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Alternative Scale(ing) Practices in Architectural Design Studio

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Abstract: Commonly associated with the accurate representation of reality according to a specific ratio, which depends mainly on measuring and precision, the notion of scale has been considered an operative tool in architecture to perceive and indicate the size of anything according to a reference system. An effort to challenge the concept of scale(ing) to include diverse reference units and their scalar articulations holds the potential of instigating novel associations in architectural design studios. Possible readings of these alternative scale(ing) conditions are discussed in the paper in reference to a series of design exercises conducted at architectural design studios. The main intention is to question these unmediated associations to the reference unit in the determination of size and proportion, thus possible scales of architectural space. This particular method of analysis aims to arrive at various scale(ing) conditions, whose internal reference system is challenged by the changes and shifts in the definition of the major reference unit. Each different scale(ing) condition studied through the given exercise was regarded as an act of confrontation for readings of scale as well as presenting provocative challenges to the architectural design processes. With this standpoint, the paper proposes a multi-layered reading of scale that argues the reference unit's instrumentality in the definition of architectural space and proposes an alternative methodology of integrating scale in architectural design education.

Keywords: Scale, Scalability, Reference Unit, Precision, Design Studio.

Introduction

Influenced by the changes in the understanding of measurement and the tools of precision that are standardized in time, the notion of 'scale' is often defined as the true representation of reality according to a specific ratio. Defined with different metrics and tools in different periods and contexts, the notion of scale and the ways of studying different scalar conditions have always been an operational agent in architecture. The reference system(s) used to specify the size, as well as the operations embraced to study the scalar conditions are mainly defined through accustomed metric references or standardized body-related operations. However, the desire of standardizing the act of scaling can limit the definition and use of scale in architecture,

where it is commonly considered to be an operative tool to perceive and indicate the size of anything according to a reference system. Although the reference system(s) used in scale(ing) practices vary according to different contexts and periods, they depend mainly on metric systems, which are universally acknowledged and therefore eliminate the possible ambiguous conditions of scale. These ambiguous conditions may either be directly related to unstandardized measurements or sizes or refer to perceptual shifts due to contextual conditions.

However, the attempts to re-question the notion of scale in architectural education by diversification of the reference systems and the inclusion of the notions of subjectivity, interdependency, non-standardization, and ambiguity can alter the apprised practices and readings of scale in design studios. This in return may define new opportunities for initiating design processes in architectural design education. Therefore the paper aims to present a discussion on the alternative methods of utilizing 'scale' as a pedagogical challenge in the design studio. In doing so, it proposes a design methodology, where a series of given objects, defined as initiators or reference units, were put under various operations of scale(ing). However, these scale(ing) operations are applied not through altering the given standard measurements of objects but through analysing their potential to create architectural space. This methodology is argued to explore an alternative utilization of scale, where certain measurements, precision or standardization qualities of scale were replaced with variable qualities that are interdependent to their potential of scale(ing) of architectural space, thus introducing new strategies for initiating design thinking.

This methodology proposes a surpassing approach to the standardization of scale(ing) in reference to a metric system or square meters but discovering new tools and units in the understanding of scale. The aim is not only to provide different conceptualizations of scale(ing) but to analyze how these methods can initiate diverse articulations of architectural space. The paper subjects a series of design exercises conducted in third-year architectural design studios, where alternative scale(ing) practices were utilized with the introduction of multiple reference units. It will try to unfold a discussion on the possible benefits of this methodology in understanding scale in architectural design studios and how different measures can initiate a self-derived system in the articulation and designing of architectural space. The main intention of the paper is to discuss the process and outputs of these exercises and scrutinize whether alternative reference units, rather than the metric system or the human body, can be used in architectural design practices.

A Methodological Framework for the Notion of Scale

The discussion on scale in architecture dates back quite far, but it mostly benefited from the perceptive connotations that can only be defined through measurable or perceivable qualities, falling behind revealing other potentials in the formation and conceptualization of architectural strategies. For example, the discussions on scale, especially in architectural schools, seldom question the relativity or subjectivity of scale(ing) practices, on the contrary, this attribute of scale is regarded as not ideal or preferred as it may cause the erosion of the rational ground of discussion. However, when we look at the history of scale and the emergence of different measuring systems, we come to realize that measuring standards are always apt to change according to who measures, and the tools selected for the practice of measuring. On another level, the concept of precision that seems to dominate the many practices of scale(ing) also turns it into a mental tool rather than a tool that is directly related to the human body as its major source of reference. The conceptualization of scale as a mental tool besides being an operative tool for measuring and representing reality, calls for the study of both measurable and immeasurable conditions (Lukinbeal 2016). [1] Scale, in these conditions, may lead to the discovery of even intangible properties. Questioning what is immeasurable in

conjunction with what is measurable, and the tools or methods of measuring, is believed to pave the way for discovering alternative approaches of utilizing the scale as; '. . . not simply an external fact awaiting discovery but a way of framing conceptions of reality' (Delaney & Leitner 1997).[2]

The idea of scale(ing) as one of the major practices of architecture, undoubtedly got influenced by the changes in the understanding of measurement and also the ways and which it was standardized in time. The idea in the standardization of measuring systems dates to the initial study of body proportions by Vitruvius in *Ten Books on Architecture*. The analysis was later transcribed with slight alterations by Leonardo da Vinci as 'Vitruvian Man', which provided a more accurate study of proportions and measures in respect to the relations between the body and its parts. The proportions of the body in the Vitruvian Man were defined in their relations to basic Euclidian geometries. Therefore The Vitruvian Man represented the utilization of the human body in relation to a calculable or measurable geometry, by analyzing the proportions of its parts as a calibration device for understanding the nature of things, thus relating man to nature (Lukinbeal 2016). [3]

The human body can be regarded as one of the earliest tools that define our conception of scale, especially in architectural discourse. However, the capacities or qualities of the human body have always been closely associated with the idea of measurability, therefore of scale(ing). The practice of scale(ing), mostly benefitting from conventional measurement systems, developed to divorce from bodily references as its major source of existence historically. All the measuring units with direct reference to body parts, like; *cubit, inch, feet, arşın*, develop to be more abstract but even more precise, especially after the invention of meter as a standard, universal measuring system (Tavernor, 2005). Historically the traditional units of measure, which varied hugely from place to place and were untidy mathematically, were replaced with the metric system in the aftermath of the 1789 French Revolution. Metric system was based on the SI (*Système International*) units, which we still use today to communicate information on measure, and which is devoid of possible associations to bodily proportions. Even though scalar comparisons through the human body call for a relative condition rather than a consistent one, one can still trace the development of standard measuring tools, for example, a metric ruler, through its relations with the human body in history. [4] Therefore whenever one tries to define or argue the scale of anything, the reference unit that creates the part of the whole scale almost always affects the final data.

