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Desineer: Experimental Space Production in VR Environment

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Abstract: Architecture students and professionals had the opportunity to produce experimental spaces with the power of computer technologies, apart from traditional methods in space production. Technologies such as parametric design, Building Information Modelling (BIM), visual coding, and virtual reality hold new horizons for space production and the architecture itself. Despite all their potentials, they are still mainly used to support the design process or to present a project. The use of these tools is limited only to the effort to produce different and "impressive" forms based on aesthetic concerns. The study aims to examine the different possibilities of space production through digital space experiments. In this context, an experimental Virtual Reality (VR) application named “Desineer” was developed with Unreal game engine. The program has an easy interface where users can directly grab, drag, place and shape mesh objects. The Hands have played an important role in production throughout human history. Desineer eliminates the intermediary tools such as keyboard and mouse, with the help of VR technology, allowing the production of digital space directly by hands. By using the program, experiments were conducted on the manual production of digital space at Dumlupınar University Faculty of Architecture for students to gain new experiences. Within the scope of the study, first, discussions were held on space and the production of it for the students to develop their own ideas and perspectives, albeit fundamentally. Later, poems on different themes belonging to various poets were given to the students. The students read these poems and think about how the poems made them think and feel. Finally, the students produced improvised spaces based on these ideas and emotions using Desineer. It was observed that the workshop contributed students to the development of different perspectives on the production of space.

Keywords: Virtual Reality, Space, Production of Space, Digital Space, Production of Digital Space.

1. Introduction

1.1. Production of Space

Although there are different definitions in the dictionary, space is a concept that is in constant motion and that is impossible to define with certainty. Definitions tried to be brought to the concept of space in the historical process played an important role in shaping the architectural understandings of that period. Perhaps for this reason, space has been one of the most discussed concepts of both philosophy and architecture. Aristotle imagines space as the environment in which we experience things (Lefebvre, 2009). According to him, the subject perceives the categories through space. Moving from Aristotle in modern philosophy, Kant describes space as the imaginary of premonitions based on external intuitions

(Ülger, 2016). Thus, space can be thought of as a priori, insulated from the subject and things. In other words, space enters the domain of the absolute. It is now object versus subject (Lefebvre, 2009). Heidegger, on the other hand, thought of space as a place of interaction and experience and positioned it within the concept of "existence". In this respect, the world we live in expresses an unpredictable universe containing many possibilities (Ülger, 2016)..

Modern architecture has embarked on a search for an objective space based on the Cartesian philosophy, in the hope that it will put an end to the debates and eliminate ambiguity. Modernists have seen space as a mathematical concept based on the Euclidean coordinate system (Koçyiğit & Gorbon, 2012; Tanyeli, 2017). Although they think that by doing this, they remove all ambiguities (Vidler, 2000) and define the concept of space in an unchanging way forever, the Modernist Mathematical Precision Ideal in architecture has also been demolished as the problem and solution metaphors lost their validity over time (Tanyeli, 2017). This experience has clearly shown that it is not possible to construct an unchanging architecture over time by bringing objective definitions and methods to architecture.

Leach (2013) says that the architectural plan, like all other techniques in architecture, is a fiction that has been historically shaped by architectural historians. According to him, it is not a gift of architecture that architects think planimetrically. Tanyeli (2017) also claims that space production in terms of design can be traced back to the second half of the 15th century at the earliest. According to him, what has had an economic equivalent for centuries is space itself as a product. In this process, the production of the space is the production of the building rather than the design in the modern sense. In Heidegger's words, it is "Building and Dwelling" (Sharr, 2010). It is not in vain that Heidegger associates' space with the subject. For example, aren't the huts made by children out of pillows a kind of space production? These places are improvised and do not have any pre-drawn blueprints. The space is almost like an extension or even a continuation of the child's body. It exists with the subject that builds it. Similarly, reed huts or mud houses built by the locals are also a kind of building and dwelling action. That experience based structures are often produced without a blueprint.

