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3d spaces in architecture: Structural examples and user experience in Bitlis

Mimaride 3 boyutlu mekânlar: Bitlis'te yapısal örnekler ve kullanıcı deneyimi

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ABSTRACT

After the outbreak of the pandemic in 2020, which had a global impact, the concept of space, both as a definition and as an experience, has moved far away from traditional frameworks that only describe a physical realm. It has introduced "Virtual Spaces" into our lives, making it necessary to reconsider the concept of space. This study focuses on the city of Bitlis and its 3D virtual representations of its historical sites, taking into account the richness of its cultural heritage, while investigating what differences emerge between physical and virtual spaces in terms of user experience. The research includes elements of historical heritage that already have virtual data in the digital environment, such as Ahlat Seljuk Square Cemetery, Bitlis City Center, İhlasiye Medrese, Hizan City Center, and the Döküktaş Church. The differences in the navigation schema between virtual and physical spaces were evaluated based on users' experiences in virtual spaces. In this context, a field study was conducted with 22 participants, limited to some questions and tasks directed at them. Thus, the reasons behind the differences in navigation experiences between virtual and physical spaces, based on the users' experiences, were explored. The results of interviews conducted through a virtual platform revealed the user's virtual space experience and the variety of this experience.

As a result, it was observed that the increase in virtual space data enhances the visibility of the city and sparks curiosity in individuals, thus creating a desire to physically experience the space. Additionally, due to Bitlis' scattered urban texture, it was found that 3D representations of historical sites enable a richer spatial experience.

Keywords: *3D Spaces, Bitlis, Cultural heritage, Physical space, Virtual space.*

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Bu makale, Narin Onat'ın Dicle Üniversitesi Fen Bilimleri Enstitüsü'nde yapmış olduğu "Tarihsel Süreçte Kamusal Mekânın Değişim ve Dönüşümünün Kavramsal Analizi: Gelenekselden Sanala" isimli doktora tezinden üretilmiştir.

ÖZET

Mekân teknolojik gelişmeler doğrultusunda, gerek tanım olarak gerekse de deneyim olarak, fizikselin tarif ettiği geleneksel alandan epeyce uzaklaşmış ve 'Sanal Mekân'ları hayatımıza sokarak kavramsal değişime uğramıştır. Gerçeğe yakın deneyimi amaçlayan sanal teknolojiler fiziksel mekânda gerçekleşen süreçleri taklit ederek veya yeniden kurgulayarak mekan deneyimini farklı bir boyuta taşımaktadır. Bu çerçevede çalışma, Bitlis şehri ve tarihi mekanlarının 3D sanal temsillerine odaklanarak, kültürel mirasının zenginliğini göz önünde bulundururken, fiziksel ve sanal mekanlar arasında kullanıcı deneyimi açısından ortaya çıkan farklılıkları araştırmaktadır. Araştırma, Ahlat Selçuklu Mezarlığı, Bitlis Şehir Merkezi, İhlasiye Medresesi, Hizan Şehir Merkezi ve Döküktaş Kilisesi gibi dijital ortamda halihazırda sanal verilere sahip tarihi miras unsurlarını içermektedir. Sanal ve fiziksel mekanlar arasındaki navigasyon şemalarındaki farklılıklar, kullanıcıların sanal mekanlardaki deneyimlerine dayalı olarak değerlendirilmiştir. Çalışmanın metodu, sanal ve fiziksel mekan arasındaki gezinti şemasının birbirinden nasıl farklılaştığını belirlemek üzere, kullanıcıların sanal mekândaki deneyimlerinin değerlendirilmesidir. Çalışmanın yöntemi, 22 katılımcı ile gerçekleştirilen, onlara yöneltilen bazı sorular ve görevlerle sınırlı bir alan araştırmasıdır. Böylece sanal mekanda kullanıcı esas alınarak edinilen gezinti deneyiminin ardında yatan nedenler netleştirilmeye çalışılmıştır. Sanal bir platform üzerinden gerçekleşen görüşmeler neticesinde kullanıcının sanal mekan deneyimi ve bu deneyimin çeşitliliği saptanmış olup, bunun çeşitlenip yaygınlaşması neticesinde kente sağlanacak mimar mekansal potansiyel sorgulanmıştır. Sonuç olarak, sanal mekanın deneyiminin fiziksel mekandan duyusal, zihinsel ve mimari olarak farklılık gösterdiği ifade edilmiş olup; sanal mekan verilerindeki artışın şehrin görünürlüğünü artırdığı ve bireylerde merak uyandırdığı, böylece mekanı fiziksel olarak deneyimleme arzusu yarattığı gözlemlenmiştir. Ayrıca, Bitlis'in dağınık kentsel dokusu nedeniyle, tarihi mekanların 3D temsillerinin daha zengin bir mekansal deneyim sağladığı tespit edilmiştir.

Anahtar Kelimeler: *3 boyutlu mekânlar, Bitlis, Kültürel miras, Fiziksel mekân, Sanal mekân.*

1. INTRODUCTION

Space, by definition, is a complex and multifaceted concept, and as such, it has been considered a concept worthy of research for many disciplines. In its most general definition, the concept of space—used to describe the limited, physical things in which we live and act—is the domain of disciplines such as philosophy, mathematics, sociology, politics, and even history. Architecture, on the other hand, can be defined as a practice that, without considering the characteristics of space or its context, is relatively less open to debate. This situation is directly related to the fact that space has been approached for many years as a geometric and volumetric void (Zevi, 1999 and Hasol, 1999). Thus, technological, sociological, and historical contexts have been incorporated into the spatial dimension of architecture only later.

