TOBB UNIVERSITY OF ECONOMICS AND TECHNOLOGY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

CONCEPT OF TECTONICS IN ARCHITECTURAL EDUCATION

MASTER OF ARCHITECTURE

Işınsu AĞCA

Department of Architecture

Supervisor: Assoc. Prof. Dr. Murat SÖNMEZ

MARCH 2022

DECLARATION OF THE THESIS

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Işınsu Ağca

TEZ BİLDİRİMİ

Tez içindeki bütün bilgilerin etik davranış ve akademik kurallar çerçevesinde elde edilerek sunulduğunu, alıntı yapılan kaynaklara eksiksiz atıf yapıldığını, referansların tam olarak belirtildiğini ve ayrıca bu tezin TOBB ETÜ Fen Bilimleri Enstitüsü tez yazım kurallarına uygun olarak hazırlandığını bildiririm.

Işınsu Ağca

ABSRACT

Master of Architecture

CONCEPT OF TECTONICS IN ARCHITECTURAL EDUCATION

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Institute of Natural and Applied Sciences
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The creation of space in architecture can be explained in many ways and understandings. The ideational and practical creation or production of space, as the principal act or focus of architecture, is the result of a form of conception associated with the technological, cultural, social, philosophical or structural data contained in the relevant time. It can be said that researching expressions about the creation or production of space gains meaning depending on time, theoretical reading style and factors that affect architecture, such as technology or culture. This study sees the theoretical and practical expressions related to the creation of space can acquire different contents according to time and conditions, in the context of different factors, and the new readings to be made in current conditions that can produce new meanings as different conceptions of space as the source of its discussion. In this context, for example, investigating the effects of digital production and software technologies on the creation and production of space these days creates a research and discussion area in order to understand the attitudes of contemporary architecture towards the creation

of space and to create a contemporary reading of space. This research, which can be generalized as the production of space and the questioning of the effect of current technologies on it, requires understanding different approaches and methods from the past in terms of the creation and production of space, considering the production of space before digital technologies. In addition, this study includes a discussion for the changes and transformations that have occurred or will occur in the spatial production of contemporary architecture, in the field of architectural tectonics, with the developing technology. Thus, it claims that classical and digital tectonic understandings have affordances for each other and understanding the affordances can enable the definition or comprehension of the new tectonic approach. In this framework, this study investigates James Gibson's concept of affordances as a theoretical basis. Afterwards, an experimental study in the field of education in the context of the results of this research is explained. This experimental study, which was created within the scope of Building Technologies MIM107 and MIM108 courses conducted at the first-year level of TOBB ETU Department of Architecture, provided the research and definition of the content of the new tectonic approach. This thesis depends on classical and digital tectonic understandings and concludes that hybrid tectonics, which emerged from them, as a theoretical research and experiment area, can create different and innovative approaches in all relevant areas of architectural theory and practice.

Keywords: Tectonics, Digital tectonic, Hybrid tectonic, Design studio.

ÖZET

Yüksek Lisans Tezi

MİMARLIK EĞİTİMİNDE TEKTONİK KAVRAMI AÇILIMLARI

Işınsu AĞCA

TOBB Ekonomi ve Teknoloji Üniveritesi
Fen Bilimleri Enstitüsü
Mimarlık Anabilim Dalı

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Mimarlığın mekanını yaratması veya üretmesi farklı bir çok biçimde ve anlayışla açıklanabilir. Mekanın düşüncede ve pratik olarak yaratılmasının veya üretilmesinin, mimarlığın asal eylemi veya odağı olarak, ilgili zamanın barındırdığı teknolojik, kültürel, sosyal, felsefik veya yapısal verilerle ilişkili bir kavrama biçiminin sonucu olduğu; mekanın yaratılması veya üretilmesine yönelik ifadeleri araştırmanın da zamana, kuramsal okuma biçimine ve mimarlığa etki eden, örneğin teknoloji veya kültür gibi unsurlara bağlı olarak anlam kazandığı söylenebilir. Bu çalışma, mekanın yaratılmasına ilişkin kuramsal ve pratiğe yönelik ifadelerin, zamana ve koşullara göre, farklı etkenler bağlamında, farklı içerikler edinebileceği ve güncel koşullarda yapılacak yeni okumaların, farklı mekan kavrayışları olarak, yeni anlamlar üretebileceği tartışılmasını motivasyonunun kaynağı olarak görür. Bu bağlamda, örneğin bugünlerde, dijital üretim ve yazılım teknolojilerinin sağladığı olanakların mekanın yaratılması ve üretilmesine yaptığı etkinin araştırılması, güncel mimarlığın mekanın yaratılmasına yönelik tavırlarını anlamak ve bir mekan okuması oluşturmak için bir araştırma ve tartışma alanı doğurmuştur. Mekanın üretilmesi ve güncel teknolojilerin buna etkisinin sorgulanması olarak genellenebilecek bu araştırmanın mekanın yaratımı ve üretimi bakımından, dijital teknolojiler öncesi mekan üretimi göz

önüne alındığında, geçmişten farklı anlayış ve yöntemleri kavramayı gerektirdiği iddia edilebilir. Böylece, mimarlık alanına etki eden teknoloji gibi bir faktörün ve de bundan önce mekanın yaratımı ve üretimine yönelik içeriğin, bugün güncel mimarlıkta mekansal üretimlerimizi düşünce ve pratik alanlarda nasıl etkilediği ve geçmişe göre neyin farklılaştığı üzerinden kuramsal bir tartışma yürütülmüştür. Bu çalışma, teknoloji ile birlikte güncel mimarlığın mekansal üretimlerinde, mimari tektonikler alanında, oluşan veya oluşacak değişim ve dönüşümleri tartışmaya açmıştır. Klasik ve dijital tektonik anlayışların günümüzde birbirlerine yönelik olanaklılıklarının olduğunu ve olanaklılıkların kavranmasının yeni tektonik anlayışın tanımlanması veya kavranmasını sağlayabileceğini iddia etmektedir. Bu çerçevede bu çalışma öncelikle James Gibson'ın olanaklılık kavramını kuramsal dayanak noktası haline getirmiş ve araştırmıştır. Sonrasında, bu araştırmanın sonuçları bağlamında eğitim alanında deneysel bir çalışma planlamıştır. TOBB ETÜ Mimarlık Bölümü 1. Sınıf düzeyinde yürütülen Yapı Teknolojileri MIM107 ve MIM108 dersleri kapsamında oluşturulan bu deneysel çalışma yeni tektonik anlayışın içeriğinin araştırılmasını ve tanımlanmasını sağlamıştır. Bu tez sonuçta klasik ve dijital tektonik anlayışlara bağlı olan; onlardan varlık bulan hibrit tektoniklerin kuramsal bir araştırma ve deney alanı olarak, mimari kuram ve pratiğin ilgili tüm alanlarında farklı ve yenilikçi yaklaşımları oluşturulabileceği sonucuna ulaşmıştır.

Anahtar Kelimeler: Tektonik, Dijital tektonik, Hibrit tektonik, Tasarım stüdyosu.

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ABBREVIATIONS

CAD **:** Computer Aided Design
CAM **:** Computer Aided Manufacturing
ICD/ITKE **:** Institute for Computational Design and Construction (Institut für Computerbasiertes Entwerfen und Baufertigung)/ Institute of Building Structures and Structural Design (Institut für Tragkonstruktionen und konstruktives Entwer

1. INTRODUCTION

1.1. Problem of the Study

The creation of space (poiesis) is related to the volumetric situations created by concepts and technique. In this framework, the theoretical and practical creation and production of space in the context of current technological and structural developments is a field of inquiry in this thesis. The creation and production of space is related to the concept of tectonic as a structural content. In other words, this research considers the concept of tectonic as a focus in the creation and production of space, in the context of its general purpose. In the context of space production possibilities of technology, this thesis expresses the concept of tectonic as a unity which defines the structural relations that produce the volume and defines the relationship between space and tectonic as the problem area of the study. This study also considers the question of how to handle new insights and productions that can be initiated by changes and transformations in the spatial productions of contemporary architecture, for example, in education, as a theoretical and practical problem area.

The concept of tectonic can be defined as a focus or design area that represents the conscious actions of the designer in a building and expresses the theoretical and practical features of a building as the integrity of materials, details and technique. It has been observed that the concept of tectonic contains important theoretical and practical depths in terms of its relationship with concepts such as material, technique, form, as well as other contents such as time, perception, action, and the questioning of the effect of technology on the theoretical and structural contents of the creation and production of space. In this context, investigating the effects of technological and structural conditions on the creation of space in current theoretical, practical, and educational environments describes a problem area in this study in the context of the tectonic concept. This problem is aimed at establishing a field of inquiry on questions of how the developing and changing technology and the factors affecting the contents of architecture to produce the space in thought and practice transform and affect the

definitions and meanings of the concept of tectonic, and the creation of practical applications in the research, analysis, and educational environment for its solution.

Today, in the context of technological developments, it is claimed that the meaning and content of the concept of tectonic, which can be defined as classical, differs from the meaning and content of the world before digital and technological developments. It is argued that the innovations in today's technological and digital world have transformed the meaning and content of the concept of tectonic in the production of space in theory and practice. This argument also reflects the claim of the conditions of space production being transformed in both idea and practice. At this point, this thesis considers the followings as its primary field of inquiry:

- What the changing meanings and contents of the concept of tectonic in historical continuity are,
- How the changes created by the developing technology in the field of architecture differentiate the existence and content of the concept of tectonic and the production of space in theory and practice,
- How to define and discuss the equivalents of possible new contents in the theoretical and practical fields regarding the concept of tectonic in contemporary architectural education and practice environments.

Thus, this study defines the changing and transforming content of the tectonic concept in accordance with the current technological developments, and the innovative conditions of the concept in the production of space in the field of theory and practice, in the context of a studio course created in architectural education, as a problem area.

1.2 Claims of the Study

The concept "tectonic" refers to the intellectual and practical links formed with materials, construction methods, senses, action/needs, and the context in which space is produced. Although there have been numerous changes and alterations in recent years, it can be said that the fundamental expressions of the relationship between the concepts of tectonic and space, as well as the sub-meanings or concepts that compose its content, have remained mostly the same; because the concept specifies the focus and concepts in the production of space through matter, construction method, senses, action/needs, and the context in general, as it did in the past pertaining to the framework of architectural history and theorists' conceptions. Thus, while

technological advancements in architecture and other disciplines appear to have differed in the production conditions of space in the modern era, the fundamental aspects that comprise the concept, such as matter, construction technique, senses, action/needs, and context, remain unchanged. Therefore, in this study:

The creation of space (poiesis of space) or production of space is discussed in the context of the concept of tectonic. The relationship between the concept of tectonic and technology was examined in the context of the concept of noesis. Discussions under the title of classical and digital tectonics are the results of this review.

The meaning and expressions of the concept of tectonic is questioned, and it is established that, nowadays, the equivalents of the concept of tectonic in theory and practice can be handled with a different approach. As can be seen from Table 3.5 in the comparative analysis section, the intellectual and practical equivalents of the concept of tectonic in contemporary architecture, which can be described as classical, digital and hybrid, have been reached. The main problem of this thesis is to find the equivalence of classical, digital and hybrid tectonic qualities contained in the concept of tectonics in the field of education today.

The study concludes the claims made in accordance with the scope and problem focus as follows:

The claim that the concept of noesis is at the root of tectonic understanding and is a fundamental element in comprehending tectonics has been confirmed, though the relations between technology and tectonic concepts have changed.

Despite the claim that classical and digital tectonics, which are the results of the theoretical research on the concept of tectonic, cannot be sharply separated from each other in terms of meaning and expressions in contemporary architecture, the examination of these tectonic structures with concepts such as material, form, construction method, action, senses, design process, production technique showed that a partial distinction can be mentioned, though their content may complement one another.

The claim that the classical and digital tectonics are possible for each other in current conditions has been confirmed by the definition of the mixed tectonic structure, which is defined as hybrid tectonics. The sub-meanings that constitute the classical and digital tectonic supply the contents of these two tectonic understandings, while forming the essence of a mixed tectonic understanding.

As a result, the tectonic understanding reached by this study has led to the questioning of the content and results of this new tectonic understanding in the field of architectural education.

- Despite the developments and transformations experienced, there are no differences in definition and meaning in the contents of the concept of Noiesis, such as matter/material, construction technique, necessity, and form which define the concept of tectonic,
- Tectonic approaches defined as classical and digital within the scope of the thesis should not be sharply differentiated from each other, since data and experiences can be obtained from both tectonic understandings of present day,
- In current conditions, it is realized that the thoughts and actions that produce classical tectonic structures and the same contents for digital tectonics have possibilities for each other,
- It is feasible to define or realize the possibilities of classical and digital tectonic approaches towards each other as content and productions, and a new tectonic definition can be made as an intermediate area that includes aspects of both tectonics,
- It is claimed that a course can be developed based on the content and results of this new tectonic understanding in the field of architectural education, and thus a tectonic understanding emerged from both classical and digital tectonic contents can generate new meanings and contents for tectonics in architectural thought and practice.

1.3 The Aim of the Study

This study aims:

- To define the concept of tectonic in terms of meaning and content in architecture,
- To question the place/existence of the concept of tectonic in the creation and production of space in contemporary architecture,
- To research the change and transformation in the meaning and expressions of the concept of tectonic in the context of technological developments in

contemporary architecture and to define the differentiations created by these transformations in the content of the concept,

- To define the changes and transformations in the meaning content of the tectonic concept in the context of contemporary architectural approaches and to compare the differences,
- To define the current meanings and expressions of the concept of tectonics theoretically within the framework of transformations in contemporary architecture in the context of factors affecting the field of theory and practice, and to discuss the content and results of an experimental course created in the context of first-year studio courses in the field of architectural education to produce their practical equivalents in the fields of design and construction.

1.4 The Scope of the Study

The scope of this thesis includes the investigation of the classical content of the tectonic concept and its digital content, which is formed as a result of the changes and transformations in the context of technological developments, in the context of the "Noiesis concept". Thus, it will be possible to comprehend how the concept of tectonic and its sub-meanings are subject to influences or differentiations because of current technological developments.

The concept of noiesis describes one's actions, first mental, then practical. These mental and practical actions that produce space in the context of environment, requirements, matter, form, and technical concepts correspond to the conscious activities of human beings or architects. In other words, it is the expression of the production of an object or space in the context, necessity, substance, form and construction method or technique with the personal consciousness of the human being, the builder, or the architect. While the concept of noiesis constitutes a fundamental theoretical basis in the explanation of classical tectonics, it is also an effective concept in understanding of digital tectonics in the context of the effect or input of technology on architecture.

The scope of the thesis is what classical and digital tectonics, which define the meaning and content of the concept of tectonics, mean in the context of the concept of Noiesis and their differences in comparison to each other. Additionally, a practical study on the contemporary meaning and expressions of the tectonic concept in the field of

architectural education within the framework of the noiesis concept is within the scope of this thesis.

1.5 The Method of the Study

This study is based on three main research methods. The first is literature research. The second is the "comparative analysis", which defines the meaning and content of the two subheadings of the concept of tectonic and then compares classical and digital tectonics. The third is a "case study" conducted within the scope of the Building Technologies course at the first-year level in the field of architectural education, for the current theoretical content and practice of the concept of tectonic in the context of research, analysis, and inferences.

Within the purview of the literature review, an attempt has been made to describe the content and elements of the tectonic concept. With this research, the subject's terminology was determined, and a classification was created. To determine the terminology of the subject, ideas, discourses, and productions of architects and architectural theorists on the concept of tectonic starting from Ancient Greece, especially Aristotle, proceeding with modern architects such as Semper, Sekler, Bötticher, more recent architectural theorists such as Frampton, and finally contemporary architects and architectural theorists such as Neil Leach, Zaha Hadid, Patrik Schmacher were investigated. In addition, in this literature study, James Gibson's affordance theory was investigated to establish a theoretical basis for the conclusion made as a result of the comparative analysis conducted in the third part of the thesis.

Second, tables were provided to explain the contents of the classical and digital tectonic definitions that comprise the study's scope and the sub-elements and methods generated throughout the space production. These tables, which define the content of classical and digital tectonics in terms of noesis of the object, knowledge of the object, and noesis of the space and knowledge of the space, as well as the distinctions between theoretical and practical fields, are intended to facilitate the creation of classifications that clearly define the content of tectonic differentiations. In this context, this classification was first made in the context of subject, matter, form, purpose, then architect, material, configuration, necessity, time, action, and finally techne, technology, and technique.

Hence, the groundwork for a comparative analysis of the sub-elements of the tectonic concept and the differences in content in producing space was established. After conducting a comparative analysis of two distinct tables generated for classical and digital tectonics, an inference matrix was created to identify the distinctions between classical and digital tectonic concepts. The historical and contemporary content of the tectonic concept in the production of space were interpreted using this matrix through the titles of the intellectual and structural distinctions that define the space, the construction method, the senses, the needs/actions, the technique, the context, the form, and the mode of production.

Lastly, through the comparative analysis carried out within the context of theoretical definitions of the tectonic concept and its relation to space production, this thesis consists of the deductions from this experimental study into its result searching method. Considering the theoretical framework created by the transformation of the production conditions of the space between the past and the present, this experimental study, in which the thesis defines and includes, the creation of innovative expressions of the production of the space as a result of the inferences, and the Building Technologies course conducted at the first-year level in TOBB ETU Department of Architecture, and the studio environment created within this scope are described. In this experimental study, the contents created for the transformation or processing of matter upon a necessity are discussed within the scope of the concepts of “Noiesis” and “Making”. The concepts of noiesis and making and their contents were realized in an architectural environment based on the philosophy of “conceptual discussions” and “learning-by-doing”. With all productions created with models, and at the conclusion of the technical search for the revelation of the material’s possibilities, various visual data were obtained during the phase of processing a substance called the “design codes” and transforming it into a whole in a manner that produces form. In this thesis, the experimental study and its visual contents are used as a method to discover new meanings for tectonics and to ascertain what its intellectual contents could be. This experimental study enables students’ attempt to process matter and transform it into a unique form through design codes, the construction phase of this process, the development of creativity, the discovery of materials, contexts, and construction methods, and productions in the context of the concepts of noiesis and making. The experimental study, which served as the application area for the thesis’s inferences, enabled the definition of an intermediate area related to both classical and digital

tectonics without the use of adhesives by overlapping, stacking, weaving, constructing, bending, diminishing, and clustering one or several selected materials.

2. CREATION OF SPACE

2.1 Main Element of Creation of Space: Concept of Noesis

This study divides the creation of space into two basic elements, classical and digital tectonics. Before doing so, it is necessary to explain noesis as a basic concept of tectonics.

One's ability to make sense of the environment and matter is possible with the ability of consciousness that makes them unique among the other living things. How human cognition and consciousness evolve, what exactly is at the basis of the process of cognition, how and when it acquires objects is a complex issue that spans thousands of years. However, the human species, which started to become conscious of its existence, managed to keep themselves different from other beings with the perception of thinking ability, as well as observing and imagining. They may have been also improved because of being inspired by their surroundings.

