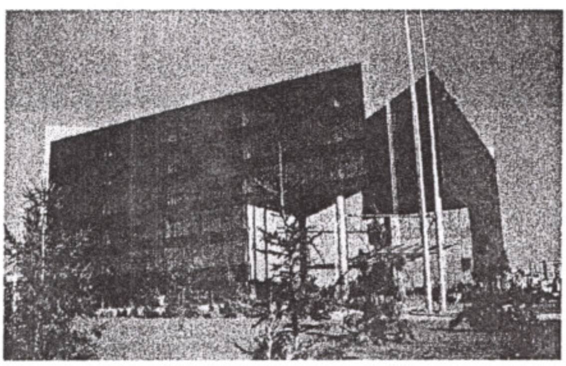


Fig. 4.7. Doğan Medya Center, H.Tabanlıoğlu, 1992-93; (source: Tabanlıoğlu 1994)

Chapter 5

CONCLUSION

The scientific progresses in 16th and 17th centuries, the development of mathematics and the inclusion of geometry led the practice of architecture to be technically more sensitive and to surpass all formal perfections. As it is the case with all other areas, the positivist and rational way of thinking has dominated the field of architecture.

The theories developed in the era, pointing out the beginning of modernization in 18th and 19th centuries, has marked the "progressive" characteristics of material and related building methods. On the other hand, the meaning of tectonic expression in modern architecture has gained importance as honesty of expression and later on as abstractness in architectonic expression.

Today, in a world of an interdisciplinary medium, it became difficult to discuss architecture within the domain of its own jargon. The technology used in architecture can many times be in need of being in harmony and getting support from the other fields of industrial technology. Architecture, which has always been under the influence of four main industries, according to Semper, is in the face of enormous forces acting upon it today.

The conclusive assessments have been viewed as the followings:

- There are concepts which are current for all eras, but they should be redefined with the new formations. In other words, the concepts should be evaluated with the dynamics effecting the era.

- The compilation of technical knowledge today is not limited as the knowledge of classical crafts technique gained by the pragmatic solutions. It is rather treated as the scientific knowledge evaluated for the "technologies". The practicing of life can neither be formed of technical tools nor the practices depending on the traditional rules. The rationalization of both, is required.

- Technique is an issue of expression. For this reason, it is an act which is always ready to re-experimenting, use of new materials and producing new solutions. All these attempts show that how much the "technology" becomes sophisticated, the aim is to render this process closer to human. Since the technology today seems to exclude the traditional craft based architecture, this fragmentation is tried to be disregarded. Therefore, **a craft technique based on the machine production has been experienced.** Although, this determines special and expensive system solutions, the uniqueness involving a poetics of construction must be sought with appropriate material and appropriate detailing, because it is not affordable for all conditions.

As Piano marks, architect must be a craftsman, and today although the tools are replaced by computer, experimental modeling and mathematics, it is still a craftsmanship. It is not possible to catch the same authentic meaning of traditional craft technique, but it is also certain that the authentic relation between human and building does not exist. Trying to catch the same meaning is, in a way, ignoring the realities of the period in which we live.

- Against the purist discourses of 30s, nowadays contemporary functional architecture, high-tech, has developed a new modernist handling or in other words a new "conceptualization of modernity" emphasizing the work of "assembly". By this way, architecture, on one hand, relates to the determinants of the post-industrial age which are "ephemeralization", "information", "energy", "environmental concerns", "high technology", and on the other hand, it proposes an aesthetic and formal approach. The pioneers of this "style" have not avoided to take these functional determinants as a part of their discourse. An architecture of "transformation" has been created corresponding with "ephemeralization".

- In the face of developing technology, fields of professions have increased. While the building technology including the climatization, lightning, mechanical and electrical systems were concerned by architects, today each of these components are treated as different professions. For this reason, all the necessities mentioned above should be regarded from the beginning of the design process by a team including the architect. In order to consider the practice of architecture apart from education, the collaboration of engineer and architect can be evaluated as a politics of education. Teamwork of similar branches created the basis of this formation.