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First defined by Aristotle as “a dynamic field consisting of places that contain all directions and characteristics” (Partorekes, 1992), the concept of space is described by Karabey as a multidimensional perception. Heidegger, on the other hand, explains the concept of space as “Space includes linear orientations, measurable, calculable dimensions (2018). The essence of space is the extension within this void” (Aydınlı, 2003). Although architecture needs to conceptualize space as an object related only to its physical qualities without taking into account the evolutionary process of contemporary architecture, space reminds us of itself with a meaning far beyond these qualities. The concept of space, which was initially associated with a geometric concept, has transformed with Cartesian thought, abstracting its meaning and taking the position of an object opposite the subject (Lefebvre, 2014). Therefore, it is not possible to speak of a purely objective, volumetric, or self-contained spatiality. As Lefebvre states, “… until the 1970s, space referred to something defined mathematically (1991).” At this point, Casey expresses the changing meaning of space, which has undergone both conceptual and social fragmentation, as “the inclusive volumetric void in which things are located, an arena of action that is at once physical, historical, social, and cultural” (1997). Thus, space diverges from the definition accepted by architecture as “a part of science's quantitative and analytical aspect” (Portugali, 2006), repositioning itself technologically, socially, and historically.

Neither purely object or physical; nor abstract and cognitive. But at the same time, it is something produced formally or socially within its context. When considered alongside the concept of time rather than as a static and lifeless physical space, it refers to a perceived, fluid, variable, and living production. This living space, identified with the body, is the space of experiences, emotions, and excitement. For this reason, Lefebvre argues that every living being is a body-space and relates this to the person's self-production there and, consequently, to the production of their space (2014). Lefebvre produces the concept of the spatial triad by referring to the contradictions, relationships, partnerships, or conflicts that space contains. This conceptualization can be explained as “spatial production, spatial representation, and representational space,” based on the experience-based concepts of “perceived, designed, and lived” and derived from linguistic production (Lefebvre, 2014).

Even when considered solely in these contexts, space encompasses a meaning that is too broad to be confined to a purely physical assessment. Space, which can be experienced in multiple dimensions, is reproduced practically and theoretically by establishing relationships with other spatial formations. Rather than being merely a physical phenomenon, space can also be explained in terms of perception, interaction, and communication, acquiring a subjective and abstract character alongside measurable and objective data. "Architecture does not consist of the width, length, and height of the structural elements surrounding space.

Space is defined through these elements. In reality, space is the defined void that is experienced and moved within, surrounded by these elements" (Zevi, 2015). Modern thought re-conceptualizes space as absolute space. Thus, the concept of boundaries comes into play, and geometric rules are defined. Like Newton's understanding of absolute space, it is generally expressed by abstracting it from qualities other than physical, geometric, volumetric, and three-dimensional qualities. However, spaces are a multidimensional and multifaceted concept that carries traces of many disciplinary dimensions, such as physical, social, psychological, philosophical, historical, environmental, and ideological.

Technology and new media channels add a new dimension to this versatility of space, transforming its concrete and abstract characteristics. In other words, they have added a dimension that diversifies the language of communication and opens up new possibilities in spatial design. In this new dimension, space has become a concept that can be placed in entirely new contexts, differentiating design, experience, perception, and form, and promising new discourses about space as it differentiates. Especially after the Covid-19 pandemic that began in 2020, the relationship with the virtual world (space) has become stronger due to physical limitations. This situation has led to changes in the nature of computer games, the proliferation of new media platforms, the widespread use of social networks, and, of course, an increase in virtual spaces in the field of architecture. Spaces that cannot be physically experienced are being recreated using virtual environment data, offering a new and unmediated experience. In this virtual space where personal experiences take center stage, a mental space formation that allows for the perception of all senses rather than just a visual experience comes into play. This visually centered experience enables the space to change dimensions, shift locations through mental associations, and facilitate the formation of new identities.

The concept of 'space' is as important for social, economic and political issues as it is for architecture. In recent years, especially as a result of technological developments, space is not only something we experience physically, but also something that allows for virtual travel and experience. Space, both in terms of definition and experience, has moved far away from a space defined only by the physical in traditional patterns and has made it necessary to reconsider space by introducing 'Virtual Spaces' into our lives. Aiming for a near-real experience, virtual technologies have tried to adapt the experience of space to virtual spaces by imitating the processes that take place in physical space. Spaces formed by interconnected areas bring with them the necessity of establishing a ground for circulation, just like in the physical world. The space that finds meaning virtually has now become a space that is rethought with different concepts. These concepts can be characterized as virtual wandering, the digital experience of the virtual or simply relating to the physical.

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In order for a space to be experienced virtually, it should have various qualities just like physical spaces and there should be various auxiliary tools to provide these qualities. From this point of view, it is clear that virtual space is a matter that needs to be considered at least as much as physical space in the design phase, so it should include more than just an environment where physical space is imitated. (for conclusion) The interfaces provided by virtual reality offer highly advanced tools for imitating architectural spaces and modeling them close to reality (Henry and Furness, 1993). During the experience of the space, the user's recognition of the space to be navigated, the design of the interface where the user can explore the use of appropriate tools, and the creation of a visual effect that evokes the feeling of being in a real physical space have pointed to a new problematic for architecture. In addition, in the area described by virtuality, unlike physical space, the relationship of space with scale should be taken into consideration with the fact that the issue of scale can evolve to the point of misleading the person at any moment. In addition to the factors that will facilitate the movement of the person in the space, it should not be ignored that the visual experience also corresponds to a personal experience of space, since the personal connection with the space is completely visually constructed (Figure 1).

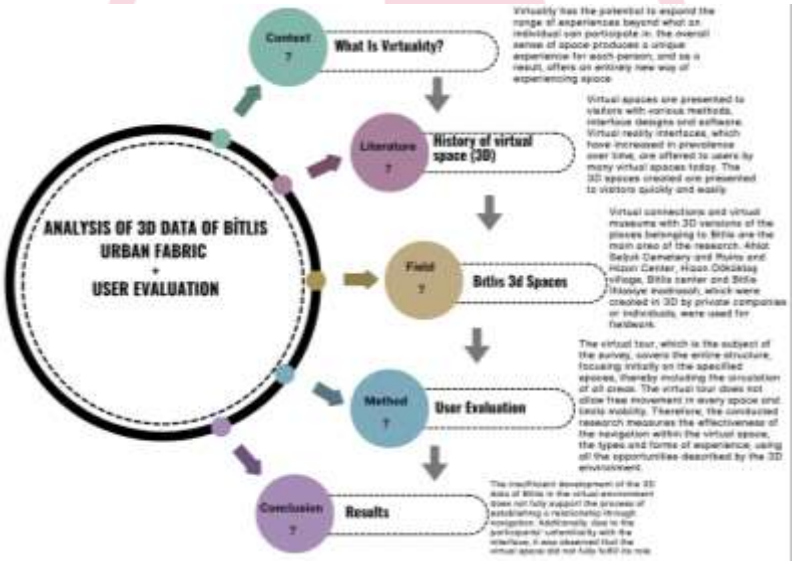

Figure 1. Methodology of the study

Virtual museums and 3D spaces - the most common ones in Turkey - are one of the places where we can experience more navigation and visual communication processes in virtual spaces. While in the physical space the museum or space experience is usually planned to relate to social memory, personal experience, publicness, freedom, can this be the case in virtual space? In other words, the question of whether the purpose of the experience promised by the physical can be exactly adapted to the virtual, and even if so, whether it will have the same effect is particularly important in the context of this study (Figure 1).

