Tectonics (of Earth and Architecture) through a Physical Model: Conceptual and Corporeal Tools of an Architectural Design Studio

By inquiring into the tectonics of earth and architecture, this study tries to reveal different ways of conceptualizing their place in design education. It pays particular attention to interrogating the scope of tectonics and tries to narrow down the options using conceptual and corporeal tools. While the term tectonics is under focus as a conceptual tool, the physical model is employed as a corporeal tool in the process. The aim of the study is to define tectonics through bilateral relations such as relationalities, dualities and dichotomies, and thus revealing to students, a powerful method among others, a flexible approach to the idea generation stage. The discussions in the process focus on the analysis of the tectonics of the earth and researching its reproduction by means of a model, and how this form of representation affects the production of space. The final product can be considered as a methodical tool by which the relationship established with the site and the concept of tectonics is put to question through a model, thus revealing an answer as end result.

Keywords: *Architectural Design, Architectural Design Education, Tectonics, Stereotomics, Physical Model*

Introduction

This paper aims to research the concentric relation between the *tectonics of earth and tectonics of architecture* through three dimensional physical models reproduced by students. It pays particular attention to interrogating the scope of tectonics and tries to narrow down the options using conceptual and corporeal tools. Tectonics' miscellaneous properties such as referring to the activities of making, producing and designing; and being related to material, form and meaning shows its proceeding through bilateral relationalities. In this context, the study deals with tectonics through bilateral relations and it is predicated on a fictitious process in an architectural design studio. While the main aim is to search for a way of anchoring to the site, the conceptual background depends on an inquiry into tectonics. With an emphasis given to the relationship of site – tectonics; importance attached to the students' awareness on the bilateral relations of these two concept and students' conscious decisions on settling on earth. Within this scope, tectonics is handled in two aspects: The tectonics of earth and tectonics of architecture. Their coexistence, feeding from the earth's tectonics, determines the approach that sustains or breaks their sequentiality. Understanding and interpreting tectonics, and the subsequent representation and reproduction, which results in a unique approach to the site are the basic building blocks of this process.

We formulated the first step in the architectural design studio as raising an awareness to the site with an emphasis on tectonics. One line of argumentation

spanning the whole semester, took into issue this relationship between the site and its tectonics. The crucial question to discuss these concepts in, is “how to anchor to the site?”. Yet, there are also sub-questions that serve to lead students to find out the manifold ways of articulating the site: “Do the sites’ way of representation affect the design idea?; Do the tectonics of the model material affect the tectonics of the space?; Does the way in which the model is made, reveal the sites’ hidden features?; Does the way of representation provide us with a tool to design spaces?. The vital apparatus of this query lies in both the conceptual and physical levels. The conceptual apparatus questions the dichotomy between tectonics and stereotomics. These two concepts are here employed with reference to both the space and form of the site. The physical apparatus—especially used in the initial phase—is a three-dimensional physical model. The main aim in pursuing this method in this studio is to maintain a flexible thought process of anchoring to the site. In addition, it is important to understand tectonics through relationalities, dualities and dichotomies and to define them accordingly. In line with these aims, firstly, the concept of tectonics is put under investigation and its relation to the concept of architecture is underscored.

We explain using the literature heretofore published the reason why we locate tectonics as the focus of the study. Herein, it should be mentioned that the focused literature is mainly composed of three prominent names, Karl Bötticher (2002; 1844), Kenneth Frampton (1995, 1996, 1998) and Maria Karvouni (1999), who concentrated tectonics into various perspectives. Along with the literature review, in-depth research of these names’ expressions and visualizing them by converting into concepts enabled us to refine the concept, tectonic, and reveal the bilateral relations. Accordingly, we also expressed our comprehension on the concept and presented it as a visual in a similar way with the previous ones.

Then, we use the fictitious thought process of the authors in order to convey the execution process of the architectural design studio process, focusing especially on the tectonic relationality of the site and students approach to it. This format we propose is best embodied in the three dimensional model reproduction by students. The discussions in the process focus on the analysis of the tectonics of the earth and researching its reproduction by means of a model, and how this form of representation affects the production of space. Viewing the reproductions in terms of tectonics reveals implications that provides students with a useful method of inquiry. Finally, the study aims to articulate alternatives in conceptualizing tectonics in architectural education and design courses.