Looking closely at the metric system, it becomes obvious that the reference unit as a part repeats itself and initiates another part of a whole in a consequent manner. In this system, the relationships and dependencies between the parts are usually direct and contingent. For example, a *centimeter* in a metric system repeats itself ten times to define a larger part or a whole that is composed of smaller units, which is a *decimeter*. However, *decimeter* as a whole is composed of smaller part(s) and repeats itself to define another whole such as a *meter*. Successive repetition of the same unit value defines whole(s) which are part(s) of other whole(s). The reciprocal relationship between part(s) and whole(s) in a metric system necessitates the questioning of how part(s) act in the formation of whole(s) or how they repeat themselves to attain the desired whole. The structure of the whole(s) is usually clear and well-defined so that one can easily decipher the constituent part(s) and identify the "ontological dependency" between them. (Türkay Coşkun, 2017) Considering the structure of a whole, where part(s) and part(s) of these part(s) come together to form a structured whole, Brentano states that "wholes are things which need to have parts…a thing exists in itself if it can exist without being a proper part of another thing - if it is possible such that there is nothing of which it is a proper constituent." (Brentano, 1981)

However, an architectural design process may demand a more flexible dependency between

the part(s) and whole(s) of a unit system to study the conditions, cases and experiences of architectural space. What if the reference unit, which is considered to be the constituent part of the metric system repeats itself but initiates the definition of another part or whole? As Husserl questions, what if the whole which is the larger part of the metric system does not necessarily need to have part(s)?

Although the metric system has a direct and ontological dependency between parts that relate to the other part(s) and whole(s) in the same manner, their relations may vary and blend into one another when subjective concerns are included. Blending of part(s) and whole(s) in various ways initiate the consideration of new and diverse dependencies between them, which may also originate alternative practices for architects. Consideration of alternative dependencies between part(s) and whole(s) opens up new grounds for discussions and discoveries. Therefore, their amalgamation initiates the questioning of the metric system(s) as the only reference system used for understanding and studying the scale in architectural design.

Even though the concept of scale is an inherent part of architecture, the concept is seldom questioned critically in architecture schools or in architectural practice. One pioneering study that challenges this association for discovering alternative measuring systems where the metric system is intentionally overlapped with another system belongs to Le Corbusier and his renowned work; the '*Modulor*'. In his words the main idea behind the Modulor was defined as: *"In a matter of building houses meant for men, the metre seems to have introduced a strange and unreal method of measurement, which, if looked at closely might well be found to be responsible for the dislocation and perversion of architecture."* (Le Corbusier, 1950/2011). Le Corbusier's Modulor, tries to break away from conventional measuring methods to embrace a different measuring system based on the proportions of the male figure and the golden ratio. The Modulor Man is the outcome of this search for determining the right proportions of units, and in this case also 'new parts' for architecture. Therefore, it not only synthesized two separately used units of measurement, the empirical system (feet & inches) and the French metric system, but also sought to define a relation between the body's form and nearly all designed objects, from the scale of architecture to the scale of artifacts. (Le Corbusier, 1950/2011). The idea was to initiate a visually more pleasing and apprehensible system for measurements since the scale(ing) practices are derived from human scale but not limited to its exact measurements. The Modulor tried to introduce a different scale(ing) methodology, which can be named as a scale for architecture that is inspired by the scale developed, for example, for musical scripts. The work of Le Corbusier, besides failing to raise a common acknowledgment in the architectural milieu, was one of the most and maybe only controversial and experimental attempts in questioning the operative relationship of architecture with proportions, systems of measuring and scale(ing).

However, attempting to challenge the practice of scale(ing) requires a deeper inquiry into its instrumentality. For example, how scale(ing) is argued in the paper is devoid of its limited use as a tool indicating the change in size or means of representation. It was tried to be regarded from a larger context where the size of an object is discussed through its relativity with a reference unit, which can only be defined according to many external inputs like a human body, measuring techniques and tools, or construction methods (Anderson 2002). [5] So the main point of departure is to disable the singularity of a measuring system or a reference unit but on the contrary enable the possibility for the multiplication and variation of the reference units. The flexibility offered through the multiplicity of reference systems enabled Le Corbusier for example, to study architectural scale not only in metric units, but also in relation to other reference units such as the human body. Any reference unit (be it an abstract unit in meter system or a more relative one defined through body parts) holds a certain amount of equivocality directly affected by

either our subjective intentions or incoherent contextual conditions, scale(ing) can enable the interpretation of altered dimensions, relationships or amount of detail and therefore can be utilized for exposition and speculation in architecture.

Understanding Scalability Through a Reference Unit

The studio exercises subject to this article include the output from different years. One common attribute in all exercises is the discussion on the notion of scalability. Scalability was discussed in relation to the concept of flexibility in particular scale(ing) systems. It can be regarded as the quality to be able to grow or change size without impeding the main working principles. Scalability is directly related to a system that does not get affected by major decreases or increases in the number and quantity of certain things (*parts*) that compose the whole. This tolerability has of course certain limits to it. The studio examples in this first category, focusing on the limits of tolerance to such increases or decreases, tried to uncover the potentials of each and every element depicted as a reference unit from different contexts. These initial exercises weren't directly carried out till the end of the design process in the studio as in the later examples discussed in this paper, but they were preparatory exercises for analysing the interchangeable or inter-dependent relation between the parts and whole in architecture.

Here the students introduced a list of various different elements that are chosen with reference to the context or extracted from particular situations without contextual limitations (Figure 1). There is no single size or proportion required in the selection or determination of these reference units. Scalability as a quality was applied to various units that are regarded as reference units, such as an umbrella or a bathtub, a shower cabin, a bed, a counter etc. Even though each example defines a particular reference unit, they do not recall an immediate determination on size initially, yet the chosen element itself becomes the very tool of measure that can be altered or modified within the limits of tolerance.