- Technology as an aesthetic concern can be regarded as "technological illusion", with heavy metallic parts, steel plates, highly polished surfaces, hinges, rods and large rivets. They are acting not as structural, but visual elements accomplished for the sake of visual impact, as well. This is not something merely concerned with "being technological", it also depends on the stylization and representation of "technology" as a product of popular culture. These approaches create a visual togetherness by using "technology".

- The materials themselves, like plastics or metals which are industrially produced, may become disturbing as well as their utilization. But here, the problem is not the quality or the form of material, but the connotations of it. The answer lies in the relation between object and subject, or in other words, in the fragmented relation changing from the beginning of crafting as an ontological act.

GLOSSARY

- **age of ephemeralization -** The age in which the modern society is in need of changing itself according to the quick consumption
- **age of information** - the 2nd machine age with highly developed mass-production which distributed the electronic devices to wider parts of society
- **age of machine** - The age in which the "machine" is seen as the instrument of progress
- **analytical approach** - as a basic character of the modern age it is the way of studying with complex series of procedures where everything is measurable
- **aura** - the unique existence of a thing at the place where it happens to be
- **bioclimatic approach** - climate oriented design related to the climate of the place
- **biomorphic approach** - seeking to use nature as a model and designing buildings that apply the structural principles found in nature
- **biostructural approach** - trying to develop ways in which nature itself can do the construction work
- **critical theory of technology** - an open-ended and self-critical approach proposing an alternative technical determination or conceptualization of modernity and adapting it to the needs of a freer society
- **cybernetics** - the science of control by communication
- **descriptive geometry** - drawings the three-dimensional objects on paper two-dimensionally
- **Fordism -** set forth the standards of efficiency adjusted for the functioning parts of the machines applied to the movements of the workers in the new large-scale factory system
- **fragmentation in the technological process** - the transition from techne to technology. According to Hartoonian, fragmentation denotes the absence of transferring tradition, including the craft of architecture
- **homo faber** - tool maker
- **homo sapiens** - mind maker

- **information society** - society which governed a technological advance developed by computers and information technology
- **instrumental theory of technology** - technology is a subservient to other social spheres
- **integrated building component** - the building component with full variety of activities and minimum constraints
- **intelligent structures** - by embedding sensors in structural components, environmental conditions are cautiously checked in these structures with fiber optic strands
- **masonry building practice** - stereotomics of earthwork, with repetitive, heavyweight elements; load bearing construction
- **modus operandi** - method of dealing with a piece of work
- **ontology** - department of metaphysics concerned with the nature of existence
- **positivistic rationality** - reasoning based on observable phenomena and positive facts rather than speculation
- **sensing systems in building** - allow various pieces of equipments in building to stay within their optimum range like the biological systems in the way the signals travel in the human body
- **stereotomy** - the art or the technique of cutting solids; stonecutting
- **substantive theory of technology** - technique becomes autonomous
- **Taylorism** - increasing the productivity of labor with time and motion studies" according to the principles and rules of scientific management
- **techne** - "the logos of making" in the original Greek sense
- **technic** - technical, technique
- **technician** - a person skilled in the technical details and techniques of a subject
- **technique** - totality of methods of doing something skillfully
- **technocracy** - government by technical experts
- **technological** - relating to or characterized by technology
- **technologist** - someone who specializes in some branch of technology

- **technology** - systematic application of knowledge to practical tasks in industry. It is implied with a transition from “techne” to technology where the ontological bound has been broken with the advent of mechanization
- **technology transfer** - a process whereby techniques and materials developed in one creative field, industry or culture are adapted to serve in other creative fields, industries or cultures
- **technological society** - a society where technology is exercised as an influence upon society, the social power and authority
- **technopoly** - the totalitarian technocracy where the traditional world view disappears
- **tectonics** - the art and science of constructing buildings. Poetics of construction. The reveal of meaning of the architectonic elements beyond their structural rationality
- **trabeated building practice** - tectonics of frame, with lightweight linear components
- **western rationalization** - philosophy of the mechanical life where the culture is shaped by the scientific knowledge

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