Tectonics over Bilateral Relations

The term tectonics is taken from geology where it indicates the study of large-scale movements and changes in form of the planet Earth. It includes ideas of disintegration, reuniting and merging of components, as a result of

natural effects such as earthquakes, temperature differences, volcanic eruptions, or aelion phenomena. In architecture, the term is employed in with an added geographical meaning, including the idea of *fragmentation* and *reunification*. In different parts of the world's surface layers, this dual action may appear as a continuous movement —at times slow, and at times fast. Therefore, the earth, which seems to have a more dominant stereotomic feature, can be said to also exist with its own, indigenous tectonics.

The origin of the word, tectonics, indicates that it is inextricably linked to the etymology of the term architecture. The term comes from the Greek word *tekton*, and signifies carpenter or builder (Frampton, 1996; Karvouni, 1999). This double reference to both carpentry and construction is significant, as in the classification systems of the arts from ancient times, architecture was included among the seven mechanical arts (Kristeller, 1951). Although Vasari categorizes architecture as being among the visual arts, we know that prior to the establishment of the fine arts system in the 18th century, architecture was always included in a class related to construction (Kristeller, 1951, p. 508). Hence the word *archi-tekton*, which means architect.

Tectonics proceeds through bilateral relationality, as seen in the previous explanations of the original form taken from geography, along with the etymological origin related to architecture. It refers to the activities of making, producing and designing while it is also related to material, form and meaning. According to Stanford Anderson (1981), tectonics refer not just to the construction with requisite materials of an object or space that answers to a certain need, but rather to the activity that raises this construction to an artform. So, a holistic view of the architectural product and the process of construction would also have to take into account references to meaning and aesthetics. This holistic dimension of the term can be traced in the following theoretical explanations that are generally established over relationalities, particularly in dualities and dichotomies. These explanations foreground the fact that bilateral relations are what the concept of tectonics progresses through.

Karl Bötticher (2002; 1844), who is best known for his theory of architectural tectonics, concentrated tectonics into two perspectives: their ontology, that of *"kernform*" and their representation, as in *"kunstform*." In his perspective, *kernform* was related to the functional, structural and cultural purposes of the object, while the *kunstform* was all about the aesthetics and purposes of its expression, that is its representation. Here, the holistic view takes into account the combination of the structure and material, along with the aesthetics and expressionist purposes. On the other hand, Kenneth Frampton (1998, p.30.), who defends that "[t]he primary principle of architectural autonomy resides in the tectonic rather than the scenographic..." defines it as a path that focuses on the poetics of construction and aesthetic expression. Accordingly, environmental factors and local culture are also counted among the factors that affect tectonics (Frampton, 1995). Frampton (1998) argues that it is one out of three essential characteristics of architecture, the other two consisting of *the topos (the site) and the typos (the meaning).* Here the intricate

relationship of dwelling and meaning with tectonics comes to the forefront. Related with the "typos", Frampton also points out to an alteration in the meaning of the concept throughout history. In Homer, the tectonic "alludes to the art of construction in general." In the fifteenth century this meaning expanded to include "a more generic notion of making, involving the idea of *poiesis*." (Frampton, 1996, p.3). After this point on, *poiesis*, an aspect of tectonics that is based on meaning and which progresses at a more abstract level emerges.

