EXPLORATION OF NEGATIVE SPACE IN THE FACULTY OF FINE ARTS AND DESIGN BUILDING AT IZMIR UNIVERSITY OF ECONOMICS

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ABSTRACT

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M.SC. in Architecture

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Designing architectural space is a major subject in both education and practice. Architectural space is continuously studied and modified for its usage. Understanding the limitation of space and its implications on the built environment is key to revert the logic of consumption. The scope of this present study is defined by its focus on the concept of negative space in architecture. Negative space, as an effective tool in every design project, can improve architectural design both structurally and aesthetically. Beyond the artistic and aesthetic appeal, negative space can optimise usability and functionality of space. Based on the data gathered from primary and secondary sources, the aim of the study is threefold: (1) to examine and classify negative space and its different types in architecture; (2) to investigate a selected number of negative spaces in the architectural design of the Faculty of Fine Arts and Design (FFAD) building and how they are perceived by the author; (3) to analyse whether these negative spaces have the properties and characteristics of intentional design or they are the results of random design process. The findings of this study contribute to the

literature by offering a new classification of negative space and its various types in architecture. The study also highlights that there is a knowledge gap among architects in knowing how to embrace the concept of negative space to improve the efficiency of design.

Keywords: negative space, empty space, perception, Izmir University of Economics, Faculty of Fine Arts, and Design building.

ÖZET

İZMİR EKONOMİ ÜNİVERSİTESİ GÜZEL SANATLAR VE TASARIM FAKÜLTESİ BİNASININ NEGATİF MEKÂN KEŞFİ

Seyedalipour, SeyedehMahboubeh

Mimarlık Yüksek Lisans Programı
Tez Danışmanı: Doç. Dr. Burkay Pasin
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Mimari mekan tasarlamak hem eğitimde hem de uygulamada önemli bir konudur. Mimari mekan, sürekli olarak incelenir ve kullanımı için değiştirilir. Mekanın sınırlamasını anlamak, küresel sürdürülebilir kalkınma hedefleri doğrultusunda tüketim mantığını tersine çevirmenin anahtarıdır. Bu çalışmanın kapsamı, mimarlıkta negatif mekan kavramına odaklanılmasıyla tanımlanmaktadır. Negatif mekan, her tasarım projesinde etkili bir araç olarak mimari tasarımı hem yapısal hem de estetik olarak iyileştirebilir. Sanatsal ve estetik çekiciliğin ötesinde, negatif alan, alanın kullanılabilirliğini ve işlevselliğini optimize edebilir. Birincil ve ikincil kaynaklardan toplanan verilere dayanarak, çalışmanın amacı üç yönlüdür: (1) mimaride negatif alan ve farklı türlerini incelemek ve sınıflandırmak; (2) Güzel Sanatlar ve Tasarım Fakültesi (FFAD) binasının mimari tasarımındaki seçilmiş sayıdaki negatif alanları ve bunların yazar tarafından nasıl algılandığını araştırmak; (3) bu negatif mekanların kasıtlı tasarımın özelliklerine sahip olup olmadığını veya rastgele tasarım sürecinin sonuçları olup olmadığını analiz etmek. Bu çalışmanın bulguları, mimaride negatif

mekan ve çeşitli türleri hakkında yeni bir sınıflandırma sunarak literatüre katkıda bulunmaktadır. Çalışma aynı zamanda, tasarımın verimliliğini artırmak için negatif alan kavramını nasıl kucaklayacaklarını bilme konusunda mimarlar arasında bir bilgi boşluğu olduğunu da vurgulamaktadır.

Anahtar Kelimeler: negatif alan, boş alan, algı, İzmir Ekonomi Üniversitesi, Güzel Sanatlar ve Tasarım Fakültesi binası

Reza

Without your endless love and encouragement I would not have been able to complete my graduate studies. I love you and I appreciate everything that you do for me.

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LIST OF ABBREVIATIONS

IUE: Izmir University of Economics

FFAD: Faculty of Fine Arts and Design

CHAPTER 1: INTRODUCTION

1.1. Problem Statement

Thirty spokes are joined together in a wheel,
but it is the centre hole
that allows the wheel to function.

We mould clay into a pot,
but it is the emptiness inside
that makes the vessel useful.

We fashion wood for a house,
but it is the emptiness inside
that makes it liveable.

We work with the substantial,
but the emptiness is what we use.

By Lao Tzu
(Laozi)
Tao Te Ching - Chapter 11

The question about space is perhaps one of the mostly asked questions in various branches of knowledge, especially those that are concerned with physicality, e.g. physics, mathematics, geometry, engineering, communications, art, and architecture (Suvanajata, 2001; Whatis, 2016). Vincenzo De Risi's investigation shows that the earliest geometrical understanding of space has been found in some Renaissance treatises on perspective and in Pascal's pioneering studies. A century and a half later, this geometrical understanding of space became commonplace and helped reshape

pure and applied science, philosophy, and even the visual arts (2019). With the passage of time, non-Euclidean spaces have led scientists to a better understanding of the universe and of mathematics itself (Faulkner and Hosch, 2018). Britannica sums up space as immaterial essence that the painter suggests, the sculptor fills and the architect envelops, creating a wholly human and finite environment within the infinite environment of nature (Britannica, 2019). However, space which philosophers talk about, architects design, and users move in is always the same which suggests complex relations among different approaches (Suvanajata, 2001).

As an architectural concept, space has been explored in many ways over the centuries. The essence of architectural design is in relation to considering "space and mass" as two crucial elements of design and the interaction between them (Memarian and Niazkar, 2014). An art theorist and perceptual psychologist, Rudolf Arnheim (1977) identifies two definitions of space. He believes that space is spontaneously plausible and thinks that space "as a self-contained entity, infinite or finite, an empty vehicle, ready and having the capacity to be filled with things." He further points out that consciously or not, except some specialists like psychologists, artists, or architects which probably can be confronted with the challenge of questioning the notion of space, others receive the concept of space from the world as they see it. Accordingly, space as a container would exist even if it were completely empty.

Arguably, space is beyond a three-dimensional closed and empty surface that consists of all points that are given distance from a centre. The articulation of space in architecture resonates with the wider appreciation of the theoretical context within which it is defined and put into use. If this is achieved, space in architecture can be assumed as a relational and overlapped product of time, place, and change (person); a person can differently understand the space based on their perception.

By no means can we be separate from space, either naturally shaped or designed around us. Moving through a range of diverse spaces of varying styles and volumes, we experience the scale of the landscape. Barbara Holzer (2019), a Swiss architect, believes that an architect can change the point of view or pull something into focus by creating a lookout, a focal point, or a certain route to be followed.

But how can this be achieved? Are there any specific rules that an architect can rely on to design space as a focal point or a background? Does the word “emptiness” in the above-mentioned verse from Lao Tzu signify the notion of space in architectural design? How can such empty spaces be identified in architecture?

One of the simplest concepts applied in fine arts is that of positive versus negative space. However esoteric it may sound, its applications to every design are immediate and tangible (Gellner, 2000). When a piece of artwork is created, generally three elements come into play: the frame, the positive space, and the negative space. The frame or border is the surrounding dimension of artwork, the positive space is the main object which tends to be more active, dynamic, and motivating, and the negative space is the empty space around the object (Cass, 2009; Ambreen, 2019).

Among many elements that can create a pleasing photograph, the negative space can be considered as an important part of a picture’s composition and helps to define the main object better (West, 2019). Therefore, negative space is more articulate when there is a balance between the positive and negative spaces. A brand designer Jacob Cass (2009) believes that if more attention is given to negative space rather than to positive space, the result is often a “more accurate and aesthetically pleasing design and balanced composition”.

Based on this simple definition, it can be understood that the white or pure background (empty space) in photography can be considered a negative space while the main object is a positive space. Can this rule also be applied to architecture? Can it be claimed that the empty space in the centre of Saint Peter's Square in Rome (Fig.1) represents negative space and the buildings surrounding the empty space are positive space? Is there a scientific platform in the field of architecture which would allow architects to share information about and promote innovative ideas to generate specific knowledge on negative space?

Figure 1. Saint Peter's Square in Rome, Italy (Source: Google image, 2020)

While these questions remain to be answered, if architecture students are asked to draw an object like a vase, they are expected to make the most of their skills and experience to create textures, materials, and shadow effects (the umbra, penumbra, and antumbra as three distinct parts of a shadow). Will the students instinctively take notice of empty space around the image of the vase? How can these students be trained to focus on the empty space so it would accentuate the main object? How would the same students draw the vase after many years into practice of architecture? And, how likely would they recognise the significance and effectiveness of empty spaces in their architectural drawings?

One of the key skills in architecture is how an architect can perceive a space and what they should do to make that space more memorable. So, the question is, what percentage of architecture students does develop and use this particular skill during and after their studies? Why can most architecture students remember details of well-known architectural works like Villa Savoye and Fallingwater House, but they may forget details of their own sketches after a while? Will other fine arts students have the same approach toward empty space in their fields of study?

It may not be possible to find a single, comprehensive answer to these questions but part of what makes the whole issue so compelling is the utter simplicity of the concept and application of negative or empty space in fine arts such as music, photography, and painting, whereas it is far too complicated in architecture. Sometimes, a composer creates moments of absolute silence in a piece of music, or a photographer uses a pure white background to draw viewers' attention to the main subject of the photo. They use the concept of empty space to add value to their artwork, just like Lao Tzu's observation of emptiness in the creation of a wheel, a pot, and a house.

There are only a few scholarly sources on negative space in architecture. Steven Kent Peterson's articles provides a fundamental insight into the subject. He criticises current architectural discourses for overlooking or taking for granted the exact nature of the definition of space and ignoring the consequences. He argues (1980) that negative space provides an effective tool to look back at the history of architecture and interpret space, mass, and volume through a new perspective.

Peterson (1980) asserts that the Romans were the first who observed the phenomenon of space as a perceptual architectural element in its positive form. By using the plasticity of concrete vaulting and the consequent bending of the walls below domes, the Romans could create daring structures where they explored "a positive volume of emptiness". He claims that if positive space is any perceived created space, negative space can be a solid space that has some features to support the positive space. The key challenge of this study is how these features can be comprehended tangibly in architecture.

1.2. Research Questions

The main questions of this study are: (1) How can the concept of negative space be explored in the context of architectural design? (2) How will the author perceive a selection of negative spaces in the Faculty of Fine Arts and Design (FFAD) building at Izmir University of Economics (IUE)?