The physical museum, which is built on a systematic transfer of knowledge, provides an experience by simply existing in that space, touching, hearing and seeing the space. As a result of this experience, the space formed in one's mind points to a multifaceted cognitive fiction. However, in the virtual museum, rather than being in that space in person, being in the virtual world, using its tools and staying within the limitations described by it, a completely different experience is experienced. This experience is quite different from the physical one even in the sense that it takes place only on a visual ground. The software for virtual spaces and 3D spaces, which are presented only in the virtual world and focused on visual experience, aims to shape this experience with the tools it offers.

1.1. Literature Review

The first works involving virtual space and architecture appeared at the end of the last century. Over time, with the evolution and popularization of technology, studies have been conducted that have enabled the spread of virtual space in various fields, including the representation of cultural heritage. Research on the use of the changing concept of space in architectural practice with digital technologies is mostly explained in relation to the concepts of advantages-disadvantages, opportunities, possibilities, change, architectural education, and publicness. The study titled "Preserving cultural heritage with digital design and NFT technologies: Innovative approaches in architectural education" by Özeren et al. not only investigates the impact of digital technologies on architectural education, as in other studies, but also presents research on the use of digital technologies in the preservation of cultural heritage. (2024) Because cultural heritage elements, by their very nature, are an area where all traditional discourses related to the concept of space can be produced. But at the same time, it is an area where, in addition to all traditional narratives, the virtual space is conceptualized, experienced, and discourse is produced using digital data.

İbrahim and colleagues (2021) published a study investigating the effects of virtual reality on the study of architectural history, according to which users virtually visited famous buildings such as Le Corbusier's Villa Savoye and Frank Lloyd Wright's Fallingwater. According to the research results, the continuous structure of the virtual space was found to be more effective in acquiring spatial knowledge compared to the traditional spatial experience. In 2021, Chan and colleagues used virtual reality for the remote teaching of architectural history, reconstructing the Parthenon in Rome in a virtual environment by adding interactive and audiovisual tools. In this study, which was created based on user experience, the ways in which users expressed their experiences regarding the relationship between architectural structure and history were evaluated (Chan et al., 2021). In this study, a comparative analysis of traditional and virtual spaces was also conducted.

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Ashraf Gaafar (2021) conducted a user-based study on the use of a meta database (i.e., a multi-user immersive virtual reality aimed at teaching architectural history) in architectural heritage education in Egypt. The research, conducted in a remote education (virtual) environment using virtual data, is based on conducting architecture education entirely virtually by replacing traditional users with avatars.

1.2. Materials/ Preliminaries

Virtual connections and virtual museums with 3D versions of places belonging to Bitlis are the main area of research. Ahlat Seljuk Cemetery and Ruins, one of the virtual museums created by the Ministry of Culture and Tourism, and Hizan Center, Hizan Döküktaş village, Bitlis center and Bitlis İhlasiye madrasah, which were created in 3D by private companies or individuals, were used for fieldwork. Due to the lack of 3D data on Bitlis other than the selected places, the study was limited to the specified areas. With the surveys conducted with the users, the specified areas were experienced.

1.3. Methods

The method of the study is to evaluate how the navigation scheme between virtual and physical space differs from each other and how users experience virtual space. Accordingly, the field study was conducted with 22 participants. Thus, the reasons behind the user-based navigation experience in virtual space were tried to be clarified. As a result of the interviews conducted on a virtual platform, the user's virtual space experience and the diversity of this experience were determined, and the tourism potential that will be provided to the city as a result of the diversification and spread of this experience was questioned.

2. WHAT IS VİRTUALİTY?

Radio, cinema, television, Web 1.0, Web 2.0 and now Web 3.0. At this point, the speed of digitalization has reached such a state that it has created the need for a definition. What Thomas Friedmann called “Globalization 3.0” (Friedmann, 2005) Klaus Schwab called “The Fourth Industrial Revolution” (Schwab, 2016), and Azhar called “The Exponential Age” (Azhar, 2021). These definitional changes, which emphasize the change of digital processes, cause changes not only at the level of definition but also in practical life Cyberspace, which allows people to 'be' in the same places regardless of their geographical location, and multimedia, which can be created with sound, image and movement, bring new forms of spatial experience. This environment, which we conceptualize as 'virtual space' or 'virtual environment' in Turkish, becomes a new type of public space plane thanks to the mass communication network on which it is built, and contains images of space beyond space and place.

While its technological infrastructure methods provide advantages with new instrumentality, the new virtual space that emerges reproduces the concept of space, and continues to spread rapidly thanks to its potential to expand day by day.

Nowadays virtualization is not only a form of remote telepresence, but also a simulation of some dynamic changes in the virtual environment. Virtual environments provide the perception of movement in the visual field by changing the direction, path and speed of the viewer. The concept behind virtual reality is that it conveys the feeling of "being there." (Negroponte, 1975). Although virtual reality has been experimented with since the 1960s, mostly for computer games, until recently VR devices have been inadequate as consumer processing power has become indistinguishable for virtual environments (Kopiec, 2018). The inadequacy of VR technology has led to the development of enriched environments (Figure 2).