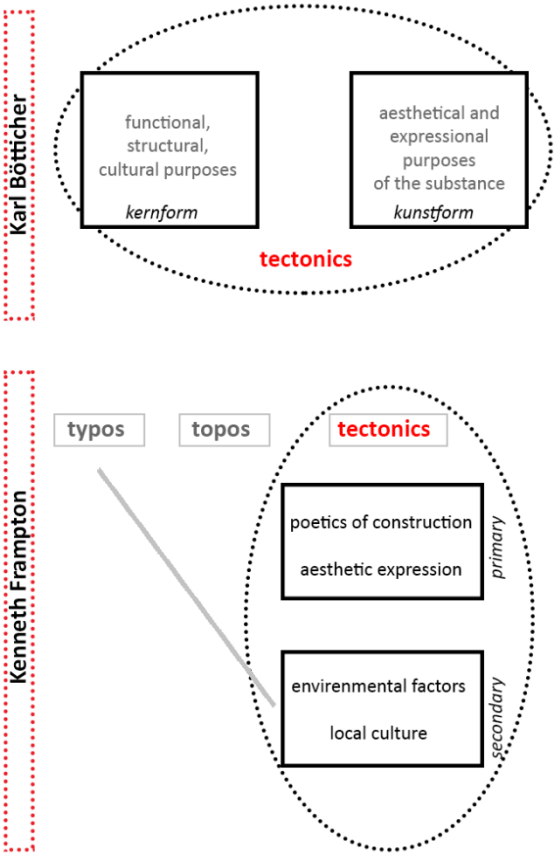

Figure 1. *Reflections from Frampton's and Bötticher's ideas of tectonics (authors)*

Along with Bötticher's (2002; 1844) and Frampton's (1995, 1996, 1998) definitions which focus on the expression of the concept, the executive operations of tectonics also include bilateral relations. Thus, Maria Karvouni (1999, p. 106) explains the basic operations of *tecton* as follows: "A *tecton* cuts and joins, divides and connects. Dividing and composing are also the two main modes of operation by which an art (*techne*) proceeds, according to Plato. Surprisingly, the *tekton* is the only artist-artisan who shares with *techne* the common root 'tek'". From this point of view, Karvouni (1999) establishes the connection between *tecton* and *techne* not only because of their similar origin

but also because they employ a similar methodology. The relation of the *tecton* with the *techne*, thus *poiesis*, indicates a meaning that goes beyond being a work in mechanics. This relation implies something hidden and may refer to Frampton's concept of typos-meaning. *Techne* is the revelation of what is hidden. In this context, Heidegger's thoughts provide us with food for thought about the concepts of "*techne*" and "*poiesis*", which we see in relation to the concept of *tecton*. Heidegger reads the concept of *techne* in a different context than making and using material. "*Techne* belongs to bringing forth, to *poiesis*," and "it [*techne*] is as revealing, not as manufacturing, that *techne* is a bringing forth." (Heidegger, 1997, p. 319). From this point of view, we see that the act of doing and its stages are actually associated with meaning rather than the simple act of doing. This, the action of doing being strictly related to *poiesis*, helps us unearth the embedded relations of tectonics with meaning.

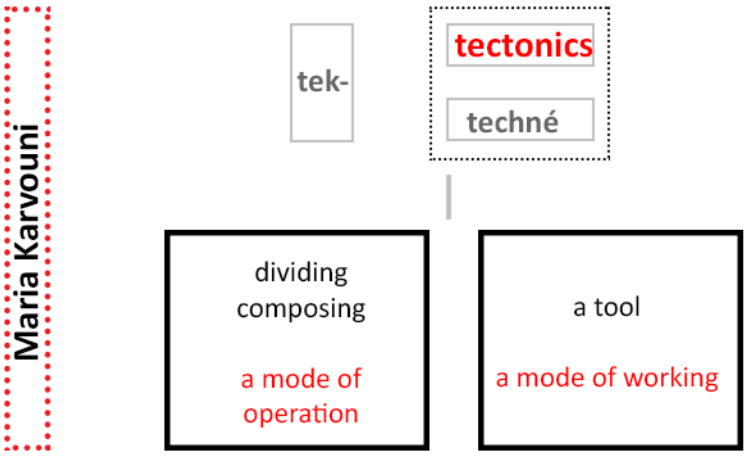

Figure 2. *Karvouni's perspective on tectonics* (authors)

With the separation and joining operations that *techne* and *tecton* contain, the difference between the concepts of tectonics and stereotomic also surface. Stereotomic basically can be defined as an activity of design that proceeds from the whole. Although Karvouni does not use the concept of stereotomic, she reads the *tecton* in terms of the applied operation through the duality of using a tool and producing manually, including all the interruptions and continuities the process entails. According to her (1999, p.106): "A tekton's mode of working requires a tool (the axe), unlike work done with bare hands, such as molding (platto, to mould, is related to palame, palm, hand). Whereas molding involves continuity, tectonics is defined first by the discontinuity of cutting and then by joining. Tectonics deals with the arrangement of "distinct units" that the *tecton* first shapes with his tools and then places and joins together." Thus, the continuity and hand-shaping present in the dualities that Karvouni puts forward seem to refer to the concept of stereotomic. Seen from this point of view, the concept of tectonics also includes the idea of division and uniting the parts formed as a result of this division. Stereotomic, on the

other hand, refers to a more holistic approach with mass rather than parts. Semper puts forward the dichotomy between stereotomy and tectonic as being based on the physical differences between them. He classifies building crafts in accordance with the differences between tectonic and stereotomic: “the tectonics of the frame, in which lightweight, linear components are assembled so as to encompass a spatial matrix, and the stereotomics of the earthwork, wherein mass and volume are conjointly formed through the repetitious piling up of heavyweight elements.” (Frampton, 1996, p. 5).