As a self-conscious species, it is clear that human beings are unique in the way they perceive and interact with everything. The first stage of perceiving, of course, should be related to the ability to sense as knowing the surroundings through what is seen, heard, or sensed is inevitable. For this reason, human beings should be able to explain what they know about. At the point of establishing awareness, they must clarify what they feel through a perceptual filter, as well as the world they reconstructed in their mind. This is the first interaction stage with the environment. Even the realization of the self-emergence when a projection of the world in the human mind can be taken as the center and the rest as 'outside', is an indication that the reaction to this interaction will have exceeded the state of being a reflex. For the part of the environmental effects created by the perception device, which is reflected in the consciousness as information, brings the conceptual thinking ability to the fore. This ability gives human beings the capacity to discuss everything felt in the environment, at the level of consciousness along with to re-interpret and shape them.

It is also worth mentioning that the re-interpretations, the way of interaction, and mental plans are built on the necessities for the individual who becomes aware of oneself, the environment, and the matter. The feeling of needing something is often the first incentive for the first reactions and the products of these reactions. This state of production is initiated through the matter grasped, as well as the new meanings it will provide or transform into. To achieve something, answering the question of why it should be obtained is often the main issue. It is inevitable for people who can comprehend the necessities to turn the environmental effects and qualities in their favor or to re-transform the materials in this direction.

The first human species with conscious actions are called “homo habilis”, the gifted human (about two million years ago). Later, “homo erectus”, the human beings who can stand on their feet (about one and a half million years ago), can be considered the turning point of conscious progress. Because with the freeing of the hands and arms of the human species, an interaction begins between hand and brain, labor and mind power, skill and thought as each facilitates tool processing and other forms of labor (Faulkner & Öncel, 2016). Thus, the behavior of a human being can change and dominate its limbs under the control of cognitive functioning. With the evolving consciousness and physical abilities, and by not accepting the matter or conditions encountered as they are, it is possible to think about how they will work, transform, as well as using them with the ability to reveal the products of such thoughts.

The products of this new form of conscious behavior and skill began with the invention of stone tools by several diligent explorers about two and a half million years ago. According to the historical records, the first known stone tools are from parts of eastern Africa consisted of simple sharp pieces of stone (Tattersall, 2007). When homo heidelbergensis (Heidelberg man) developed the “acheulean handaxe”, which was a chopper, or the clactonian flat stone, which was a cutter, they combined mind and consciousness with the quality of matter (stone) in a more complex way. The hardness of the stone has been experienced or felt, and the object has emerged as the substance of necessity of creating a sharp side. The stone tool-making style was the best indirect response and expression of various cognitive capacities (Tattersall, 2007). Undoubtedly, the invention of the hand ax can be considered as a conscious advance, as it represented a way for the human mind to foresee possibilities.

The human being can lay the groundwork for a more complex social and technological environment that fosters the emergence of behavioral innovations to produce expanding mental power and skills. Therefore, new ways of life, perception, and production are to develop under such circumstances since the human species can adapt to other people and their natural environment along with creating more detailed tools by sharing their knowledge and experience. The initial tool kit consists of a variety of specially designed spikes, blades, and scrapers (Faulkner & Öncel, 2016). By the improvement of the techniques and their transfer as being repeated in the formation of products, tool technologies are formed, and thus, transformed into cultural products used by large communities.

Ultimately, homo sapiens or modern humans, made it possible to store information, think creatively, and communicate in complex ways. The modern human being, who can fully establish a connection with the world, now has no limits about what can be done with one's knowledge, resources (material), and labor. It is also possible to respond to environmental challenges and requirements with new methods and learnings gradually acquired with the accumulated knowledge.

While performing something new, various behavioral patterns and states of consciousness are constructed as it can be understood from the anthropological examination. The construction process starts with covering the emergence of the consciousness, which is being aware of oneself, as well as the environment. Then it is followed by interacting with the world, re-establishing the influences of the outside to one's inner world, shaping reactions through necessities, and revealing products due to the relationship established with the matter.

Making is related to building knowledge and consciousness. For this reason, it enables more complex actions such as housebuilding, cooking, and tools, in contrast to the primitive actions such as shelter, nutrition, and protection. Everything that is created from consciousness requires the meaning and representation of the mind to seek the concrete counterparts of the state of representation, which also occurs based on the concept of making. For this reason, all objects arise as the result of making.

Making is a process that takes place in the continuum of knowing, making sense, and transforming. Knowing is the manifestation of the knowledge of the mind in the

relationship that human being establishes with matter and the environment. Likewise, making sense is the reshaping of what is known through necessities or purposes and the creation of the object's plans in the mind. Transforming, on the other hand, is establishing and revealing the qualities of all mental projects in the matter. Therefore, this process reveals the structure as the whole of ideas and actions, in which mental and physical structuralization are associated, mixed, intersected, and adapted.

For a thing to become an object in the existing environment, requires human beings to be directed to matter along with the conception gained from the materials and the environment. These conceptions include knowledge of form and formation of it. Therefore, the object might be considered as the design of the conceptions obtained through materials. Aristotle discusses a similar understanding of the formation of objects in his book *Physics*. According to him, the first thing that causes the formation of objects is substances since they contain form/extracts. For this reason, all principles of motion and change are in the form of substances (Aristoteles, 2014). In other words, all actions of the human being who process and transform substances originate from the substance itself. Thus, objects occur as a way of conception of the forms in the substances, and the act of making which produces the object takes all its principles from matter and form.

Although the design of the object depends on the foundations such as matter and form, it can be considered as a creation since it is the expression of conceptions and abstract concepts. Plato addresses bringing all things that do not exist into existence as "poiesis" (to make, to create). Thus, he believes that each creator is "poietes" (maker, producer) (Platon, 2017, p. 48). Here, the creative position of a human being can be understood through the fact that one creates non-existent or abstract concepts and conceptions. Therefore, the cause of designing objects is the human being who can be considered creative like God. It can be accepted that human beings shape all their conceptions that will bring the object into existence according to a purpose, because the idea of bringing something that does not exist into existence stems from the need or necessity. Every object is made because of something, for something (Aristotle, 2014). For this reason, it can be considered that human being creates the form for a particular purpose and shapes the substance accordingly.

In this context, the expressions of objects can be summarized by Aristotle's principle of the four causes he mentions in his book *Physics*. The first of these principles is the substance ("causa materialis"). The material that forms the objects is a potentiality which makes the formation possible and brings it to the body. The matter is the one that accepts change and can hold various qualities while form or essence ("causa formalis"), the thing that should be due to the nature of the substance, is the second principle of Aristotle. So, they already exist before they exist. The action required for the form to manifest itself in the matter is the creator ("causa efficiens"), being the third principle of Aristotle as the god or the causative person. The fourth principle is the purpose ("causa finalis"), what the object is made for. In the integrity of these four principles, the object is formed when the substance is formatted following its purpose by an effect. They all must come together so that the object can be itself.

These four principles of Aristotle can also be considered as concepts that produce architectural objects. For example, Gottfried Semper's discussions on the production of architectural objects correspond directly to these concepts. He considers the material reasons in the occurrence of the architectural object as wood, stone, soil, and netting products. These elements contain the form of the structural elements of the architectural object. For example, the wood contains the roof form, the stone contains the floor form, the soil contains the hearth form, and the netting products contain the wall form. Therefore, the formal reasons composing the architectural object are considered to be roof, floor, hearth, and wall (See Fig. 2.1). However, the forms will not occur spontaneously in the substances. There is a need for a carpenter who will turn the wood into a roof, a stonemason who will turn the stone into a floor, a ceramicist who will turn the soil into a hearth, and a weaver who will turn the netting products into a wall. Carpenter, stonemason, ceramicist, and weaver are Semper's efficient causes. And finally, there must be a purpose in the existence of the architectural object. For example, when the carpenter tries to put the wood into a form, the purpose is to turn it into a roof. The roof will be a cover for a building, which will eventually close the structure. When all other structural purposes are completed, space will be produced as the main purpose of the architectural object.

> "The first sign of human settlement and rest after the hunt, the battle, and wandering in the desert is today, as when the first men lost paradise, the setting up of the fireplace and the lighting of the reviving, warming, and food-preparing flame. Around the hearth the first groups

> assembled; around it the first alliances formed; around it the first rude religious concepts were put into the customs of a cult. Throughout all phases of society the hearth formed that sacred focus around which the whole took order and shape. It is the first and most important, the moral element of architecture. Around it were grouped the three other elements: the roof, the enclosure, and the mound, the protecting negations or defenders of the hearth's flame against the three hostile elements of nature" (Semper, 1989, p. 150).

It is possible to think that all the abstract conceptual descriptions of architecture are made to create a defined place in the infinite universe. For this reason, Henry Lefebvre defines it as "any definition of architecture itself requires a prior analysis and exposition of the concept of space" (Lefebvre, 1992, p. 15). Architecture has been discussed within the framework of the enclosing of space concept since the theories of the origin of architecture which Gottfried Semper introduced in the 19th century (Hensel, M., Menges, A., & Hight, C., 2009). The source for the German-speaking proto-modern architects, who interpreted the concept of space in the first decade of the 20th century as the object of architecture, is undoubtedly Semper (Forty, 2004). Adolf Loos in 1898, H.P.Berlage in 1905, and Peter Behrens in 1910 commented and provided publications considering the enclosed or limited area as the purpose and essence of architecture. So, the conditions for such circumstances are defining and identifying structural situations of material qualities. Structural situations emerge as the equivalent of conscious and transformative actions towards the matter. According to Semper, for example, these structural elements are hearth, floor, roof, and wall, while the materials of these elements are soil or clay, stone, wood, and natural netting products. When each material finds its form and becomes a structural element, it establishes the space. According to Semper, the space description begins with the hearth concept. He also defines the hearth as the first sign of human existence, the place where the flame gives life and fire which provides warmth and means to prepare food (Semper, 2015). It is developed as an indicator of the social center and serves as a key theme for the need to build. For this reason, the hearth is the conceptual infrastructure of the space to be created. The other three elements are shaped upon the establishment and definition of the hearth, namely space. The floor is the foundation that makes the space elevated and more protected. It is a preliminary preparation between natural environment and man-made structure, a bond point in a nature

transition. It defines the limits of the specified area in both directions (width and length).

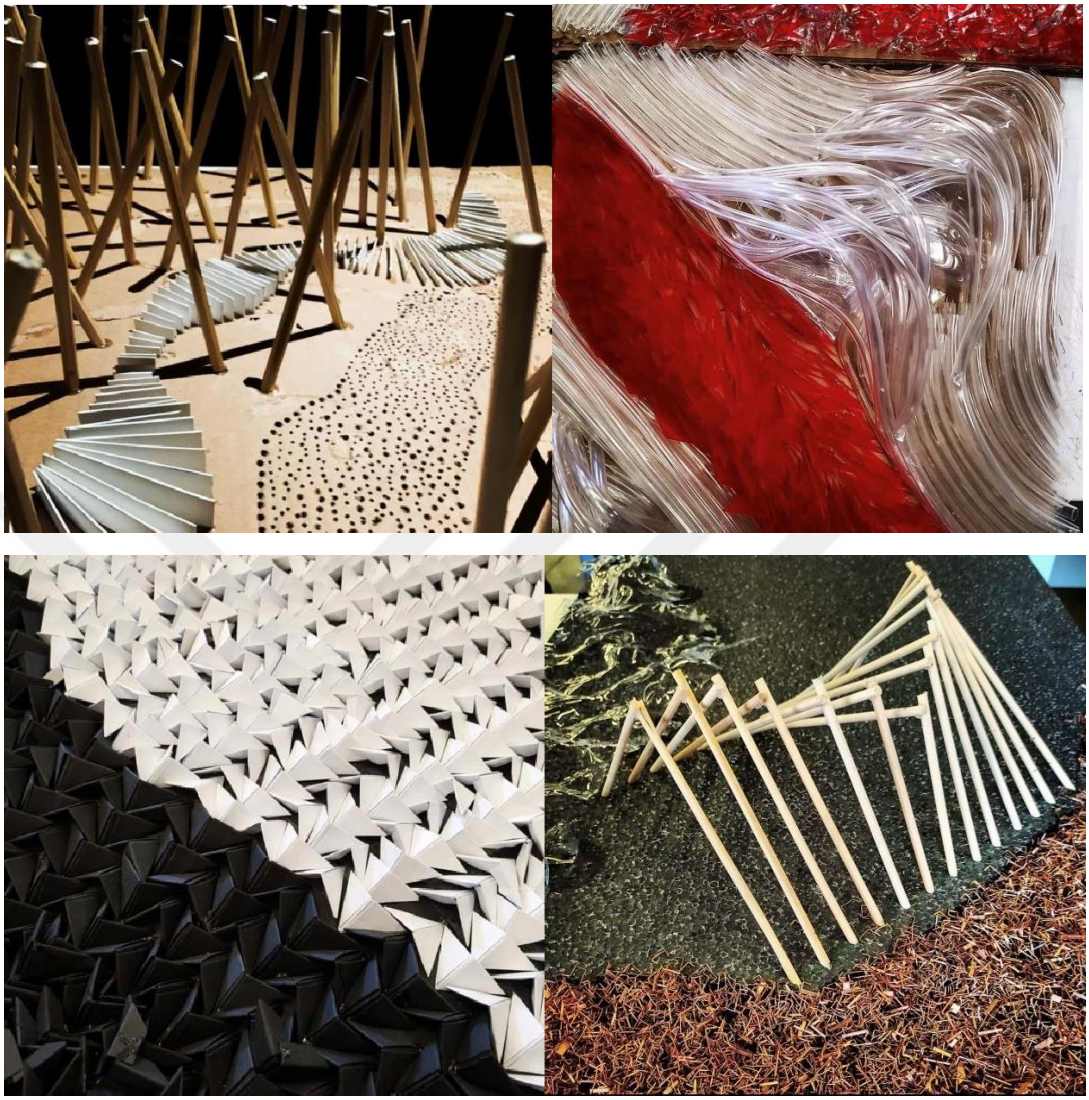


Figure 2.1 TOBB ETU design studio student studies showing the creation of space within the scope of floor, wall, roof, and action discussions

The roof is the most basic element protecting and shaping the space while the wall is the element that defines the limits surrounding the space. Considering the nomadic tribes, carpet was used horizontally to protect the floor, then vertical protection or containment tools, which are now called wall or separator were created. In other words, lightweight dividers made of mesh can be considered solid walls. As a result, materials (soil, stone, wood, or netting products) are shaped to form architectural members (hearth, floor, roof, and wall) while these members actualize the creation of the space in architecture (Bötticher, 1852). Frampton theoretically explain this with Semper's tectonics description:

> "The concept of layered transitional space as it appears in traditional Japanese architecture may be related indirectly to the distinction that Semper draws between the symbolic and technical aspects of construction, a distinction that I have attempted to relate to the representational and ontological aspect of the tectonic form: the difference, that is, between the skin that re-presents the composite character of the construction and the core of the building that is simultaneously both its fundamental structure and its substance. This difference finds a more articulated reflection in the distinction that Semper draws between the ontological nature of the earthwork, frame, and roof and the more representational, symbolic nature of the hearth and the infill wall. In my view, this dichotomy must be constantly rearticulated in the creation of architectural form, since each building type, technique, topography, and temporal circumstance brings about a different cultural condition" (Frampton, 1995, p. 16).

Semper argues that the beginning of the construction coincides with the onset of textiles. This claim is an indication of the fact that architecture does not emerge from the understanding of concrete protective home, but from the idea of creating or defining an interior space. Semper expresses this situation as "For it remains certain that the use of the crude weaving . . . as a means to make the 'home,' the inner life separated from the outer life, and as the formal creation of the idea of space – undoubtedly preceded the wall . . ." The structure that served to support, secure, and carry this spatial enclosure was a requirement that had nothing to do with space and the division of space directly (Semper, 2004, p. 254). The idea of creating a space and providing it with a surface of matter indicates the development of the perspective of what architecture defines based on action rather than matter. The hearth, which is the conceptual substructure of the space, is for action as it is the place where people gather. It can be thought that actions are the basic initiators for understanding and realizing the desire to create space.

In this context, space creation and spatial experience (action) are expected to be equal. The equivalence of space creation and experience is a reminder of space having a fourth dimension called time. It is the user who moves within the space, examines it from various points of view, experiences it, and in a sense, creates the fourth dimension. Considering the space not only momentarily but as the reaction of the accumulated experience of the user from numerous points of view has been questioned since the cubists who questioned the planar (drawn on a surface) perspective (Rowe & Slutzky, 1963). Hence, discussing the elements that establish the dimension and the holistic reality of the space along with its other experienced dimensions can be thought upon.

According to Moholy-Nagy, space is the relation between the position of bodies. The creation of space is the nexus of spatial entities while the building materials are the mediators that create the medium of space-creating relations (Moholy-Nagy, 1949). The way materials are handled and the physical conditions of the space that they form are the technical efficiency of architecture. However, space is defined in the more layered content of tectonics, as it requires more understanding than matter and forms technical activities.

The relationship the architect establishes with the space is one of the most critical moments of the emergence of the space. Architect, as a professional, tends to produce space in line with the factors of place, material, ethical-aesthetic understanding, education, and relationship with the user. Nowadays, with the developing technology, construction methods, and design tools, the architect begins to become an architect-engineer by acquiring expertise continually. Against the imagination of all these parameters to be seminal, one cannot avoid repeating the rational and the known by showing reflexes in material, as well as the structure decisions on occasion. The concepts of architecture and space have been discussed repeatedly since Vitruvius's definition of strength, functionality, and beauty, along with the social changes experienced in parallel with the Enlightenment Period and the Industrial Revolution. Another understanding of architecture, under the influence of function-form relationship and machine thinking, continues to be interpreted and stretched with the emergence of the modern. Today, as it is defined as the communication and digital age, the concepts of architecture and space continue to change and expand with the developments in information technologies and the diversification of the methods in the process from design to implementation. Simultaneously, architects try to keep all these technological developments on their agenda and to diversify their knowledge of the architectural profession. Architect criticizes, tries, and reconstructs methods to find a relationship with place, tools, and materials while moving from Euclidean geometry to topographic, from modular to parametric.

2.2 Classical Tectonics Approaches

The term “tectonic” originates from Latin “tectonicus” referring to the builder, carpenter, and woodworker of Greek “tecton”. Frampton explains the etymology of tectonic as:

> “Greek in origin, the term tectonic derives from the word tekton, signifying carpernter or builder. The corresponding verb is tektainomai. This in turn is related to the Sanskrit taksan, referrinf to the craft of carpentry and to the use of the axe. Remnants of a similar term can be found in Vedic poetry, where it again refers to carpentry. The poetic connotation of the term first appears in Sappho, where the tekton, the carpenter, assumes the role of the poet. In general, the term refers to artisan working in all hard materials except metal. In the fifth century B.C this meaning undergoes further evolution, from something specific and physical, such as carpentry, to more generic notion of making, involving the idea of poesis” (Frampton, 1995).