Space is a critical element for consideration in architectural design and practice. Architects modify space through the process of designing a built environment and, in

return, the built environment modifies the users' perception and behaviour. In this context, it is crucial that architects have a solid grasp of architectural perception as well as the intricately intertwined nature of perception and behaviour. The reason behind examining the author's perception in this study is to analyse how the concept of negative space can be either consciously or unconsciously discerned by a regular user of a built environment. The FFAD building, as a contemporary construction, serves to provide a descriptive case study for converting the question of negative space into a testable hypothesis.

1.3. Research Objectives

By relying on primary sources (on-campus data collection through observation) and secondary sources (mainly electronic information resources including online periodicals, databases, e-books and internet resources), this study adopts a threefold aim: (1) to examine and classify negative space and its different types in architecture; (2) to investigate a selected number of negative spaces in the architectural design of the FFAD building and how they are perceived by the author; (3) to analyse whether these negative spaces have the properties and characteristics of intentional design or they are the results of random design process.

1.4. Research Significance

In the present time, the widespread use of cyberspace and large-scale multi-user virtual realities has significantly diverted our attention from the physical spaces around us. Sometimes, we pass by certain spaces without noticing them or overlook certain areas of the city that are bursting with charm. Ironically, we experience many various spaces on a daily basis, but we may hardly remember any details of them.

Designing architectural space is a major step in both architectural education and in the design process (Kurmann et al., 1997). Jeffery Horowitz points out that:

> *"contemporary designers are rediscovering the value of enclosure and definition of architectural space, of making space readable through the use of*

formal circulation and sequential, articulated rooms. They are searching for ways to make architecture mean more than shelter through investigating its forms: the thickness of a wall, the shape of a space, the nature of enclosure" (Peterson, 1980; p.29 B7-a).

In an increasingly urbanised world in which land is extensively being bought, built, and occupied, it is encouraging to find other possible ideas that revert this logic of consumption, advocate for reuse and requalification of the built environment and make us think of a more sustainable, responsible society in the future (López-Marcos, 2017a). Addressing the concept of negative space as one of the most fascinating aspects of space composition may provide new opportunities to use space more efficiently.

If we look around, we will realise that the visual composition of the elements surrounding us is embraced by positive and negative spaces. Design is about balance; there is a ratio of positive to negative space that influences, supports, and delineates how the design is perceived (Ambreen, 2019). A right balance between them in design can make it more readable due to the gap and empty spaces that give the design room to breathe. It draws the eye away from a focus on negative or positive, and, instead, it can create a harmonious, coherent, complete, and seamless space.

In architecture, negative space is one of the most fundamental yet the most under-researched topics. Exploring negative space in its various forms holds an important place in architectural design because not only can it help architects understand the use of available space to them, but it can also help them understand the distribution of the visual and physical weight of a structure. Furthermore, the intelligent and creative use of negative space as an active element can be a real asset in every design project. It is a key element in achieving positive development in architectural spaces. Negative space enhances design objectives, creates focal point in the design composition and offers an effective tool that can help young architects explore challenges they are facing (Turnbull, 2011; 17seven, 2017).

1.5. Research Methodology

The methodological paradigm of this research concerns primarily the assumptions of qualitative research design. The architectural design of the FFAD building serves as a case study to investigate the meanings, definitions, concepts, and features of negative space. Case studies in architecture are one way to investigate different spaces within their real-life situations. They are a preferred strategy to provide an answer for a bounded subject that is either very representative or extremely atypical (Kiroff, 2002; Yin, 2003). Also, the study represents the linear-analytic type of case study. It employs a qualitative method to analyse how negative space has enhanced or otherwise has modified the elements of design at the selected spaces in the FFAD building.

The data collection methods used in this research are twofold: (1) Existing documents and literature on negative space which include scholarly publications, professional literature, theses, book chapters, etc. (2) Observational analysis which primarily involves the author's prolonged engagement and observations in the FFAD building. The observational techniques used in this study include descriptive, focused, and selective observation. Visual methods, such as photography and drawing, are used for the purpose of analysis.

1.6. Research Structure

This research contains five chapters. In Chapter Two, the philosophical background of negative space in architecture will be presented in two main sections. In the first section, a brief definition of negative space in some fields of fine arts such as photography, painting, and sculpture will be presented. In the second section, different types of negative space in architecture will be discussed in detail.

In Chapter Three, the architectural perception, as well as the intertwined nature of perception and behaviour will be detailed within the first section. In the second section of Chapter Three, the visual perception of space in architecture will be explained. In the end, a number of examples will be presented.

Chapter Four is divided into four sections; the first section focuses on introducing the case study. In the second section, the selected negative spaces of the FFAD building will be

categorised according to the broad theoretical framework discussed in the literature review in Chapter Two. In the third section, the organised information will be manipulated by the author's visual working memories which are associated with the concept of negative space. Finally, in the fourth section, the author will evaluate whether these negative spaces have the properties and characteristics of intentional design or they are the results of random design process. Chapter Five highlights the lack of specific knowledge among architects and a research gap in the area of negative space in architecture. It also addresses the need for identifying and articulating an understanding of negative space in architecture and how it can offer fresh insights into space allocation and efficiency in design practice.

CHAPTER 2: NEGATIVE SPACE IN ARCHITECTURE

2.1. Introduction

Space is a complex and multidimensional phenomenon and its exploration and analysis decode understanding and appreciation of diverse scientific fields. Either naturally shaped or designed, space is around us. We experience a range of diverse spaces of varying styles and volumes. As an architectural theme, space is a visual and critical element for consideration in architectural design and practice. It is important that architects understand space and develop a physical narrative through the use of architectural elements to make space more functional and productive.

In an increasingly urbanised world in which land is extensively being acquired, built, and occupied, it is encouraging to find other possible ideas that revert this logic of consumption, advocate for reuse and requalification of the built environment and make us think of a more sustainable, responsible society in the future (López-Marcos, 2017a). As mentioned in Chapter One, addressing the concept of negative space as one of the most fascinating aspects of space composition may provide new opportunities to use space more efficiently.

In the following two sections, the philosophical background of negative space in architecture will be presented. In the first section, a brief definition of negative space in some fields of fine arts such as photography, painting, and sculpture will be presented. In the second section, different types of negative space in architecture will be discussed in detail.

2.2. Positive and Negative Spaces in Fine Arts

One of the simplest yet least applied dual concepts in fine arts is that of positive versus negative space. However esoteric it may sound, its applications to every design are immediate and tangible (Gellner, 2000). The terms positive and negative space originated with photographers, who refer to positive space as the main object of a photo which tends to be more active, dynamic, and motivating; and negative space as the background which is the empty space around the object (Cass, 2009; Cousins, 2013; Ambreen, 2019). Among many elements that can create a pleasing photograph, the negative space can be considered as an important part of a picture's composition and helps to define the main object better (West, 2019).

In general, the most intended unused spaces in the designed area, for instance in a painting or photography, are in white colour. Therefore, it is commonly believed that the colour of negative space is white. Indeed, it is not only in white, but also it can be black, coloured, patterned, variegated, and gradient. Thus, negative space is not a single block of colour (Turnbull, 2011).

John Suler (2013) argues that negative space can be defined as any area of the photograph that the mind recognizes as space around, between, or behind the object, regardless of its contents and form. As some photographers tend to assume negative space as a place for the eye to relax while observing the photo (like the silent moments in a piece of music), any area that the mind presumes as a break from the object may be thought of negative space.

The object or positive space is that part of the image that stimulates the higher intensity of emotional response to the viewer, while the background or negative space serves to support that reaction (Suler, 2013). Therefore, if more attention is given to negative space rather than to positive space, the result is often a "more accurate and aesthetically pleasing design and balanced composition" (Vangoghgenova, 2020).

In two-dimensional artwork, such as paintings, drawings, and photographs, artists often like to offset the positive space to one side of the work. This allows the negative space to lead the viewer to the object. In some designed works, positive space may overtake the frame and the negative space is minimized (Vangoghgenova, 2020). Also,

sometimes designers use an extreme amount of negative space to grab attention to a certain part of their design. Having a single object to look at in the middle of a considerable amount of empty space is an effective way to make a user stop, look, and read what is on the screen (Cousins, 2013; Suler, 2013). Nicholas Africano *(*Fig.2) uses a vast field of empty space to draw attention to the figure and the text (Infinite dictionary, 2015).

Figure 2. Painting by Nicholas Africano (Source: Infinite dictionary, 2015)

One of the best examples of negative space in photography is the optical illusion called Rubin's vase (Fig.3) (Barnes, 2019). Apart from some three-dimensional techniques in painting and photography, the painter and photographer's medium is the surface, a two-dimensional space in which the third dimension of depth is introduced only by indirection (Arnheim, 1977).

Figure 3. Rubin's vase (Source: Barnes, 2019)

In Rubin's vase positive and negative spaces are meant to be ambiguous or to switch back and forth between each other, which is known as a figure-ground reversal. Most people can reverse their perceptions and switch back and forth between the vase and images. These illusions demonstrate that the negative space has the same significance as the positive space (Infinite dictionary, 2015; ISFDN, 2019; Cherry, 2020). While the negative space itself has no defining details in Rubin's vase, the hard edges of the vase and the contrast of the vessel to the rest of the image activate the area and allow your mind to fill in the blanks (Barnes, 2019). Figure 4 demonstrates examples of these types of illusions.

Figure 4. Figure-ground reversal (Source: Barnes, 2019)

Positive and negative spaces are not limited to two-dimensional artwork. In sculpture, carving, and other three-dimensional works, the positive space is the solid piece of artwork that occupies space making the space around it comes to life, where negative space is the area around positive space (Fig.5). In carving, positive space is revealed through the removal of negative space. Since the artifact is a three-dimensional piece, the negative space needs to be visualized on all sides of the object (Infinite dictionary, 2015; Vangoghgenova, 2020; Archive, 2020).