The different meanings and forms of application that the concept of tectonics has gained over time show that this concept cannot be considered only ontologically, in other words, it cannot be reduced to the issue of technical ‘making.’ In fact, it has the potential to produce meaning with regards to the whole of the architectural idea. In addition to the bilateral relations embedded in tectonics, the relationship established with the stereotomic also gives us different possibilities both in terms of way of production and approach. The dualities of discontinuity/continuity; lightweight/heavyweight; sky/earth; immateriality/materiality; parts/mass can also be traced in the dialectical relation between tectonics and stereotomics. Considering the literature, here, we also conceive of tectonics through bilateral relations but in a narrower sense: relating the tectonics of earth, the natural, with the tectonics of architecture, the artificial. This relationship can be both similarities or contrasts and is related to concepts of *meaning*, *aesthetics* and activities of *dwelling*, *making* on both a natural and artificial level. At that point, this activity not only seeks to satisfy mere needs by forming *a* volume in accordance with the necessary material but instead may elevate that volume to a *kunstform*.

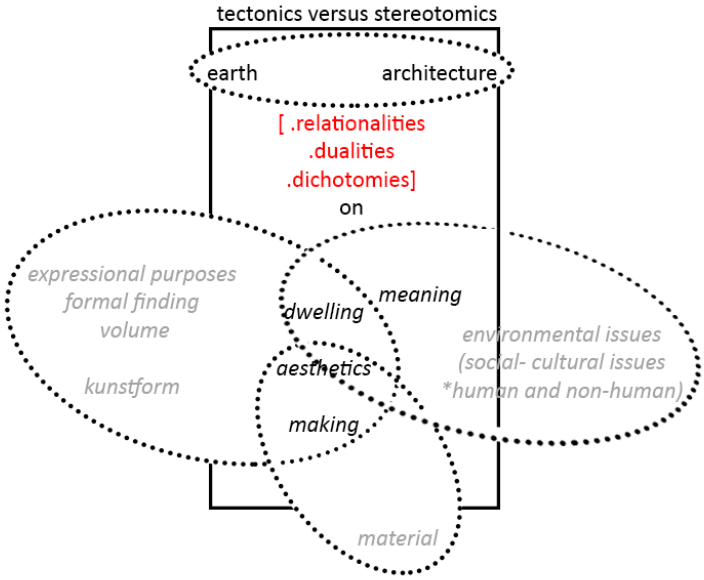

Figure 3. *Tectonics over bilateral relations* (authors)

Tectonics as a Conceptual Tool: Anchoring to the Site

As can be seen from the dualities and dichotomies compiled from the literature, the term tectonic itself includes many sub-concepts and operations on architecture in a holistic manner. In line with this statement and our definition of tectonics, we accept that bilateral relationalities of this concept can be discussed as the base for conveying the holistic being of the activity of architectural design to students, especially in their freshman year. Within this scope, tectonics is handled as a conceptual tool during the process. The binary oppositions and bilateral relations exist in the duality of the tectonics and stereotomics are under discussion along with the points where these oppositions sometimes got reconciled.

Accompanied by these thoughts, we put special focus on the physical forces of the site during the process of the activity in mention. To reveal the physical forces of the site, in other words, its hidden features, we focus on the physical model as a tool. Thus, the physical model turns into the secondary building block as a corporeal tool. Within this framework, the primary position of us as instructors is to orient the students to reconsider these conceptual and corporeal tools. They were encouraged to analyze the site by considering the bilateral relations of its tectonics, re-representing the tectonic structure in order to internalize it and then base their own designs again on the relations of tectonics. Free to choose whichever materials suited their model, the students thus explored the structure of the terrain, using different materials and methods of representation. Processing these and adding the acquired data to the initial tectonic description with these reconsiderations in mind are the studies' contributions. In this context, the main, production-oriented section of the study is based on the narration these parts of the process in which tectonics are used as a primary building block, that is, a conceptual tool along with the physical model, which operates as a corporeal tool.