Laugier, in his writing called “An Essay on Architecture”, secularizes the primitive hut as the natural and original model of architecture, as well as the representation of pure construction devoid of decoration (Laugier, 1977) (See Fig. 2.2). Considered as the beginning of architecture in the western architectural canon, this hut consists of four tree trunks on a compacted soil floor and the sloping branches on the branches that connect them to each other (Hartoonian, 1994).

Figure 2.2 Marc Antoine Laugier, the primitive hut. Source: Laugier (1753).

Regarding the pioneering studies on the concept of tectonic, Karl Bötticher can be considered as the most prominent name. Bötticher was one of the leading theorists who contributed to the formation of the model that influenced the German architectural theory in the 19th century. He studied the ornamental forms in Greek architecture, their symbolic meanings, and the peculiar development of the Greek tectonic language. According to Bötticher, every architectural assemblage in Greek temples has a wide variety of symbolic meanings along with achieving a physical function (Bötticher, 1852). Considering the elements that constitute the building, their physical performances against gravity, and the parts that become images with various symbolic meanings form meaningful integrity, he defined his theory of tectonics over a dual set of concepts.

Bötticher expressed the distinction between main-form (kern-form) and art-form (kunst-form), which became the basic elements of German tectonic theory. As a result of his research, the main-form (kern-form) structurally corresponds to performance production while the artistic-form (kunst-form) represents the symbolic and artistic production (Bötticher, 1852).

Though Kern and Kunst forms are defined separately, it is not easy to make a clear distinction between these two concepts in an architectural object since the architectural product consists of a wide variety of non-physical components. When physical components that enable a building to exist structurally are considered, the carrier system, materials used, technologies, and dimensions are the main ones to be listed. These components, which constitute the basic elements of the concept that Bötticher defines as Kern form, convene with the basic elements of Kunst form, such as character, meaning, and symbol as it forms an aesthetic unity by overlapping. Based on the unity of the basic elements that comprise Kern and Kunst forms, architecture does not only seem to exist physically but also defines existence through senses, perceptions, and life. Therefore, the factors that make existence possible vary widely according to place and time. An example of such case is the difference between the tectonics of the structural elements of a Greek temple and the structural elements of an Egyptian temple.

> "All opinions for or against a particular style have referred only to the outer shell, that is, to the scheme of the building's art-forms, which were considered to be identical with the principle of a style. The true essentials have never been seriously considered; the discussion has never

> actually turned to the principle and material conditions on which each is based" (Bötticher, 1852, p. 150).

Tectonics can be discussed with the technique of forming structural elements and the expression values of bringing these structural elements together. However, the technology, which impacts tectonic expressions, causes the architectural objects to be considered as a specific technical activity. In this case, the experiments, searches, and inventions regarding the way tectonics build the space, are evaluated as innovations brought by technology on one hand, and determinants on the other. This can create both positive and negative states for tectonic expressions. The products or construction information provided by technology is not only used as determinants in the creation of space and considered as tools, but also as sub-systems for the expression of thought since they do not restrict the expression potential of tectonics.

According to Heidegger, as in the term technical, techne also refers to the root of the term technology. Heidegger, on the other hand, considers techne as both poetic and revealing (Heidegger, 1977). In this contrast, it is noticed that techne does not only specify tools and fabrications but also primarily determines the conceptual basis of creation. Furthermore, the technology uses only its own resources, which are physics and mechanics. Filling the poetic content of the techne with practical knowledge highlights its revealing state. According to practical knowledge, it reveals objects to embody something. However, tectonic defines concrete expressions and states beyond construction. The architectonic elements exceed the structural rationality by revealing multiple meanings and perceptions. Hence, tectonic loses expression values in the practical field of technology.

In the second half of the 19th century, while the industry was booming and the technology was overly productive in introducing new possibilities, creative architecture was being advanced with the best (technological) means. However, by the end of the century, it had lost the creative power when the industry was considered as the main issue of the process of making in architecture and it was no longer in search for the new and the extraordinary (Giedion, 2009, p. 243). For example, when Paxton's Crystal Palace was built in London in 1851, it reflected a structure in which the potentials of both the architecture and other departments such as engineering were tested, as well as the risks concerning the construction methods were taken. In a period when steel utilization was new, Crystal Palace was not simply a steel construction but

contained an experimental method, as well. It was like a symbol of suggestion to develop a new method of making. In Crystal Palace, a new building expression was made, unlike a prior example, with the technique developed in glass, steel, and wood, having a size that could be defined. The area defined by the experiments in the spatial scale allowed a new tectonic expression to be possible. However, when construction techniques and building materials such as steel turn into a stable field of knowledge, they create a certain spatial expression, so experiments and discoveries disappear. Besides, when the structural conditions and other elements that constitute the building stand in the vertical position, the elements close to them are drawn into a ready-made information field and standardization; and uniformity becomes inevitable in the forms of expression that arise when trying to achieve a balance between the two. The use of technological knowledge allow progress, but materials and methods that complete their development and evolution destroy the production of new insights. In this case, the use of technology as a tool for predicting the planned spatial states and tectonics, as well as experimenting with their alternatives rather than as mere materials and methods, would achieve more creative results. Thus, it is expected to affect architectural thought and the evolution of forms more positively.

For example, the tectonics of the Serpentine Gallery Pavilion was estimated by a digital model. Their calculations can also be considered digital, yet this does not affect the fact that the idea is unique along with the technique explored for this idea. Technology remains the tool of tectonics when considered in terms of spatial expressions.

The spatial state of the Serpentine Gallery's composed by its technical features as mentioned in the previous section is its tectonic expression. The structure embodies various states and appearances that are perceived as opposites such as free-form and rigorous, transparent, and opaque, along with rectangular and blob-like. The resulting object is in an area that contains ambiguous and interpretive depths. The wall opens like a zipper, transforming from one line to two surfaces and defining an indeterminate space. The multidimensionality of the space formed in this indeterminate emptiness is worth to be mentioned. The perception of in and out is explored and experienced in different ways at every glance. It offers uncalculated and unscripted possibilities to

both architect and user. It also involves the user in the fiction and scenario of the space (See Fig. 2.3).

Figure 2.3 BIG's Serpentine Gallery Pavilion's spatial status produced by two surfaces. (Source: https://www.amc-archi.com/photos/big-briques-a-la-serpentine-gallery,5163/pavillon-2016-de-la-serpentine.4)

In the Swiss Sound Box, the gap defined by the mass clusters is the spatial state created by architectural tectonics. Contrary to the impermeable and solid forms imposed by the wood and the stacking method, the entire texture of the wood is completely replaced in its fullness with a unique stacking method. So, the newly created surface textures do not only provide air and light transmission but also the flexibility of spatial production and the richness of experience (See Fig. 2.4).

In architecture, the technique is related to numerous aspects such as form, function, program, and environment. By being aware of the production process during the design, the architect tries to remain faithful to the purpose of production and integrate with the place, as well as to establish a relationship to be more informed and creative while experimenting with the forms required from various materials and different techniques. To understand how the terms presented relate to an architectural structure, it seems necessary to define subjects related to tectonics which can be identified through several generations. Semper emphasizes the materials as the essentials of becoming as they are equally important in their tools and techniques. A conscious creative work can describe the tectonic (Semper, 1989) . Hartoonian discusses tectonics following the conceptual technology theories of Martin Heidegger and the Greek technology principle, which unites the meaning with the end of the process and

its purpose (Hartoonian, 1994). In architecture, British architect Kenneth Frampton, one of the questioners of tectonics argues that tectonics is a useful material for a critical approach to postmodern architecture while examining the ability to bring construction to the level of art and stands by the modernist period.

Figure 2.4 Swiss Sound Box (Source: https://en.wikiarquitectura.com/building/swiss-sound-pavilion/)

Tectonics, according to Frampton, comes from both poetic and cognitive aspects. He states that there is a distinction between representation and technique of tectonic form. Since each building belongs to a different time and technology, the creation of architectural form must constantly be re-thought (Frampton, 1995). Moreover, the fundamental developments in architectural design processes by the use of technology have brought a new trend of architectural paradigm.

The approach utilized for forming structural elements and the significance of expression of bringing these structural parts together may be explored using tectonic. However, technology, with an influence on tectonic expressions, also leads to the consideration of architectural objects as a distinct technological activity. In this scenario, the tests, research, and inventions on how tectonic builds space are assessed by innovation on one hand while technology is on the other hand.

For tectonic manifestations, such a case can refer to both positive and negative aspects. When the technology-based items or building information is not utilized for space creation and is understood to be tools and subsystems of the expression of the thinking, the expressive potential of the tectonic becomes unlimited.

This reveals its state to fill the lyrical substance of the techne with practical information, showing that objects embody something according to practical knowledge. Tectonic, however, defines certain phrases and non-constructive conditions. The structural rationale of the architectural pieces is beyond those presenting other meanings and conceptions. In the practical realm of technology, therefore, tectonic loses expressive values. Creative architecture was promoted in the second half of the 19th century, as it was amid the industrial boom and the time in which technology was too prolific to provide new possibilities. At the end of the century, however, when the industry was considered as the key concern in the architecture process, it lost its creative strength since it ceased seeking the new and remarkable (Giedion, 2009, p. 243).

For instance, when the Crystal Palace Paxton was created, a structural expression tested the capacity of architecture and other departments, such as engineering, and the hazards involved in building procedures. During this age of novel steel uses, Crystal Palace was not merely a steel building but also a new experimental approach. An idea for developing a new manufacturing process might be contrasted. An unexpected new construction expression was created in Crystal Palace as it was to establish the necessary dimensions by using the technology used in glass, steel, and wood. A new tectonic expression was feasible thanks to the region designated by the experiments on the spatial level. When construction processes and materials like stainless steel became a solid area of knowledge, they established a definite spatial expression, which eliminated experimentation and discoveries. If the structural conditions and other elements that enable the construction stand in the vertical position and the closing

elements are drawn into a ready-made field of information, the forms of expression that arise when trying to achieve the balance between the two are inevitable for standardization and homogeneity. Progress has been achieved with technical understanding. In addition to this advancement, the technology and mechanizations in the 19th and early 20th centuries have reflected the features of its time. In the 20th century, technology was considered as a modern approach to the materialization stage in the production of digital architectural objects. However, the new manufacturing was destroyed by materials and processes completing their development and evolution. In this scenario, technology would lead to more creative outputs rather than just materials and ways to forecast the desired spatial states and tectonic to explore with alternatives. Thus, architectural consideration and evolution are assumed to have greater beneficial effects.

According to Heidegger, techne is also at the origin of the term technology, as it is evident in the technical phrase. Additionally, he considers technology as poetic, as well as illuminating (Heidegger, 1977). It is thought that techne mostly influences the intellectual framework of the work instead of only specifying tools and manufacturing.

Eduard Sekler describes tectonics 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” in his book called *Structure, Construction, and Tectonics*.

Sekler relates the tectonic expression to the visual outcome of the relationship between structure and construction compared to the various parts of a building and the balances between forces and arrangements that bring them together. After evaluating the historical sources using the concept of tectonics, Sekler suggests that the removal of abstractness and ambiguity in architectural criticism can be achieved through a tectonic reading of structure and construction (Sekler, 1965). Sekler also introduces the concept of atectonics, as opposed to the concept of tectonics, since it is not possible to evaluate every aspect of a considered building with the same tectonic. According to Sekler, construction is related to the process and technique of material selection and use (Sekler, 1965).

Semper emphasizes the materials as the essentials of becoming, which are equally important in their tools and techniques. A conscious creative work can describe the

tectonic (Semper, 1989). Hartoonian discusses tectonics following the conceptual technology theories of Martin Heidegger and the Greek technology principle, which unites the meaning with the end of the process and its purpose (Hartoonian, 1994). The fundamental developments in architectural design processes by technology usage have brought in a new trend of architectural paradigm.

To understand the concept of tectonics, it is necessary to consider the meaning of the concept. The conceptual origin of technology is explained by the Greek term *techne*, which refers to the art of making (Hartoonian, 1994). Techne is to do something out of something it is not. Although matter can produce something in the direction of any coincidence, action, or luck under all conditions, it is techne, as long as it can be defined consciously in the direction of a request (Meagher, 1988, p. 159). The word techne, which is used by the Greeks for art and manual labor, also refers to knowledge management. For the ancient Greeks, the essence of knowledge was to know the existence and the truth of being (Gregotti, 2017, p. 91). Imaginary freedom is fundamental in technics so that an architect is a producer, not a creator. Architecture is an example of techne since it is built from things and not created from anything (Meagher, 1988, p. 162).

According to Heidegger, the five essential features must be included in any technological account. These are techniques (tools, tools, appliances, equipment), products (consumer or non-consumer goods), nature (material and capacity), theory (science role), and intersubjective (social labor organization) (Mitcham & Mackey, 1983). When explaining the relationship between architectural thought and architectural products in the context of its historical origin in Ancient Greece, it is necessary to evaluate architecture itself as a technology to understand what architecture does with the kind of tools used.

In the essence of technique, Heidegger points out that it is not only technical, but what makes the truth unfold and revealed in the beautiful, as well. To describe it, he uses the word “poiesis”, which is the ancient Greek word that means to produce, create, and reveal the truth. It traces the essence of the technique back from instrumentality to causality, from causality to responsibility, from responsibility to poiesis, from poiesis to revealing, and from there to its essence. The word technique also states episteme while techne opens its essence (Heidegger, 1998). Since technique means to create,

make, produce, and reveal, the process from architectural thought to the production of architectural products becomes a matter of technique.

The industrial revolution was characterized by various developments from the mid-18th century such as population growth, growth in industrial production methods, and mechanization of productive systems (Benevolo, 1980). Along with industrialization, architectural culture followed to highlight its general standards. Towards the end of the 18th century, technological domination began with the mechanization process, along with the change in the way of production and thought. Nowadays, daily life is subject to change as new construction materials and technologies become available, as well as the spaces in which they exist. In the spirit of the age, glass, steel, concrete brought particularly new insights and symbols of architectural products. As a result of the digitally produced architectural object, there is no identical architectural product but there is a transition from mechanical to digital. While identical products are becoming obsolete with new technologies, new architectural products become unique, as well.

Architecture is shaped under the influence of history within the framework of aesthetic values as it is a cultural expression and a technical achievement. Still, the most important component in the realization and understanding of architecture is technology. Technology shapes the architectural imagination and determines the materials used in the building and the boundaries of architecture. In addition, the advantages of technology lead mankind to new thoughts and styles. Presently, architectural designs are not the same as Renaissance architecture or even when compared with the ones from 20 years ago. The integration of computers into design has allowed the construction of complex buildings easier, faster, and more accurately. Today, the solution to any problem of representation, expression, production, and construction of buildings can be found through digital information. The support of computers, when combined with basic design principles, enables the emergence of high-quality, sustainable architectures as they help to make architecture a useful discipline for the whole society.

In the Dominus Winery building in 1998, Herzog and de Meuron used a steel cage and a surface made of stones of different sizes. They use a technique for maintaining roads in steel cages known as gabions containing rocks created locally. With technological background, the surface and thickness of these rectangular cages were calculated

beforehand. The knowledge of the load of the stones has certainly affected the resulting architectural product.

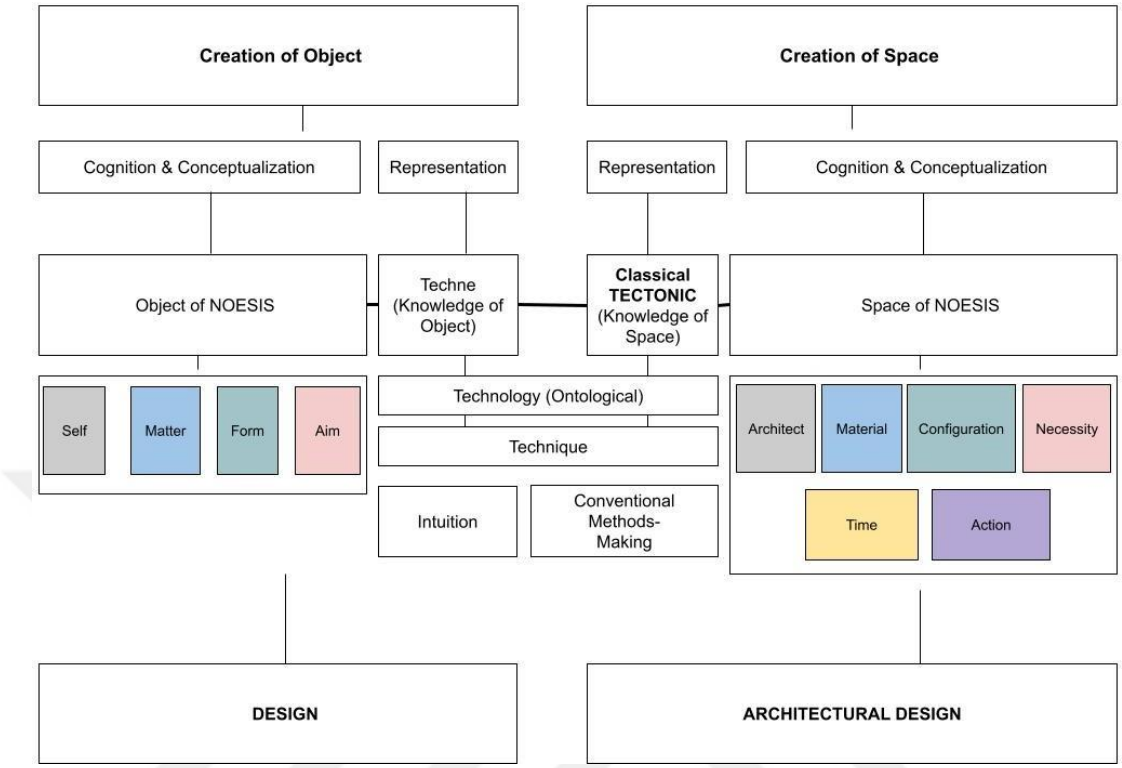
Frampton refers to the concept of tectonics in Ancient Greek architecture and underlines its association with poetry in Ancient Greek texts, though it originally refers to a carpenter. In this sense, he emphasizes that the design skill of the architect is also included in the concept of tectonics, in the context of poetry, when the concept is transferred to the architectural context (Frampton, 2011).

Technology is epistemologically the knowledge that architecture acquires externally. Technique, on the other hand, is the knowledge that is ontologically created by humans. While the act of adding two blocks of wood together is ontological knowledge for architecture, adding a new material to be used instead of wood is a technological issue. Creation of object refers to any object other than architecture. The transformation of matter into the material is the transformation of wood into a wooden production. An individual's creative identity might be revealed when one's mental capacity for cognition and conceptualization is comprehended (See Fig. 2.5). Humans are not the only ones who can perceive matter with different and distinguishable properties.