The transformation of space into an abstract concept by being cut off from time with modernism (Koçyiğit & Gorbon, 2012) paved the way for the systematization of design work by placing it in an academic framework. Thus, the production of space has been reduced to a project-based uniform method. The study aims to create new paradigms on the production of space by questioning the channels other than project-based space production. However, it is not a method suggestion. It is just one of the questions about the endless possibilities of space production.

1.2. From Space to Digital Space

Philosophical and scientific understandings, technology and production techniques that change over time are constantly undermining the concepts in architecture as in many other fields. Even the concepts that were previously thought to be the most agreed upon are becoming increasingly groundless. The concept of space has also begun to become obscure and disembodied (Vidler, 2000). The fact that computer technologies and digitization play a more active role in architecture cause the space to shift from concrete to abstract -reality to digital-. With the spread of the Internet and the introduction of social media into our lives, people are increasingly building virtual lives parallel to their real lives and allocating more time to these virtual lives. As a result, the boundaries between real space and digital space are increasingly blurred. Digital space, with its new perspective to architecture, has affected the existing design understanding and made the physical space flexible enough to turn it upside down. Because it is more flexible and variable, compared to physical space, it has fewer limiting elements.

2. Production Methods of Digital Space

The use of information technologies in architectural education has mainly been limited

to supporting project-based space design, in other words, computer-aided design (CAD). Integrating tools such as computational design, parametric design and virtual design environments in universities has been no significant yet (Gül et al., 2013) and their stimulating potential for space production methods has not been used sufficiently.

2.1. Computer Aided Design (CAD)

Since the 1970s, the concept of digital design has developed rapidly and has undergone many structural changes until today's technology. Firstly, one-dimensional, text-based digital designs were replaced by visual interfaces that were developed as two-dimensional and graphical databases later. The beginning of the design method called computer-aided architectural design (CAAD) dates to these dates. The idea of computer-aided design (CAD) first emerged in 1963 with the program called "Sketchpad" created by Ivan Sutherland in his doctoral thesis. The fact that the program has parametric variables has also allowed the idea of parametric design to develop. Later, computer aided design tools have been widely used in terms of architectural presentation techniques in the 1980s. However, in those years, it served more as a way of expressing designs rather than using it to support design.

2.2. Parametric Design

Kolarevic (Kolarevic, 2003) stated that digital technologies and parametric design have an increasing importance in contemporary architectural practice. Unlike traditional methods, parametric design tools have serious potential in design, production and building construction in architecture. These technologies offer architects new design and production approaches and provide powerful tools for the creation and analysis of architectural forms (Kolarevic, 2003).

Aish and Woodbury (2005) emphasize that parametric design is an approach that includes the interaction of parameters at different levels to affect the design process and results. Unlike traditional design, parametric design is an approach where design decisions are based on mathematical parameters and can be changed. Parametric tools allow the design to become more flexible, adaptive, and optimizable. The multi-level interaction potential of parametric design allows architectural projects to be more sophisticated, optimized, and sustainable. Therefore, parametric design is an approach that is becoming increasingly common and important in architecture.

Menges and Ahlquist (2011) focused on how algorithms and computational methods can be integrated into the design process and how they can optimize the design in their work on the philosophical foundations and theories of computer aided design thought. Computation and algorithmic design is an important approach in architectural practice that transforms design processes and enables design to achieve more complex and optimized results.

Parametric design, on the other hand, is a design process in which a problem created using certain variables is defined and many alternative results can be produced by changing the variables. Parametric design systems are based on algorithms and act as tools in original-variable product design. Designs created using codes and functions open new avenues for non-project-based space production. Parametric design allows the design to be renewed and updated by changing the parameters at any time of the design stages (Varlı, 2013). It has a significant potential in the production of experimental spaces, as it allows different variations to be tried easily. The fact that the parametric design allows different variations to be tried easily has a significant potential in experimental space production (Eltaweel & Su, 2017).