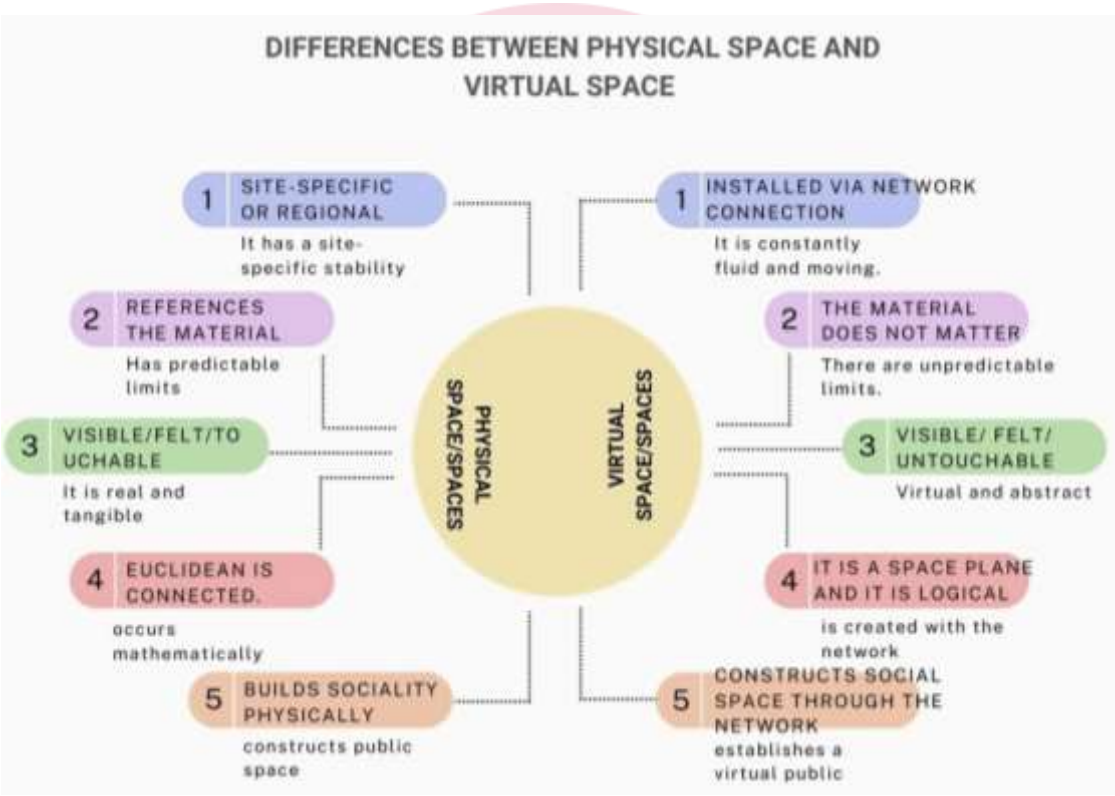

Figure 2. Differences between Physical Space and Virtual Space (source: created by the author)

The blurring of boundaries between physical and virtual spaces leads us to the fact that digital space is not completely disconnected from physical space(Figure-2). Beyond the built environment, this intersection creates an ideal environment for the designer to communicate and interact with spatial ideas, with the physical and virtual working together. Designers have begun to find ways to transfer the actions derived from this interaction and the results of these actions into cybernetic space.

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In line with the changing spatial usage practices with technological developments in recent years, virtual space requires the creation of more creative spaces for the user. These spaces have a position that triggers creativity, becoming more experiential, dynamic, open to transformation rather than being monumental in an absolute way, and changing the forms of publicness. This creative space in virtual space is essentially the space of the visitor. This space belongs to the people who use it and changes with them and their expectations. It is an environment where users learn, are inspired and develop themselves, and is represented in the visitor's memory as if it were a physical space. This technological interface now serves as a communication between the user and the user of the virtual space.

This form of communication is much different from the boundaries defined by physical space and changes the perception of time-space. From the 1990s to the 2015s, when technological developments gained momentum especially in the practice of architecture, one could speak of a kind of space in limbo, that is, a virtual space wandering around the boundaries of physical space. However, in 2015 and beyond, we can say that space rapidly ceased to be an object, lost its materiality and turned into a 'thing' that is perceived differently by everyone. This 'thing' is no longer the space of the physical world, and its speed, spatial definitions and boundaries have changed.

Surfing the web, switching between links, does not only refer to changes of location in a two-dimensional environment. It also refers to a circulation between virtual spaces. This circulation refers to a different spatiality that operates very differently from the activity of the concept of time in physical space, a spatiality that can be entered but cannot be touched, a spatiality that establishes a close connection with the physical as well as the mental experience. It points to a spatiality that promises more than a 2D or 3D visualization. Rather than a spatiality defined only by the interface, there are new mental spaces produced by the mind that thinks with the images given. The mind leaps from space to space, acquiring a new spatiality through images and the given interface. The mind is now beyond the limits of the body and therefore beyond the limits of physical space. Space, too, exists in different ways in virtual space with the images it transforms in minds, as a signifier. Real and virtual spaces are consistently superimposed; the virtual is seamlessly embedded in the physical. What virtuality offers is to make this parallel virtual world visible, to produce architecture as an enabling platform. Virtuality has the potential to expand the range of experiences beyond what an individual can participate in. the overall sense of space produces a unique experience for each person; and as a result, offers an entirely new way of experiencing space (Uğurlu and Yakın, 2015).

2.1. History of virtual space (3D)

We can see that the first examples of virtual spaces were archives or information sources. Launched in 1991 under the name 'The Museum Inside the Telephone Network', the online exhibition was able to reach only a few countries with internet access in those years. In the early 1990s, Apple created an art museum consisting of 3D virtual spaces produced with Quick Time Virtual Reality (QTVR) technology (Huhtamo, 2010) In Turkey, the first step was taken in 1990 when Topkapı Palace decided to share a part of its collection in the virtual environment (Atagok and Ozcan , 2001). Virtual spaces are presented to visitors with various methods, interface designs and software. Virtual reality interfaces, which have increased in prevalence over time, are offered to users by many virtual spaces today. The 3D spaces created are presented to visitors quickly and easily.

2.2. Navigating Virtual Space

The architectural element called space basically exists through the processes of navigating and establishing visual relationships. In virtual space, this situation should be in a position to support the person's navigational processes such as navigating and visual cognitive processes as well as describing the space. For the physical form of the space, orientation is relatively much easier than in virtual space, as it is the result of the simultaneous activation of the five sensory organs. Human beings first disassemble the information they receive from their environment and then tend to make sense of them by grouping them. The 'readability' of the cities we live in depends on their ability to be grouped into their elements (Lynch, 2012).