Certainly, we must accept that all the components and phases of an architectural design process are in essence, inseparable, however, this study focusses on a specific part that is the students' interpretation of tectonics. Our focus though, depends on the idea that the whole process contains extensive information and interpretation that cannot be included in one single piece of research. In this context, reflecting on the role of earth tectonics in architecture and the relationship established between the two are crucial points of the process. This process is structured in two main phases. The first of these is the stage where the natural is grasped, the topography is understood and thus represented in line of subjective expressions. Then, in the second stage, the relationships are established between the natural and designed through relationalities, dualities and dichotomies. In line with these stages, the students first understand the site, then establish a relationship with the site and the design proposal therein. The basic method of the process is to gain the ability to think in the proposed manner that belongs to the site (even if it is opposite), rather than thinking like a singular object.

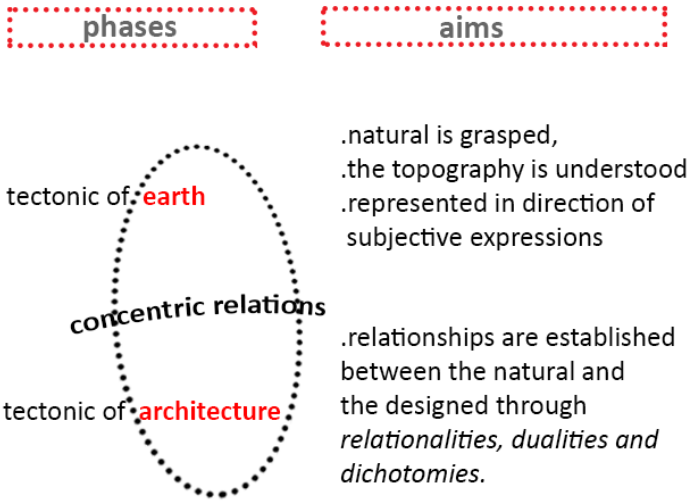

Figure 4. *Phases of the process* (authors)

Tectonics of Earth

In the studio process, we aim to inquire into the tectonics of the *topos*, and the relationship between tectonics of space and this delineated tectonics of the *topos*. Alongside these assumptions, in order to conduct discussions on tectonics/stereotomics, we have selected a site which has a strong tectonic quality. In this context, the Mid-Atlantic Ridge on Iceland is an interesting terrain that describes a system with important geological features indigenous on the planet. This system, mostly submerged, has a large number of transformation faults and an axial rift valley along its length (Unesco, n.d.). The earth opens itself and becomes visible through these axes. The acts of concealing and revealing are observed simultaneously. The existing dichotomies are as follows: the heat of the magma and the cold of the snow, the pale, barren soil juxtaposed with the shine off the walls of underground caves, visibility of the Eurasian plate and North American plate at the same time. Most of the ridge system there is submerged, but the land forms a series of volcanic islands of various sizes that run along the Atlantic Ocean (Unesco, n.d.). One of these islands is the selected site for this studio, to be exact, it is in Grjótagjá, Iceland where the ridge system reveals a series of caves. In terms of being an area where tectonic movements and the earth can be observed from the bottom-up, along with both land and water, and the various continents, the site is definitely considered rewarding in terms of interiorizing pure tectonics. The ridge, which is the most prominent reason for choosing this area as a site also stands as a symbolic representation of the dualities and dichotomies of the *tectonics of earth*. The tectonic-stereotomic properties of the site, which we define as the place, or the land for a certain given time, that is, the massive effect, appears as a predominant and given information. Anchoring to this site has defined the transition point between the existing natural tectonics of the

world and the artificial one. Thus, the problem is to design in this cross-section where there is nothing built previously and the reference is only to the natural tectonics of the site.