2.3. Virtual Reality (VR)

Digital technological developments also affect our understanding of creating contemporary spaces by influencing today's architectural infrastructure. Manipulations using virtual reality and cognitive technologies play an important role in the formation of today's technological age (Rashid & Couture, 2002). Virtual reality was initially used for the presentation of projects with panoramic pictures or videos. With the discovery that game

engines can be used to produce simultaneous realistic images, the use of this technology has advanced in architecture as well as in many other fields. Today, with the further development of game engines, factors such as illumination, shading and reflection can easily be animated simultaneously by computers. Realistic 3D images can now be easily obtained with the support of powerful graphics cards. Although its use in architecture remains mainly at the level of project presentation, virtual reality technology has serious potentials for questioning the identity of the architect and the methods of space production. In addition to contributing to overcoming the material and physical restrictions in the real world, this technology also provides many conveniences in learning by trial and error and by doing and living (Dede, 1995).

3. Desineer: Production of Experimental Space in Digital Environment

As in many fields, the developments in technology have paved the way for a radical change and transformation process in architecture. Tanyeli (2017) underlines that architectural concepts need to be redefined and redefined every time in a changing world. Redefining the concepts also means that questioning and redefining the methods and tools used in the production of these concepts.

3.1. Desineer

Desineer is a VR-supported experimental application developed to examine the different possibilities of space production in line with this purpose. The name of the program was produced by distorting the word "design", which is the English equivalent of design, as a reference to the reduction of space production to project design today. The program was developed using the Unreal game engine. Its interface consists of a virtual environment reminiscent of 3D game spaces (Figure 1).

3.2. The Interface of The Desineer

By pressing the button tagged as 2 of the Oculus right hand grip, it is possible to switch between the types of objects to be added. Currently, there are 8 simple geometric shapes that can be added to the program: cube, cylinder, sphere, triangular prism, pyramid, cone, torus, and plane. Which shape will be added to the scene appears as an icon on the left side of the screen. By pressing the 2nd button of the left-hand grip, it is possible to switch between operations