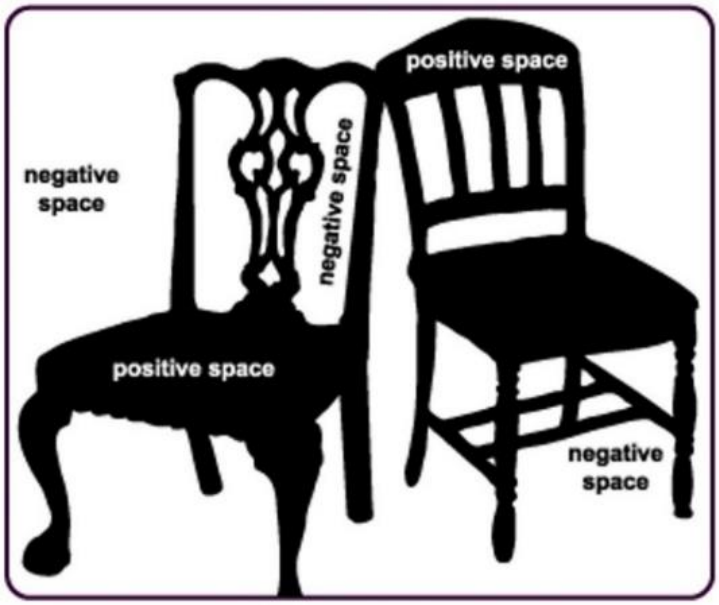

Figure 5. Simple demonstration of positive/negative shapes in sculptural work (Source: Archive, 2020)

Sculptors use negative space in a variety of ways; sometimes they create forms that enclose space and some other times they carefully place objects in a particular spot in a larger space which are demonstrated respectively in Figures 6 and 7 (Infinite dictionary, 2015).

Figure 6. Objects enclose space; left: standing mobile, 1934; right: elephant, 1927 (Source: Calder 2020)

Figure 7. Objects are exhibited among a larger space; left: a detached person, 1944; right: four arches, 1977 (Source: Calder, 2020)

2.3. Positive and Negative Spaces in Architecture

In Michael Leonard's view, three-dimensional space in architecture is divided into two components: positive and negative spaces which are one of the most fundamental yet the most under-researched topics (Robinette, 1972). The literature on these concepts is scant and heterogeneous, and much of it is incidental information in articles concerned with architecture. Perhaps, some of the complexity and ambiguity associated with these concepts in architecture is due to its three-dimensional nature and its representation in various social, cultural, and political contexts. According to Benoit Beckers (2009) in architecture, we perceive the built environment "with our eyes that do not surface, but complex organs, active and restless, that is continuously moving, in middle of the fluxes of light. Forming. Informing".

Historically, Peterson asserts that the Romans were the first who observed the phenomenon of space as a perceptual architectural element in its positive form. On the one hand, by using the plasticity of concrete vaulting and the consequent bending of the walls below domes, the Romans could create daring structures where they explored "a positive volume of emptiness". One of the early examples of this invention can be seen in a small bath at Hadrian's villa (Fig.8) (López-Marcos, 2017a). On the other hand, they add another direction (depth) in two-dimensional wall paintings (murals) to

trick the viewers visually. It can be seen in the first pictorial space of depth in Pompeian wall paintings (Fig.9) (López-Marcos, 2017b). Through these two methods, the Romans could create spaces that were more dynamic, effective, and functional which can be named as positive space.

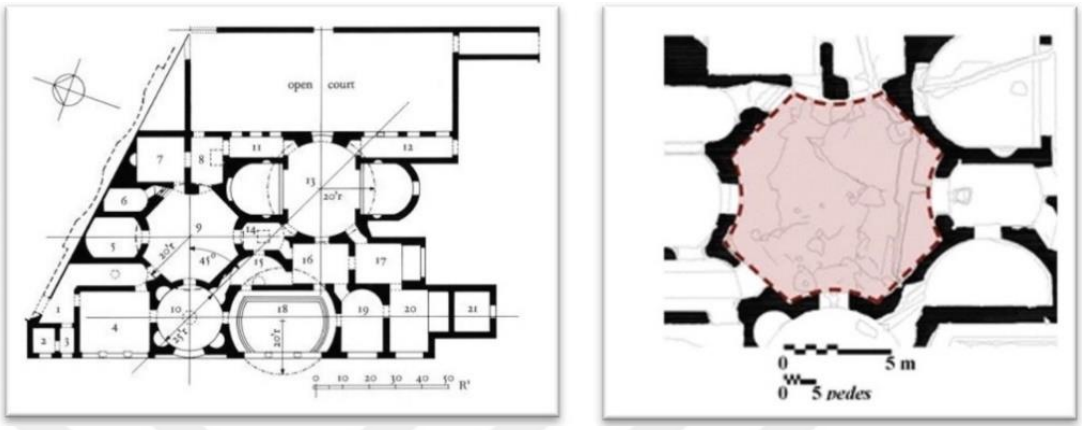

Figure 8. Left (A): Hadrian's Villa (Ytterberg, 2005); right (B): plan of the small bath in Hadrian's Villa (Source: Cipriani, Fantini and Bertacchi, 2017)

Figure 9. Pompeian wall paintings (Source: Ambler, 2020)

According to Marta López-Marcos (2017b), Peterson emphasizes that there are three conditions of space in architecture that can be experienced:

- Man-made, figural, closed, and formed spaces: public spaces like piazzas, squares, street corridors; interior spaces like rooms in apartments, classes in schools, halls; all linking elements in architecture which by making sequences and patterns can define hierarchy.

- Natural, surrounding, unformed, background, open continuous spaces: like parks, oceans, landscape, the sky, the whole earth from the moon.
- Ancillary or secondary spaces that are formed as a result of designing figural spaces. He claims that these spaces are kind of left-over spaces which infilling between the elements of grouped composition.

It seems that the third group can be called derivative space or negative space. The following is an example of the concept of derivative space in architecture. At first, imagine different shapes of coasters like ovals, squares, rectangles which all are pushed together to create a new assembled complex shape composed of figural space (Fig.10A). Then, put the new composition form on a tight-fitting rectangular tray. It creates some left-over spaces that are called derivative space by Peterson due to the interchange between both the edges of the assembled figure of coasters and the bounding edge of the tray which are shown in red colour in Figure 10B (López-Marcos, 2017b).

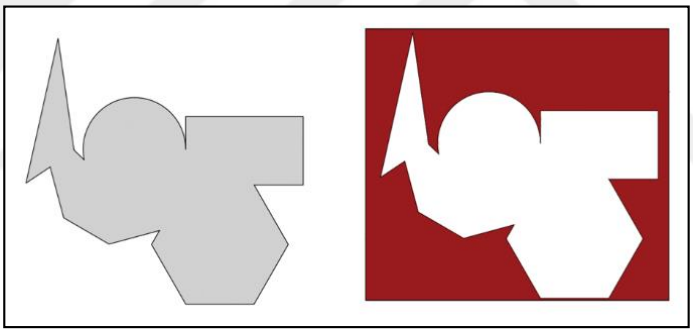

Figure 10. Left (A): new assembled complex shape composed of figural space; right (B): new composition form on a tight-fitting rectangular tray (Source: Seyedalipour, 2021)

In the third step, put the tray in an open space like on a lawn or a park. Here the tray is sitting in the emptiness of continuous space (Fig.11A). Then, if we add ten trays and group them as a grid, by making some spaces between each tray to form streets and designing some defined squares, we can create a town of trays (Fig.11B). In this case, there are layers of figural spaces, blocks of trays, and residual derivative spaces (López-Marcos, 2017b).

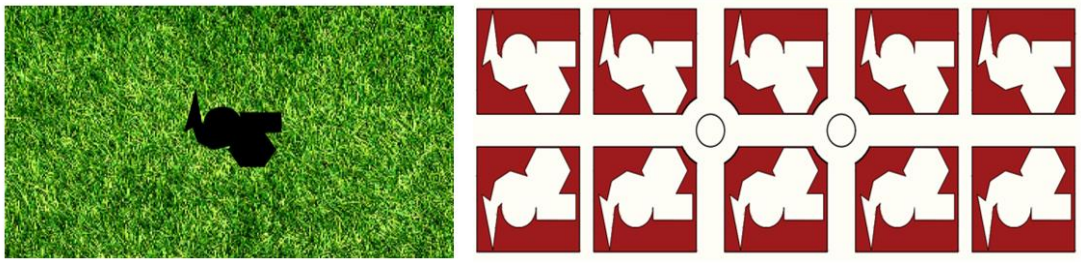

Figure 11. Left (A): new assembled complex shape in a lawn; right: town of trays consist of layers of figural spaces, blocks of trays, and residual derivative space (Source: Seyedalipour, 2021)

Regarding the above-stated classification, Gary O. Robinette (1972) believes that positive or figural space is contained, with the visual field limited, inner-focused, and static in character that is an area inside of a building; while negative or derivative space is left over, dynamic, with the visual field unlimited and lacking centre focus. Likewise, Peterson claims that if positive space is any perceived created space, negative space can be a solid space which has some features to support the positive space (1980). The main query is how these features can be comprehended tangibly in architecture.

One of the basic missions of architecture is to encourage people to experience space in certain ways defined by architects. When a building is experienced from a considerable distance, its scale and form draw viewers' attention. Once they enter the building, they start to interact with its empty spaces such as courtyards, hallways, and closets. The size, form, and arrangement of these empty spaces are as important as the form, material, and visual appearance of the building (Infinite dictionary, 2015).

Peterson considers these empty spaces as negative spaces. He (1980) outlines two criteria that clarify the configuration of negative space:

> *"first, it must be shaped to define and form space externally and cannot appear as a detached object. Second, it must be empty, thereby containing space internally. In other words, if positive space is the void which is 'in-between' form, negative space, is the void which is 'in-between' space. Negative space is the specific design of a physical solid to solely serve the formation of space, both*

inside and outside itself. It is a condition of multiple appearances, looking solid and being empty" (p.101).

Unlike Peterson, Diana Coole in her book entitled *"negativity and politics: Dionysus and dialectics from Kant to poststructuralism"* claims that it would be impossible to present a clear, and unambiguous definition of negativity in architecture without destroying that. Many scholars have considered the term just in varied philosophical contexts and have offered manifold connotations to define negativity like 'dialectics, non-identity, difference, the invisible, the semiotic, the virtual, the unconscious and the feminine' (López-Marcos, 2017a). Thus, it can be understood that we are challenging with a vague term that can be defined as a dark, hidden, imaginary, and ancillary space.

Regarding the factors that have been explained about negative spaces in fine arts and architecture, it can be stemmed that they are formed and designed to support and elevate (visually or structurally) the figural or positive spaces. These spaces can be varied from an architectural element to control the amount of light entering the building or a spandrel in a vault that supports it structurally to that of defining a pattern on the floor to grab the user's attention or completely distract them intentionally.