Therefore, all the analysis rather than adopting or responding to a system of measurement outside itself, regarding any conventional systems of scales, introduce their own system of scale(ing) through their very beings. Here the definition of scale(ing) does not refer to the particular size of the object but recalls for a comparative and sometimes speculative study to discover the potentials and constraints of different scale conditions and how they became interdependent to one another. Most of the studies preferred to use collages, photomontages or pictogram graphics instead of conventional scale-based drawings and architectural representations. This allowed students to be able to think independently of the actual measures of the units taken as a reference in all analyses and to focus on the reference units' tolerance levels of scalability graphically.

'Multiplication' and 're-size', were applied as the two major operations in these initial exercises. Constant repetition of resize and/or multiplication operations were considered to trigger part-to-whole conditions and hence define an experimental ground for architectural design education. When the same unit is resized or multiplied recursively in a metric system, the relationship between the parts, between parts-to-whole, or even between several wholes remains constant. Therefore, the accustomed relations of the reference unit continue to serve the architect in the design processes. However, if the reference unit is not a standardized one like the metric system, the repetitive execution of certain operations redefines the scalar relationships in each cycle anew (Delanda 2011). [8] During the iterative application of resize or multiply operations, the architect continuously questions the scalar references and the interrelations between the reference unit and the output; namely part-to-whole relations. At a specific recursion time, when the project starts to lose the relative scale and the reference unit, the part-to-whole relations are re-questioned and the output of a certain recursion is defined as the reference unit of another recursion cycle. Therefore, the relative condition of the reference unit is also updated at each iteration.

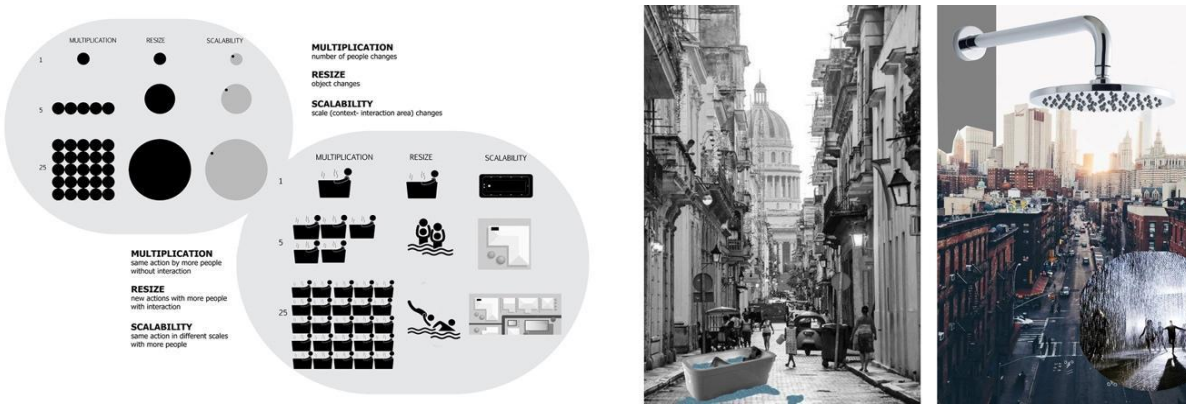

***Figure 1**: Scale(ing) conditions_ Measures of Scalability. (TEDU Architecture Archive, Melis Acar, Çağrım Koçer)*

In these exercises not only does the definition of a reference unit at each example change but monitoring the change reveals how a unit's manifestations alter under different scalar actions like multiplication and resize. Taking a 'bathtub' or a 'shower cabin' as a reference unit, for example, can manifest diversified contemplations when multiplied over a certain number or after a specific amount of resizing. And while the 'bath' as a unit may respond to the same series of actions differently, another preferred reference unit of the shower cabin can react in a completely different manner (Figure 1 & 2). There is no straightforward formula for both of the actions, which can transcribe to exact mutual coordination between the increase in the number of units with respect to the increase in the number of services achieved per unit. All the tactics applied also cause the metrical information and measurements to become redundant leaving its place in the discussion of part-to-whole.

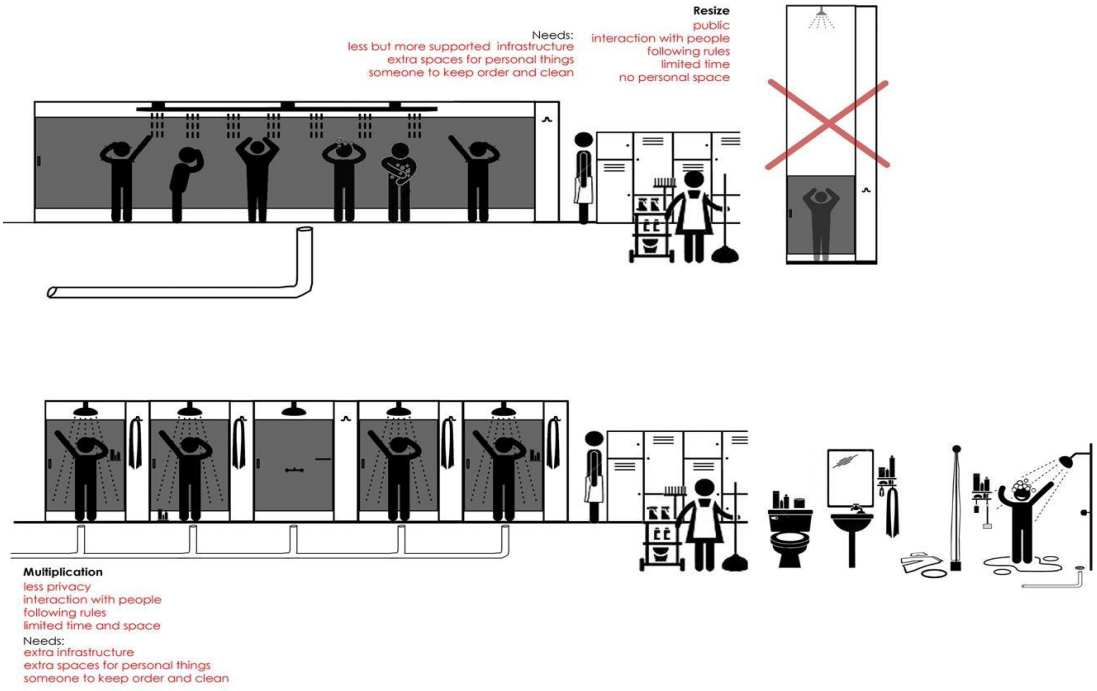

***Figure 2:** Scale(ing) studied in pictograms; multiplication & re-size of 'shower cabins'. (TEDU Architecture Archive, Elif Köse)*