There are several ways to communicate a purpose using noesis of form and it is common. As a result, the shape is dictated by the aim (Sönmez & Batı, 2019). It is the transformation of wood, which already has a form, into cognition and conceptualization with the architect. As a real element of the mind and its effective creative side, cognition and conceptualization of known objects are essential. Noesis, the Greek word for intelligence or understanding, can be used to explain the mind's perception and process of understanding as a single phrase (Sönmez & Batı, 2019). With the intervention of the architect, the spatialization of the form and its disappearance from being an object are possible with time, action, and sense. As it becomes spatial, matter turns into material with consciousness. Configuration, on the other hand, is the possibility of transforming from a raw form into an architectural one.

In this case, the one who designs the method also gives the knowledge of making the technique which determines how the mentally produced creation should be constructed.

Table 2.1 Creation of space definitions



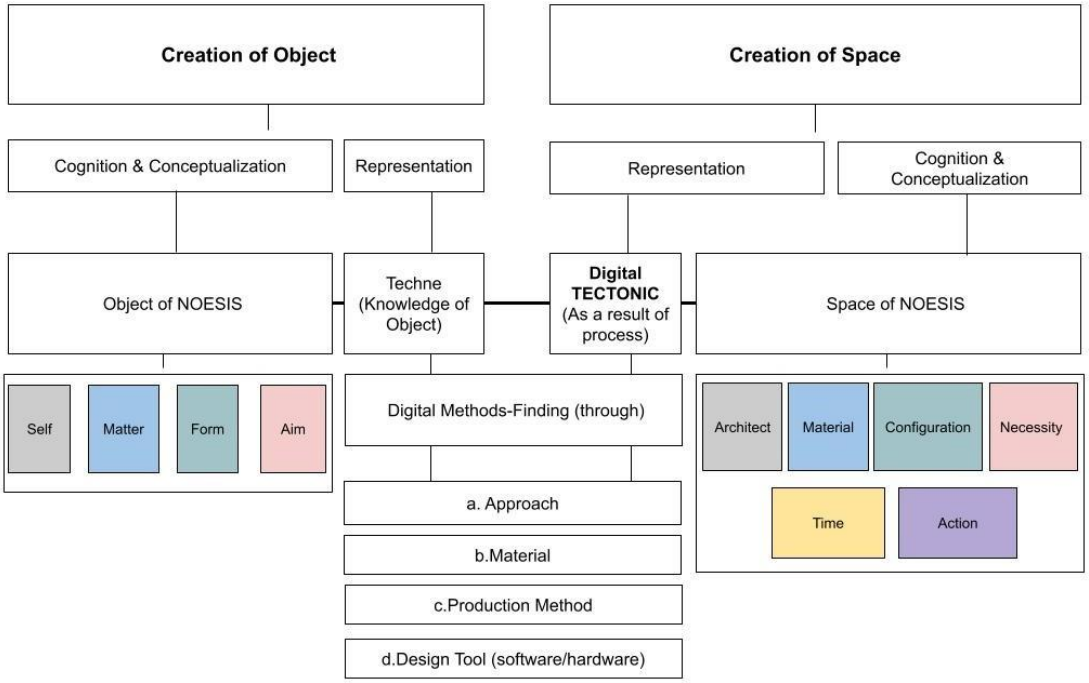
Techne in classical tectonics corresponds to the intuitive part of the design. New experiments and repetitions can be established on the knowledge of the technique created by experiments.

2.3 Digital Tectonics Approaches

Numerous studies address digital computer technologies in architectural and engineering practice, such as design, computation, and cognition through John Gero, who deals with how designers think about computer systems (Chen, 2001). Yet, virtual architecture is associated with the brand-new aesthetic language created design (Mitchell, 1999). Furthermore, Industry Computing and Cognition deals with how designers think about computer systems. Due to the complexities of these procedures, they no longer discern between distinct architectural styles.

The only assumption concerning the link between computers and architectural tectonics can still be found in written sources. As a result, digital tectonics and this collection of works are critical for research.

Table 2.2 Creation of space according to digital tectonics



Thus, the works on which this research relies on as a foundation for comprehending tectonics and critical assessment of the interaction between computer and tectonic practice are digital tectonic records. As a result, in this chapter, concept of digital tectonics has been analyzed.

The information era, which began towards the end of the 20th century, was closely tied to information processing delivered by a computer (Castells, 1996). Design programs that debuted in the 1980s had the first direct effect on architecture. The early tools were designed to emulate the methods of penning an architectural design, later 3D design software was more forward-thinking in terms of its ability to create digital representations and operate as a tool for developing architectural conceptions (Kolarevic, 2003). Schmidt mentions Greg Lynn and William Mitchell tectonics approaches as:

> "Initially, the focus with the virtual was perceived as a rival to the priority with the tectonic excellence of structure. Greg Lynn highlighted his paper on why tectonics is square and

> topology is groovy. William Mitchell highlighted it with his article at Antitectonics: Poetics of Virtuality. Both authors voiced their dissatisfaction with tectonic knowledge of structure, which they interpreted as reducing the structure to a reaction to gravity forces, resulting in dull, rectilinear structure. It may be claimed that this competitiveness toward tectonics became connected to tectonics being treated as a quality of the architectural building rather than a specific activity" (Schmidt, 2007, p.80).

The Guggenheim Museum in Bilbao, designed by Frank Gehry and completed in 1997, exemplifies the anti-tectonic concept of architecture (Mitchell, 1999). The structure was designed in the style of a digital sign, with curves and free space dominating over rectilinear lines. The design, manufacture, and building of the same road were all done digitally. The Guggenheim Museum enacted an important role regarding the function of computer technology in architecture. Frank Gehry was particularly concerned with the spatial and aesthetic aspects of the structure, along with less typical tectonic criteria such as the manifestation of the construction concept. Although the Guggenheim is tectonic in terms of material and technology due to its innovative sheet metal applications, it lacks tectonic traits, at least in terms of the building principal approach (Schmidt, 2007).

While Kolarevic, Abel, and Szalapaj were captivated by free-form curves and innovative material uses, Frampton and Leach were critical because as an architect, he did not maximize the building's expressive potential. As a result, Frampton argued that Gehry constructs artworks rather than architectural constructions. In this sense, the Guggenheim, directly or indirectly, escalated the notion of digital tectonics (Schmidt, 2007).

In 2002, a symposium sponsored by engineering company Buro Happold at Bath University confirmed the concept of digital tectonics. According to Neil Leach, theorists and practical architects and engineers should contribute to the evolving paradigm through publications and presentations (Schmidt, 2007). Following the symposium's heightened interest, several writers expressed their concerns about the new approach. Wassim Jabi and Jeremy Ham were both curious as to how computers may be utilized to teach architecture students about structure and construction (Schmidt, 2007). In the new solution procedures, it is critical to take advantage of classic construction solutions. In particular, algorithmic software systems are advantageous in building new construction techniques by utilizing this spectrum at the point where today's technology has arrived (Kara & Selçuk & Akan, 2021).

The intuition in digital tectonics is starting to become computational. While the tools used in the intuitive part, the preliminary stage of the design, are unclear and ambiguous, the information outside the architect is taken by the architect and used in that design. In the digital stage, the technique is mathematically calculated and included in the design process. Intuition is a technical problem as it transforms around the consciousness of the world. As soon as this problem transforms from intuitive to computational, the nature of tectonics and, thus, production of space changes. As mentioned in classical tectonics, there is a design method with intuition and manual tools, while there are mathematical design tools in digital tectonics. The main difference between classical tectonic and digital tectonic is due to technology. While it is produced with an analog method that is intuitive in classical tectonic understanding, it is produced with a digital method that is intuitive in digital tectonics.

Today, there is a transition from the ongoing experience to a modern awareness in process of design. In digital medium that assists the design process, a wide variety of digital technology has been used since the 1990s (Lim&Liu, 2006). The design processes and techniques of architecture are rapidly evolving with the numerous features that the digital age brings. Therefore, with classic tectonics, another collection of new tectonic factors is required. The influence of this generation of new tectonic would model the reality of modern architecture's existing tectonic conditions, which have changed since 20th century. Beyond the change of the means of architecture, the aspect that complicates this transformation phase is also the change of the conceptual framework. Lim and Lui remarked this transformation as:

> "Some of the critical phenomena of tectonic thinking involved in the five digital cases are far beyond the boundary of classic tectonics; the classic factors are no longer sufficient. Therefore, another set of digital tectonic factors is necessary to coexist with classic tectonics. This new set of digital tectonic factors will reflect the reality of current tectonic considerations in digital architecture, which have evolved from the architecture of the 20th century" (Liu & Lim, 2006, p. 286).

Theoretical discussions sparked by the concept of tectonics in the 19th century quiesced for a while after Kenneth Frampton. Later, the concept of tectonic came to the fore again and more intensely in the late 20th and 21st centuries, thanks to the tension that escalated between digitalization and architecture in the beginning. The reason for this is that the digital environment carries its dynamics. Each innovation brings along an update of existing concepts. For example, while stereotomic and

tectonic were two separate components in the past, today an inclusive tectonic concept is preferred instead. Similar confusions continue to be experienced in the definition of digital tectonics. Is it a digital tectonic form generation tool, or should it be handled differently? Perhaps, it is best to accept that digital tectonics offers a new way to understand architecture, rather than understanding it as an advocate of digital methods added to the traditional (Andersson and Kirkegaard, 2006). Philip Beesley and Thomas Seebohm define tectonic and digital tectonics in their study as "Tectonics means focusing on assemblies of structural elements. Digital tectonics is an s methodology that combines the use of design software with traditional construction methods" (Beesley and Seebohm, 2000). Digital tectonics can be handled in various ways, for example, fluid tectonics are also digital tectonics. The point to be considered within the scope of the study is that tectonics is a constructional and sufficiently material phenomenon, even in the digital age. Bermudez also believes that despite cyberspace, architecture is based on the material, and states that no matter how technology develops, the physical aspect of architecture provides a direct reference to the analog world.

The Guggenheim Bilbao Museum by Frank Gehry was first constructed physically due to the building's mixing as an important example from analog to digital in the 1990s. The kind then formed its physical model's borders and form points and updated it with the CATIA 3D design application. Gehry states that digital technologies are not a definition; they are an instrument of conversion that is encoded digitally using input from the model (Kolarevic, 2003). Frank Gehry was the first and last to participate in the project.

Furthermore, the material is the most important element that provides digital tectonic approaches. An important branch of science that studies materials is biotechnology. It has been tried to create self-contained systems within the scope of biotechnological architecture. In this context, smart materials and shape memory materials are the new expression of dynamism in architecture. This is because the architect, as a single actor, cannot adequately control complex phenomena. Therefore, the technology that has been transformed into a tool for control can be used. Due to the revival of the discourses about tectonic, it became necessary to develop new design discourses against the diversity expressed by the concept of tectonic and the change experienced by the concept of tectonics in the 21st century. No concept stands still or stays as it

was when first founded, but constantly evolves. This issue of concepts gaining different meanings, can be considered as a different dimension of temporality. Baliński and Januszkiewicz emphasize:

> "Digital tectonics focuses on the role and application of materials and technology in the creation of contemporary architecture. CAD/CAM technologies create new opportunities by allowing the production and construction of complex forms, which until recently were difficult to design and build using traditional construction technologies. A virtual free surface imposes such technical solutions and materials which question the traditional thinking about a building. Computer linked fabrication techniques of many kinds have become an integral part of the design process, while new digital tools allow engineers and architects to understand in whole more detail the behaviour of load carrying surfaces and to generate new architectural forms. In this field, digital tectonics design appears as a new approach to architectural design methodology and application of materials and technology in the creation of contemporary architecture. This approach shows a new way of thinking about the architectural project but at the same time indicates new tasks to solve" (Baliński & Januszkiewicz, 2016).

Progress of technology impacts the creation and construction of architectural goods and processes. Digital technology forms the architectural imagination and specifies the materials in the field of design and architecture. In this century, the machine is utilized as an instrument toward the conclusion of the century and the computer generally impacts the architecture of the following period. As Yan and Yuan mentioned:

> "When traditional craftsmanship is replaced by the contemporary digital technology for construction, CNC machines and rapid prototyping methods provide entirely new directions for creation as well. From ancient times to the Middle Ages, buildings were constructed by artisans and master builders working on the actual construction site. Through the process of making, the intuitive dialog between human body and material is regarded as part of the source of design creativity" (Yan & Yuan, 2021).

Another logical idea of the digital tectonics system is tectonic thinking, redefining their role, and the role of architectural space by new tectonics of contemporary technology. One of the options for characterizing the word digital tectonics is a poetics of structurally displayed and built architecture (Andersson & Kirkegaard, 2006). The evolution of digital tectonics has been the outcome of the use of digital technology between architecture and architectural thinking. Modern technology and tools, often utilized in digital software, are driven by new technologies in architectural discipline, especially in the design and creation of complex shapes.

> "With the assistance of a computer, the structural analysis for the dynamism of the free form can be performed easily. The framework system and the surface to be structured can therefore be separated digitally. As a result, the generation of the digital model implies a new way of construction: be it a simple geometric structure or free form, everything can be modeled through a digital tectonic process, and have performed actual structural analysis and simulation with the assistance of a specialty computer software program" (Liu & Lim, 2006).

These architectural styles and new technology have started to develop alternative tectonics than conventional tectonics. Facilities, shape, and methods of the architect's interaction to what might be termed digital tectonics in diverse ways. The ICD-ITKE Research Pavilion, which was created in 2013-2014, is another example. The shape and the procedure are selected based on the observation that nearly every biologic structure with a load bearing contains fiber composites. For modular, double layered fiber composite structures a single winding approach has been devised. Geometer-based structural principles derived from beetles elytra are generated in a total of 36 unique components. Each has a separate fiber arrangement which enables an effective material loading method. It is ultimately a structural element in its entirety.

In ICD-ITKE Research Pavilion, the cells produced by the fiber material and the winding technique constitute the structural conditions. These cells' shells create a fibrous tectonic system. The interior which is created by the shell interacts with the environment in which it exists by producing complex spatial conditions. It discovers new spatial qualities by overlapping data such as created structural state, environment, time, climate, and day.

Similarly, in the ICD/ITKE Research Pavilions, the structural conditions formed by the winding methods define different types of space by forming different models. Each line represented an approximate robotic tool path that was modified during the fabrication process (Doerstelmann, et al., 2015, p. 62). The fact that the structural and material organization was implemented by a robot does not change the uniqueness of the generated spatial situation. This is the tool for generating alternatives to the spatial situation (Figure 2.5).

Figure 2.5 ICD-ITKE Research Pavilion (Source: (https://www.archdaily.com/522408/icd-itke-research-pavilion-2015-icd-itke-university-of-stuttgart/53b21346c07a806b4b0001bb-icd-itke-research-pavilion-2015-icd-itke-university-of-stuttgart-image)

Computations, simulations, robotic productions have made new fibrous tectonics discoveries possible in architecture (Menges, 2015, p. 13).

The concept of tectonics has similarly evolved and moved to a sub-title called digital tectonics. It is thought that the difficulty in defining the concept of "digital tectonics" generates from the fact that these two concepts (digital and tectonic) are contradictory to each other on the material plane (Andersson and Kirkegaard, 2006). Despite this difficulty, it is possible to approach the concept of tectonic from a poetic perspective and to interpret contemporary concepts with a timeless approach, thanks to digital tools in architecture (Colletti, 2016). While talking about the productivity provided by the inter-concept hybridization, attributes the fact that Forty (2000) is no longer valid for architectural representation, stating that language as a means of expression, unlike classical architectural representation, is no longer valid for information-based digital architectural representations. As the laboratories that comprise its field become more meaningful, connections are established between experiment and architecture, experience and tectonic. The experiment requires at least one observer and one observed in the scientific sense. This work defines a continuous space in all three

dimensions. The cells formed by the fiber material and winding process are the structural conditions of the ICD-ITKE Research Pavilion. The shells of these cells form a fibrous tectonic structure. The interior generated by a shell interacts in a complicated spatial circumstance with the environment in which it resides. It enables the discovery of new geographical characteristics through the combination of overlapping data such as structural condition, environment, time, climate, and day. Nowadays, the experience and design process has changed to a new process of consciousness and design. Since the 1990s, the design process has employed a digital media by a wide range of developing technologies.

The first project in Los Angeles to utilize CAD/CAM in full was Frank Gehry's Walt Disney Concert Hall. Several construction pieces were designed and built via the BOCAD program. This building hides its architectural structure by not displaying a distinct or distinctive shape of its program behind the construction.

Manual DeLanda and Neil Leach supply the most important texts from the publication Digital Tectonics (Leach et al, 2004), while Greg Lynn, Kristina Shea, and Bernard Cache provide the most informative architectural examples. Leach describes digital tectonics by claiming that the whole history of architecture can be separated into two fundamentally distinct ways of seeing form, a concept he draws on Deleuze and Guattari. In his book *Digital Tectonics*, Neil Leach and other writers suggested the digital tectonics as a future of computer tectonic tradition (Leach et al., 2004).

> "…computer technologies have infiltrated almost every aspect of architectural production, and are now being used to offer insights even into the realm of the tectonic. In particular, they are allowing us to model – with increasing sophistication – the material properties of architectural components. This volume, then, marks a particular moment in the history of architecture when the old oppositions between the digital and the tectonic has begun to collapse, and the digital is beginning to be used increasingly in the service of the tectonic. A new tectonics of the digital – a digital tectonics – has begun to emerge" (Leach et al, 2004, p. 4-5).

According to these writers, to develop this new culture, a manifestation is required for digital tectonics. Leach says the history of architecture was produced in digital tectonics in two separate ways, classical and gothic knowledge of building. On the one hand, there is the Classical (Renaissance, Mannerism, Baroque, neo-classical) view of architecture, in which form is generated by imposing stylistic choices as principles. The Gothic view of architecture, on the other hand, is one in which form is continually negotiated and impacted by materials and programs. "Architecture becomes the

consequence of contending forces" says the Gothic approach, which is more of a process than a style and more focused on structure than the Classic does. It is a programmed architecture that registers and responds to the impulses of human existence (Leach, 2004,p.73). While the shape is formed in the context of particular laws, the shape might subsequently be decided according to gothic architecture by the effects of different elements (Leach et al., 2004).

For example, the engineering computer technology utilized the optimization of construction in the British Museum court roof to the possibility to form the roof structure by Foster and Partners, Buro Happold and Waagner-Biro in London. Therefore, Leach characterizes digital tectonics as a new technique of developing architectural form through the use of structural components employing computer technology. It is crucial that the meaning of technology, its relationship to the material and experiments concerning the design process is investigated while considering digital tectonics.