Derivative space is an umbrella term that Peterson has assigned to cover all forms of negative spaces. However, closer scrutiny of the concept of negative space reveals two main categories. The following sections will examine these categories in architecture through tectonic and qualitative approaches. While the tectonic perspective focuses on the contribution of structural factors to the creation of negative space, the qualitative perspective of negative space deals with the understanding of how negative space can influence the interactive dynamics of human behaviour within a built environment. It is hoped that these approaches will further enhance our understanding of the dynamics of negative space in architecture and beyond.

2.3.1. Tectonic Approach to Negative Space

Tectonics in architecture is defined as the science or art of construction by challenging the quality and techniques of using materials in the building, either as a mise-en-scène

of material and construction or as a form of scenography (Maulden, 1986; Voorthuis, 2020). It can be argued that negative spaces within the tectonic approach can be explored under three subcategories: 1) by-product space, 2) space within the walls and 3) habitable poché. The following sections present certain architectural drawings, photography, and archival material featuring how the concept of negative space meets tectonic architectural practice.

2.3.1.1. By-product Spaces

Peterson assumes that negative space is the residual space that appears as a by-product of the built environment that has been considered as a powerful realm for architecture in projective terms (López-Marcos, 2017a). Thus, a by-product space is a secondary space that derives during the production of the figural or positive space. These inadvertently designed spaces are an inevitable result of an intentional operation. For example, a space between the first step of a staircase and the floor which created due to the design of the staircase. This type of negative space can be useful if it is well-defined in dimensions and proportions in comparison with the positive space which can give a new value to space. Otherwise, it can create an unusable or left-over space (Portella, 2020; Luenendonk, 2014).

One of the most common examples of this type of negative space in architecture can be seen in the process of designing a vault or dome. Spandrels (or spandrils) are triangular spaces formed by the intersection of two arches or between a curved figure and the rectangular area around it (Przybylek, 2017). They are necessary architectural by-products that can occur in the construction of vaults and domes where a dome needs round arches to rest on a square or rectangular base (Fig.12). The system begins with an architectural constraint: the necessary four spandrels and their tapering triangular form (Gould and Lewontin, 1979; Spandrel, 2016).

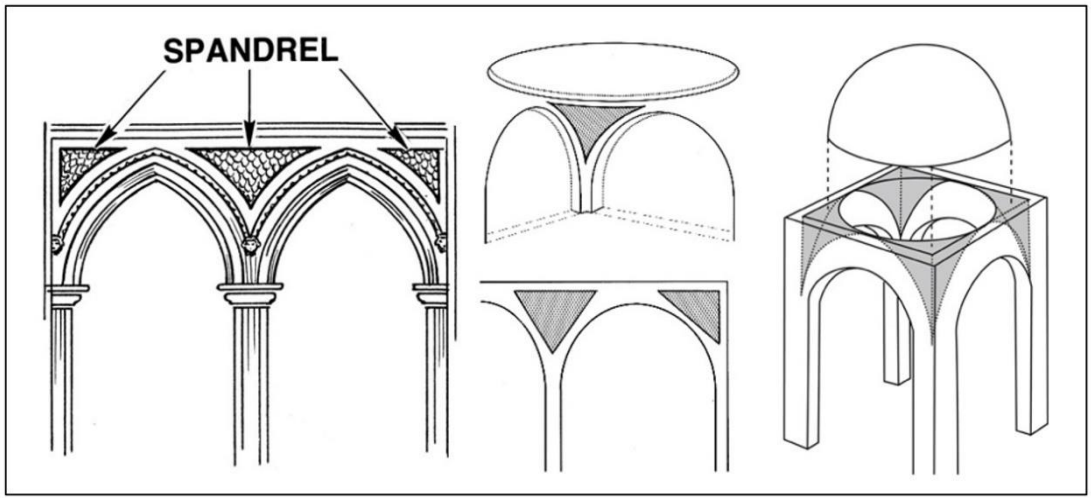

Figure 12. Four spandrels and their tapering triangular form in a dome (Source: Olson, 2019)

In the historical buildings, these negative spaces provided an opportunity for other forms of art to create an eye-catching scene. They were often ornamented with elegant decoration in a particularly fitting way (Gould, 1997). Some of these spaces were filled with swirling flowers, vines, and leaves with delicate colours (Fig.13A) and some others were filled with sculptural figures (Fig.13B). Similarly, in Islamic architecture, like mosques, these spaces were used to display the Quranic verses on mosaics executed in calligraphy (Fig.13C). These secondary spaces, which were initially created due to structural limitations, were transformed to display other symbols.

Figure 13. Left (A): Taj Mahal in India; middle (B): a hotel building in Paris; right (C): west-side iwan of the Jameh Mosque, Isfahan (Source: Google image, 2020)

By-product spaces are a predictable form that arises as a side consequence of design rather than a direct adaptation. They are negative spaces that create the necessary support for the larger geometric volumes. The spaces that resist form and imposition and yet a good design is not possible without them that can offer a potential to elevate the architectural spaces in another level of design (Gould, 1997; López-Marcos, 2017a).

2.3.1.2. Space within the Walls

Tectonically, negative space can be identified as "the specific design of an apparent solid to serve the formation of space, both inside and outside itself" (Peterson, 1980). Therefore, it can create a positive space externally. However, being empty internally, it can create a hidden space within itself. This hidden and unexpected space in Peterson's words (1980) is "the space within the walls" which can create an illusion of walls. This architecture "of walls" has also been explored by artist Gregor Schneider in Haus UR[1], where the combination of art and architecture has provided a possibility to define the 'interiors of interiors,' the dark space that hides behind flashy and hypertrophic architectural scenery. For Schneider, these invisible spaces are as important as the visible ones. These negative spaces are not real. In fact, he creates a showcase space to cautiously demonstrate the space within the walls but, as a whole, it serves well to express the meaning (López-Marcos, 2017b).

Peterson detects these spaces in 16th and 17th-century Roman buildings, such as Bramante's plan for St. Peter (Fig.14A), Villa Rotunda (Fig.14B), St. Agnese on the

[1] Gregor Schneider is a pioneer of built art rooms and one of the most important German artists of his generation. Since 1985 Schneider has been working on the house on Unterheydener Straße in Mönchengladbach-Rheydt. He replicated existing rooms by building rooms in their entirety within other rooms. These double rooms are not visible as rooms within rooms to the viewer. Using machinery, he also moves elements of the rooms out of sight. This results in hollows and inter- spaces. Some rooms become inaccessible because they are hidden behind walls, and some have been isolated using concrete, plumbing, insulation, or sound-absorbing materials. Different times of day have also been simulated.
There has been much controversy around his ideas for a dying room. Death and dying are an important part of his work and visitors are thrown back on themselves, confronted with their own fears (Adams, 2015).
In below there is a complete video about his work:
https://www.youtube.com/watch?v=8yKC9EaguDo&ab_channel=AASchoolofArchitecture
https://www.youtube.com/watch?v=EsPCp6aUvlk&ab_channel=ArtGalleryofNSW

Piazza Navona (Fig.15A), and the Palazzo Barberini (Fig.15B) (López-Marcos, 2017a). One of the common features in all these buildings is the thick corner triangle or rectangle walls (marked in red in Figures 14 and 15) that define different positive spaces around themselves. These spaces appear as solid columns with a hollow void in the middle which, in these examples, offer space for spiral stairs. Peterson (1980) describes these spaces as hidden pockets within the buildings' fabric.

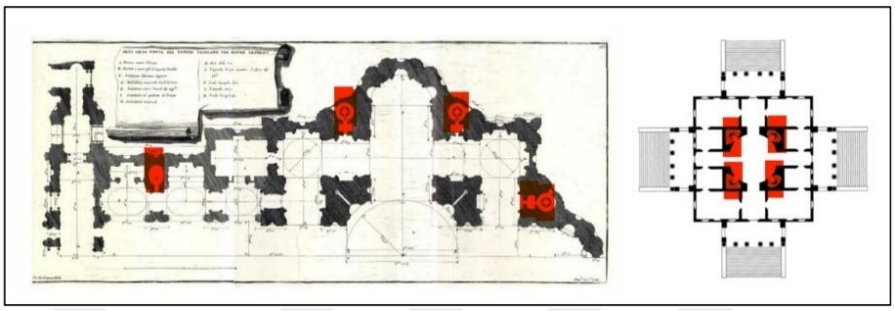

Figure 14. Left (A): Bramante's Plan for St. Peter's Basilica (Source: Google, 2020); right (B): Villa Rotunda, Vicenza, Italy, Andrea Palladio, c 1554 (Source: Peterson, 1980)

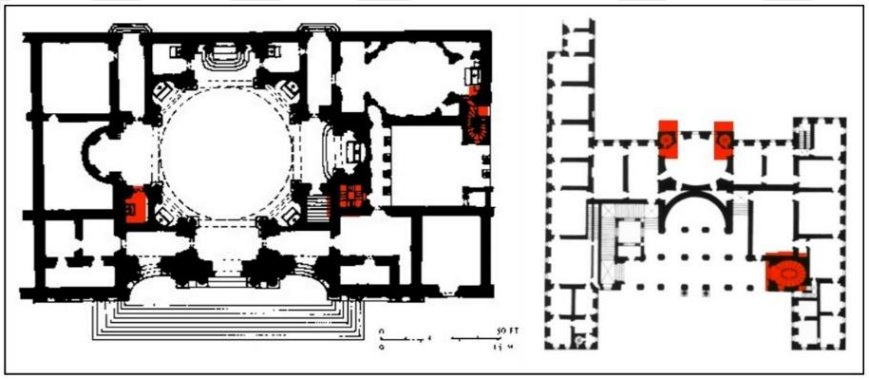

Figure 15. Left (A): St. Agnese on the Piazza Navona; right (B): Palazzo Barberini, Rome (Source: Google image, 2020)

In the above-stated examples, negative spaces were initially designed to structurally support the buildings. Due to the existence of explicit coherence in the buildings' plans, it seems that the architects had intentionally designed these characteristics.

The second example of this type of negative space can be seen in the work of John Soane, in which ‘volumetric space separated by the thickness and independent surfaces of negative space’ (López-Marcos, 2017a). This work is a starting point towards an architecture that actively occupies the space of the wall; a condition of multiple appearances, looking solid and being empty. This ‘condition of appearance’ of the space within the wall of the drawing-room in Soane’s house represents a tangible example of negative space within a contemporary setting (Peterson, 2018).