To give but one example is to compare different reference units as a shower cabin and an umbrella; each unit can respond to certain services like sheltering for an 'umbrella' or showering within a shower cabin (Figure 2 & 3). When the unit gets multiplied up to a certain point the capacity of the total response also increases proportionally. However, after a certain number of multiplications, there is a disruption in the equation resulting in the obscuring of the reference unit's role in the formation of the whole. It is discernible in the series of studies that after a certain number of multiplications, which is, by the way, may differ when the reference unit changes, the individual unit begins to lose its individuality and identity to become part of a pattern or an order. So the initial reference unit as the identifier of various scaled conditions starts to lose its capacity to define the very same relations after a certain number of multiplication, causing the reference unit to lose its instrumentality within the process. Both reference units, shower cabin and umbrella, were initially designed for individual use. The multiplication of the single reference unit and the resizing of the single unit may seem to result in increasing the capacity of service however both actions change the limits of tolerance of the reference unit as well as its inert qualities respectively.

In these exercises, the students came to realize that the measuring tools can be diverse, however, these tools are also not static entities that can prolong their validity throughout the design process. The constant change of the reference unit under different actions for example like multiplication is evidence for bringing out the dynamic quality of the process

Figure 3: *Scale(ing); multiplication & re-size of the 'umbrella' as a reference unit. (TEDU Architecture Archive, Elif Köse)*

that carries the potential to further transformations in our conceptualization of scale and hence the architectural space. Challenging the concept of standardization, which can be considered as one of the elemental qualities of measuring and scale(ing) practices throughout history, these exercises intended to explore the potentials of non-standardization in scale(ing) practices and how this strategy can alter the conceptualization of scale as an ever-changing, adaptive or even responsive instrument in the way we relate with our environment. This strategy initiating the failure of measurement provided an experimental process for students in realizing the moments of the inadequacy of the reference unit for the scale(ing) process. It is in these moments that representing architectural space can flourish as the students started to develop alternative ways of understanding, perceiving and conceptualizing the qualities of architectural space as a whole together with the parts that compose that whole.

Scaling up & down in architectural practices can be regarded as a common conventional strategy for responding to possible needs and requirements. It is very likely that the resizing of the unit radically changes our ways of interacting with the object as a reference unit, with one another and with the context. In certain examples, the reference unit taken as a shower and a shower cabin resized in two different manners defined as proportional or disproportionate resizes (Figure 2). [6]

To achieve the desired increase for example in the case of shower cabins, all three different strategies which were defined as the multiplication of the reference unit, the proportional resize and disproportionate resize of the same unit, all produce diverse scale(ing) practices and configurations. The resize operation also has a direct response to the inherent definitions and contextual relations. For example, there is a range of tolerance to what extent the bath as a reference unit can be enlarged and still continue to be defined as a bath. As seen in the example of Figure 4 the inherent features of a bath lose those qualities to turn into a pool after a certain limit of enlargement. Similar quests provide different ranges of tolerance when we compare a bath, a working space, and a living room, all of which carry the potential to define a library or a cinema under different scaling actions (Figure 4). Resizing the reference unit not only changes the initial size and measurements of the very same unit but radically changes the way we conceptualize the architectural space. Exploring how certain elements occupied by architectural space can be transformed to replace it through the exercise series enables the students to question the definition of architectural space in reference to a specific condition, dimension, program, etc. Therefore, embracing the tools and methods of scalar practices in architectural design education is regarded as holding the potential of challenging the conventional definition and practice of architectural space.

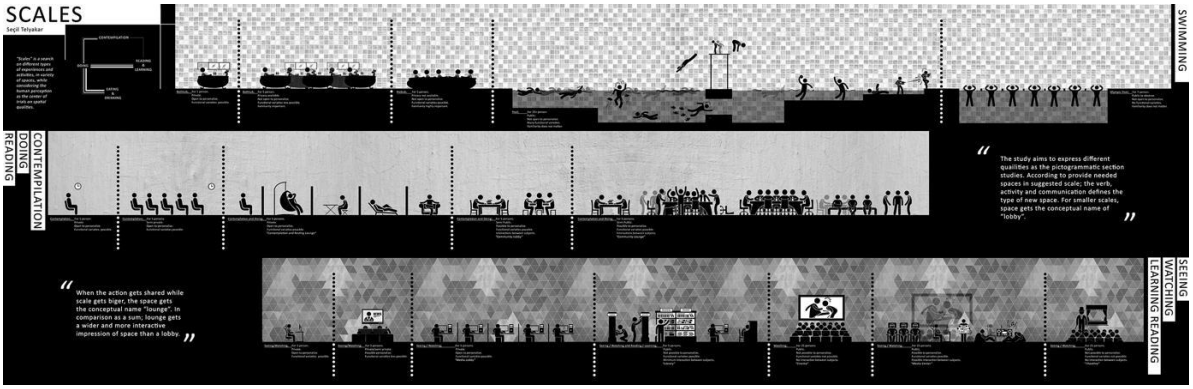

Figure 4: *Scale(ing) studies: multiplication and re-size of swimming & working spaces (TEDU Architecture Archive, Seçil Telyakar)*

Following these initial studies through the concept of scalability, in the following years, the studio offered to work with a reference unit not only as an initiating exercise for understanding the limits of scalability but an extended strategy that enabled the study of different relations between part-to-whole, in a semester-long project in the studio. For all the discussions in this paper, the selection of the reference units was done according to the content of the assigned architectural program. Therefore all the exercises intend to question the network of relations both defined through the reference unit (parts) and the architectural space (whole).