Leach relates the Classic and Gothic styles to two paradigms. One is static and the other is dynamic paradigms of understanding architecture. According to Leach, the current scientific and societal tendency is to reject the static in favor of the dynamic (Schmidt, 2007). The static paradigm, Classic style to design is characterized as "any viewpoint that stresses aesthetics above performance." (Leach, 2004, p. 73). It demonstrates via Modernism, Postmodernism, and the projects of Frank Gehry. However, the dynamic paradigm represents gothic idea of architectural form, and according to Leach, rekindles interest in tectonics since it implies the production of an architectural form through materials, architecture, and structure rather than an ornamental approach.

There are relatively few connections between the digital tectonics and the writings of classic tectonics. Leach's only clear connection can be considered his claim that Frampton's work on tectonics may be seen as a long-winded defense of the digital revolution (Leach et al, 2004).

While Leach's approach, here referred to as the Building Principle, focuses primarily on tectonics, he does mention the impact of the computer on the Component and Composition, exemplified by Bernard Cache's work, which focuses on making the transition from a digital design to digital manufacturing information as smooth as

possible. Creating software that allows for automated architectural detailing can be an example (Schmidt, 2007). According to Manual DeLanda (2004), a lack of understanding of materials' complex behavior has resulted in the architecture that fails to reflect the complexity of a structure, as evidenced by use of refined steel as a building material, regardless of the structural need of a specific structural element. Using a computer to calculate building materials can lead to a more comprehensive knowledge of building materials and, as a result, architecture in which each structural part represents its true structural role (Schmidt, 2007).

As a growing technique integration of digital software with traditional architectural systems, Beesley and Seebohm highlight digital tectonics (Beesley & Seebohm, 2016). They emphasize that the new approach to tectonics in the domain of physical architecture lies within digital software. Liu and Lim allude to digital architectural tectonics but say that conventional tectonic understanding cannot fully match all varieties of approaches to tectonics. Therefore, this is a tectonic understanding to be updated (Liu & Lim, 2006). One of the options for characterizing the word digital tectonics is a poetics of structurally displayed and built architecture (Andersson & Kirkegaard, 2006). The evolution of digital tectonics has been the outcome of the use of digital technology between architecture and architectural thinking. Modern technology and tools are often utilized in digital software and driven by new technologies in architectural discipline, especially in the design and creation of complex shapes. Gao defines digital tectonics in detail:

> "The process of manipulating design by computer can be viewed as digital tectonics. It's a display of digital design thinking. The demonstration of knowledge relative to the technique and mechanism of the process of digital architecture production proves that computer technique is not just a tool for design, but is also a medium for inspiring thinking in the realm of design, a means of producing the logic behind even more complex forms" (Gao, 2004).

These architectural styles and new technology have started to develop alternative tectonics than conventional tectonics. Facilities, shape, and methods of the architect's interaction to what might be termed digital tectonics in diverse ways. According to Zaha Hadid, tectonics governs the incarnation of dynamic concepts using computer technology, the interplay of strength and shape, and the link between aesthetic and structural components. Hadid finds tectonics as a crucial idea integrating the functional usage and dynamic architecture of computer design. The dynamic situation was

handled in accordance with four systems of architectural tectonics: structural system, the system of kinetics, assembly, and regulatory system (Hadid, 2010). Gao clarifies the dynamic process of digital architecture:

> "Computer techniques can easily simulate the state of many actions, making it a model when considering design manipulation. This allows the designer to explore much more complex and nebulas concepts, like speed, molecular activity, hydrodynamics, etc, changing from dynamic simulated action to action and to reaction. This can not only be expressed in idea and design, but can be demonstrated in the process of studying structure and form" (Gao, 2004, p. 9).

For Patrik Schumacher, architects need to do engineering research and select the options best suited to the primary task to reach the articulation of tectonics. Social requirements are achieved through adaptive structure differentiation and changes following the environmental performance of the building (concerning exposure to the sun, etc) (Schumacher, 2014). Diverse theories, according to the digital tectonic method, compose the definition of the attributes of these tectonics, the architect's creative function in speech, and the architect's impact in the production of digital tectonics. The architect's high degree of insight, knowledge, and awareness of technology-independent design, building technique, material, definitions of the form may be developed to design the overall characteristics of digital tectonics. If digital tectonics are real, a presence in all these domains must be shown and purposeful design activities must be taken. In this sense, it is not only the digital technology builder and a maker.

Since the structures have no real structural impacts, before the design begins, the codes of the digital manufacturing process must be established. Thus, although in the digital world there is no substantial influence of reality, representing the tectonic reality as a design parameter is vital.

Progress of technology impacts the creation and construction of architectural products and processes. Digital technologies shape the architectural imagination and define the materials utilized in the design and architectural borders. In this century, the machine is utilized as an instrument toward the conclusion of the century and the computer generally impacts the architecture of the following period. Another logical idea of the digital tectonics system is tectonic thinking, redefining their role by new tectonics of contemporary technology and the role of architectural space.

It is crucial to decide, depending on the idea of digital tectonics, if a link between materials and procedures exists. In the definition of digital tectonics, a three-dimensional relationship must be established instead of building a linear relationship as seen in traditional tectonics.

In this case, looking at architecture as an experiment makes the architect an observer, and the act of building becomes observed. When the act of construction becomes public, in other words, open to human interaction, architecture will create an environment of interaction for people. Digital design tools have a radical impact on architecture. As Schmacher mentions:

> "It can also be said that parametric design tools have begun to break down the acceptance of modern architecture, which is still trying to survive today. This situation shows that a new era has begun in architecture and modern architecture and the arguments developed afterward are insufficient in terms of discussing the designs produced in parametric terms. The style of parametricism is a new paradigm that informs the daily work of daily objects, architecture, and spaces" (Schumacher, 2009).

The greatest contribution of the Parametricism Manifesto to today is that it initiates the products of the emerging new architecture to be discussed on common ground and inspires new theoretical ideas and discussions. From this perspective, his discussion proposes a new reading on the architectural methods with technology established by digital tools on the parametricism style. To discover the digital design process in the field of architecture, the paradigm of new tectonics combined with digital technologies is required.

Nowadays, changing digital tools, design processes, communication, and design herald a new era, in which Patrik Schumacher states that the architectural design at the intersection of design and technology constructs a framework by addressing its environment. In this study, re-readings about the manifesto for a new style by Patrik Schumacher have been thought to be important. In the manifesto, it is argued that parametricism is the most important trend that emerged after modernism, and it is claimed that parametric design is realized through several assumptions or refusals (Schumacher, 2009). Schumacher describes the purpose of organizing and clarifying the purpose of parametricism, the diversity, and differences of social situations on a post-ford. The society, standardized by mass productions and combined with parametricism, becomes more heterogeneous due to different lifestyles and variable

levels of distribution of income. Thanks to this period, the link between all design elements and subsystems is established using software for design and production. The platform, which is formed at the intersection of technology and design, incorporates traditional architectural design presentation forms, transforming the architectural design process into an interactive, relational, three-dimensional representation form as a whole. The style of parametricism is a new paradigm that informs the daily work of objects, architecture, and spaces (Schumacher, 2009). The feature of parametricism represents the complexity and dynamism emphasized by the proliferation of constantly differentiated components at a similar rate.

Zaha Hadid's Guangzhou Opera House is one of the earliest parametric structures to be created in real life. It has an entirely different kind of steel structural framework constructed of a decomposable plane mesh. These facets mix edges and vertices and do not keep a consistent and smoothly curved surface that fits the conceptual assumptions presented by the project. The new materials are also required so that the skin is continuous and additional support systems can be minimized. Architects are forced to look for new techniques and geometry while waiting for new materials that are lightweight and easy to shape (Baliński & Januszkiewicz, 2016).

With the rise of digital technology, design methods in information technologies, traditional design, and creativity understanding are changing. As a result, several rules of traditional design methods are exceeded. By digitizing the design, various possibilities of the architectural product are provided. A new search and perspective emerge in the integrity of form, material, structure, and space. Baliński explains this as:

> "Digital tectonics outlines an emerging paradigm in architectural design a renewed interest in structure and a growing synergy between architects and engineers. The last few years were a time of a great development of digital tools for creating curvilinear forms with simultaneously developing the theory and methodology of the design of these shapes. These new architectures emerging from new kinds of industrial production and design tools require new thinking and conceptions of architecture both from the perspective of the designer and the person experiencing the built environment. Growing out of the analogue digital tectonics becomes the primary factor in modern thinking, designing and constructing buildings. One can only expect its impact to bring new materials, technologies and design tools, and even more interesting buildings" (Baliński & Januszkiewicz, 2016).

According to Schumacher, Parametricism's computational complexity has grown more in recent years and its methods are much more efficiency oriented. The convergence of engineering and manufacturing logic through new digital tools has led to a new stage in the creation of parametric called tectonism. Tectonism is the only style appealing to the recent improvement in the ability of structural and environmental engineers centered on computer analysis and optimizations (Schumacher, 2019). (Fig.2.6)

Figure 2.6 : Foldism, Blobims, Swarmism and Tectonism

Economou explains the autopoiesis as:

> "The concept of Autopoiesis refers to the overall discursive self-referential making of architecture. This is a continuous historical process and to remain effective, it continues to require new theoretical efforts at each stage of its ongoing evolution. An autopoietic system for architecture can only be realized at the hands of an all-encompassing theoretical system" (Economou, 2015).

Also, Maturana and Varela mentions of autopoiesis as:

> "The word autopoiesis means that a project is created by nature or by itself. The concept of autopoiesis is a parallel model of the organization of living organisms to that of a machine. The machine is an entity that consists of individual items/parts, which in turn hold properties and are combined aiming to reproduce the same machine, otherwise if these factors act independently and in a disconnected way the machine stops working" (Maturana & Varela, 1980, p.77).

According to Economou about Maturana and Varela's idea:

> "Schumacher lifted the Autopoietic system from Chilean biologists Humberto Maturana and Francisco Varela who understood the peculiar closure of living systems, which are alive and maintain themselves metabolically whether they succeed in reproduction or not. It is Schumacher's opinion that Parametricism continues the autopoiesis of architecture and constitutes architecture as a discourse" (Economou, 2015).

The literature in Digital Tectonics shows that, like the understanding of classical tectonics, it is a theoretical umbrella encompassing a variety of techniques rather than a single unified strategy (Schmidt, 2007).

2.4 Comparisons about the Digital and Classical Tectonics

Currently, the interaction between technology and architecture is ever-increasing and it is not possible to say that classical and digital tectonics have a sharp contrast. The previous concept of classical tectonics and digital tectonics are nearly identical, both emphasize the interaction between building, materials, and expression (Al-Awan, 2020). As Table 2.1 and Table 2.2 show the titles that form both tectonic concepts are similar or the same. In other words, technology has not yet sharply distinguished the classical and digital tectonics' content to space creation. Accordingly, it might be said that the digital opportunities provided by technology has resulted in the consideration of tectonics holistically without making separate definitions of classical and digital, yet the opportunities of the knowledge of these two different tectonic approaches might be rediscovered. The reproduction conditions of the statements and content of the classical tectonic towards technique and material, in the digital tectonics' production area, are determined as a different situation than the content defined within both classic and digital tectonics efforts.

- Tectonics is a form of architecture that evolves from a response to context, science, and forces (Al-Awan, 2020). While the context affecting the production of space such as the weather conditions, the cultural and physical landscape represents unlimited, infinite element group in the classical tectonic, therefore, limited in digital tectonic due to data input to the software. Within this framework, the differentiation of classical and digital tectonic context towards creating the space and revealing the tectonic structure is shaped with topographic, environment-related, cultural, historical factors in the classical tectonics and simulative in digital tectonic. At this point, it is

Table 2.3 : Comparisons about the digital and classical tectonics

	Main Concept	Sub-Concepts	CLASSICAL TECTONIC (classical methods)	DIGITAL TECTONIC
TECTONIC	Noesis	Context	Unlimited	Limited
		Action/need	Linear, intuitive, build on experiences	Multi-layered string, based on relationship networks, parametric, containing optimizations
		Form	Rational geometric, defined form	Rational geometric, amorphous
		Material	Concrete (reality)	Abstract (representation)
		Making Method/technique	Technical (intuitive) Cultural Craft-related (Actions towards bending, adding and subtracting are developed over artistic knowledge) It is built on randomness, creativity and material characteristics.	Technology (computational, parametric) Related to a computer program and their opportunities (Actions towards bending, adding and subtracting are developed over pre-defined operations)
		Production Type	Unique	Multiple
		Intuition (experience)	Direct existing within the context and space (instant interaction between climatic and spatial data creating the scope and their unpredictable change and transformation and sensing these elements)	Existing within the representation of context and space
		Design Process	Intuitive	Transparent
		Representation	Knowledge of Object	Knowledge of Software

possible to mention the reality and representation distinction within the context like the other items.

- It is possible to say that the action is linked with the program and environmental factors in both classical and digital tectonics. In classical tectonics, the action exists as singular or by processing the data from singular factor context gathered together.

For example, actions such as sitting, looking at somewhere, eating exist as fundamental elements to create the space with the frame related to context. In classical tectonics, it is possible to say that the relationship between action and context affect the tectonic structure built on intuition and experience. Within this context, it can be mentioned that the action and context relationship of classical tectonics contains certain constancy. When sitting in an inclined topography to see the sea and being protected from the sun and wind is a design problem. Seeing the view directly has primary importance and protection from the sun and wind, and the comfort provided in the sitting area will form the tectonic structure on intuition and experience, therefore, the space. Although it is possible to mention the effect of context-related data on the action, the data showing that the resulting tectonic structure is based on experience and intuition and whether the data provides the most accurate place and position are unaccounted for. However, since both the data belonging to digital tectonic context and definitions about the action are built on the optimization among the whole, there are different possibilities of the place to sit down to see the view and be protected from the sun and wind, and data for each of these are optimized. As Gao stated:

> "…computer techniques can easily simulate the state of many actions, making it a model when considering design manipulation . This allows the designer to explore much more complex and nebulas concepts, like speed, molecular activity, hydrodynamics, etc, changing from dynamic simulated action to action and to reaction. This can not only be expressed in idea and design, but can be demonstrated in the process of studying structure and form. T." (Gao, 2004).

Within this context, classical and digital in the same context and action definition evolve into an optimization defined by locations and mathematical data of these locations different from the content developed over different intuition and experience. It becomes clear that the design process exists over certain constancies, since the computer optimizes the design parameters in the digital tectonics, the content of the location, form and action of the design is optimized. Therefore, to think about the intuitions and optimizations in a common content might lead to the possibility to

answer what will be the comfort level in which place, how much sun exposure will be and how will this impact the tectonic structure with intuitions. Choosing a more comfortable and better view when the risk of slight sun exposure is taken leads to an intuitive decision. When the structural provisions are seen, an intuitive optimization can be mentioned as the opportunities provided by digital tectonics.

- In classical tectonic, form is one of the factors creating the result within necessity and need, material, and production knowledge context as the sub-components of noesis concept. In classical tectonics, the form knowledge is not regarded as pre-existing. Humans who know to put their hands together to drink water as an instinctive action produced an object by consciously processing the environmental data. The form created by the hand to drink water is the root of the cup transformed from wood by processing the material. A person who perceived the necessity of an object for a certain need designs the form of that object in the mind and associates the processable material with the form of the object. In other words, the necessities will first transform the ideas into form and then objects with actions. In digital tectonic, the control interface of the virtual environment is reproduced from a different source with the help of digital software rather than the methods controlling the classical tectonics. Novel shapes, materials, and constructional procedures are developed with the use of computing, allowing for new possibilities to be realized as a concept or a physical form (Al-Awan, 2020). At this point, it is possible to mention the difference between what classical tectonics represent with the noesis concept and what digital tectonics represent with the noesis concept. While the relationship between context, material, construction technique and form in the classical tectonics occurs through the consciousness between the physical skills, analogies and perceiving the environment with consciousness, all content belonging to noesis in the digital tectonics is under the provision of tools creating the virtual environment. Gao states that:

> "With the aid of computers, the controlling interface of the digital environment is derived from a different source than methods controlling traditional design. If architecture spatial form could be viewed as the derivative result of tectonics, then digital architecture form could, by means of tectonics analysis, be understood and examined. Under these circumstances, in a digitally designed environment, the role of tectonics would vanish or change" (Gao, 2004).

Therefore, it signals a fundamental separation between the virtual space in the physical environment and consciousness relationship nested in the process to form an object

based on a long experience and creating the different forms of the object as various alternatives and the opportunity forms belonging to these. With the publication of Frank Gehry's proposal for the Guggenheim Museum in Bilbao, architecture entered a new era at the end of the 20th century. Frank Gehry employed computer tools to usher in a new age of free-form architecture, resulting in the emergence of digital architectural form production (Al-Awan, 2020).

In digital tectonics, the form is revealed with the help of different parameters. The material, environmental data and structural methods added to the virtual space to create the form enable developing alternatives to choose the most useful form. Within this context, a singular and repetitive process can be mentioned in classical tectonic approaches compared to the dynamic production process in digital tectonics. The content that forms the tectonic in the digital tectonic contains new variables that can interpret and improve both the object and the architectural space. According to Branko Kolarevic:

> "The digital generative processes are opening-up new territories for conceptual, formal and tectonic exploration, articulating an architectural morphology focused on the emergent and adaptive properties of form. The emphasis shifts from the making of form to the finding of form, which various digitally-based generative techniques seem to bring about intentionally. In the realm of form, the stable is replaced by the variable, singularity by multiplicity" (Branko, 2004).

- In classical tectonics the material is real, in digital tectonics it is a representation. According to Gao, classical tectonics material is:

> "…it is not just a functional concept, as if architectural expression were just a mixing of materials and intentions. For example, an architect will consider how to use glass to highlight the various characteristics of light, or how to use concrete to present volume and capacity, etc. Use of materials also calls for considering source quality. In order to illustrate purpose through pillars, walls, beams, panels, doors, or windows various materials and elements with differing functional qualities must be used to achieve such representation. Aside from describe specific knowledge and comprehension, using appropriate materials can also reflect intent of design concepts. For example, the relationship of pillars and wall on the plane how to affect depth of expression through shadows and light on the elevations, etc" (Gao, 2004).

It is possible to say that the sensitivity towards the material in the digital tectonic approach is still debatable, and development compared to the knowledge and experience of the classical tectonic in the same field. For there is a vast difference between design and production over the representative value of the material and design

and production over the reality of the material. The verisimilitude of the representation in the digital environment depends on the real experience the designer has with the material. Tectonic happens in reaction to physical, material, and natural rules, whereas digital is perceived as ethereal, absolute, and indifferent to natural laws (Al-Awan, 2020). According to Al-Awan:

> "Classical tectonics is more tangible and concrete for its emphasis on detailing in terms of materials and constructions. Digital tectonics is more abstract and process-oriented for its emphasis on technique in terms of assemblies of the building components, where the architect who masters the programs and controls all aspects of technology and aesthetics, seems to be a modern tekton" (Al-Awan, 2020).