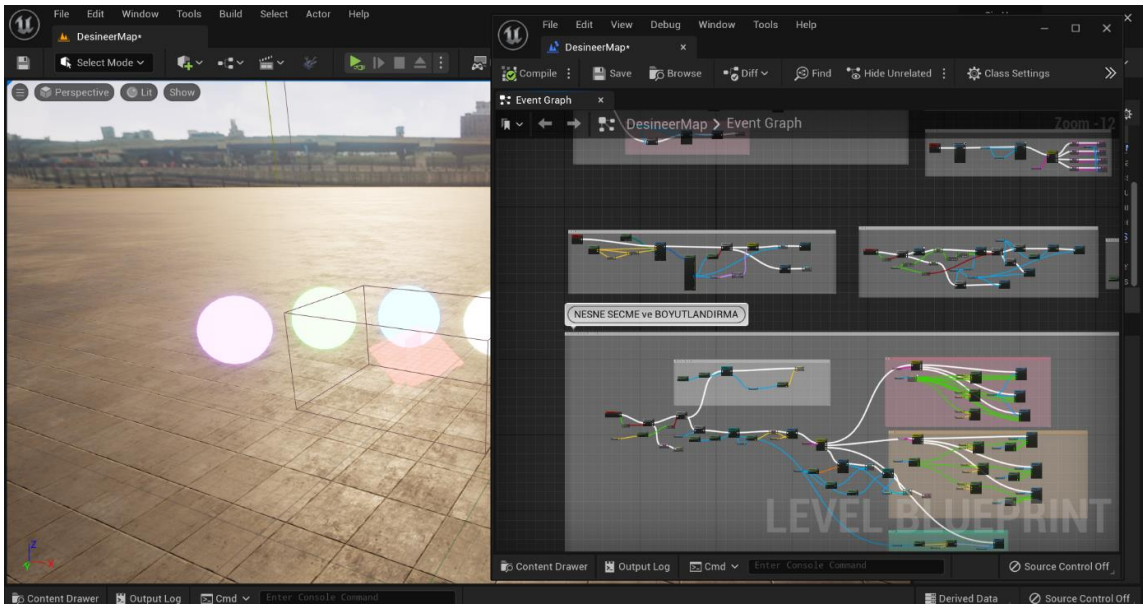

Figure 1: *A screen capture from the development process.*

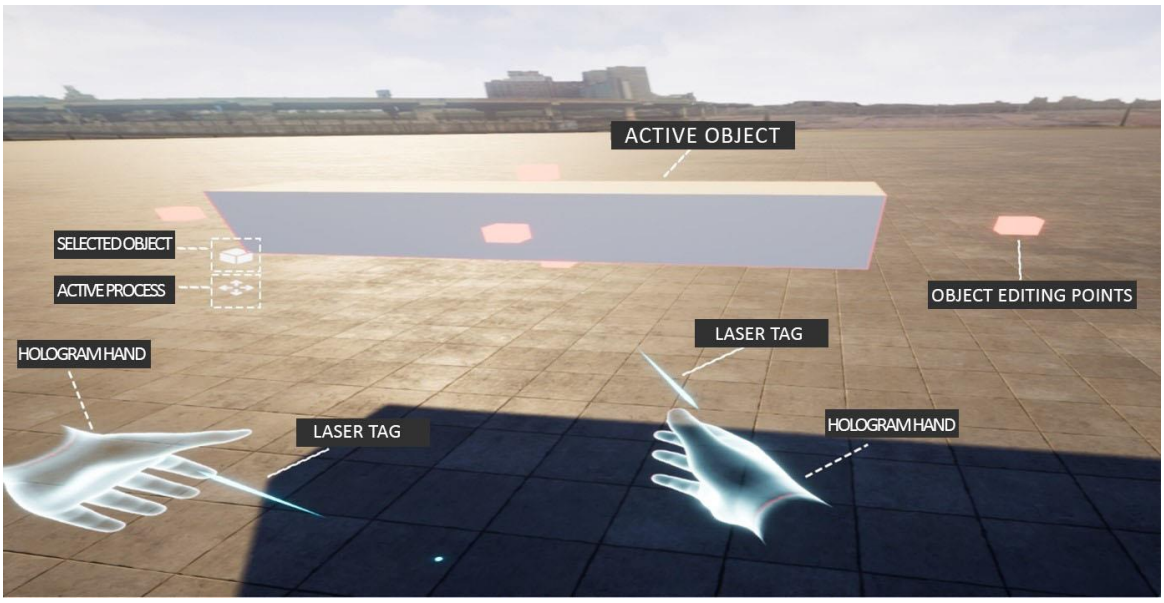

Figure 2: *A screen capture from Desineer.*

(push-pull), moving, rotating, copying, etc. on active object. The selected operation can be also seen as an icon on the left side of the screen (Figure 2).

Desineer has interactive tools such as surfaces and meshes used for space production. In order not to limit the production of space as a visual and graphic-based activity, light sources, and sound (audio sources) elements have also been added to these tools. With using these tools, users can produce experimental spaces as they wish.

Tadao Ando says hands are extensions of our minds. There is a direct relationship between manual creation and production. With the help of VR technology, Desineer eliminates intermediaries such as keyboards and mouses in the production of digital spaces and allows the use of hands directly. Just as students can create mass experiments in a bird's-eye environment just like making models, they also can experience the space and continue to produce it simultaneously by descending to the human scale.