In Soane’s house, the designer combined a new type of construction with old concepts to create both thinness and thickness simultaneously. The thickness of the wall (Fig.16) is illusory and incomplete but, in a dramatic way, it conveys the concept of space in between two separate walls. The empty spaces in this building are used for decorative objects.

Figure 16. Illusion of wall defined by thin construction elements (Source: Peterson, 2018)

Different types of double and triple layer domes are the third example that illustrates the importance of empty spaces within the walls. Historically, two and three-layer domes have played a significant role in the development of Islamic architecture, with Iran featuring prominently in the design and construction (Ashkan and Ahmad, 2010; Yari et al., 2016; Dinani et al., 2018).

Architecturally, the size, shape, and scale of the domes were commensurate with the size of the cities in which they were constructed. In larger cities, domes were built high enough to provide unobstructed visibility from within and outside of the cities. Domes

were associated with celestial symbolism and have been a general representation of power and authority. Since one of the main features of Iranian architecture was human conformity, the architects designed another layer at the lower part of the domes to bring the interior design closer to the human scale.

The empty spaces between the layers of the dome (Fig.17) could substantially reduce the weight of the structure and minimise material usage. Also, a layered approach to building design was crucial in ensuring that the air trapped between the layers was effective in controlling the temperature by reducing heat exchange between the inside and outside of the building.

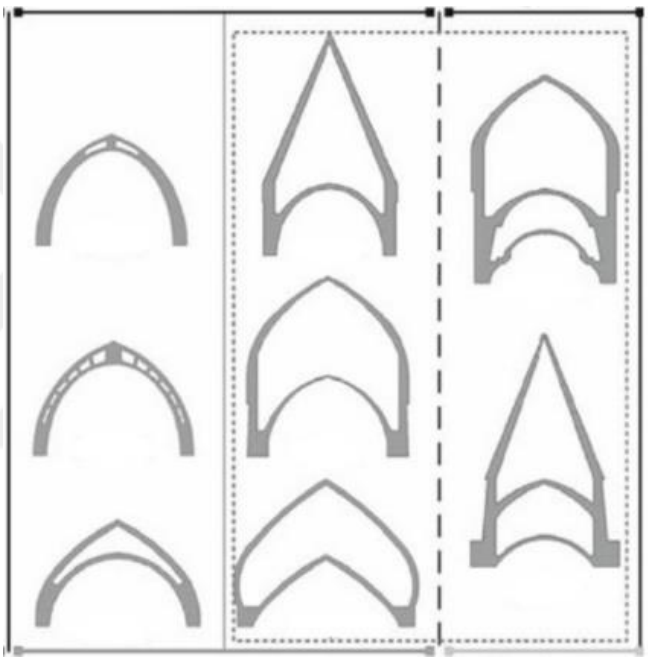

Figure 17. Illustration of the Islamic dome typologies according to the composition of their shell(s) (Source: Ashkan and Ahmad, 2010)

In more recent times, the new version of this method is used by architects to design a layer under the ceiling, thus creating negative space. The empty space is used to place the heating, ventilation, and air conditioning (HVAC) systems (Fig.18). This system is widely used in industrial, commercial, public venues, residential, and institutional settings (Seyam, 2018; Dunkin, 2018). The main function of the HVAC system is to provide thermal comfort and acceptable air quality in the indoor space. Therefore, architects consciously design and use these hidden spaces (negative spaces) to create

energy flows between the structure and its surroundings and help to maintain a balanced atmosphere.

Figure 18. Heating, ventilation, and air conditioning (HVAC) in building sections (Source: Dunkin, 2018)

2.3.1.3. Habitable Poché

According to Peterson, the term poché, meaning pocket, is borrowed from French to describe "the areas of wall that are shaped to define the different positive spaces in a composition of rooms". He observes that when architectural elements such as walls, floors, and columns, are literally solid they are pochés; if these elements are hollowed out and are accessible, they become negative space or habitable poché (Peterson, 1980; Trancik, 1986).

Habitable pochés are supportive structures that engage various architectural elements defining them as a unit. A habitable poché can then be a space for absorbing or echoing the sound, to control the light entering the space, to hold aesthetically pleasing objects like statues, candlesticks, and paintings. In all these examples, negative spaces offer solutions and add new value to architectural design.

One of the prominent examples of classical use of this type of negative space can be seen in the music hall in Ali Qapu Pavilion in Isfahan, Iran (Origiran, 2017). Based on geometrical and mathematical calculations, Sheikh Bahaei[2], the architect of the pavilion, designed a number of unique plaster decorations which were cut out in the

[2] Bahāʾ al-Dīn Muḥammad ibn Ḥusayn al-ʿĀmilī was an Arab Iranian Shia Islamic scholar, philosopher, architect, mathematician, astronomer, and poet who lived in the late 16th and early 17th centuries in Safavid Iran (Baha' al-din al-'Amili, 2020).

shapes of vases and other vessels on the ceiling of the hall (Fig.19) (Mohammadi, 2016). This was a creatively designed habitable poché which helped to create echoes for the musical instruments, thus improving the acoustics of the space.

Figure 19. The music hall in Ali Qapu pavilion, Isfahan, Iran (Source: Origiran, 2017)

Other examples of habitable poché in architecture are the niches in the walls and ceilings of cathedrals, temples, and palaces that were designed to hold grandiose objects such as statues, candlesticks, and paintings (Fig.20); or else in old houses, they were used as shelves in halls, rooms, or kitchens' walls (Fig.21).

Figure 20. Habitable poché that creates a space for statues and paintings (Source: Google image, 2020)

Figure 21. Habitable poché in rooms' walls (Source: Google image, 2020)

One of the simplest examples of habitable pochés in everyday life is bathroom niches that can offer the perfect place to put the bathroom utensils. Apart from saving the space and using that to place pleasant objects like candles, air fresheners, tableaus, or vases, it can also greatly contribute to the hygiene of the space by preventing the installation of extra appliances (Fig.22).

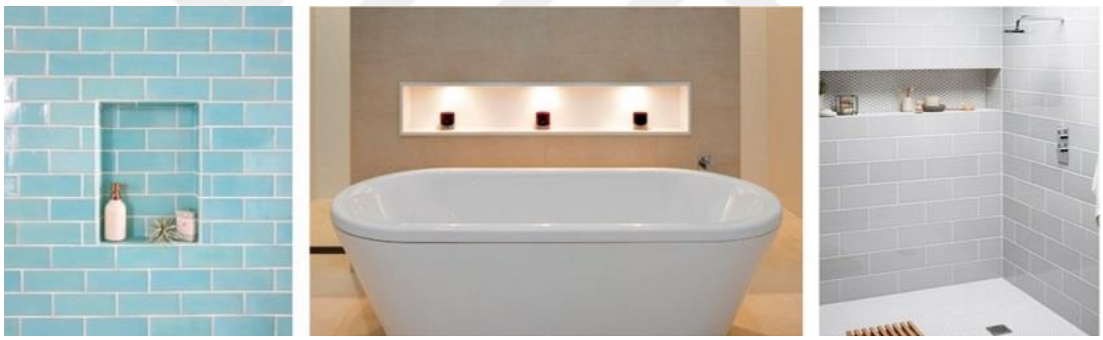

Figure 22. Habitable poché in bathrooms' walls (Source: Google image, 2020)

In short, exploring negative and positive spaces in their various forms holds an important place in architectural design because it can not only help architects understand the use of available space to them, but it can also help them understand the distribution of the visual and physical weight of a structure. An accurate understanding of them is a very subtle design element, but one which is very crucial to the success of the overall aesthetic.

2.3.2. Qualitative Approach to Negative Space

As it was discussed, apart from the philosophical realm, scholars in the field of architecture have rarely reached a consensus on defining negative space. Therefore, architects have mainly applied this concept in their designs based on their own understanding adding further complexities to the analysis of the concept that has been posited in architectural studies. This understanding of negativity has also hindered an accurate comprehension and representation of negative space and its potential in setting and achieving common goals in design. The following sections will briefly focus on reasons for the selection of qualitative approach to negative space, simplification, and application of the concept to design, as well as definition, types, and significance of negative space.

Within the tectonic approach to negative space, we talked about quantities in architectural design. We established that if these dimensions are defined adequately, the proportion of negative space will be reasonable compared to positive space. However, in the qualitative approach, space features such as colours, patterns, the texture of furniture as well as the user's experience, mood, memory, and knowledge can influence both the dimensions and the amount of negative space in the design. For instance, we may imagine two equally-sized furnished rooms, one of which is painted in blue and the other one in white (Fig.23). How would the empty space in each room be perceived? Obviously, there are certain factors that influence the quality of empty space, but it seems that the answer to these and similar questions lies in the qualitative nature of negative space.

Figure 23. The effect of colours on users' perception of empty space (Source: buildwith5th, 2020)

In architectural space, architects deal with human beings who are highly influenced by senses, memories, and emotions. If architects intend to influence users' behaviour or perception without overloading them, they may need to use qualitative tools. This is an instinctive process, and most architects and even non-architects almost always use negative space in their design without having profound knowledge about it. That is perhaps why the qualitative approach to negative space has generally been overlooked.

The qualitative approach concentrates on various aspects of design from the most general items (arrangement of all architectural elements like walls, ceilings, floors, staircases, the place of doors, windows, and so forth) to the most detailed ones (selecting the patterns for tiles, cushions on the sofas, the colour and texture of covering materials, and so forth). It is a common experience by architects that sometimes, after observing a space, they will be puzzled by its spatial proportions, furniture arrangement, and selected colour palette. Revisiting the concept of negative space can make a difference in architectural design. According to the Gestalt theory, when we enter a new space, our brains initially process the room as a whole. If the brain can successfully categorise different parts of the space based on its function, it will also be able to focus on the space's aesthetic features and design elements. From a functional point of view, adequate negative space declutter space and allows the user to navigate through it easily. Aesthetically speaking, it is more pleasing for the users to react to the spaces which feature plenty of negative space. Negative space increases the legibility of space, making it easier for our brain to classify and understand the space (Mastroeni, 2020).

Challenging commonly held assumptions, it can be argued that applying negative space to design is not merely instinctive but, in fact, it is a logical process. Once architectural design elements and features put together with a defined amount of negative space can create a seamless user experience. This will enable the architect to achieve themed connections across space to create an overall balance, unity, and harmony within the design.