This situation is just like the process of breaking a sentence into its elements; finding or making sense by breaking it into parts... The roads, borders, regions, nodes and sign elements that make up the elements of the city work in harmony and undertake the task of guiding the user navigating the city (Lynch, 2012). The aforementioned elements help both orientation and navigation as elements offered by the physical environment.

When physical space is taken as a basis, we can talk about static elements and moving creatures moving between and around them. This makes it possible to move comfortably in the space, to collect information about the space and to establish information that can describe it in the mind. In virtual space, a web interface design with visual elements is necessary to present spatial arguments. An interface design should provide ease of use for the visitor beyond the aesthetics of the visual elements. Navigation not only depends on the visual acquisition of information about the space, but also on the physical movement of the person, which we can call displacement. Sebok categorizes the visual information and physical tasks performed during navigation into three groups: orientation, wayfinding and navigation (Sebok and et al 2014).

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Navigation can be defined as a goal-oriented movement of a person that includes two elements: navigation and orientation (Montello, 2005) of the route one needs to follow to get there (Montello, 2005). Orientation is moving towards the target in space (Figure 3).

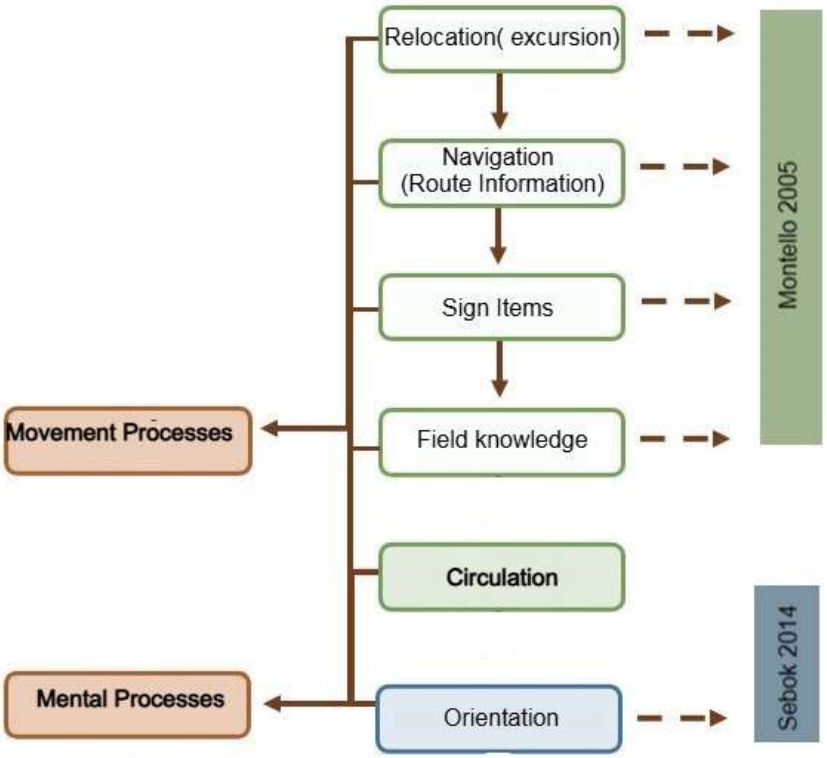

Figure 3. Navigation items in virtual space(Made by the author based on sources (Sebok and et al 2014) and (Montello, 2005)

In the created virtual space, variables such as placed sign elements, architectural differentiations, visual access tools, and the density of hand tools affect orientation(Figure-3). The realization of orientation and wayfinding tasks depends on the person's visual understanding of the space during the space experience, positioning it correctly in the mind and recording it in the mind with the mapping technique. Lynch mentions various cue elements to facilitate making sense of space and orientation. These are place-specific images that express location and that the person determines as a reference point (Lynch, 2012). Cue elements support the 'orientation' ability by helping the user to determine their position in space. This helps to draw a route to the space and to have an experience in this direction. Spatial knowledge, which develops with the experience of orientation and organization, is to comprehend the position of objects in the space and their distance to each other (Thorndyke and Goldin, 2012). Moving around the space, maps, photographs, verbal information, sign elements contribute to route and area knowledge (Thorndyke and Goldin, 2012).

Just like in physical spaces, spatial navigation is of great importance in virtual spaces. It has been observed that navigation, which involves visual cognitive practices such as navigation, wayfinding, locating or positioning as well as movement, is provided by various tools and spatial focal points presented in 3D spaces. While these spatial focal points can be made from the definitions of the physical world, the language and use of the tools have no equivalent in the physical world. In this respect, how does the experience of virtual space using these tools differ from the experience in physical space? The answer to this question is important in the context of the study.

As in physical spaces, circulation in virtual spaces depends on the person's ability to create a map with visual data about the space and to reach spatial orientation. Every movement of the body in physical space changes the field of vision, making it easier for us to collect information about the space and record it visually. Thus, the wider the field of view, the more effective the perception and orientation of the space. In virtual spaces, orientation is provided by maps and landmarks presented as data. This situation allows to reach spatial experience in the virtual environment without moving the body, only by moving and orienting the eye. As Sebok says, this navigation offers the opportunity to experience the virtual environment through various auxiliary tools (Sebok and et al 2014).

It is very difficult to obtain all the information about the space from one's point of view (Darken and Sibert, 1996). Especially due to the limited field of view in virtual environments, it is not possible to perceive even small-scale spaces from a single point of view. Therefore, in order to explore the space in the virtual environment, the ability to move in the space gains great importance. Realization of movement with minimum effort is the main purpose of virtual environments. In the interface developed in this direction, placing predetermined movement routes in the space has been an option (Campbell, 1995). As it can be understood, the acquisition of spatial information can be based on the person's experience of the virtual space and the time spent there. At the same time, maps, compasses and similar tools that we use in physical space can shape the experience of space as auxiliary tools that can be used in virtual space.