3.3. Space Production Experiments

An experimental workshop called "Digital Space Production" was carried out with the Desineer program at Dumlupınar University Faculty of Architecture to conduct experiments in which digital space is produced directly by

Figure 3: *Digital space production studies with Desineer (Photo: Şahbaz & Bakırhan, 2022)*

hand with VR (Figure 3). Within the scope of the study, first, discussions were made on space and the production of space.

Students were asked to come up with different ideas about what the production of space could be apart from project design and building construction. Thus, it is aimed to develop their own ideas and perspectives on the subject, even at a basic level. Later, poems on different themes belonging to various famous poets were given to the students. By reading these poems, the students thought about what the poems made them think and feel. Finally, they were asked to produce improvised spaces on these ideas and emotions using the Desineer program. Some of the studies are briefly mentioned below.

Study #1:
The subject of the study is the poem entitled "The Interrogation of The Good" by Bertolt Brecht. The poet questions human virtues through the concepts of good and bad in his poetry. What makes a person good or bad? Is being different from the bad enough to be good? Is it a virtue to be a good person? So, what is the thing we call virtue? In the work, there is a thin

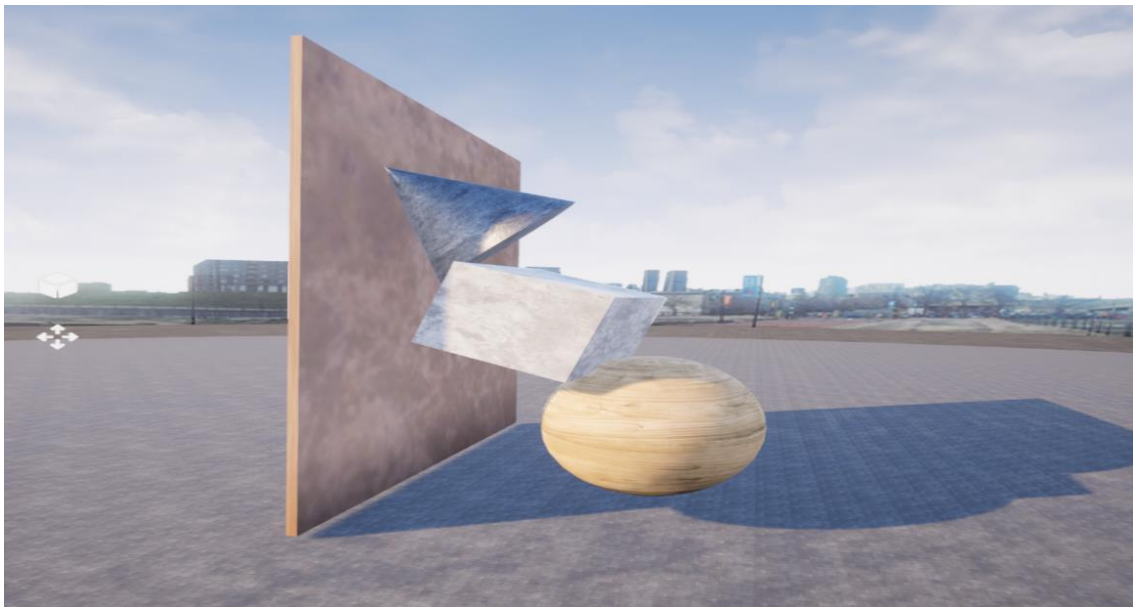

Figure 4: *Screen capture from Study #1*

wall and three geometric figures standing on top of each other (Figure 4). It all seems to be in a very delicate balance. It is not clear whether the wall holds the objects or whether the objects prevent the wall from falling over.

Study #2:
The study is about Ahmet Haşim's "The Stair" poem. The poem describes life and death with the metaphor of a stair. In the poem, life is symbolized by slowly climbing the stairs and death is symbolized by the reaching end of the stair and seeing sunset. The desperation of slowly approaching death is strongly felt. There is a long passage that evokes a tunnel and illuminated shapes on the path that looks as if you're reaching out to touch it in the work (Figure 5). Each illuminated shape represents special experiences in the life.