In short, the qualitative approach to negative space is about having the knowledge of classifying and arranging the empty spaces between the design components by

defining a structure for different layouts in the design. It is an effective aspect of what makes a space usable by drawing architects' attention to the various layers in a design.

2.3.2.1. Definition of Negative Space in Qualitative Approach

Prior to presenting a definition for negative space based on a qualitative approach, a brief account of the origin of this concept may shed light on this poorly understood topic. Evidence shows that the application of negative space has a rich history in Asian countries. One of the most important forms of this concept is the essence of the Japanese aesthetic which is called 'MA' (pronounced "maah"). MA means pure, empty, spatial void, and interval of space between people and objects; the emptiness that is full of possibilities. This emptiness allows them (people and objects) to co-exist with less friction. Far from being just a philosophical or artistic concept, MA is ever-present in all aspects of Japanese daily life. It is widely represented in Japanese traditional music in the form of silence or pauses (Oyamatsu, 2013). It can also be noticed in Japanese conversations that are marked by long pauses that would be unsettling to the Western ears (Kisaki, 2011; Eastgate, 2018; Framer, 2020).

Japanese art and architecture have made extensive use of the concept of MA. It does not just mean the kind of empty space that is background; it is often arranged to be a focal point in a design (Reynolds, 2013). It can reconcile different design elements by creating interruptions or absences among them. By minimising tension in space, it can also create a sense of movement, balance, and harmony in a design. One of the best examples of MA in Japanese architecture is shrines (Fig.24) that have often been built at the end of long uphill hikes; the long and tiring walkway to reach prepares the mind to enter the shrines and leave behind other distractions and worries. In fact, this long walkway gradually creates an empty space (negative space) in the minds of visitors (Jerrold, 2018; Eastgate, 2018).

Figure 24. Atago shrine in Tokyo, Japan (Source: Google image, 2021)

Japanese concept of space and spatiality, with a focus on negative space, embraces not only space but also time and human relationships. It differs from those of the West's interpretation of space that traditionally has tended to focus on specific objects (positive space) in design. Japanese approaches to design in particular were highly influential on Western Modernism (Framer, 2020), and clever use of negative space can be found everywhere from the minimalist architectural works of Mies van der Rohe to the evolving repeat-patterns of Maurits C.Escher (Eastgate, 2018).

There is a common definition between scholars about negative space: negative space is the blank areas around and between objects; unoccupied by furniture, art, or accessories. For example, in interior design, it is the space between the sofas, the empty wall behind the dinner table, or the bare spot on the chimney breast. They also believe that positive spaces are almost preferred by people for lingering and social interaction while negative spaces tend to promote movement rather than dwelling in place (Causey, 2020). Although these examples attempt to describe the various dimensions of negative space and, more importantly, its relationship to positive space, none of these scholars define the true nature of negative space as a key element of architectural composition. This also begs the question of how negative space can be defined in a completely empty room without any furniture and accessories. Based on a definition of negative space as a blank area, can it be claimed that the entire empty room is a negative space due to emptiness? Philosophical discussions aside, is there such a phenomenon as an absolute empty architectural space?

While quantum mechanics indicates that there is no absolute empty space (Adler, 2014), the philosophical approach to the concept of architectural space in Western

tradition offers a different understanding of empty space. As Henk Oosterling[3] (2005), points out "a room is empty until someone enters". In Eastern culture, however, "a room is always filled with invisible structures, regardless of its occupants". In other words, spaces have meanings prior to any activity that happens within them (Oosterling, 2005; Jerrold, 2018). What is important to notice in the qualitative approach is that even in an empty architectural space (without any furniture and accessories) there are many elements that may influence our understanding of negative space (empty space). Features such as walls', ceilings', and floors' covering materials; the colours, textures, and patterns of materials; the place of windows, doors, lights (natural or artificial); and architectural design principles (symmetry or asymmetry, contrast, or harmony) still exist in a presumably empty space. By providing certain basic answers to some of the fundamental questions surrounding negative space in architecture, the qualitative approach offers two main categories of negative space: 1) macro, micro, and nano negative space and 2) active, passive, and left-over negative space.

2.3.2.2. Different Types of Negative Space in Qualitative Approach

In a sense, negative space in architecture is more felt than seen (Jagyasi, 2019). Due to the fluid nature of architectural designs, there are no certain rules or predefined methods for manipulating the right quantity of negative space. However, insufficient negative space makes a design, and its components feel cramped, cluttered, incomprehensible, and devalued. Similarly, by allocating excessive amounts of negative space in design, barely anything will stand out. So, it can give the project a look of being unfinished (Kisaki, 2011).

The right amount of negative space separates objects from each other, brings harmony, and can have a dramatic impact on the mood and tone of the finished work. It counts as one of the best tools that can be used to maintain a sense of space and interaction

[3] Henk Oosterling is a philosopher and a strategic advisor. He studied philosophy, linguistics and Japanese in Leiden and Rotterdam. He has studied, taught, and written on martial arts. He has published philosophical and non-philosophical books.

between objects in design projects (Cousins, 2013). Additionally, the right amount and place of negative space can visually generate a sense of direction that complements or contrasts with the direction and movement of the object in the space. Negative space on the bottom creates a vertical “up” feeling, and on the top emphasises “down”; on the left pushes elements to the right while if it places on the right pushes elements to the left (Fig.25) (Suler, 2013).

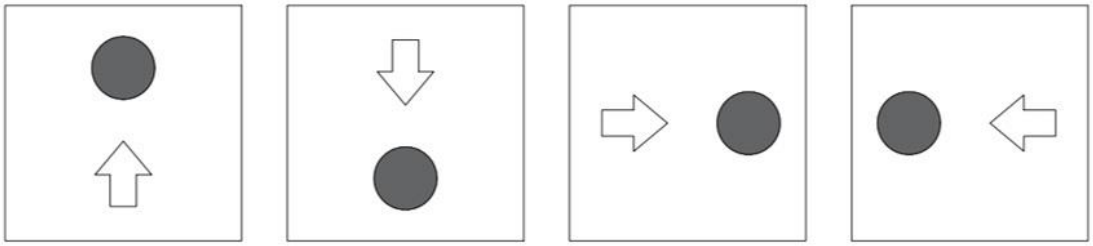

Figure 25. Generating a sense of direction by negative space (Source: Seyedalipour, 2020)

Therefore, the intelligent and creative use of negative space can be a real asset in every design project. It is a key element in achieving positive development in architectural spaces. It can make a design look luxurious by using the "less is more"[4] principle. Likewise, enhancing the design objectives brings the focal point of design into focus (Turnbull, 2011; 17seven, 2017).

Although the “less is more” principle does not indicate that negative space is always equated with minimalism, most architects prefer to design with that connection in mind. In fact, the importance of negative space in architecture can be observed in any type of design from minimalist to maximalist (Cousins, 2013; Hamstech, 2018). By applying coordination and synergy techniques to the selection of elements (like colour palettes, textures, patterns of materials, and so forth), despite using a large number of them, architects are still able to minimise distractions and create a calming atmosphere with ample amounts of negative space. Moreover, it provides visual relief and space

[4] For almost a century, Mies van der Rohe' minimalist style has proved very popular; his famous aphorism "less is more" is still widely used (Archdaily, 2021). Yukiko Kisaki’s article of *When Less is More: Japanese Concept of "MA", Minimalism and Beyond* is based on this aphorism.

organisation. One of the best examples of this type of space can be seen in some sort of the Bohemian style (Fig.26). Given the importance of the amount of negative space, the next sections will investigate two main categories of negative space in the qualitative approach:

1. Macro, micro, and nano[5] negative space
2. Active, passive, and left-over negative space

Figure 26. Despite a large number of items, there is still sufficient negative space in the design (Source: De Combo, 2021; Google image, 2021)

- Macro, Micro and Nano Negative Space in Architecture

In evaluating architectural scales, every inch matters. Architects should get a sense of the overall scale of the space and focus on factors such as the height of the ceilings, size, and place of the windows, appropriate exits, and entries, as well as number and

[5] Anastasia Diachenko (2018) outlines two categories for negative space: micro and macro. While micro negative space is related to the space between small elements like lines, words, and letters, macro negative space is the space between larger blocks or elements. Some interior designers also follow Diachenko's categorisation. In this study, the author introduces another category for negative space—nano negative space.

locations of artificial lights. Architects take all these factors into account and determine the placement of them from the biggest to the smallest ones. Assessing these factors requires a carefully crafted plan for negative space. The classification of objects and the empty spaces between them takes place in three stages, as detailed below:

- Macro negative space: when the architect groups the distance between the main architectural elements like the locations of natural light, doors, the height of the ceiling, openness of the space, and organising the main furniture around the space (Fig.27).

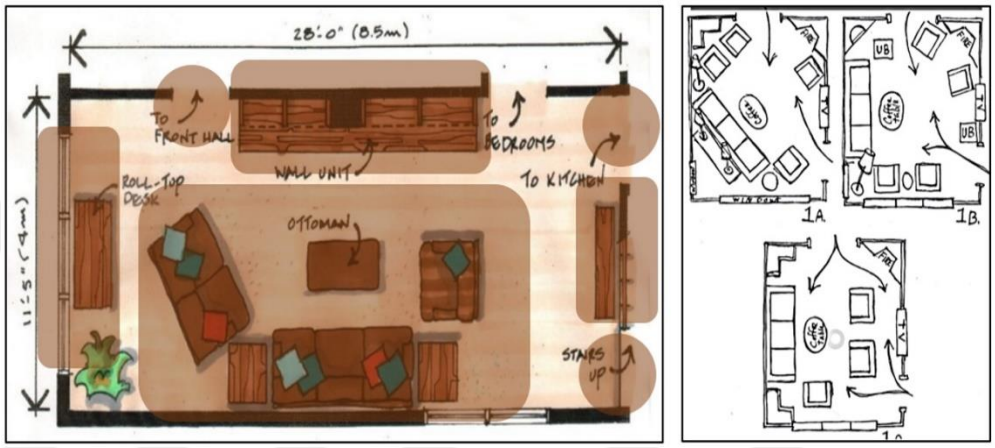

Figure 27. Macro negative space (Source: Google image 2020)

- Micro negative space: when the architect groups the distance between smaller design items in a space. It can include the space between sofas, chairs, a desk and a wall, space between cushions on the sofa, candlesticks and the clock on the fireplace, and the arrangement of books on the bookcase; or grouping of objects such as a pencil case and desk lamps, and even the distance between a pencil and a book on the table (Fig.28).