One remaining problem concerns the program components that require design, which will be completely alien structural additions to this place where there is such strong tectonics. The challenge that students will have to face is to decide whether to simulate these structures into being part of the natural terrain or if deciding to establish a contrast, to create a fictional tectonic structure that increases and complements the value of the place. Accordingly, in the 1st phase, the potentials of the site and tectonics of earth are explored, interpreted and represented with different materials. Communication with the material progressed in the form of perception of topography in three-dimensional form, topography-material relationship, and then the interpretation-representation of the student with the selected material. At this point, the student reproduced (re-presented) the site in line with their own unique expression and perception.

Students thought on the representation of the ridge firstly, because the ridge is the hallmark of this terrain. It is a spot that the earth not only opens itself from the outside, but also lets the users inside. Thus, it is not a two dimensional object only perceived from the surface, but it is a three dimensional volume which you can feel it from the inside. It is like an entity formed throughout the history. In the light of the specific features of the site, students tried to answer the questions such as: “what kind of meaning does the ridge have on this land?,” “what kind of tectonics does the ridge and the land have?,”and “how the reproduction of it may be?”. In line with these queries, they reached their own perspective on site and its tectonics and reproduced it.

Considering these re-presentations of *the tectonics of earth*, we infer two separate approaches in the way the students made use of the material and their execution patterns: (1) stereotomics and (2) tectonics. While the studies of stereotomics (1) are discussed through homogenous and heterogenous use of solids and heavy materials, they are also classified as bringing a strong monolithic effect into play. This stereotomy is gained through the design of massive, solid, rigid and unified models, all made of heavy materials. However, the (2) studies of tectonics progress through the collation of singular elements and light materials, and using them in linear or vertical directions, or in a way that results in a web to reach the whole. This method of execution in terms of repetition or by using different forms of continuity, similar with assemblage, is considered as representing the site based on *tectonics*.

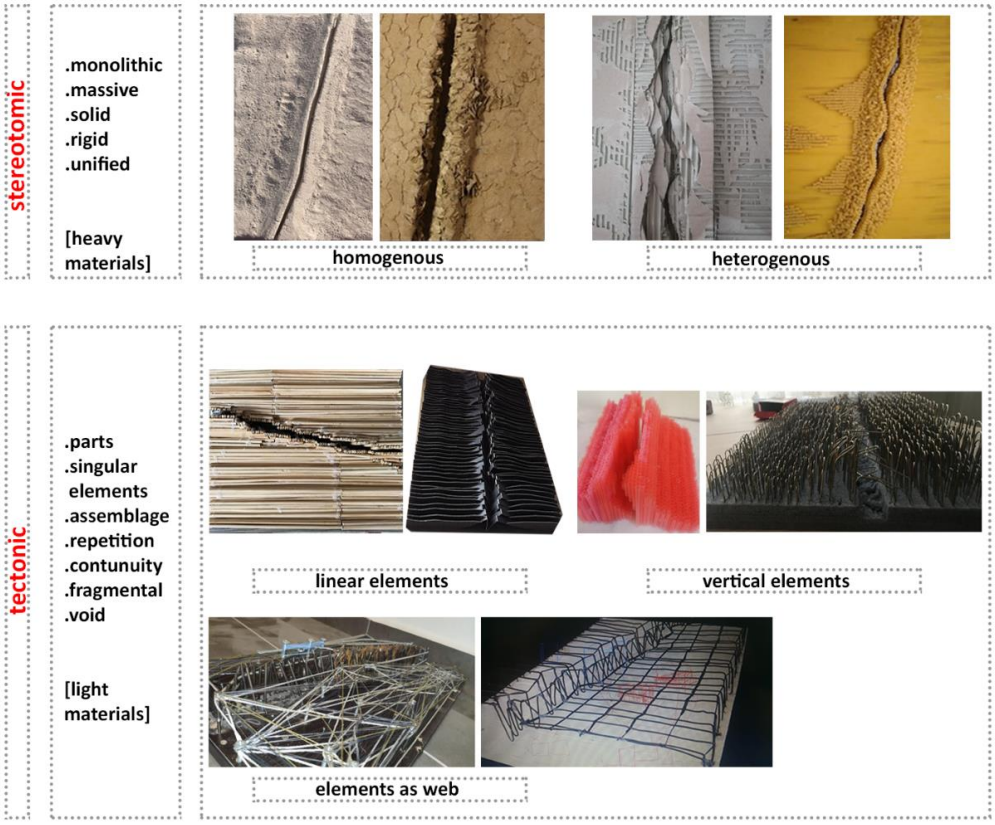

Figure 5. *Representation of site: tectonics and stereotomics of earth* (authors)