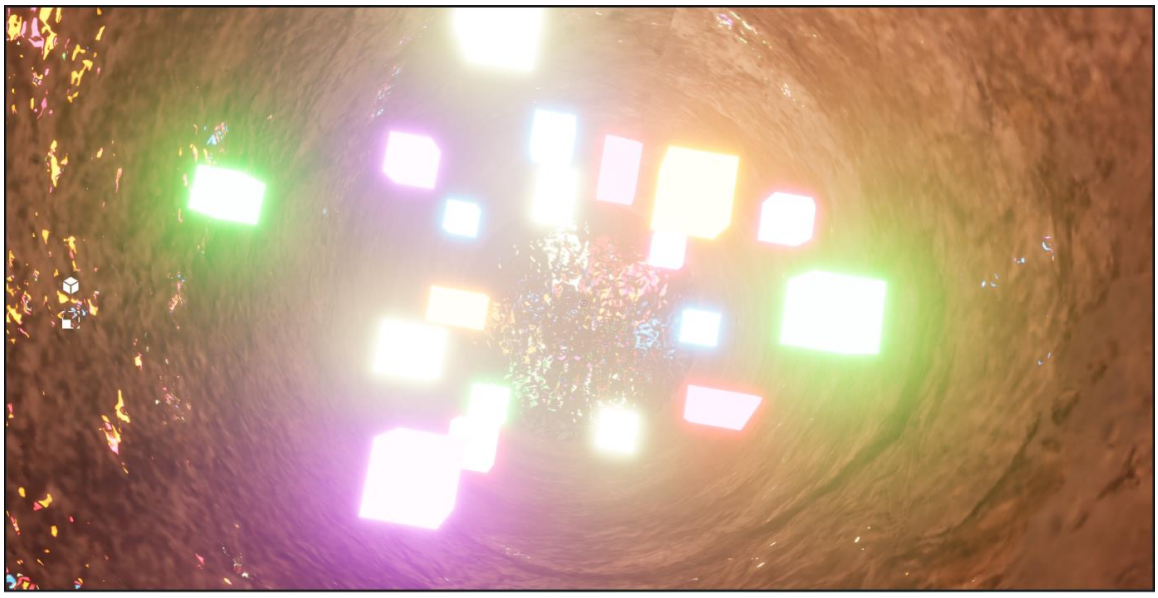

Figure 5: *Screen capture from Study #2*

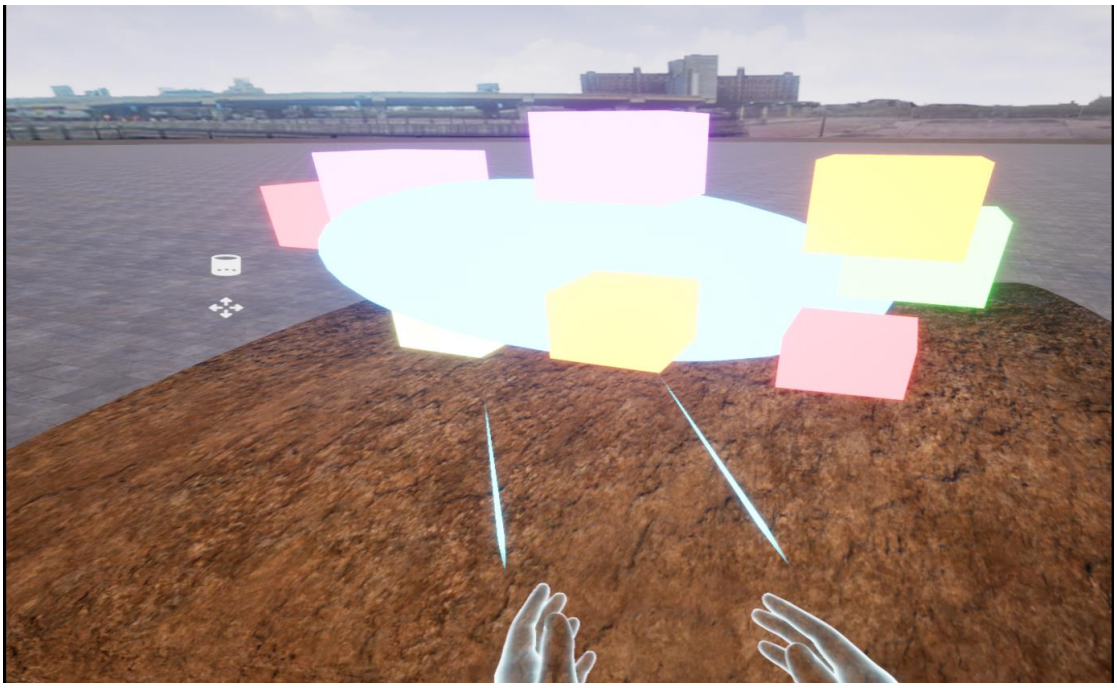

Figure 6: *Screen capture from Study #3*

Study #3:
The study is about Sezai Karakoç's poem entitled "Mona Rosa". In his poetry, the poet describes his desperate love for a woman with the metaphor of a rose. The poet named the rose, which he identified with the woman he loved, mona rosa. He identifies with the delicateness of the rose that he cannot reach her even though he is close enough to touch her. There is a deep sense of desperation in the poem. In the work, there is a blue shape resembling a balloon and surrounding masses which holding it (Figure 6). These objects stand on the far edge of a large rock. If someone touched, it seems the masses holding it will fall off and it will be rolling down the rock or flying away trough the sky.

Study #4:
The study is about Nazım Hikmet's poem entitled "Green-Eyed Giant". The poem is about a man who has great ideals and puts his ideals before everything, and a woman who does not understand the greatness of his thoughts. The woman has abandoned him and his ideals for a better life. Although the poet blames the woman for left himself alone, he seems to be caught between his desires and ideals. The scene consists of many masses in different materials, colors, and shapes (Figure 7). At first glance, it is not clear whether the scene is chaotic or organized. Are the colors on the objects their own colors or do the reflected lights cause illusion? Do the beams prevent the top cover from falling or rising up?

Heidegger says that producing works in art with purely aesthetic concerns will reduce them to the craft level (Bolt, 2014). Today, aesthetic concerns have also become dominant in architecture. Architects often prioritize the aesthetic dimension of the space when designing projects. Again, the architectural products are often evaluated in terms of aesthetic concerns. However, space is more than aesthetics, and just like in art, keeping only the aesthetic dimension in the production of space reduces architecture to the level of craftsmanship. Based on this, the experience dimension of the space was tried to be examined in the experiments. What is tried to be produced is the search for the space that triggers our feelings, rather than the space in the sense of building -reduced to aesthetics-. The students tried to abstract the effect and feelings of the poem they read on them in the spaces they produced.