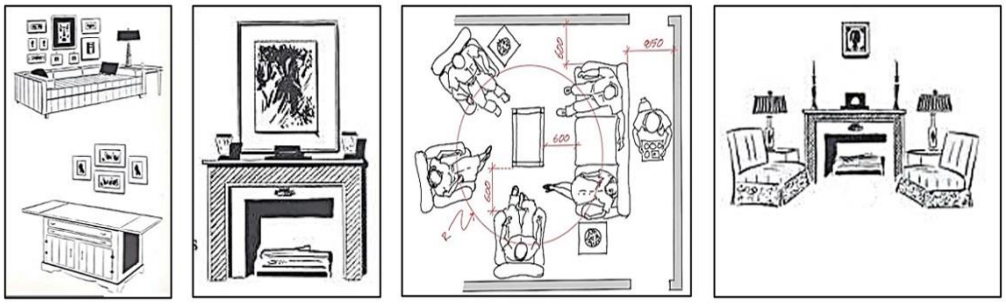

Figure 28. Micro negative space (Source: Google image, 2020)

- Nano negative space: This is perhaps the most critical component of applying negative space within the architectural design process that has a profound impact on the whole space. By paying attention to minute details beyond the routine analysis of space, the architect delivers a creative solution to spatial design instinctively or intuitively. This is an informal, unstructured, and almost invisible process which can often be explained as intuitive or derived from a natural, unintentional sequence. The scope of applying nano negative space involves almost every element of design including textures, patterns, colours, contrast, and harmony as well as compositional, symmetrical, and asymmetrical balance. The following examples may clarify this process.

  Texture in interior design refers to the surface quality of material. For example, in choosing appropriate cushions for sofas, the material (smooth, silky, woven, or embroidered), colours, and quantity of them can influence the tone and weight of negative space in a room by creating visual distractions or preventing that. Apart from other elements in space that can have a great impact on the amount of negative space, in Figure 29, by focusing exactly on the sofas and pillows, obviously, the amount of negative space decreases from left to right. In Figure 30, leaving some shelves empty, or adding doors for some of them in a bookcase tangibly affects the quality of negative space from left to right.

Figure 29. Nano negative space and the texture of materials (Source: Google image, 2020)

Figure 30. Nano negative space and the arrangement of books (Source: Google image, 2020)

Another example of a better understanding of nano negative space is the floor material. Based on their layout, materials can create either a cramped, cluttered appearance or they can give an open, spacious feeling to space. Using various flooring options (in size, colour, pattern, and texture), or creating changeable patterns by applying natural or artificial light can impact the amount of negative space in a design. For instance, in Figure 31, two parts of one space are shown beside each other. Due to the difference between the floorings based on their colour, texture, and pattern, the left part of the space seems airier and more open.

Figure 31. Nano negative space and the features of materials (Source: Google image, 2020)

- Active, Passive, and Left-over Negative Space

In this section, the differences between the three types of negative space will be presented in the form of an example. We may imagine an architect is tasked to showcase sculptures as the focal points of a gallery. Is it possible that they achieve this by defining only empty spaces around the sculptures? Considering the fact that the amount of negative space is critical to the design process, if the empty space compared to the positive space (the sculpture) is insufficient, then the negative space is left-over. However, if architect considers creating sufficient empty space around the sculptures, then the negative space is passive.

Moreover, there are other architectural rules and elements which can activate the empty space. For instance, the architect can use a contrasting colour to complement the background of the sculptures; or they can emphasize the sculptures with a visual (light) effect; or create a specific pattern using a fabric-like material in the background of the sculptures. All these considerations by making a huge difference in the quality of negative space and also creating a great impact to enhance, extend, and animate positive space, clearly emphasize that negative space is activated.

The above example indicates that both active and passive negative spaces are created intentionally. It means that the architect makes a conscious effort to incorporate negative space into the design to emphasize positive space. Therefore, the proportions of negative space are well-defined in both of them. However, in active negative space, in addition to a good proportion of empty space, architects by applying other architectural rules and elements like using a contrasting colour, a visual (light) effect, a specific pattern, or texture, disrupt or create a balance, harmony or symmetry in space, can activate the negative space.

Left-over negative space is achieved when architects focus on designing merely a positive space. In this condition, the negative space is very much dominated by positive forms in the design and, due to the unintentional and unconscious creation, it has no defined proportion. Left-over negative space appears like randomly scattered segments throughout the design with no logical pattern. It may even seem unfitting to amateur designers.

1.3.2.3. The Importance of Negative Space in Qualitative Approach

Emptiness, silence, or colourlessness as the solid foundation of the contrast in a design, generally are not counted as good elements between people. However, only empty space allows us to understand what we want to fill it with; silence allows us to appreciate the value of sound; and colourlessness allows us to feel the colours brighter and deeper when they appear in space (Yalanska, 2019). On the one hand, when every designed space holds something to observe, due to the formation of insufficient empty spaces, sensory overload happens and the eye floats aimlessly without being able to detect individual objects. In addition, using too many elements causes confusion, increases the uncertainty of displacements, and fails to make an impact. On the other hand, using few elements in designing a space, due to the creation of great amount of empty space, induces lack of response, motivation, and receptivity. Therefore, a careful application of negative space creates a uniform background for clear and readable separation of objects, which is a vital component of every design (George, 2012; Dunn, 2017).

Among the benefits of a qualitative approach to negative space in design, and based on reviewing of the published literature by some interior architects, the following may be singled out (Turnbull, 2011; Dunn, 2017; Devero, 2019; Smith, 2020; Handgraaf, 2020; Kay, 2020; Portella, 2020):

1. It increases the sense of focus: it sets the user's concentration on core elements or goals of the space while reducing the level of distraction. It is the moment when visual stimulation stops to give the eye a chance to focus and regain balance by creating a subconscious sense of visual comfort and harmony.

2. It creates decluttered space: in a room where every wall has something hung on it, every available spot has a piece of furniture, or every surface is covered with stuff, the user's eyes do not know where to go first, so the effect is just one big-cluttered space. By providing enough empty space around objects, negative space can prevent the feeling of clutter and chaos in the space. Sometimes, the next step to prevent clutter in design might be subtracting rather than adding. For instance, in Figure 32, only the functional elements of the washbasin take up any visible space, while the rest of it is concealed behind the mirror; or by designing some floating shelves instead of a normal bookcase on the wall, the designer can create a clean and distraction-free space.

Figure 32. By concealing some items, negative space prevents chaos in the space (Source: Google image, 2020)

3. It increases the legibility of space: negative space increases the legibility of space by creating visual order or hierarchy in a designed space. Empty space around objects affords them the breathing room to stand out on their own and be noticed. The viewer can also perceive the overall design more easily.

4. It enhances interaction rate: studies have proven that the average attention span of a user is less than 8 seconds and so the main role of a designer is to deliver the message to the user in that span of time. Based on the Gestalt principles, the negative space defines links between objects and their limits. Therefore, improving the legibility of space makes it easier for our brain to interact and understand space.

5. It plays a key role in the overall functionality of space: we all appreciate endless space to use but space is limited and needs to be used in the wisest way possible. Beyond the artistic and aesthetic appeal, negative space highlights the space functionality which also contributes to the overall look. The best example of using negative space in enhancing functionality is the arrangement of empty space in Apple stores (Fig.33). The empty space gives enough room for the products to be noticed. Apple Stores are a vivid example of how expert workplace design plays a vital role in the success of businesses.

Figure 33. Increasing the functionality of a space by applying adequate negative space in design (Source: Google image, 2020)

6. It evokes emotions in the users: a careful design of negative space can evoke emotions. It means that the negative space says something. It may speak about something frightening, amusing, touching, gloomy, or thoughtful. It may put the user in a state of observation and awareness. In design, evoking emotion is subjective to the designer and the user. The user might not see what the designer intends but they will most likely observe something, and they might have no idea what it is and why. Each of the following pictures portrays how the artistic design of the negative space simply helps to evoke emotions and feelings in the viewers.

Figure 34. Left: sense of weightlessness on the right side of the image; right: sense of distance or separation (Source: Google image, 2020)

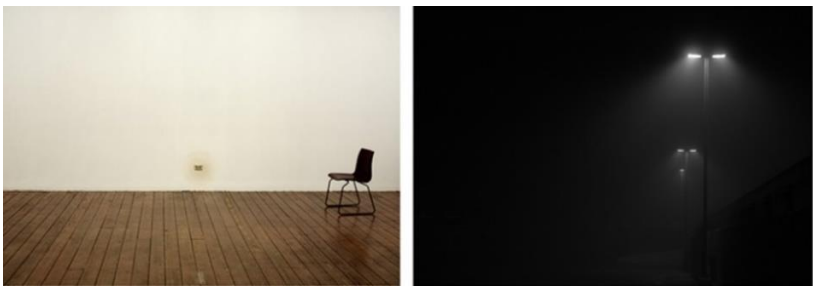

Figure 35. Left: sense of loneliness; right: sense of fear and ambiguity (Source: Google image, 2020)

7. It creates a balance, harmony, and flow in design: if the space is well-balanced, the eye has an opportunity to linger on important features. The overall balance level in architecture is determined by both the occupied as well as unoccupied spaces and can establish a cohesiveness in design. Using a good proportion of

empty space in design is a good technique to balance the visual gravity between different areas of the space. It prevents the feeling of cramped in design and as a perfect tool provides a way to direct the overall flow of a space. It defines a simplicity that reflects clarity, beauty and meaning to space.

2.4. Conclusion

In brief, the qualitative approach to negative space offers an effective tool that elevates the architectural design. Since architects deal with a fourth-dimensional space (time is also added), a better understanding of the amount and the place of negative space is more difficult than the other fields such as photography, paintings, sculpturing and web design. Moreover, architectural space is experienced by humans who have different emotions at different times. People and space are connected and co-exist, but their perception of the same space may differ from one another. By the same token, for different people the same amount of negative space may have distinct implications.

In order to make good use of negative space in design, architects need to be trained to see the negative space as much as the positive one. They need to participate in evidence-based spatial experiments. Perhaps, one of the best ways to achieve this is to rediscover the relationship between architecture and photography. In the other words, they should observe and think like a photographer. The framing technique in photography provides architects with a powerful tool to improve their understanding of negative space. Sometimes viewing negative spaces through a different medium can enhance the creative thinking process (Smith, 2020).