Virtual spaces produced with QTVR technology can be experienced through the control and orientation of panoramic images (Sylaiou et al, 2017) It is the ability to move that makes the space virtually effective and therefore makes navigation possible. It is important for the user to focus on the other information offered by the 3D space with the least difficulty while reaching from one specified space to another. In this respect, it is necessary to be able to perform the actions that the five sensory organs we use in physical space can do with auxiliary tools in virtual space. It is necessary to have the ability to rotate in the virtual space, to move away and zoom in, as well as tools that provide circulation between floors.

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3. A VIRTUAL SPACE PHRASE: BITLIS 3D SPACES

After the outbreak of the 2020 pandemic, which was effective all over the world, space, both in terms of definition and experience, has moved far away from an area defined only by the physical in traditional patterns and made it necessary to reconsider the space by introducing 'Virtual Spaces' into our lives. Aiming for a near-real experience, virtual technologies have tried to adapt the experience of space to virtual spaces by imitating the processes that take place in physical space.

In this framework, the study, which aims to compare the manifestation of the virtual in architecture with the physical on a user-based basis, focuses on the city of Bitlis and the data of the historical areas of the city in 3D virtual environment, considering the richness of cultural heritage. Virtual connections and virtual museums with 3D versions of the places belonging to Bitlis are the main area of the research. Ahlat Seljuk Cemetery and Ruins, one of the virtual museums created by the Ministry of Culture and Tourism, and Hizan Center, Hizan Döküktaş village, Bitlis center and Bitlis İhlasiye madrasah, which were created in 3D by private companies or individuals, were used for fieldwork. Due to the lack of 3D data on Bitlis other than the selected places, the study was limited to the specified areas. The study was basically shaped in line with these objectives.

Analyzing how 3D data created specifically for Bitlis is experienced by users, User-oriented determination of the differentiating aspects of Bitlis virtual spaces from physical space, User-oriented determination of navigation, orientation, focus and description of virtual spaces.

3.1. The Method Followed In The Research

The method used in the study involved participants navigating through the specified 3D environments, experiencing the space, and expressing this experience through various questions. Each experience content aimed to measure navigation, wayfinding, information retrieval, and mobility skills at different rates, and it was structured as the user interpreting the spatial experience. Additionally, it was important for participants to interpret the differences between physical and virtual spaces through Bitlis.

In the first step of the research, which was conducted through individual interviews, the link to the survey containing the tasks and the virtual tour links were shared with the participants. A brief introduction to the spaces and the research was provided, and the survey questions were shared. No detailed information about the 3D environments was given, and participants were expected to explore them on their own. The 3D experience, which was to proceed simultaneously with the tasks, was conducted by participants sharing their screens via the Zoom platform. This aimed to create observational and verbal data based on the participants' reactions during their virtual space experiences.

Additionally, throughout the virtual tour, the researcher and participants remained in communication, with the researcher intervening when necessary to ask questions. The expected sequence for participants was as follows: navigating the 3D environment, acquiring spatial information, and explaining their experience using the survey questions. Therefore, the tasks progressed step by step.

3D environments created from images obtained from the physical space offer a more realistic virtual tour experience that enhances the user's sense of presence in that space. One of the most important elements for navigation in the interface is the guidance tool, which provides direction. (Figure 4, 5, 6, 7, 8, 9, 10, 11)

Figure 4. Hizan Döküktaş Church exterior view (virtual data)

Figure 5. Hizan Döküktaş Church interior view (virtual data)

This tool, when clicked, allows the user to move right, left, up, and down during the navigation, and also facilitates the transition from one area to another. In this regard, it is a tool that provides time-saving during the virtual tour experience and allows for quick navigation through the space (Figure 4, 5).

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Figure 6. Hizan Center square view (virtual data)

Figure 7. Hizan Center general view (virtual data)

Additionally, spatial descriptions consisting of small images at the bottom of the virtual environment are another key tool for navigation. During the space experience, the user can either draw a navigation route indicated by arrows or navigate by clicking on the images. These 3D environments, which allow movement in the desired direction by holding down the mouse button, perform the actions that the eye can do in the physical world (Figure 6, 7).

Figure 8. Bitlis Center general view (virtual data)

Figure 9. Bitlis Ihlasiye madrasah image (virtual data)

The use of spatial reference points is common among the techniques for setting objectives in virtual museums (Figure 9). These points, accessible through a menu, are displayed as soon as the screen opens and allow the user to navigate to the desired space. They also facilitate an overview analysis of the space. By placing numerous tools in virtual environments, which encompass tasks such as movement, wayfinding, reaching a goal, space experience, and memory formation, the completion of these tasks positively impacts the use of the space. (Figure 8, 9).

Figure 10. Entrance and interior view of Ahlat Seljuk Square Cemetery Ruins (virtual data)

Figure 11. Entrance and interior view of Ahlat Seljuk Square Cemetery Ruins (virtual data)

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The nature of acquiring information about the space in virtual museums depends on the ease of use and effectiveness of the tools provided by the interface. Virtual environments produced with QTVR technology can be experienced thanks to the control and navigation of panoramic images. According to Sylaiou, what makes the space effective virtually and thus enables navigation is the ability to move (Sylaiou et al, 2017).

This is important in terms of allowing the user to focus on other information provided by the museum with minimal difficulty while moving from one space to another. From this perspective, the abilities of the five senses we use in physical spaces need to be replicated in virtual spaces through supporting tools. These include the ability to rotate within the space, zoom in and out, and the ability to navigate between floors. Additionally, features such as mapping or visual elements, which are very useful in physical spaces, are also crucial tools for interpreting the virtual space. Maps, which support memory formation about the space and the objects it contains, should indicate the user's position within the virtual environment (Sebok et al, 2014).