Concentric Relations in the Tectonics of Earth and Architecture

The styles of representation that the student perceive tectonics and topography in definitely affects their approaches to the site and guides the design process. In this second stage, after the natural terrain along with subjective expressions are grasped, the clues and traces are further obtained from the tectonics of the earth. Moreover, particular attention is paid to the creation of open, semi-open, and closed areas in relation with tectonics and other characteristics of the site. In addition to this spatial organization, compliance with topography and correlation with the tectonics of the site are of essential importance when considering three dimensions.

Students represent the site in ways that display their understanding of the different ideas and methods of generating components of space. While some studies progress as a continuity of their own method, which are defined as -from stereotomics to stereotomics- or -from tectonics to tectonics-, some studies included alterations in expression, displaying the shift in their perceptions. These are, generally, defined as –from stereotomics to tectonics-, or –from tectonics to stereotomics. More precisely, expressions that are “continuation of massive being of the site to the mass”; “folding as a making way in both site and space” and “dissolution of the mass” are usually found in

the projects that adopt a continuous progress on stereotomics. The projects that are based on the ideas of "the basic fragmentation of a whole" and "spaces [in and on] land" are discussed in order to shift their perspectives from the stereotomics of earth to the tectonics of architecture.

This stereotomics-based evaluation is also valid for tectonics. Projects that have pursued the approach of using singular elements in both tectonics of earth and architecture even if they include changes (such as repetition, framing or web) are accepted as partaking in the approach from tectonics to tectonics. On the other hand, we examined that some students shifted their execution process from tectonics to stereotomics, such as: "from fragmented pieces to monolithic pieces," or "from linear elements to massive pieces," or "web as a void forming the solid." These methods, continuities and shifts in the relations can also be considered as part of the bilateral relations we speak of, especially within the context of dualities and dichotomies. When examined from this point of view, the approaches in which students establish continuity between tectonics of earth and architecture, namely natural and artificial, and deal with both as a whole, are generally included in projects where both the material, the structural and the construction techniques are similar to each other in all stages. These approaches are discussed as ones that border on similarities, dualities and relationalities. On the other hand, fragmentations-reunifications, interruptions–continuities are the dichotomies specified on the execution phase. While choices to conceal or reveal are more related to spatial organization, the use of heavy or light materials are accepted as fundamental decisions that are mainly subjective.