Reference Unit for Initiating Architectural Program

In order to extend the instrumentality of scale(ing) and scalability, in the following years the design studio initiated the scale(ing) exercise not only as a short exercise for the discovery of interdependency between the reference unit and the whole but as a semester-long assignment that runs parallel to the development of design and its programmatic requirements. The students were given the program details, where they were expected to define the spatial conditions and requirements in reference to the studied scalar conditions of the reference units that were introduced in line with the program. They were expected to define the spatial requirements not only in reference to meter squares but also in reference to the number, size and interrelations of the reference units. However, it should be noted that these exercises do not aim to disregard the metric relations or human scale, rather they aim to diversify the number of reference units considered in a design process.

In the first project, which considers the design of a marketplace in İzmir in the third-year design studio, the "counter" was defined as the initiating reference unit. Similar to the previous exercises, the students started working with resize and multiplication operations on reference units to develop an initial understanding of the relationship between architectural space, architectural program and spatial experience. Of the two examples analyzed for this specific design exercise, the first example explored the potential implications of resize and multiplication operations, where the counter, as an element, lost its acknowledged conditions and started to get recognized as a spatial/volumetric unit, providing a volumetric scale as an initial design idea. (Figure 5)

Focusing on the volumetric quality of the counter, the example in Figure 5 explored the

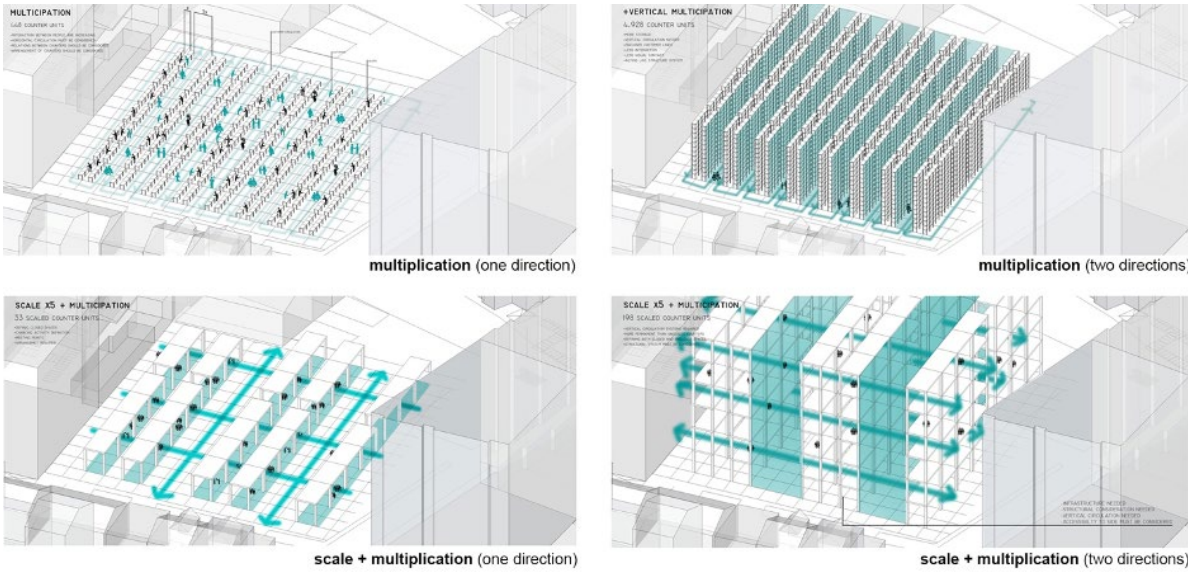

Figure 5: *Scale(ing) studies: Multiplication + resizing operations applied in diverse scales and numbers. (TEDU Architecture Archive, Elif Ezgi Öztürk)*

potential of the third dimension of the counter and derived an alternative reading of the counter as a significant part of the architectural program, hence the structuring principle of the architectural space. The volumetric potential of the counter and its proportional relations were considered the major references in the subsequent stages of the design process. In the further stages of design, the contextual conditions of the site provided the project with another layer that started to work together with the discovered scales of the reference unit. As indicated in Figure 6, at the further stages of the project, the design utilized the multiplied condition of the counter as a volume that indicated a three-dimensional reference grid as an initiating idea of design. Overlapped with other requirements and conditions studied in the design process, the counter with various sizes and numbers enabled an alternative scalar experience that is used in defining the properties, dimensions and relations of architectural spaces.

In this operation series, recursive application of these scale(ing) operations was intentionally sought in order to experience the extreme conditions of scalability and its tolerance levels. [7] The exercise revealed that, when the reference unit was scaled up and multiplied several times, the relative definition of the reference unit is disoriented, where it is not a 'counter' anymore, but rather a volume or a space. More recursions result in various new reference units such as a 'block' or a 'volume', including scaled up & down and multiplied conditions of an initial reference unit, which has lost its referential definition to the human scale. The reference unit (counter) is a discrete element (part) of which collectives (wholes) are defined through several recursions of resize and multiplication operations.

The part and whole condition defined through these exercises depend on the relationality of the discrete reference unit and the collective, which is assessed through these relations. The reciprocal condition of parts and wholes is open to interpretation since they are defined through the multiplicity of relations. In order to take the advantage of this approach, the students urge to study the scalar relations of the reference unit and extend its existential givens to include various relations, where the micro/macro definitions are connected to many others. [9] This approach has the potential of defining the scale, not as a metric unit, but rather as a network of relations, which constructs contingent definitions of scale. Accordingly, scalar recursions turned out to incite conditional definitions of architectural space that are dependent on the selected framework, where the part and whole (collective) transform each other's definition constantly.

Possible conditions and implications of the reference unit that is studied in the first phase of the assignment initiated the definition of various architectural spaces, which were

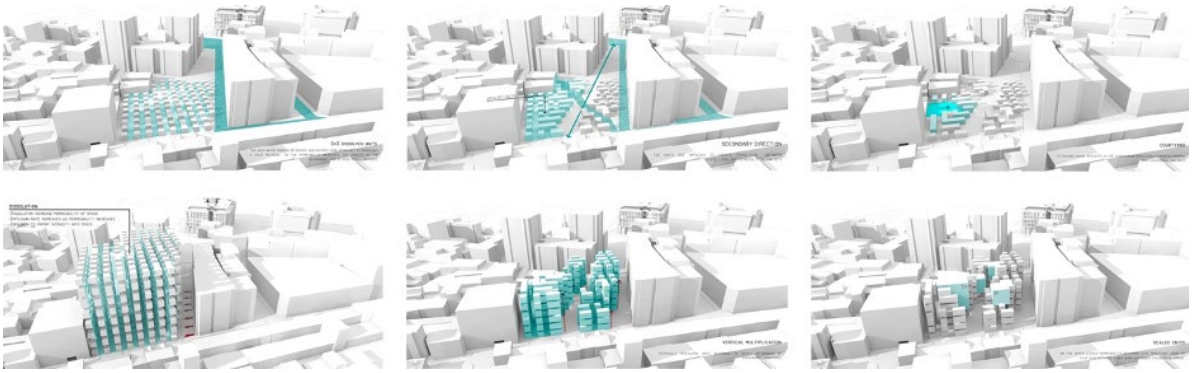

Figure 6: *Volumetric search for the marketplace that is initiated by scalar operations. (TEDU Architecture Archive, Elif Ezgi Öztürk)*