3.2. Interview Texts and Analyses

The main goal of the study is to investigate how various tools embedded in virtual environments support users in wayfinding, spatial experience, and information acquisition. To this end, a field study was conducted with 22 participants. The participants' professions—architect, urban planner, and civil engineer—were taken into consideration, as they are familiar with planning drawings. It was required that the users had experienced the specified 3D environment at least once in a physical setting, as this would highlight the differences between physical and virtual experiences. This condition allowed the researcher to gather more detailed data during and after the participants completed the tasks. Since the research did not involve entering a virtual environment with a random circulation forecast, constant communication with the participant was maintained. Additionally, during the virtual tour, interventions or additions were made when necessary by the researcher. The virtual tour, which is the subject of the survey, covers the entire structure, focusing initially on the specified spaces, thereby including the circulation of all areas. The virtual tour does not allow free movement in every space and limits mobility. Therefore, the conducted research measures the effectiveness of the navigation within the virtual space, the types and forms of experience, using all the opportunities described by the 3D environment. Since the user has previously experienced the physical version of these 3D environments, their first experience of the virtual environment is crucial for the survey data. This is because it is important to determine how the user, familiar with the physical space, initially struggles or does not struggle when transitioning to the virtual environment.

In this context, the following questions were asked to the users during and after their navigation of the 3D environments, and the answers provided were analyzed.

- The first question pertains to the circulation of the Ahlat Seljuk Cemetery and the Archaeological Site and was asked as follows: "What distinguishes the circulation in a virtual museum from that of a physical museum? Could you please explain?"

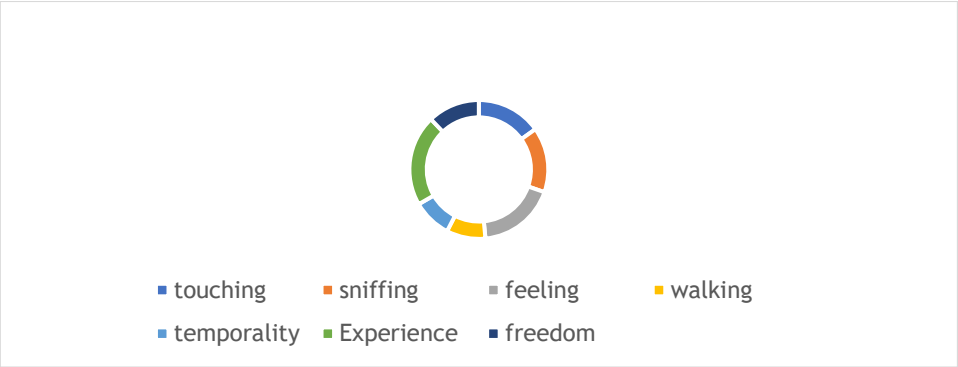

Figure 12. Graphic expression formed in line with the answers given to Question-1

All users who responded to the question stated that physical and virtual experiences are completely different. As seen in the graphical representation (Figure 12) created based on the responses, users expressed how navigation in a physical environment differs from navigation in a virtual environment.

These differences are mostly associated with the five senses, and it has been observed that virtual environments do not provide the same experience as physical environments in terms of smell, touch, and sensation. "…a person exploring a virtual environment will see the world from a perspective similar to that of a camera mounted on their head, rather than from a fixed camera position and perspective." (Chan, 1997). It has also been noted that the features of walking and being in a specific time frame, present in physical spaces, are not present in the virtual environment, creating a sense of incompleteness in the experience. Some users stated that virtual environments, with their ability to enter and exit any location and move quickly, provide a better experience than physical environments in this regard. Chan explains this situation as follows: "The success of creating a VR environment is not whether the virtual world created is as real as the physical world, but whether the created world is so real that viewers can suspend their disbelief and create the experience of being there for a while" (1997), (Figure 13, 14).

- The second question was asked to gain a more general inference regarding virtual environments based on the 3D experiences, and it is as follows: "Considering the 3D tours conducted, would you still feel the need to physically experience a space that we navigated through using the navigation tools in the virtual environment, even though it has never been physically experienced? Why?

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Figure 13. Answer to Question-2

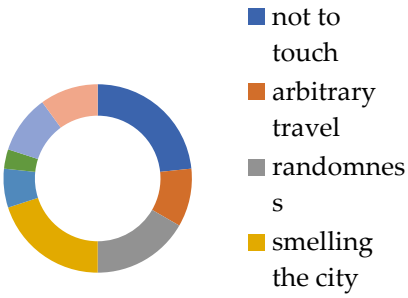

Figure 14. Graphic expression of those who said yes to Question-2

All responses to Question-2 were affirmative, with users emphasizing that it is not possible to fully experience a city they have never visited physically just through a virtual experience, and that physical navigation is absolutely necessary(Figure-13). Due to all the answers being "yes," the following question was asked to the users: "(If the answer is yes) What exactly do you base the experience of a space on? For example, which of the five senses would alter the experience?"

Users stated that the experience of a space is mostly related to touch and smell, and they mentioned that the ability of individuals to act randomly or arbitrarily also affects the experience of the space. It was observed that the limitation of route following within the specified network boundaries in the virtual space creates a disadvantage, meaning that the arbitrariness present in physical space does not exist in the virtual environment. It was emphasized that individuals are alone during their experience in virtual space, making physical spaces, in this respect, more enjoyable and public than virtual spaces (Figure-14). Architectural spatial structures are perceived and experienced through all senses and emotions. Appealing to all senses, space is perceived not only through its tactile, olfactory, and auditory characteristics but also through its luminous properties (Rasmussen, 2010).

Users associated space experience with time, stating that the fact that time in the virtual space does not align with real time and the inability to establish a time-space relationship influenced their affirmative response. Physical space is determined by its elements, measurable distances, and the interrelationships of the objects within it (Arnheim, 1977) (Usta, 1994). Perception and sensation of space means feeling it with all the senses rather than just perceiving it visually.

The third question was asked to determine whether the virtual environment is perceived as something different from the physical space. Therefore, the following question was directed to the users: "Considering the 3D tours conducted, do you feel detached from the physical space while navigating through the virtual space?"

Seven users stated that they experienced detachment, eight users mentioned that the detachment was partial, and seven users said that they never felt detached. This result reveals that 68% of users are at least partially disconnected from the physical space. This suggests that the attachment to the virtual environment is mostly based on the physical space (Figure 15).