• It can be said that in classical tectonics, the construction method is related to the knowledge of the past, therefore, to crafts within the cultural content scope. The period of processing material for necessity, both in the production of the object and the space, is developed based on simple structural techniques within the repetitive knowledge context of craft that is open for development. While the builder uses the construction processes such as bending, adding, and subtracting to process the material, the builder can also take initiative to combine different techniques. However, since the materials are based on representation in digital tectonics and the technique is a computer-based technologic element, the technical construction actions such as bending, adding, and subtracting are developed on pre-defined operations and program commands (bend, subtract etc.). The deeper meaning of architecture and tectonics has not changed as they still show the reality of a structure and its surroundings, but the technical aspect has altered because of the digital tool's new capability (Al-Awan, 2020). Construction methods have progressively become a product of computerized processes as a result of digital computer technology usage (Gao, 2004). Within this framework, it is possible to discuss the necessity of intertwining, which would pioneer the development of design technique and information flow across the classical and digital tectonics. Therefore, the construction method is related to directly contacting the reality of the material on the one hand, and innovative digital software which would enable the transformation of the reality of the material in the digital space on the other. It can be said that the designer has limited opportunities to find the techniques necessary to create the space and reach the unique form in digital tectonics which is carried out with computer software. Within the context of a unique solution of a design problem in the digital tectonics field, whether the designer is a specialization tool in

terms of how sub-concepts create the main content of the tectonics in architecture, material, construction methods, sensation, actions/needs, context, architect and designer, what these represent and their methods. The problem for technique generates within the context of computer program affordance. If the program does not have sufficient hardware, the production technique of the tectonic will be limited. The conditions to go beyond the construction method related to the program's command characteristics in the digital environment is only possible when an intermediate space that enables gathering various techniques is defined, and innovative software and production environment that will enable relating the digital constructive technique with the classical techniques in computational and parametric terms is created. Under these conditions, the digital construction methods associated with reality will neither be classical nor digital.

- In classic tectonic, it is possible to talk about the boundaries of creating the object and space. The main factor for these boundaries is the relationship between the content belonging to noesis, the reality. Therefore, production in classical tectonics is in a limited and slow transformation process. Since the production process in digital tectonics occurs in representative environments, creating the object and space is almost unlimited and instant. Additionally, it is easier to analyze the optimal level by producing different variations of both the object and space with digital tectonics.
- With all the data belonging to the context in the classical tectonic field, while the user and designer will be directly subjected to environmental factors affecting the sensation within the instant and action-based actions towards climate parameters, light, shadow, material's visual-tactual affect framework, all environmental data affecting the sensations in the digital tectonics field are built on the representation of the data. Therefore, within the context of the process to create the space and the relationship of this with the sensations in the classical tectonics, the material can be distant from the effects of the construction technique and a fixed sensation while the sensations are already fixed within the context of predefined data in the digital tectonics. In classical tectonics, it does not seem possible to refer to a certain constancy in the sensation and space relationship like in the digital field. In the classical tectonic fields, the fluctuations of sensations are directly related to the reality of all content forming the parameters of the context, material and construction technique and contain realities. Therefore, instant data towards unpredictable context and action in classical tectonics can produce results that can change the content and sensations of the tectonic structure

completely differs from digital tectonics. However, it can be said that the relationship between the different climate data and abstract factors such as light and space perception has infinite possibilities to investigate how the tectonic productions within the context of representation of digital tectonics will affect the infinite experience. Within this context, the affordance of the gathering of the classical and digital tectonic production to impact each other from reality and representativeness approaches to gather the content of classical tectonics addressing to sensations directly and from realities and the relationship of digital tectonic to address to sensations with representations in the common ground in the current tectonic productions are important. The combination of the technology's possibilities in tectonic, that is sensation relationship of digital tectonics and the content to gather the production method and technique in tectonic and sensation relationship in the classical tectonics, raises the possibility of a tectonic structure simultaneously including the sensation of reality and representation, and the affordance towards this.

• All factors affecting the relationship between the thought, result, and matter to create an object or a space exist in past knowledge on one side, and intuition of the designer on the other in classical tectonic processes. Processing a material for a need contains the interaction between consciousness and intuition. This interaction can be defined as a creative initiative of the relationship between material selection, construction technique and form and it is the unity of mental activities of the designer. Therefore, the design process in classical tectonics is associated with ambiguous aspects as the creativity of mind including culture, skill, construction knowledge and interpretation affected by various parameters. However, it is possible to say that data creation and articulation to the design space in digital tectonic processes define a mathematical model. Processing all the data entirely separate from the intuition crystallizes within the context of the boundaries of this mathematical model. Within this context, while creating content in classical tectonics is built on processing the content belonging to noesis between the designer and intuitions, the content in digital tectonics occur with selections based on possibilities created by the transparent data inputted by the designer.

• In both classical and digital tectonics, turning the design into an object after creating the design in the mind is represented with the presentation. The main distinction between these two is the importance of object knowledge in objectifying the design in the mind in classical tectonics and program knowledge of digital software in digital

tectonics. The attention is not just on the structure as a method of protection, but also on the representation of construction knowledge (Gao, 2004). In other words, while the production and context of the object in classical tectonics are based on the processing technique, and repetitive and transformative knowledge enabling to create the existing form; the production of the object in digital tectonics is based on the data content forming the representation in the virtual space and the programming knowledge to produce the object or space.

Within the context of titles given in Table 2.3 and detailed analysis made in this section, this thesis investigates the main titles of the tectonics concept identified as classical and digital within the context of the noesis concept. It can be suggested that the most fundamental theoretical and practical predicament in digital and classical tectonics is completely separating the digital and classical tectonics when a comparative analysis is provided for factors such as context, individual/architect, material, form, necessities, and construction methods. The content of classical tectonics to produce objects and space provides input to the content of digital tectonics to produce objects and space and the opposite is valid, as well. Therefore, it is not possible to refer to a distinct and solely classical or digital field in today's process to produce the object and space. In other words, today's object and space production process is evaluated and analyzed under two main titles in this study and it is possible to mention a hybrid/intermediate space which will emerge from the contents of these two fields and position itself at the conceptual and practical boundaries of these.
Within this context, this thesis is built on the assumption that this intermediate field will enable the content of digital tectonic based on data processing and representation will provide new structural opportunities to classical tectonics; and multiplicity production towards the technique based on realities will provide different possibilities to develop the representative limitations of the digital tectonics. Therefore, it is important to explain the conceptual background of this intermediate area that accepts the content produced by both classical and digital tectonics in the theoretical and practical field and defines its own content from actions developed on this network of relationships between these two fields. Accordingly, the next section focuses on Gibson's affordance theory that will form the theoretical content of this intermediate/hybrid tectonic structure in this thesis explaining what one contains of others.

2.5 Affordance Theory for Explanation of Hybrid Tectonic

The affordance concept can be used to explain the idea of the classical and digital tectonics and the theoretical structural depth in the practical sense within the context of the theoretical content of this study. The affordance theory concept was first used by J. Gibson in his article titled “The Senses Considered as Perceptual Systems” in 1966. Later, the theory was explained in detail in his book *The Ecological Approach to Visual Perception* in 1979. According to Gibson, affordance can be defined as the possibilities provided by one thing to another:

> “The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill. The verb to afford is found in the dictionary, the noun affordance is not. I have made it up. I mean by it something that refers to both the environment and the animal in a way that no existing term does. It implies the complementarity of the animal and the environment” (Gibson,1979, s. 127).

With this expression, Gibson states that all living and non-living beings forming the environment are to an extent affected by each other, and both body and action strings are shaped with the references collected from the surroundings.

Within the context of explanations provided in Chapter 2.1 regarding classical and digital tectonics, the noesis concept that forms the essence of content provided in Table 2.3 becomes a direct focal point since everything in an environment interacts with each other as expressed in Gibson’s affordance theory. In other words, noesis describes a field to explain the assertion given by the affordance theory that everything is related to each other. It is possible to say that each of the factors discussed under the noesis concept such as need, material, form, and construction method are interacting, providing content or various opportunities to each other. A mind that perceives drinking water means a mind that can question the affordance concept to understand the location of water, consciously look at the body to see how to drink the water, form a relationship between form of hands and the object to drinking water, to turn material in the environment that can imitate the form of the hand. Is it “the form of the water”, “the processability of the wood” or “the consciousness of humankind” that lead to a water cup? According to Gibson, each factor that forms a thing is equally responsible for the results. In other words, the flexibility of the wood for processing and the

discovery of humankind to process it have common responsibilities to reveal the affordance of two things towards each other. Accordingly, a wood becoming a cup represents that each piece forms the environment, and all data are transformed into substance with a conscious string of actions. In other words, while the state to fill palms with water to drink it defines the relationship between the need and form, turning a tree into a wooden cup is the transformation of the technique and material to produce an object to process the environmental data according to needs. In this case, the affordance created by the tree existing in the surrounding of the water drinking action and consciousness of humankind leads to the production of the wooden cup. A similar example is expressed by Gibson as: "is being able to climb a tree is our innate physical skill or did our body learn the skill to climb by evolving according to the shape and position of the tree branches?" According to Gibson, a monkey's action to climb a tree is related to that monkey's perception of the tree and climbing the tree with its own athletic characteristics. However, if the tree did not have a vertical body to enable the monkey to climb on, the texture of this body did not permit the monkey to grab it, and the structure of the tree was not as strong as to bear the weight of the monkey, the monkey would not be able to climb the tree. Gibson explains this as:

> "If a terrestrial surface is nearly horizontal (instead of slanted), nearly flat (instead of convex or concave), and sufficiently extended (relative to the size of the animal) and if its substance is rigid (relative to the weight of the animal), then the surface affords support. It is a surface of support, and we call it a substratum, ground, or floor. It is stand-on-able, permitting an upright posture for quadrupeds and bipeds. It is therefore walk-on-able and run-over-able. It is not sink-into-able like a surface of water or a swamp, that is, not for heavy terrestrial animals. Support for water bugs is different"(Gibson, 1979).

Gibson, James J. (1979), used the term "affordances" to characterize the interactions that exist between creatures and their surroundings. The affordances of the environment, as defined by J. J. Gibson, are what the environment affords or supplies to the animal, for good or ill (Gibson, 1979). Gibson defined affordance as what the environment provides to the animal, implying that the environment immediately conveys not only perception but also alternative behaviors. According to Gibson, an affordance is neither an objective nor a subjective quality, alternatively, if you choose, it is both (Gibson, 1979, p. 129).

James Gibson explains this as:

> "Terrestrial surfaces, of course, are also climb-on-able or fall-off-able or get-underneathable or bump-into-able relative to the animal. Different layouts afford different behaviors for different animals, and different mechanical encounters. The human species in some cultures has the habit of sitting as distinguished from kneeling or squatting. If a surface of support with the four properties is also knee-high above the ground, it affords sitting on" (Gibson, 1979).

According to Gibson, the observer may or may not perceive affordances according to his mutable needs, but possibility does not change and is always present. The object does not provide for the observer's need but presents what it does as an object. There is a lot of evidence that the child does not begin by identifying item attributes and then learning the combinations of traits that define them. Attributes do not constitute things, in fact, the reverse is true. The availability of an object is what the baby starts to recognize. The object itself is seen before it is realized as meaning, matter and surface, color, and form (Gibson, 1979). Gibson states this in detail as:

> "There is information in stimulation for the physical properties of things, and presumably, there is information for the environmental properties. The doctrine that says we must distinguish among the variables of things before we can learn their meanings is questionable. Affordances are properties taken with reference to the observer. They are neither physical nor phenomenal" (Gibson, 1979).

According to Gibson the term possibility introduced the environment as a way of describing the environment in terms associated with activities. However, environmental features that fit and support the characteristics of the organism are defined as "possibility". Thus, while a narrow opening enables passage for a small child and is defined as "possibility", it does not allow passage for an adult, what constitutes a playground equipment for a child may be a seating equipment for an adult. In summary, individuals perceive not all the possibilities provided by the environment, but an opportunity that has functional importance and appropriateness for them. In other words, the existence of possibilities depends on the coordination between the environment and the organism (Mumcu, 2019.). According to Scarantino;

> "But how do organisms pick up information? To pick up information,argued Gibson, is to become attuned to invariants and disturbances that specify to-be-perceived properties. An intuitive understanding of these technical notions is the following. An invariant is a property of the structure of ambient energy arrays4 (e.g., the optic array, the acoustic array, etc.) instantiated when, relative to some source of change such as a moving point of observation or a moving source of illumination, the structure is left unchanged in a way that is typical of the item specified (e.g., a reflectance can specify the substance ''coal'' by being unchanging in the

> way characteristic of coal substances). A disturbance is a property of the structure of ambient energy arrays instantiated when, relative to some source of change (e.g., the change constituted by an approaching predator), the structure presents a pattern of change that is typical of the item specified (e.g., the contour of an animal can specify the even‘‘approaching predator’’by changing in the way typical of approaching predators)" (Scarantino, 2019).

Though not directly related to design, Gibson (1986, p.130) says, "Why does man change the forms and materials around him? To change the possibilities it provides". Thus, a person makes what is beneficial more accessible, while reducing the pressure of what is harmful. Lang (1994) also states that the man-made environment can be adapted to enable desired behaviors, that is, the possibilities it provides can be changed. Chong and Procter explain possibilities according to perceptions as below:

> "To better understand how the concepts of affordance and direct perception relate to one another, consider an example presented by Mace (1977). In this example, one must consider a cellophane fig leaf that allows for optical information related to its transparency and size, among information provided to the other senses. Because affordances would be directly perceived, the cellophane fig leaf could be related to whether it can be seen through, hidden behind, and hammered with, among other actions that can be performed by an observer. According to ecological psychology, these directly perceived affordances would do away with the necessity of mental representations, such as those related to the object's properties of hardness, opaqueness, and so on. These representations would be outside of the observer–object relationship and thus would not be a part of direct perception" (Chong & Proctor, 2020).

It also states that if properly constructed, the artificial environment will provide support and protection for human activities. It states that any set of possibilities constitutes the potential environment for people's activities and aesthetic tastes. The active environment, on the other hand, is the environment that people pay attention to and that reveals possibilities that have meaning for them (Mumcu, 2019).

Erik Rietvald and Ronal Rietvald explain:

> "Affordances are possibilities for action offered by the environment—an environment which, in the case of humans, is to a large extent designed. Many interpretations of this theory of affordances are tied to motor behavior, such as the fact that something—like a cup or a book—can be grasped because of its dimensions, shape, texture, etc., or that the relatively horizontal, structurally supported, elevated surface of what we call chairs allows one to sit on them" (Rietvald & Rietvald, 2018).

There are two perspectives of Gibson's Theory of Affordance. One is that the organism is inseparable with its environment. Second one is that the organism directly perceives the information in an environment without mental processes alone. This theory is based on the interdependence between humans and their environment, in other words, on the ecological perspective (Heft, 2001).

Kyttä defined the physical opportunities or dangers that an organism perceives while in a particular location as affordances (Kyttä, 2004). Greeno defines the opportunities provided as prerequisites for activities (Greeno,1994).

3. A STUDY: THE STUDIO COURSE PRACTICE

3.1 Learning by Making: Methodology of the Design Course

Making is used as the method of the design course, which was questioned and deduced in the previous chapter. This process involves the designer's creation of object or space upon a requirement. It is to establish the production patterns and codes in the mind.

The making process, which is completely based on personal perception and action, has created a theoretical background for the first-year design courses of the TOBB ETU Department of Architecture. This process includes discussions on creation and reveals the products with the thinking and weighing side of the mind. Each object occurs as a product of human consciousness and intelligence.

This making process establishes a link between the intellectual side and the practical side of the building. This link defines a single mode of production in which the intellectual and practical advance simultaneously. The new qualities that the person recognizes, discusses the environment and matter over their meaning values, comprehends and designs them, and creates the new qualities that will be created as the embodiment of this state of representation constitute the whole. Since this unity produces personal creative acts, and therefore the unique, the structure is sought both as a product and as course content in the process of making.

In the course content, there is a thought system in which actions and objects produce each other, and expression values and technical principles work together. For this reason, the concept of making is semantically related to the technical term. Technique, like making, is discussed in its entirety of ideas and actions, and it gives information about making as an answer to how mental plans will become concrete elements. It seeks the response of transformative actions towards the substance, which it should have by its nature. Therefore, the term technique is the base content of the course on mental activities and transformative actions, rather than established ready-made methods. Students try to find structural experiments that seek the essence of formatting and ways of expression.

Figure 3.1 An example of student work

Thus, multiple production processes are created, which are formed by the diversity generated through the experiments of making. Each production process provides the creation of a new form and its autonomy of making method, because the knowledge and methods for formation emerges with personal findings.

The condition for a structural production to digress from current approaches and repetitive ready-made, clear methods, tried design approaches, known definitions, and to detach from determinative binding approaches is to discuss the results of discovering based on personal actions. Thus, the new situation or structures that will occur will be able to reflect their values and qualities. The unique process of making teaches designers the way of reconstructing as this thought system is about making. Therefore, in the field of education, rather than teaching knowledge, 'teaching to design the process of making, supporting insights or approaches based on intuition, self-discovery by making personal discoveries, making inferences' defines the final effort of the course.

It is expected that the content and tectonic comprehension of the studio courses, which have been held at the first-year level since 2012 at TOBB ETU Department of Architecture, will enter a flow towards finding a mental form for matter, concept, and

action. Thus, it is ensured that the structural forms and realities called the design codes are obtained by original intellectual and practical productions (Figure 4). What is referred to as the design codes in this studio atmosphere is the method of design processing and bringing material together with a method that will teach how to compose architecture as a way of tectonics. The design method used with materials is explained as adding, subtracting, overlapping, carving, stacking, knitting, bending, and clustering, as a result, the classical tectonic approach of making space.

From the first week of the class, students comprehend the basics of how an original architectural idea can be created and its design infrastructure with several projects like modeling and having a place for it or designing ahead. They learn what abstract thinking is and how they can present its structural tools like project “lindur spider”, “peiraye food”. Students learn to recognize the qualities and quantities that constitute a structure and to reproduce them. They comprehend the equivalents of the act of making between mental production and its realization in the context of architectural practices. They learn to define and construct a structure with concepts. They comprehend the general characteristics and principles of the act of making in architecture. They acquire the conceptual and intellectual tools of being innovative. Several projects from the first week of the class of 2021 are shown in the table below.

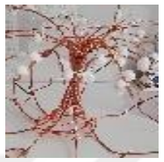
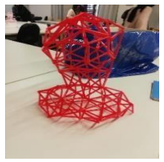
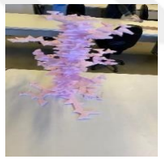
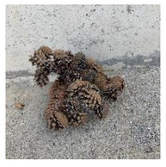
3.2 Creations of Design Codes

Design codes are the minimal parts of the noesis process between matter and form. It is the creation of a form around a requirement by the method of making.

At the origin of both classical and digital tectonics is the transformation of matter around a necessity and a method. There is a methodological difference between digital tectonic and classical tectonic. In the design studio course at TOBB ETU Department of Architecture, an in-between structure that is both related to the classical and furnished by the digital can be created. This in-between structure is a method of processing, a learning-by-doing item called *design codes* and bringing it together.