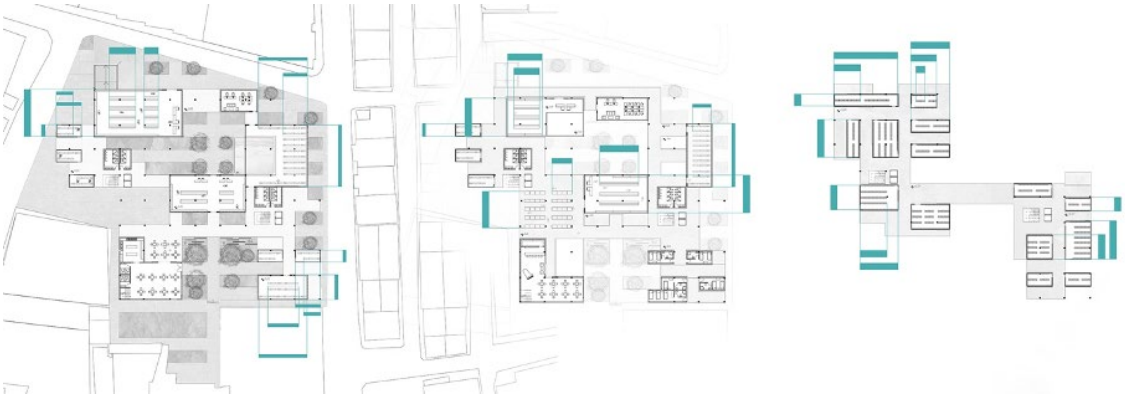

Figure 7: *Different scales and sizes of the 'counter' initiate the differentiation of architectural spaces. (TEDU Architecture Archive, Elif Ezgi Öztürk)*

defined in reference to this unit. Hence, the marketplace, which necessitates various use of the counter and related activities was studied with diverse conditions. In Figure 7, it is possible to signify these conditions which are defined in reference to the counter and its scalar studies. Different dimensions and conditions of architectural spaces are defined according to the number, size and relation of the counters with the other elements and their diverse conditions are indicated in the image.

Although each project in the studio explored different potentials of an alternative reference unit, a second common approach in the case of working with a counter as the reference unit, was the quest on the number of users and levels of interaction with the counter. In the example indicated in Figure 8, the project explored the outcomes of resizing and multiplication of the reference unit in different directions and sizes for analyzing the spatial changes introduced through these operations.

For example, studying resize operations on the counter to its extremes resulted in the alteration of the relationship with the users. The users were considered not to be in front of/behind/near the human body but rather on it; like a tray. On the other hand, resizing the counter to the other extreme, like enlarging its scale, implied a different use as a platform for public activity. The counter as the reference unit becomes a shared surface as a result of these implications. Along with that, the multiplication of the counter initiated the definition of other activities and spaces such as circulation, accessibility, storage, etc. Exploring certain requirements and conditions through resize and multiplication operations, the project experienced the potential of scalar practices and focused on the arising spatial requirements.

In another example, as shown in Figure 8, the project considered the program elements and used various sizes and conditions of the

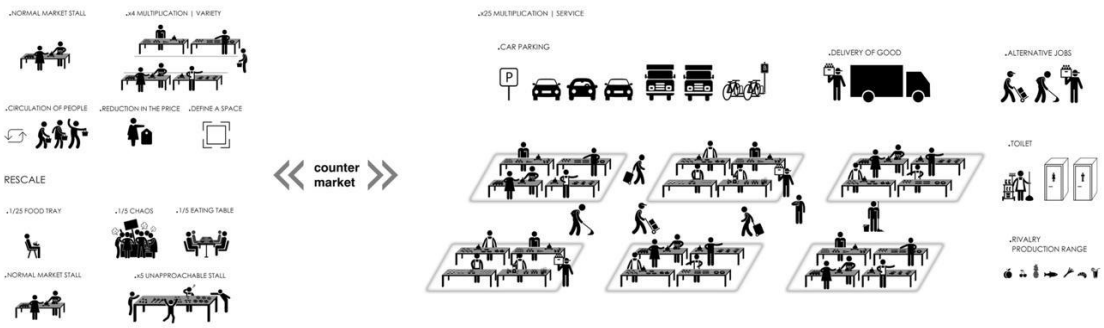

Figure 8: *Scale(ing) studies: multiple scales of 'counter' and definitions of the marketplace. (TEDU Architecture Archive, Cansu Türk)*

counter. The different scalar articulations of the counter were studied and discovered even before starting the design process. Since the exercise also aimed to appreciate various networks of relations concerning different conditions and sizes of the reference unit, the student was motivated to define the architectural space according to these relations in the design phase. Therefore the spatial requirements and additional activities enabled through the operations of resize and multiplication in the initial stages of design affected the architectural design process and the articulation of the spaces in the further stages of design. The main conceptual design idea was acquired by resizing the counter in a single direction, which later initiated a continuous surface that can be shared or used for collective purposes. This conceptual approach developed by working with the reference unit as a constituent part of the project discovered the potential of a single element the 'counter' and proposed this element as a continuous production line.

The design of the marketplace, as it can also be observed from Figure 9, benefited from this idea of the production line as a major architectural element that organizes all the spatial configurations of the program. This example also accommodated the discussion of part-to-whole relations, where the scalar references were lost after a certain number of resizing and the scalar references of the counter as a significant element or part became futile within the whole. Therefore, it is possible to state that when the reference unit was scaled up disproportionally, it may start to lose its relative scalar condition defined in reference to the human or metric scale, opening up new discussion grounds for students to question the ontological attributes of the reference unit, where it is not a 'counter' anymore.