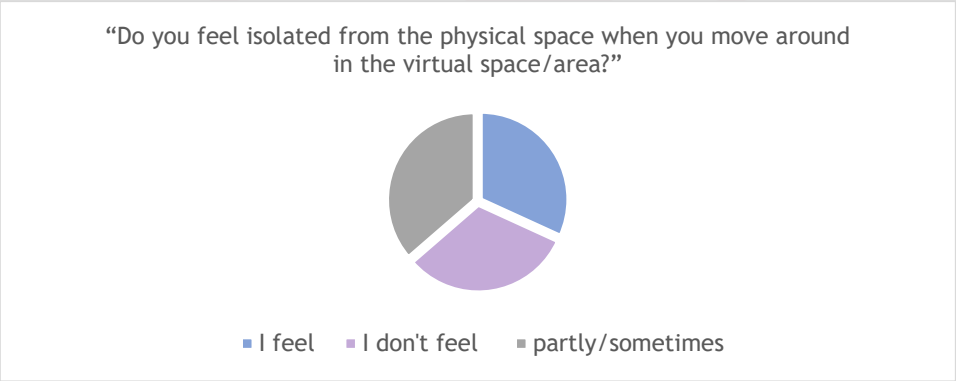

Figure 15. Response distribution graph of Question-3

For those users who expressed feeling detached, the following fourth question was directed to them: "What do you think is responsible for the detachment, and are there any VR tools you used? Are they contributing to this detachment?"

Users generally describe what leads to detachment with concepts such as focus, becoming part of the flow, temporary pleasure, immobility, concentration, quick access, easy access, inability to touch but still feeling, mental disconnection, guiding perception, visual intensity, and mental confusion (Figure 16). The majority of users indicate that the detachment arises from the mind's focus on the virtual world, suggesting that a cognitive process begins when the space changes, and as a result, the individual experiences a cognitive presence in the virtual environment.

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While this situation may trap the person in the physical world, it mentally transports them within the virtual world. Such an experience is the fundamental reason for a person's spatial perception of the virtual world.

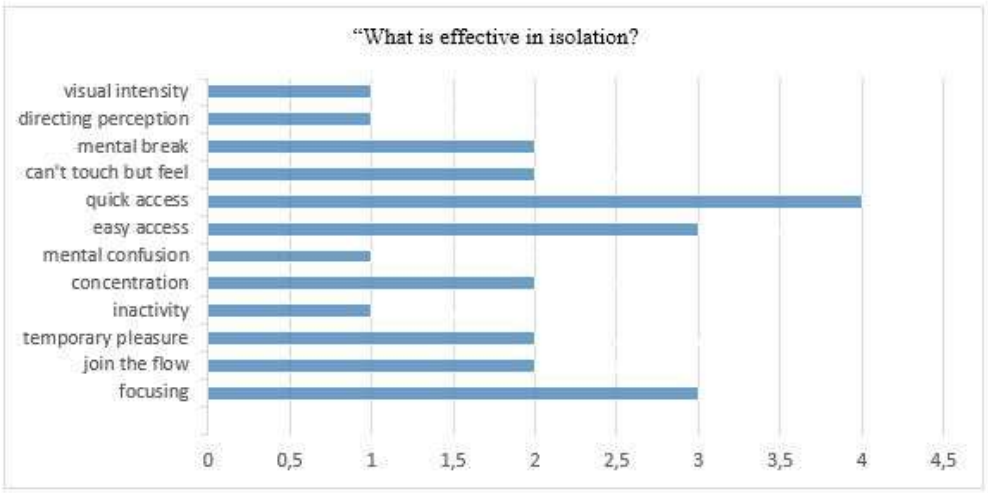

Figure 16. Justification scatter plot for Question-4

4. CONCLUSION

The conducted research is based on a survey study aimed at evaluating the factors that influence the formation of the process of establishing a relationship between virtual spaces and the physical environment, as well as how these processes differ from physical space. Based on the experiences of the participants, the study identifies the advantages and disadvantages of using virtual spaces, thereby providing resources for further development. Since it is observed that the interfaces and navigation signs of all 3D spaces and museums in Turkey are the same, it is thought that this study will serve as a pilot study, leading the way for other studies.

The insufficient development of the 3D data of Bitlis in the virtual environment does not fully support the process of establishing a relationship through navigation. Chan describes the spatial counterpart of this deficiency as follows: "In virtual space, viewers can navigate the space and perceive a computer-generated 3D image as a perspective view. When creating a realistic scene, buildings can be modeled using any 3D solid modeling software. However, in the field of VR, the fundamental issue is to provide a realistic representation in order to accurately represent reality and achieve an immersive effect." (1997). Additionally, due to the participants' unfamiliarity with the interface, it was observed that the virtual space did not fully fulfill its role.

Users expressed that the fast progression of the space's visual representation and its immediate fixation to the starting point when the Ahlat Seljuk Cemetery Archaeological Site's virtual museum interface first opened negatively impacted their perception of the space.

It is important to expand the boundaries of the virtual environment to include the exterior of the museum and an overhead view. Furthermore, it was observed that other 3D data were insufficient compared to physical data and not suitable for spatial navigation.

All participants attempted to explore the space and access information within the space with the help of directional arrows during each task. This situation leads to the idea that increasing the number of directional arrows would have a positive impact on reading the space. It was observed that users experienced difficulties when using the forward and backward arrows during navigation. Some users found the speed of progression too fast and argued that the arrows acted like teleportation tools and needed to slow down. Previous research on virtual spaces has emphasized the importance of adjustable speed.

Furthermore, it was observed that the increase in virtual space data enhances the visibility of the city and sparks curiosity in individuals, which in turn raises the desire to experience it physically. Additionally, due to Bitlis having a scattered settlement structure, there was a problem with spending too much time on navigation, making it possible for people to quickly experience the 3D representations of historical sites within limited time.

5. RECOMMENDATIONS

- The recommendations provided in light of the research are aimed at improving the visitor's navigation, experience, and relationship-building practices in the virtual environment and with the physical space.
- Having a site plan image is important for users to understand where they are. Therefore, adding an external view of the virtual space can facilitate navigation.
- Additional information points have been positively received by users in terms of experience diversity, and increasing their number is recommended. Additionally, these extra information tools should also be placed for location identification, and users should be able to click on them to see where they are when needed.
- It is important for spaces/objects outside the field of view to capture the visitor's attention. As a solution, it is suggested to use an arrow indicating that there is a partition or section in that area.
- Along with the names of spaces used in the physical museum, the floor of each space should be indicated in parentheses on the interface, and the names should be aligned according to the floor order.

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