After producing the method that is at the origin of the digital tectonic, a method of development, reproduction or design can be developed.

Table 3.1 Students works process from the first week of the class 2021

	1. week (Design a Bird Lucifia)	2. week (Design a tree)	3. week (Design a monster)	4. week (Design your own body in 1/1 scale)	5. week (Design your own body in 1/1 scale)	6. week (Design a peacock)	7. week (Design a peacock)	8. week (Design a peacock)
Student 1								
Student 2								
Student 3								
Student 4								
Student 5								

Consequently, with the classical tectonic understanding, it is the establishment of the analog system that will create those codes and then allowing it to differentiate systematically after producing these design codes. With the help of digital software, not only a design can be created in the computer environment but also a method that will reach the design code can be created. Creation of that code provides the structure of the design. It can be said that before the designing, an origin for the construction method of digital production can be created by adding the representation of reality to the design parameter for the consistency of digital production.

With design codes, the structure of the source of the form can be found externally. In this case, it can be said that design codes are a catalyst that accelerates the development and eliminates the contradiction. Design codes are one of the objects that shape the form. With a balancing act in both aesthetics and technique, Branko Kolarevic introduces the concept of performative architecture (Andersson & Kirkegaard, 2006). It can be provided with design-sized codes to improve the performance of the building. Design codes can serve as both an aesthetic and technical adaptation tool in which the performative specialty of design is one of the parameters.

In addition, design codes can be related to discrete architecture. Discrete is simply an antithesis to what Patrik Schumacher refers to as "Parametricism." It is composed of discontinuous and mostly straight forms, whereas Parametricism is of continuous and curved forms. Gilles Retsin, on the other hand, says that the discrete is more than just a popular statement (Leach, 2019, p.137). Discrete architecture, unlike Modernism or early digital work, is no longer defined by fixed hierarchies between predefined pieces, but rather becomes free, open, and changeable (Retsin, 2019). Prior to assembly, building elements regarded as hierarchically equal, generic units have no function or significance (Retsin, 2019). The emergent quality of the interplay between pieces is meaning and function. He describes discrete architecture as concerned with the creation of design methods for serially recurring, re-combinable sets of generic discrete pieces that may be combined into fully functional and sophisticated structures (Retsin, 2019). He states:

> "Discrete are equally critical of the paradigm of continuity and the last two decades of digital work. For them, the narrow focus of early digital architects on formal continuity, mass-customisation, style and craft is problematic and disconnected from the pressures of our current world. However, rather than merely rejecting the digital, this new discourse understands that

> architecture cannot just remain analogue in an increasingly digital world. Post-digital, image-, object- or affect-driven architectural culture seems indeed equally, if not even more so ill-equipped to face the impeding challenges" (Retsin ,2019).

He also mentions about discrete architecture's capability to be an input for digital as:

> "The initially Modernist understanding of architecture as an assemblage of prefabricated, discrete elements here enters the new domain of the digital, resulting in an automated architecture that is both effi cient and mass produced" (Retsin ,2019).

Jose Sanchez explains discrete architecture in detail as:

> "The Discrete tectonic paradigm privileges autonomous units, parts that are not subsidiary members of a whole. Parts can be recombined into multiple permutations identifying an open-ended tectonic field condition. The scale of such parts is relevant and again linked to a social structure that is able to manufacture, handle, recombine and deploy them" (Sanchez. ,2019, pp. 24).

From there, in design studio courses at TOBB ETU Department of Architecture, students begin creating with design codes parameters. In this point of the design process, students decide their main materials, second materials, scales, and various input to create the resulting work.

Table 3.2 : Design codes parameters from student works

	MAIN MATERIAL					OTHER MATERIAL	METHOD									MATERIAL DIMENSION		LENGTH (CM)																NUMBER OF BINDINGS		FORM					RESULT
EXPLANATION	WOOD	PLASTIC	METAL	PAPER	ORGANIC	STRAW	OVERLAPPING	INTEGRATING	ADDING	FOLDING	BINDING	KNITTING	NOTCHING	SCREWING	CARVING	WIDTH	LENGHT	5	6	7	8	9	10	11	12	14	15	16	17	18	19	20	24	10-AND MORE	10-AND MORE	SQUARE	RECTANGLE	TRIANGLE	CIRCLE	ORGANIC	
PICTURE																																								Volumes of varying sizes were produced by threading straws of different lengths into 1 mm thick skewers The irregular form of straws and skewers created a solid structure.
HEAD																1mm	3cm																								
BEAK																1mm	3cm																								
BODY																1mm	5cm																								
WING																1mm	6cm																								
FEET																1mm	2cm																								

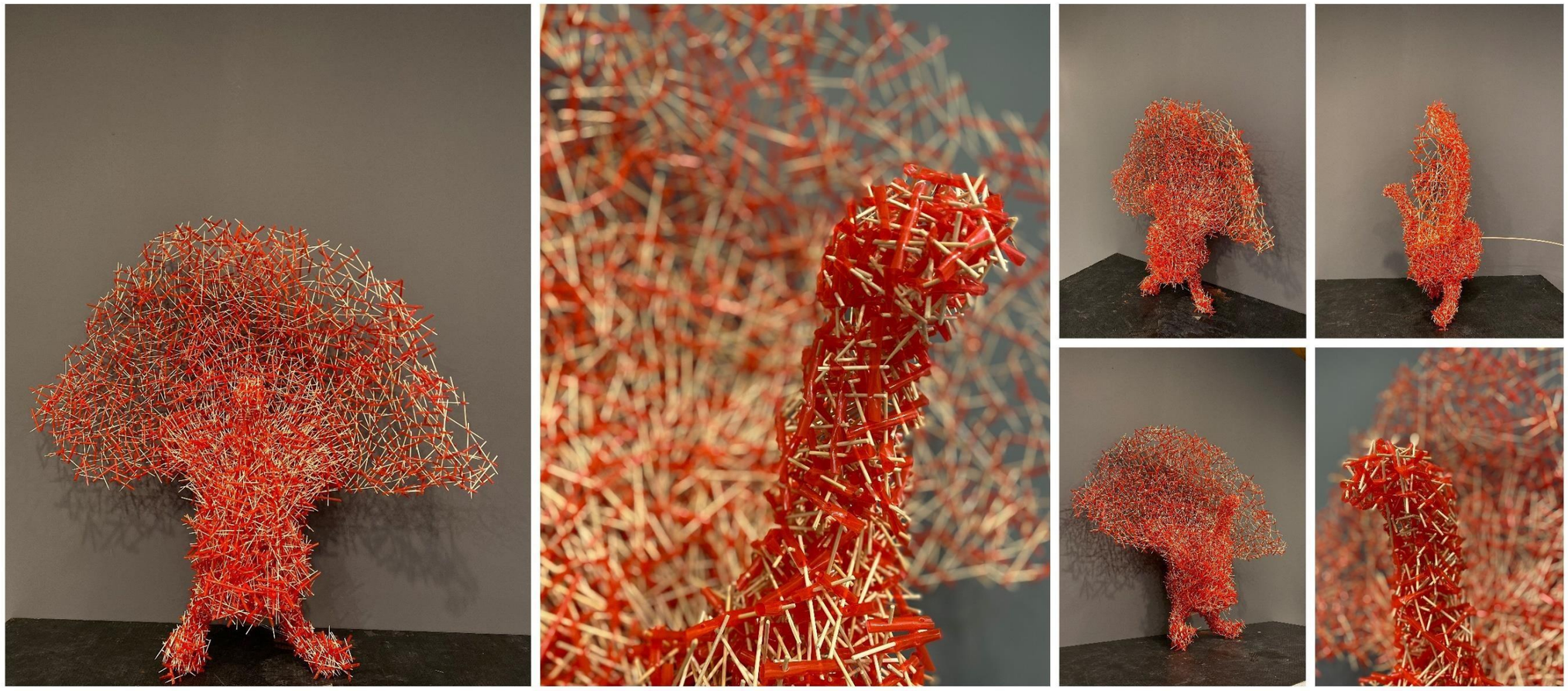
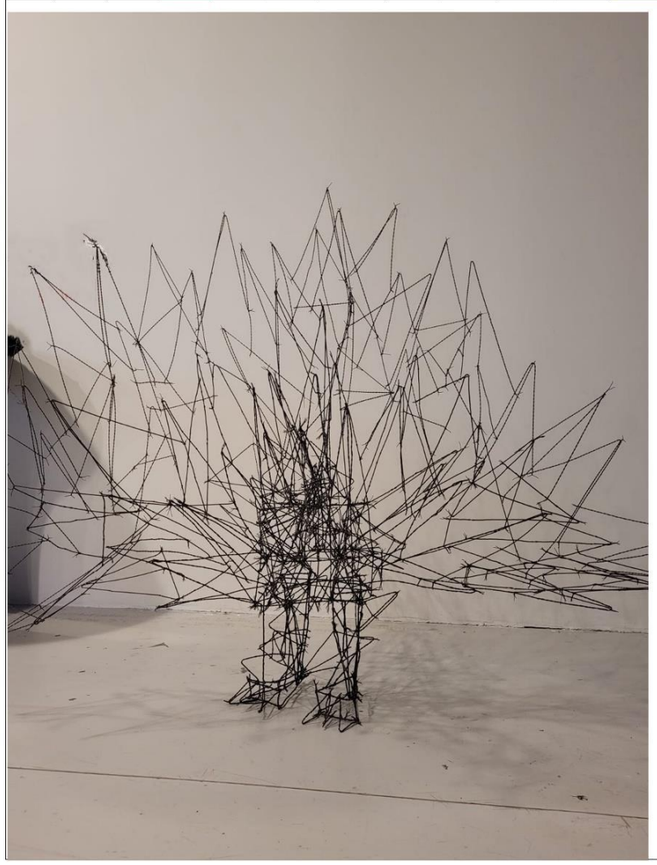


Table 3.2 (Continue): Design codes parameters from student works

	MAIN MATERIAL					OTHER MATERIAL	METHOD									MATERIAL DIMENSION		LENGTH(CM)																NUMBER OF BINDINGS		FORM					RESULT
EXPLANATION	WOOD	PLASTIC	METAL	PAPER	ORGANIC	STRAW	OVERLAPPING	INTEGRATING	ADDING	FOLDING	BINDING	KNITTING	NOTCHING	SCREWING	CARVING	WIDTH	LENGHT	5	6	7	8	10	12	14	15	16	18	20	23	25	28	30	35	1	2	SQUARE	RECTANGLE	TRIANGLE	CIRCLE	ORGANIC	
PICTURE																																											Construction wire in double, triple, quadruple, body head and wings; I obtained the peacock by using the wires I knitted in quadruple, triple and double, and connecting them together in triangular forms.
HEAD																																								
BEAK																																								
BODY																																								
WING																																								
FEET																																								



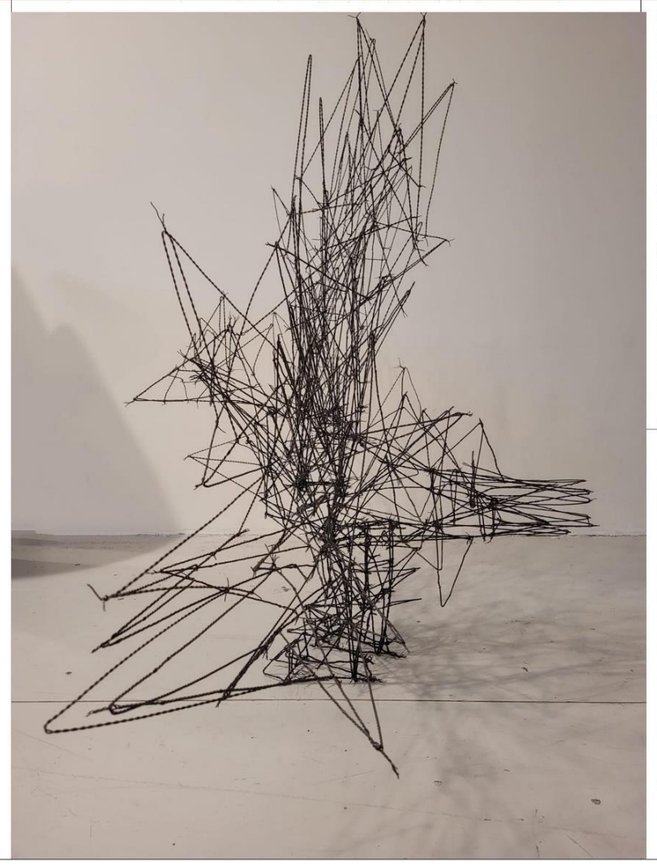


Table 3.3 : Design codes projects between 2012-2021

	Wood							Plastic							Metal						Paper		Organic
Material	Wood				Skewer	Conifer cone	Pencil	Plastic	Clothes pin	Plastic Bottle	Straw	Foam		Pipe	Wire		Nail	Pipe	Metal	Aluminium foil	Cardboard	Paper	Bamboo

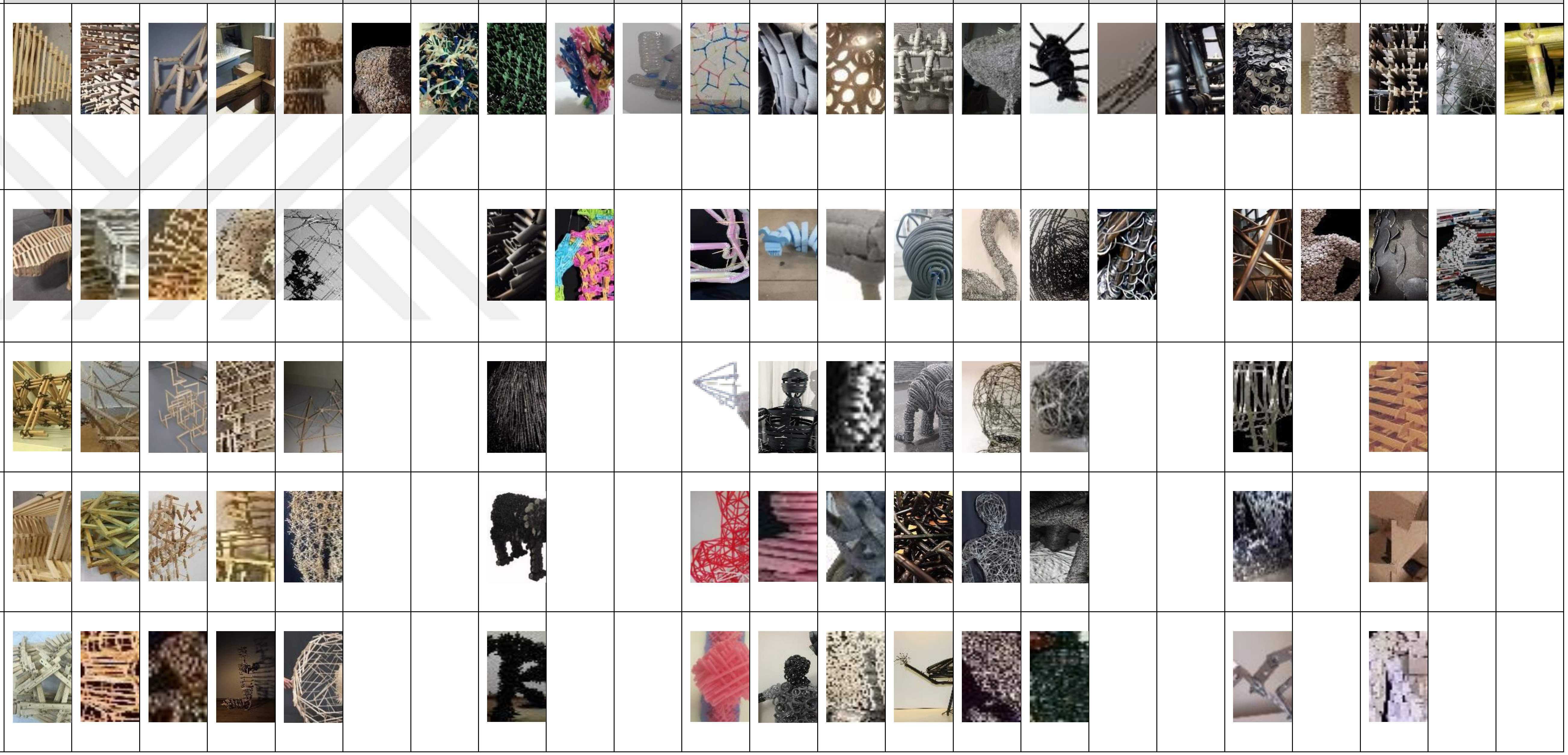
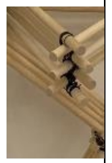
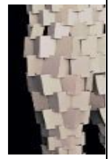
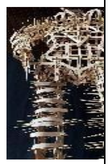
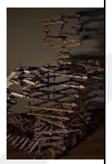
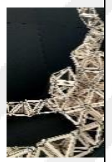
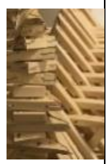
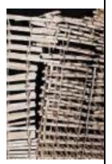
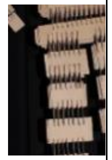


Table 3.3 (Continue): Design codes projects between 2012-2021

Table 3.3 (Continue) : Design codes projects between 2012-2021

3.3 Using Design Codes for Creation of Space

The space is aimed to be created after the design codes are generated.

The background of the architect's sensitivities is established with the student work in the studio course. The architect must know the material, creation of the form, and the sub-parts in creating the space. Although the architectural products are not digital and remain in the field of classical tectonics, they may be the background work of intuition, and therefore, technique. Superposition, addition, and subtraction exist computationally in digital tectonic, as well as in classical tectonics. It can be said that the intuition part has changed while these methods transit from classical tectonics to digital tectonics.