In another year a similar exercise was re-adopted with the introduction of a new reference unit. In this design studio, the main aim was to design a housing complex in Ankara. The new reference unit introduced to students parallel to the housing assignment was a 'bed'. At the initial stages of design all the students applied diverse multiplication and resize

Figure 9: *The resizing of the 'counter' as a production line enables spatial architectural articulation. (TEDU Architecture Archive, Cansu Türk)*

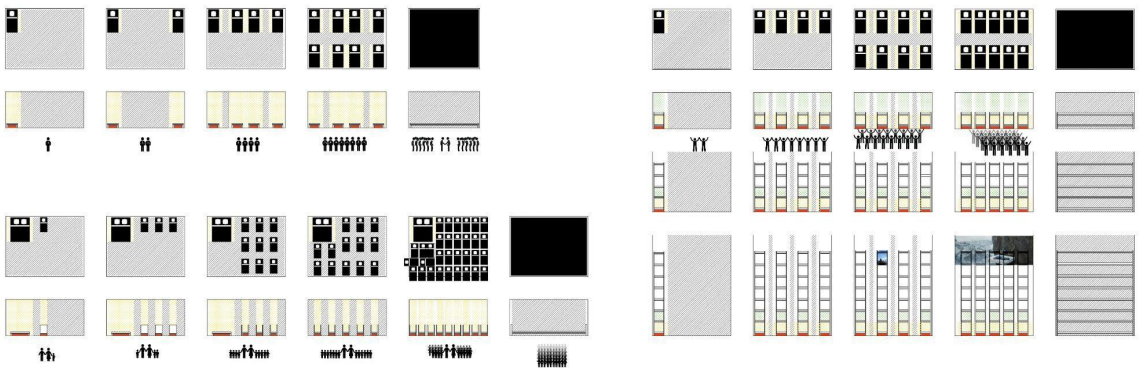

***Figure 10**: Different articulations of architectural space through the study of the 'bed' as a reference unit. (TEDU Architecture Archive, Doğuş Can Kadıoğlu)*

operations consecutively on the reference unit and tried to initiate the search for the ergonomic use of the bed and the distances near, around, and between a number of bed(s). Overlapping the conditions of the bed, with the dimensions and the number of people, the exercise opens up the discussion of the minimum and maximum number of beds and questions the privacy, and publicity conditions. Resizing and multiplication of the 'bed' as a significant architectural element enabled the discussion of the components or parts of a housing project and how they correlate with the number of inhabitants residing in that architectural space. (Figure 10) Furthermore, it defined a critical position in assessing the relation between the bed and the space it is inhabited in. Many issues related to the program, like the number of people using the space, in relation to the proportion of the space, and the level of privacy/publicity were the prevailing topics that stemmed from the discussion of the bed as a reference unit.

In Figure 11, the articulation of the reference unit initiated a design framework for understanding and discussing the altered states of housing, and the use of the bed as a surface to live, rest, work, etc. Considering the bed as the minimum requirement of a living unit, it was intended to define a new living condition where the bed was the ultimate element and where the size of the living unit has become interdependent on the scale(ing) of the bed. While defining the minimum living unit, the example project in Figure 11 extraverted and distributed the other activities of a conventional living unit to the public zones. Discovering the potential of the bed as a reference unit initiated defining the dimensions of the living unit and also the conditions of privacy and publicity in a housing complex. In

***Figure 11:** Proposal for a living complex that is initiated by the study of the 'bed' as the reference unit. (TEDU Architecture. Aylin Asır. Melike Zeynep Silahsör. Mirav Yüksel)*

the conceptual framework of the project, individual living units, having a single bed of which sizes were defined according to the time spent in the living unit, contrasted with the multiple beds initiating a shared living unit.

Final Remarks

The scale(ing) exercises in the design studios of different semesters are believed to introduce new opportunities for initiating design processes in architectural design education. Initially, the idea to adopt an unconventional method for scale(ing) started with studies on scalability. In the earlier examples, scalability was introduced in the studio to analyse how the adaptation of atypical reference units does not recall an immediate determination on size, yet how the chosen element itself becomes the very tool of measure that can be modified within the limits of tolerance. Very soon the students and instructors also discovered the potential of this scalar studies in influencing the emergence of a framework of design projects. Therefore, the later examples discussed in the paper presented a consistency in how they utilize scale in defining a conceptual ground for their projects. In these examples, the operations applied to the reference unit directly provoked the interpretation of the architectural program, hence the design of the architectural space and its spatial qualities.

Obviously, each reading provided its own reference systems and frameworks, which revealed discreet associations. For example, the study of the marketplace in relation to another unit will probably result in novel and various frameworks, which go beyond the standardization managed with metric units. Therefore, the areal definition of a condition/space/formation, etc. was extended to include various new network relations activated through diverse reference units. Testing the scalability tolerances in the configuration of architectural space and the elements that configure that space revealed how the two are contingent on one another. That is to say, the scalability tolerance analyzed through resizing or multiplication of reference units can define alternative scales in the definition of the architectural space. Therefore, these series of scale(ing) performances provided an alternative pedagogical experience both for students and for instructors in initiating diverse scales that is devoid of accustomed strategies of scale(ing) based on pre-given information of site, context, program etc.

Through embracing the subjective readings of scale(ing) conditions and acknowledging the limits in the contemplation of scale and measure these exercises stretch the limits of perception and contemplation to include a framework for scale(ing) conditions which cannot be defined in reference to a basic and perpetual source of comparison or measurement. In that respect, the drive for the conceptualization of scale in reference to precision and standardization was challenged by acknowledging ambiguity and non-standardization.

Analyzing the design processes and outputs of different exercises, it can be asserted that studying various scalar conditions with different inputs and operations can extend the existential givens to include various conditions, relations, and measurements. It can also be noted that the diversification of measuring tools and units, and also the operations used to study scale provided contingent definitions of scale. Therefore, the outputs of the exercises can also be acknowledged as stretching the limits of perception and contemplation to include alternative conditions which cannot be defined only in reference to precise and standard sources of comparison or measurement.