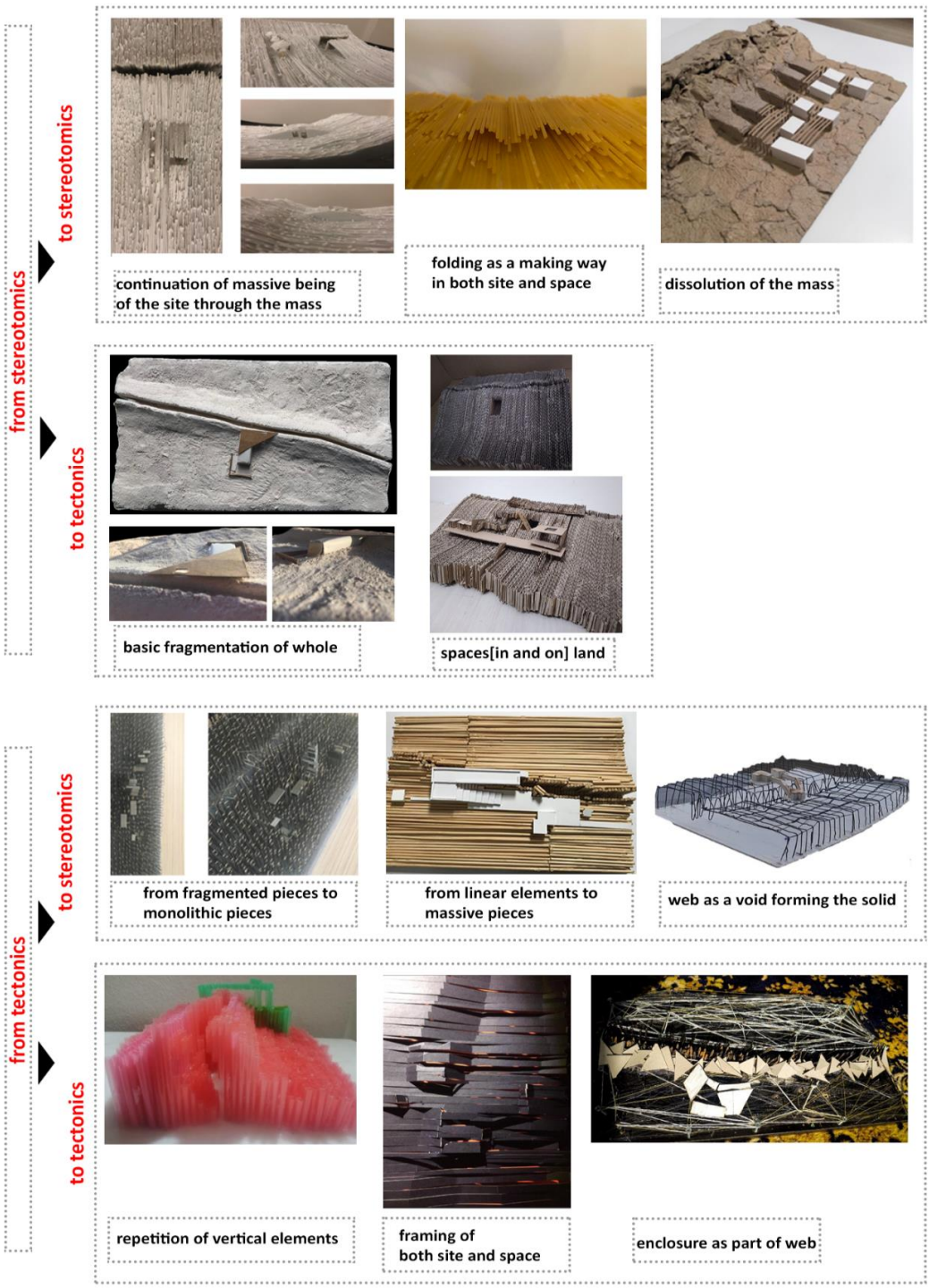

Figure 6. *Continuities - shifts in relations of tectonics of earth and architecture* (authors)

Concluding Remarks

Encompassing all levels of the design process and with a potential to become tangible in output, the concept of tectonics is a proper conceptual tool illustrative studio processes. Inquiring into tectonics with an emphasis on the holistic nature of the concept constitutes the main structure of this study, which in itself is also a studio process. Here, tectonics are discussed through bilateral relations; similarities, dualities and dichotomies come to the forefront as the relationalities surface. In addition to these relationalities the dichotomy between tectonics and stereotomics is also counted as part of the conceptual thinking that is included in the design process.

Correlating tectonics of site -the natural- and tectonics of architecture -the artificial- by means of these relations is the demarcation point of this fictitious, mental trial. Pointing a direction for questioning and perceiving the tectonics of the site creates a basis for the fiction of space, which when realized, will be what the students design. In both the reproduction and design phases, the model becomes a flexible tool to express their points of view through the site, leading to interpreting and forming their own proposals. As with their perspective on the site, it enables the students to experience their own exploration process in terms of both choices of materials and methodology of construction of the model (based on the tectonics of the site). The perception of the site and their selection in revealing what was once hidden are illustrated through the model and the chosen material. Besides, the relationship between the natural and the artificial is also effective in developing principles about the project using contrasts, continuity and discontinuities.

There are two ways in which the implications of this fiction and its contribution to the studio process are visible: First, the three dimensional model as a corporeal tool enables students to develop different perspectives on the terrain. Different model making techniques lays the groundwork for working with a useful tool in the re-representation process. The reflections on the process show us that reproduction and representation of tectonics is a crucial issue for all phases of the design process, namely analysis, internalization and generative. Second and more importantly, tectonics, as a conceptual tool, provides many possibilities while internalizing the site, generating design ideas and creating the form. The personal perspectives that emerge in both stages reveal different possibilities in terms of the production of site space. Viewed in this context, we must reiterate that the ways the students perceive the site and its tectonics determine or affect their design. Therefore, questioning the tectonics and reproducing it through a physical model provides students with at base to establish the relationship of their designs with the site as continuity or contrast.

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