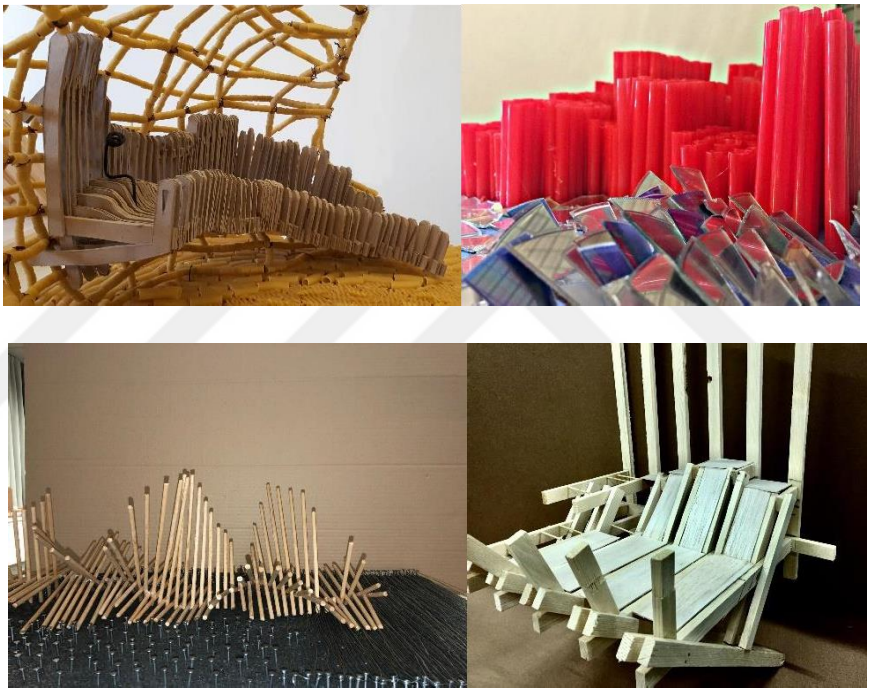


Figure 2.2 TOBB ETU design studio student projects

With basic expansions and sub-concepts to the concept of making, this course directly touches the field of architecture. In this course, it is aimed to discuss the contents of the main elements that compose the space (context, floor, action, roof) to produce the space. In this context, students' understanding of matter and handling of materials form the basis of discussions and studies in producing space. It is important that students can transform the essential elements of the space into a structural whole, with the assumption that they know the content of the concept of making and acquire personal understanding in this course (Sönmez, 2018).

The main subject for the course is tectonic architecture. It is sought to discover what will be the leading role in the structure and how to develop its structural contents and programmatic counterparts. Students first define a context through their visions, and discuss the structural elements of architecture, the floor, the wall, and the roof, over this image. Then, they begin the design process through the definition of action in the context. When students start to design a wall, combining it with action and thinking of the wall itself, it is built on the design code's content. The digital tool provides what appears to be a notion of digital-based techniques with the transition from form-making to form-finding (Kolarevic, 2003). Oxman states:

> "Gaudi's (1852-1926) use of physical modeling is considered to have introduced the method of form-finding experimentation as a process of design. In other words, he may be considered to have contributed to the emergence of a method of structural tectonics. In such a method, the modeling enabled the study of the structural influence of changing tectonic relationships. Frei Otto expanded these classical relationships between form and structure in his pioneering experimental and research-oriented approach to material form-finding in structural design" (Oxman, 2009, p. 940).

Greg Lynn was one of the first architects to use animation software to create forms rather than creating representations of future buildings (Andersson & Kirkegaard, 2006). Therefore, instead of a presentation, a computer was used as a design tool. With the design codes helping to create computational techniques, the possibilities of computational space are expanding and allowing the transition directly to the field of digital tectonics. Wassim Jabi states in article about education and tectonics relation in "The Intersection of the Physical and the Virtual" as:

> "Digital tectonics challenge architects to explore new ways of conceiving, analyzing, and manufacturing structures that remain true to the tectonic tradition while addressing the shifts in culture and media towards the digital. Educational institutions were at the source of the fundamental shift to digital tectonics that we are witnessing today, yet they need to be aware of some possible pitfalls and biases that are built into the tools they are deploying." (Jabi, 2004).

Design codes prevent the computer from being used as a form, and allows students to use it as a finding form. Design codes provide a creative limit to limitlessness in computer technology to certain extent. With the advent of computer technology, it is possible to combine almost every material with any given structure, since structures

can be sized in detail before they are built, and materials can be modified and properly reinforced to fulfil the demands of the architect. Data such as gravity appears on the computer as an abstract content. This suggests that nothing concrete can be a factor in the computer. Therefore, architectural studio progress and outputs, one way or another, mean that the data of the concrete field is collected in a context.

Table 3.4 Creation of space students' projects between 2012-2020

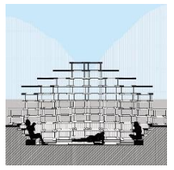
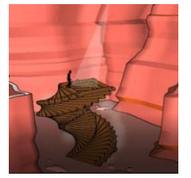
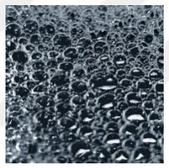
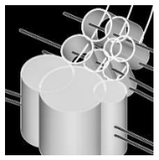
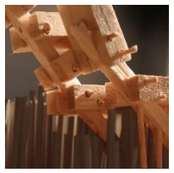
Method	Inspiration	Material	Context	Action	Design Codes	Classical Tectonics Process	Digital Tectonics Process
Adding							
Subtracting		Wood					
Knitting		Pipes					
Overlapping							
Bending							

Table 3.4 (Continue): Creation of space students' projects between 2012-2020

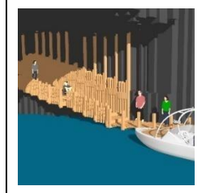
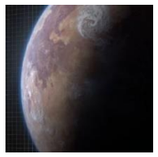
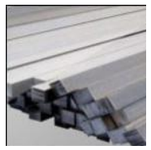
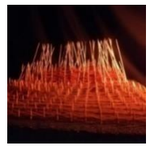
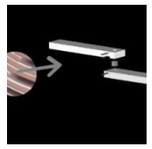
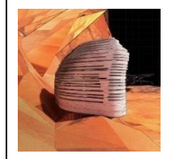
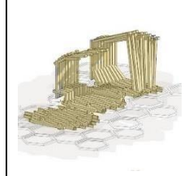
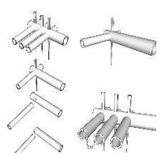
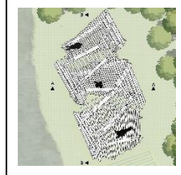
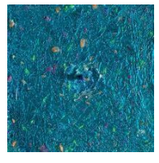
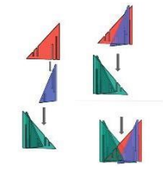
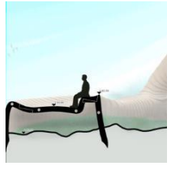
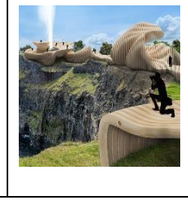
Subtracting		**Wood**					
Clustering							
Adding		**Wood**					
Subtracting							
Knitting							
Overlapping		**Wood**					

Table 3.4 (Continue): Creation of space students' projects between 2012-2020

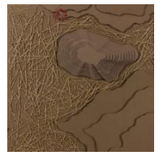
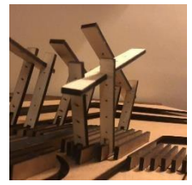
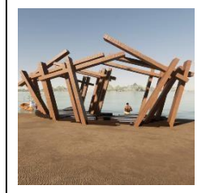
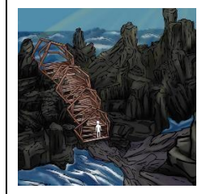
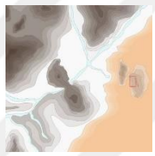
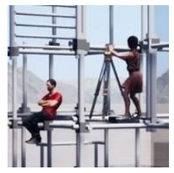
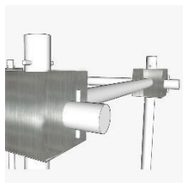
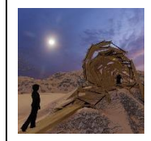
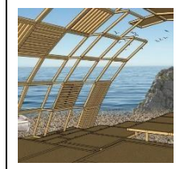
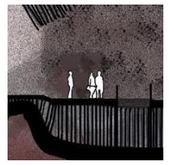
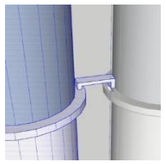
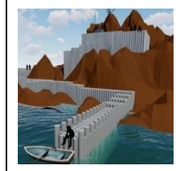
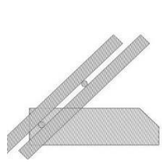
Bending		**Wood**					
Subtracting		**Wood**					
Clustering		**Pipes**					
Subtracting		**Wood**					
Overlapping		**Wood**					
Bending		**Wood**					

Table 3.4 (Continue): Creation of space students' projects between 2012-2020

Subtracting		**Wood**					
Knitting		**Wood**					
Overlapping							

3.4 Hybrid Tectonic as an Inference

Table 3.4 : Analysis of classical, digital and hybrid tectonics

	Main Concept	Sub-Concepts	CLASSICAL TECTONIC	DIGITAL TECTONICS	Hybrid Tectonic • Both classical and digital • Either Classic or Digital • Either classical or digital, but with the other
TECTONIC	**Noesis**	Context	Unlimited (Maximum optimization)	Limited (Limited optimization, organized around selected data)	Optional limited (Context can be constrained around preferences that can customize some design and manufacturing data by grasping all the data of the context, allowing a higher optimization within the context of optional data entries)
		Action / Need	Linear, based on experience, rational	Multi-layered as a string, built on relationship networks, parametric, containing optimizations	Multi-layered as a string, built on relationship networks, parametric, containing optimizations
		Form	Rational, geometric and defined formed	Rational geometric and formless	Cyclical (Sometimes with a defined form, sometimes formless. The designer can form it as he wishes in line with his preferences such as context, action, material)
		Material	Concrete (reality)	Abstract (representation)	Optional concrete (to grasp all the data and capabilities of the material and to have the possibilities to process the realities grasped through representative features when necessary)
		Construction Method	Technical (intuitive), knowledge of making (poesis of making), Associated with culture and craft. A technical problem. (Actions for making such as bending, adding, subtracting developed through craft knowledge) Based on chance, creativity, and the qualities of the material.	Technological (computational, parametric) Associated with the computer program and its possibilities and knowledge. A technological problem. (Construction-related actions such as bending, subtracting developed over predefined operations)	Intuitive parametric requiring new codes to be written (grasping the machinable capacity of the material in reality and processing it to transform into a form may require producing design actions in a digital environment.)
		Production Form	Unique	Multiple	Cyclical (Including sometimes unique and sometimes multiple modes of production, which can be fed from the knowledge of both classical and digital around the preferences of the designer)

		Senses (intuition) (experience)	Being directly present in context and space (instantly interacting with and sensing the climatic and spatial data constituting the context and their unpredictable changes and transformations)	Existing in the representation of context and space	Cyclical (Sometimes it can be found directly in the context and space sometimes in its representation, the data of both can be processed on a common ground and the content forms according to the preferences of the designer)
		Design Process	Intuitive	Transparent	Cyclical (Sometimes intuitive, sometimes transparent. Being able to manage depending on the designer's preferences within the scope of design and production phases)
		Presentation / Generation	Knowledge of Techne (Associated with the knowledge of making)	Knowledge of Technology (Associated with software information)	Cyclical (Knowledge of totality)

- It can be stated that the context in the new tectonic is formed in a cyclical content that goes back and forth between reality and representation, feeding on both classical and digital tectonics. The real and unlimited data of classical tectonics, as well as the limited and information-oriented environment of digital tectonics based on representative parameters, enable new tectonics to benefit more from the context. For example, the effect of environmental factors such as sun, rain, wind, shade on the design and construction can be reviewed at any stage of the design. The design of the surface can be altered when a surface and the shadows created by the daylight affecting it are analyzed. Likewise, the wind effect on the building can make the form stand out as a prime design element in the design of the building in terms of the possibilities provided by the added data.
- In hybrid tectonic, context, like classical and digital in the same context and action definition, evolve into an optimization defined by locations and mathematical data of these locations different from the content developed over different intuition and experience. It becomes clear that the design process exists over certain constancies, since the computer optimizes the design parameters same with digital tectonics, the content for the location, form and action of the design is optimized.
- The form is transformable as it is created in the new tectonic using both rationality in classical tectonic and amorphous forms in digital tectonic. The rationality of form in classical tectonics can be rendered fluid in digital

- tectonic, especially by means of parametric construction methods. In the hybrid, the rational form that emerged as a result of the classical making methods contains the possibilities that could become fluid after the use of digital tools. The transfer of classical production to digital takes the rational qualities of the form to a fluid dynamism.
- In the hybrid tectonics, the material is concrete. The concrete material that is directly related to classical tectonics also feeds the field of representation in digital tectonics. Although the design continues in the digital environment, the representative and abstract situation in the digital environment is never disconnected from the concrete reality because the knowledge of what to do with the material has been learned before. Thanks to the information about the material in the digital environment, the method and form of making the design are being improved on the one hand, and it is possible to conduct new experiments that will feed the digital one in the environment of classical tectonics on the other. The variety of materials can be increased by experiencing the possibilities provided by the real environment.
- After the technique has been developed intuitively in classical tectonics, it is made computable in digital tectonics and transferred to the digital environment. As new parameters are added to the architectural product, which has started to be developed in the digital environment, the construction method requires different digital interfaces. With the new tectonic, the method of making becomes parametric rather than intuitive. In this process, the parametric sometimes requires producing new data and using different digital software by producing new codes. In classical tectonics, the intuitive method of making and understanding how the material can be processed in its own reality means developing its own construction method/technique. Producing the digital equivalent of this technique is related to the possibility of the program. Hybrid means generating the codes of a technique similar to classical tectonic in digital by enabling digital to acquire new possibilities for classical technique.
- The method of production in the hybrid tectonics is mixed. In classical tectonics, the relations between form and production produced through a single product, and in digital tectonics, the contents and possibilities for form and production in accordance with the data of the parameters constitute a structure in the new tectonics that feeds from both. In the new tectonics, the possibilities

of relations established between classical tectonics and a single product are searched in the digital environment.

- In the hybrid tectonics, the senses are cyclical as they create the situations in both classical and digital tectonic simultaneously. In the new tectonics, all the context-related data of the classical tectonic field are directly exposed to environmental factors affecting the senses, while the representation area of the digital tectonics field is formed by all environmental data affecting the senses.
- In hybrid tectonics, the design process is cyclical. In this context, hybrid tectonics may build on intuition to process the contents of noesis in classical tectonic and may develop through choices made over the possibilities created by transparently entered data in digital tectonics, as well.
- The process of transforming the design into an object, which is expressed by the presentation in hybrid tectonics, at times occurs with the establishment of information about the object in classical tectonic, and occasionally with digital software in digital tectonic.

This new tectonic approach consists of the contents of both classical and digital tectonics. This state occurs in a way that includes both classical and digital, classical or digital, classical or digital but also with the features of the other. In other words, although hybrid tectonics is not entirely new, it contains new conditions and contents in the context of the weight of classical and digital processes and because it is a mixture. Therefore, it can be said that hybrid tectonics is a tectonic structure that is mixed with both but has its own meanings and expressions, as well.

4. CONCLUSION

In this study, the creation of space (poiesis of space) or production (production of space) is discussed in the context of the concept of tectonic. The relationship between the concept of tectonic and technology was examined in the context of the concept of noesis. Discussions under the title of classical and digital tectonics are the results of this review.

This study, in which the meaning and expressions of the concept of tectonic are questioned in the context of two main focuses as classical and digital tectonic approaches, the expressions that the concept of tectonic contains in the production of space in contemporary architectural thoughts and practices and its new expressions different from or consisting of these are discussed. This new tectonic approach is expressed as hybrid tectonics, as can be seen in Table 4.5 in the Comparative Analysis section, that is dependent on the classical and digital meanings of the tectonic concept in contemporary architecture and is fed by both the content and the possibilities of these two tectonics for each other.

The study concludes that hybrid tectonic approach is a mixture or cross-section of classical and digital tectonic approaches, as a result of the possibilities provided by these two primary tectonic approaches to each other.

The search for the equivalents of the classical, digital and hybrid tectonic features of the tectonic concept in today's field of education is a result of the conceptual and theoretical contents of this thesis, such as the inferences of this thesis and the possibility used by these inferences.

The results of the claims made according to the scope and problem focus of this study in the context of research and experimental studies are as follows:

- The claim that the concept of noesis is at the root of the tectonic understanding in architecture, and that the concept of noesis is a fundamental element in understanding and comprehending tectonics, although the relationship between technology and tectonic has changed, has been confirmed.
- The claim that classical and digital tectonics, which are the results of the theoretical research on the concept of tectonic, cannot be sharply separated

from each other in terms of meaning and expressions in contemporary architecture is true. Because nowadays, it cannot be said that a period was entered where classical tectonic understanding and productions are left behind and digital understandings dominate completely. Both the production and the theoretical contents of the space continue under the influence of different tectonic approaches. In this context, when different tectonic structures such as material, form, construction method, action, senses, design process, production technique are examined within the scope of the concept of Noises, it is seen that the meaning contents of classical and digital tectonics are shaped around the aforementioned contents of this concept. Classical and digital tectonic differences occur more in practical or production-oriented areas. For example, in the context of the production of space, material means the same, a concrete situation for both tectonic approaches, but the presence of the material in classical as reality and representation in digital is an element that makes the difference. In this context, although there is no mention of a completely different or sharp distinction between classical and digital tectonic approaches in terms of content, it can be mentioned that there are differences in expression and production that establish the contents.

- The claim that classical and digital tectonics are possible for each other in current conditions has been confirmed by the definition of mixed tectonic structure, which is defined as hybrid tectonics. The sub-concepts that constitute the classical and digital tectonic approaches, on the one hand, feed the contents of these two tectonic understandings, and form the essence of a mixed tectonic understanding on the other.

As a result of the tectonic understanding reached by this study, the content, and results of this hybrid tectonic understanding in the field of architectural education have been questioned. The following results were obtained by processing the tectonic concept with the classical and digital tectonic theoretical infrastructure at the first-year level in TOBB ETU Department of Architecture:

- Designers understand the basics of how to create an original architectural idea and its design infrastructure.
- Designers learn what it is to think abstractly and how to demonstrate its structural tools.

- Designers learn to recognize and reproduce the qualities and quantities that constitute a structure (Sönmez, 2018).
- They comprehend the equivalents of the act of "making" between mental production and its realization in the context of architectural practices.
- They learn to define and construct a structure with concepts.
- They comprehend the general characteristics and principles of the act of "making" in architecture (Sönmez, 2018).
- This course will help students to realize original structural productions based on their education through experiments in the applied field.
- The discovery of the production of space will increase.
- The transfer of design genes and 3D model production to the digital environment will be made for students to create the possibilities of space production.
- It will lead students to develop conceptual tools and general abilities in the design they will produce.

On the other hand, it allowed students to see the content related to the context and action in the relationship established with the material and method. This experimental course enables the student to develop construction methods. It is aimed to transfer the basic content of the design, which will move the production area created by learning by making, to the digital environment and to ensure its continuity with computer software. Learning about space creation in the context of classical and digital tectonics for students includes making personal discoveries in the digital environment in the continuity of production by making and producing and learning original spatial productions with various inferences.

As a result, situations that develop between classical and digital tectonic require hybrid tectonics. Hybrid tectonics needs new research and experiments to define its content and practical counterparts in the context of its relations with the concept of Noeisis. In this case, design genes produced by classical tectonics are tested with digital means in this course. Innovative insights in education require more research, can enable greater collaboration between education and the practical environment, and may require greater input of technology into education. Thus, new relations are established between the material and the method of construction. The possibilities are learned by transferring the information learned from classical tectonics to the digital environment.

From this point of view, new architectural approaches are included to the formation of the digital world.

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