The proposed multi-layered understanding of scale and the ambiguity of the scalar reference system can be considered as an implicit potential for architectural design processes and architectural education. This approach has the potential of defining scale, not as a metric unit, but rather as a network of relations, which can further transform our conceptualization of scale and hence the architectural space.

Endnotes

1. Lukinbeal studies the relationship of scale with the human condition and traces two specific accounts in the history of scale. According to Lukinbeal the scale is either considered as a mental artifact (mentifact), which defines its relationship with the human condition and as a representational device for the transcription of three-dimensional objects into two-dimensional representation. He uses the term together with sociofact and artifact in the discussion of cultural traits and explains the mentifact as 'mental constructions which provide the psychological framework of a culture and carry out intellectual, aesthetic, spiritual, ethical or other psychological functions.' (Lukinbeal 2016).

2.'Immeasurable' and 'unmeasurable' are two terms that often used as synonyms to one another. However, in the scope of this article, there is a conscious preference in the use of immeasurable over unmeasurable as their definitions diverse slightly. Immeasurable signifies a quality of being extensive or extreme to measure, relates directly to the quality of the object whereas unmeasurable is referring to the lack of capability in measuring, therefore can be associated to the action of measuring.

3. A close survey to the history of scale and its relation to man reveals how the body provided the first referent from which scale as a 'mentifact' as declared by Lukinbeal, was constructed. As Protagoras (490–c. 420 BC) claimed, 'Man is the measure of all things. Similarly, Leonardo da Vinci's 'Vitruvian Man' (1490; Figure 2) linked proportions of body parts in relation to the earth (the square) and the heavens (the circle).

4. As in Emmons (2005): 'Size Matters: Virtual Scale and Bodily Imagination in Architectural Drawing', Tanju (2015): 'Cetvel', Bal (2020) 'Cetvel: Elin Araçları, Soyu Tükenen Çizim Enstrümanları'.

5. The idea of trying to understand nature through the existence, gestures and actions of man has always been an issue since Renaissance in the search for how human beings meaningfully inhabit the world. In 20th century the issue also preoccupied many philosophers from Henri Bergson to Maurice Merleau-Ponty. According to Bergson, people understand the world through the body's ability to act on things. Objects in turn become meaningful because they seem to shape themselves to accommodate these capabilities. See; Anderson, 2002.

6. Focusing on the action of resizing through different reference units is another scalar inquiry studied under the notion of scalability. Playing with the size of the reference unit was a tactic for observing the limits for scaling up & down, or playing with the tolerance level of the object at hand. It is a familiar strategy, which doesn't belong to the field of architecture alone but was even subject to well-known literature like Gulliver's Travels or Alice in Wonderland. For example, in Alice in Wonderland, the constant change of size of the heroine is employed as a significant aspect in determining the relationship with the context, her environment, and the people around her. The inconsistency of such scalar fluctuations provides Alice with new problems and opportunities to deal with. In Gulliver's travels, on the other hand, size was employed as a significant aspect in determining our society's relationship with morality. See; Swift, 1726 and Carroll 1871.

7. Continuous application of scalar operations is referred to as recursive processes in the paper, which takes its reference from Delanda's statements on the assemblage theory and the multi-scalar conditions he discusses in relation to part-to-whole interactions. See; Delanda, 2011.

8. Throughout the paper multiplied conditions are deliberately differentiated from the recursive / iterative conditions, where multiplication is considered as an operation and the recursion / iteration is considered as a process. Recursive / iterative processes are defined as establishing practices that can repeat themselves or a sequence of operations or procedures, where the multiply operation can be repeated as a part of the practice.

9. This discussion is also valid in the universally accepted decimal metric unit systems, which are defined through unit multiples (of 10). As the measured values are repeated multiple times and outreach the cognitive capacity of the human, the unit multiples are applied for computational ease and the scalar ambiguity is managed through the shift in the scalar reference system (i.e. mili/canti/kilo… meter or gram/ kilogram/…etc.)

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References

Anderson, A. T. (2002). On the Human Figure in Architectural Representation. *Journal of Architectural Education*, *55 (4)*, 238-246.

Bal, B. (2020). Cetvel: Elin Araçları, Soyu Tükenen Çizim Enstrümanları. Retrieved 19 February 2022, from https://manifold.press/cetvel.

Brentano, F. (1981). *The Theory of Categories.* The Hague: Martinus Nijhoff Publishers, 10.

Carroll, L. (1871). *Alice in Wonderland Alice's Adventures in Wonderland and Through the Looking-Glass*, London: Penguin Books.

Delanda, M. (2011). *Philosophy and Simulation: The Emergence of Synthetic Reason*. New York: Continuum.

Delaney, D. & Leitner, H. (1997). The Political Construction of Scale. *Political Geography, 16* (2)*,* 93-97.

Emmons, P. (2005). Size Matters: Virtual Scale and Bodily Imagination in Architectural Drawing. *Architectural Research Quarterly*, *9* (¾), 227- 235.

Le Corbusier. (1950/ 2011). *Modulor I*. Basel, Switzerland: Birkhauser.

Le Corbusier. (1955/2011). *Modulor II*. Basel, Switzerland: Birkhauser.

Lukinbeal, C. (2016). Scale and its Histories. *Yearbook of the Association of Pacific Coast Geographers*, *78*, 15–27.

Papapetros, S. (2010). MICRO/MACRO: Architecture, Cosmology, and the Real World. *Perspecta*, *42,* 108-125.

Sallie A. M. (2000). The Social Construction of Scale. *Progress in Human Geography, 24* (2), 219–242.

Swift, J. (1726). *Gulliver's Travels*. London: Penguin Classics.

Tanju, B. (2015). Cetvel. Evren. S. (Eds.). *Cevdet Erek Az Boş Belki*. Berlin & Istanbul: Revolver & art-ist.

Türkay Coşkun, S. (2017). Part and Whole: A Mereological Framework for Architectural Form. Unpublished Ph.D. Thesis, Middle East Technical University (METU), Ankara.

Snyder, C.R. & Lopez, S. J. (Eds.). (2009). *The Oxford Handbook of Positive Psychology.* Oxford; New York, NY: Oxford University Press.

Tavernor, R. (2007). *Smooth's Ear: The Measure of Humanity*. New York: Rizzoli.

Wallick, K. (2012). *Generative Processes: Thick Drawing*. International Journal of Art and Design Education, *31*(1)*,* 19-29.