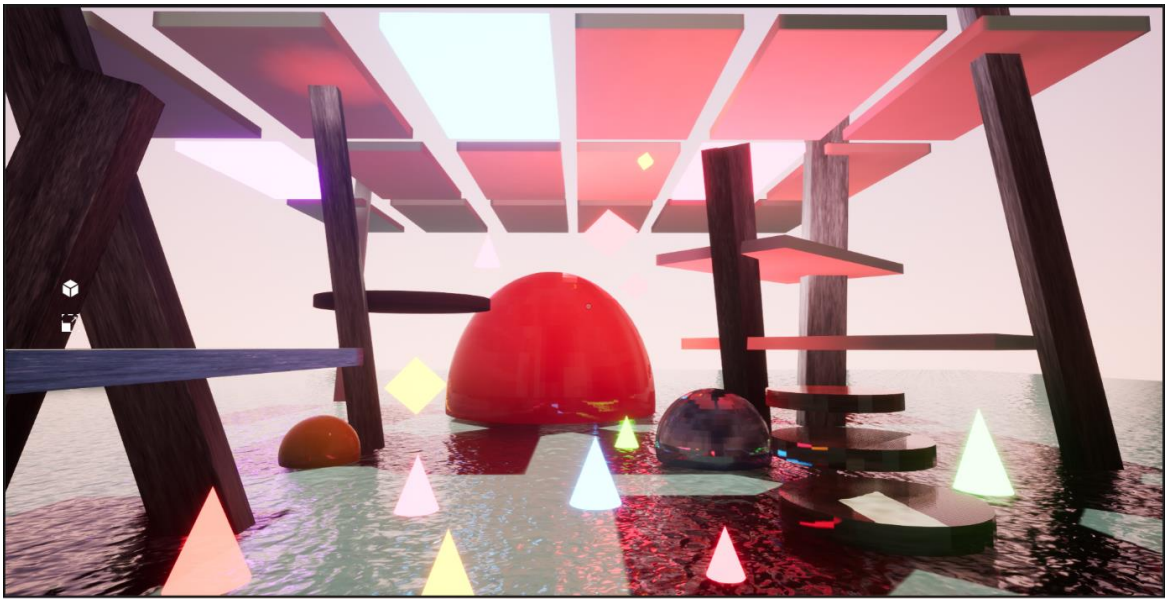

Figure 7: *Screen capture from Study #4*

Although project workshops in architectural education are mostly based on the logic of individual work, the complex nature of contemporary practices necessitates collaborative teamwork (Crosbie, 1995). Architects often need to work collaboratively not only with their colleagues but also with engineers, contractors, and clients. Desineer also allows students to produce experimental spaces as a team with the support of "Multiplayer" support. Thus, it enables the communication and interoperability of the stakeholders based on mutual information exchange in the production of space.

4. CONCLUSION

Wittgenstein states that none of our experiences are “a priori”. According to him, everything we observe could be different, and everything we can represent could also be different (Hadot, 2009). Every produced space could have been produced in a lot of different ways. Contrary to what Kant and his followers claim, space has not got a priori order (Vidler, 2000). The absence of an ideal definition—in other words, its intangibility—constitutes a dilemma when it comes to its production. And maybe this dilemma itself opens a door to endless possibilities in the production of space.

According to Heidegger, if an artist knows in advance what he will do while making a work, what emerges is not art (Bolt, 2014). Art is the challenges experienced in the process of the emergence of a work, and the work becomes an artwork when it has finally produced. Likewise, it is the encounters that shape the space in its production and experience by the user, and architecturally, space emerges with this process. In other words, it is this process that shapes the space and offers different possibilities in the production of the space.

With the workshop, it has been tried to open the door to the said possibilities that have no limits on what the concept we call "space" can be and how it can be produced. In this direction, students made different experiments on digital space production with Desineer individually or as a team. In the study, students produced both completely abstract and hybrid (abstract + concrete) spaces by using light and sound in space production as well as three-dimensional objects. In fact, these works are not very different from a child's pillow house tryouts. Or the locals’ houses which were made from reeds or mud. Just as a child experiences the space, he/she creates with his/her whole body when he/she builds a house from pillows, the students

also had the opportunity to directly experience the digital space they produced via virtual reality environment. These experiences helped the students to develop questions about the different possibilities of space production and the role of the architects in it.

In the discussions held at the beginning of the study, the students generally brought more concrete definitions to the space, and many of them directly associated it with the constructions. After the experience, it was observed that the students were no longer as sure of their views about the space as they used to be, and that there were much more question marks in their minds about what the space is.

Note: This study was produced from the paper named "Desineer: Experimental Space Production in VR Environment" presented within the scope of MSTAS 2022 (16th Digital Design Symposium in Architecture).
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