Encouraging architects to imagine architectural elements upside down (inverted) is another way to improve their understanding of negative space. In this way, they will see a wall-shaped object around a rectangular hole instead of a door on the wall. By mastering this technique, architects can be trained to use negative space more perceptively in the design, which may lead to a seamless end product (Ambreen, 2019; Framer, 2020).

CHAPTER 3: SPATIAL PERCEPTION IN ARCHITECTURE

3.1. Introduction

Space is all around us, we experience it as shaped into buildings, rooms, tiny enclosures, public spaces, squares, streets as well as natural landscapes. However, when we look at it, interact with it, walk through it, we all experience it differently (Julean, 2016). In fine arts and architecture, according to Gary O. Robinette (1972), space can visually be perceived in three ways:

> - *"The first one is flat, two-dimensional space, such as a painting lacking depth. In all pictorial phenomena, space may be depicted or illustrated, but never actually formed.*
>
> - *The second of spatial perception is plastic, three-dimensional convex, and is best illustrated by a piece of sculpture. The observer experiences the space form without as [s]/he moves around the finite shape viewing three-dimensional relationships stereoscopically.*
>
> - *The third type of spatial perception is three-dimensional concave, kinetic space, which the viewer, from vantage points within the space, experiences and comprehends it subconsciously as spatial sensation: or …when space is enclosed with the skill of an artist… then 'spatial sensation' becomes spatial emotion and enclosed space becomes architecture" (p.16).*

Similarly, Peterson (2018) states that:

> *"the form in which space is presumed to exist is the framework of our perception of the world. Space, as [an] idea, is the intangible qualifier of our vision of form,*

of location and dimension, establishing the relative measure among physical things" (p.3).

As an element of architectural design, Dana Julean (2016) identifies three types of space:

- The projected space, which can be imagined and conceived by architects through drawings, plans, models, 3D animations, and, lately, through virtual reality.
- The produced space or the built environment, which appears in all its instances such as micro-architecture, temporary architecture, spatial experiments, architectural object, or urban space configurations.
- The perceived space, which is understood by its user's perception of cultural, psychological, philosophical, and/or social differences. Thus, in order to analyse the complexity of this last layer of space, the architect needs to contextualize the impact of the built object within its historical, cultural, social, philosophical, and/or geographical environment. From this point of view, what others might think of the space created by an architect will depend on how they perceive the space.

Julean (2013) believes that this relationship between architects and users is bidirectional, and its effects are visible both ways: architects modify space through the process of designing a built environment and, in return, the built environment modifies our perception and behaviour. It is visible that in the last decades' architects and psychologists equally have been attempting to link architecture with the psychology of the individual, considered as the user of these spaces.

In this context, it is critical that architects have a solid grasp on architectural perception as well as the inextricably intertwined nature of perception and behaviour, which will be detailed throughout the first section of this chapter. In the second section, the visual perception of space in architecture will be considered. At the end of this chapter, a number of architectural examples will be examined.

3.2. Definition of Perception in Architecture

From the psychological point of view, perception is a complex process through which people can become aware of objects and events in the external world. Perception is the process of gathering information through our senses, then organising, interpreting, and explaining them based on person's own experiences, thoughts, and value system in order to create meanings. In other words, our senses collect data from the environment based on our priorities, known as a perception or hermeneutic cycle (Kiroff, 2002; Bermudez and Smith, 2005).

Due to differences in our priorities, perception is not an absolute process. Basically, it is a highly creative process. We may relate to the same reality, but we perceive it in a different way according to what the environment means to each of us (Kiroff, 2002; Bermudez and Smith, 2005; Julean, 2013; Julean, 2016).

The process of perception is essentially made up of two aspects: one of them is figurative, related to the percept or images of successive states or momentary configurations of the world by direct and immediate contact, and the second one is operative, related to the operations which intervene between successive states and by which the subject transforms parts of the world into reconstructable patterns or schemas (Julean, 2016).

In architecture, perception is the interface which encompasses the processing of visual stimulus yielding the mental realisation of environmental objects and events with its characteristic uncertainty. It can provide cues, such as depth and distance, that are important for movement and orientation to the environment (Bittermann and Ciftcioglu, 2008; Julean, 2013; Fieandt et al., 2019).

According to Julean (2013), our mental representation is based on the image we have seen. This representation is fundamentally different from that initial image, but it is not random. Mental representations, compared to physical images, are products with higher degrees of abstraction. Basically, after observing a scene, information (like the atmosphere of a place, the size of a space, the colours, the textures, the height of buildings, and the other architectural features) is decomposed into its elementary components and then placed in different parts of our memory. This decomposed

information is highly subjective, which can be recovered through different events. Based on our interest towards a certain feature, particular areas can be registered more or less detailed.

The way in which we act or react to the environment depends on how we understand and decipher the received messages from our environment. Architecture is often perceived in terms of architectural elements and features. For instance, someone cannot get into a building unless they recognise that a wooden panel approximately 3 feet wide by 7 feet high with a knob at one edge and hinges at the other side is a door. These dimensions are not randomly created. For this reason, for example, it is not easy for an Eskimo or a South Sea Islander to understand the application of this wooden panel. Therefore, for architects, knowing to give the appropriate answer in a certain situation is just like speaking more languages. The key to designing better and well-adjusted environments lies in the way architects understand how the public perceives their environment (Julean, 2013).

3.3. Types of Perception

Perception plays an important role in the quality of life (Mansourifar et al., 2021). Most of the research on the epistemology of perception[6] has focused on visual perception due to the fact that our knowledge of the world is largely attributed to our visual experiences. According to Gatzia and Brogaard (2020), the epistemology of non-visual perception explores questions not only related to traditional sensory perception, but also to proprioceptive, interoceptive, multisensory, and event perception, expanding traditional notions of the influence that conscious non-visual experience has on human behaviour and rationality (Madison, 2018).

In ancient times, after making the first note on a rock or on some other surfaces, eyesight became the main perception channel for inter-temporal information transfer between individuals. These notes appeared to be among the first artificial visual metaphors, which embraced the whole new era. Over the course of time, new visual

[6] The vast topic of perception can be subdivided into visual perception, auditory perception, olfactory perception, haptic (touch) perception, and gustatory (taste) perception (Galotti, 2017).

image creation methods were developed which paved the way to a great quantity of new arts and sciences (Architizer, 2020). However, in the Viking age culture in Iceland, for instance, hearing (as one of the non-visual factors) ranked higher than vision in the sensory hierarchy prior to documenting the Icelandic Sagas and writing down the Laws. Thus, stories were narrated from generation to generation by raconteurs (Frichot, 2013).

The nature of non-visual perceptions and the incredible power required to visualize them by developing visualization means facilitates creative architectural design. The aim of the following sub-section is to elaborate on the meaning of visual perception in architectural design.

3.3.1. Visual Perception in Architecture

Visual perception is the ability to interpret the surrounding environment using light in the visible spectrum reflected by the objects in the environment (Visual perception, 2014). "This is different from visual acuity, which refers to how clearly a person sees (for example "20/20 vision")" (Visual perception, 2014; Psynso, 2018). Based on this assumption, despite having problems in the visual perceptual process, a person can have 20/20 vision (Vivid vision, 2018).

All vision-related concepts, such as attention, perception, and visual openness are the sub-areas of vision (Bittermann and Ciftcioglu, 2008). Fatema Q. Kabir (2010) states in her book entitled “Phenomenon of Visual Perception in Architecture” that “the visual world is about an individual's perception”. This individual’s visual perception involves registering necessary information being sourced from various objects on the one hand and constructing meaningful information on the other, which is utilized for various human decision-making and activities including orienting themselves in space (Basu and Ghosh, 2017). In other words, the essence of visual perception lies in the analysis of the view in either of the following two ways; “exploring the real from the created illusions or experiencing the overall space by getting integrated within, through the view” (Etd, 2008; Kabir, 2010).

Arguably, the perception phenomenon and subsequently visual perception have not been precisely defined but qualitatively addressed. Consequently, human visual perception as an essential tool in architectural design is limited to the application of personal experience or knowledge obtained from experimental data (Bittermann and Ciftcioglu, 2008).

Visual perception is being broken down into five steps or processes which begins with receiving stimuli from the environment and ends with our interpretation of those stimuli (Kiroff, 2002; Riou et al., 2011; Johnson, 2016; Fauziah, 2016; Galotti, 2017; Vivid vision, 2018; Cherry, 2019):

1. Stimulation or selection: All the five human senses are stimulated through psychological factors relating to personal needs and preferences, past experiences in the form of previous training in a particular field and present feelings which express the current emotional status of a person.

2. Organization: The collected information is organised in three ways; rules, schemata, and scripts. The Gestalt psychologists believe that perceivers follow certain laws or principles of an organisation in coming to their interpretations (Galotti, 2017). They reject the claim that we recognise objects by identifying individual features or parts; instead, we see and recognise each object or unit as a whole. The following principles (Fig.36) may be considered under the umbrella of this step: simplicity and patterns, proximity, similarity, figure and background, and perceptual constancy.

   Most of the Gestalt principles are subsumed under a more general law, the law of prägnanz, which is a German term meaning "good figure." This law holds that objects in the environment are seen in a way that makes them appear as simple as possible (Cherry, 2021). It means that perceivers will tend to select the organisation that yields the simplest, most stable, and symmetric forms because they are seen more easily than complicated and asymmetric ones.

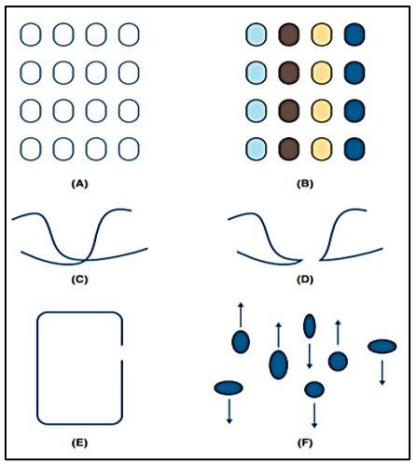

Figure 36. Gestalt principles of perceptual organisation: (A) the principle of proximity; (B) the principle of similarity; (C) and (D) the principle of good continuation; (E) the principle of closure; and (F) the principle of common fate (Source: Google image, 2021)

3. Interpretation-evaluation: A linked term which significantly affected by a group of factors including beliefs as concepts which we assume to be true; values as what one believes to be important; attitudes that are derived from beliefs and values; recency-primacy that consider the precedence and latency of events; and present feelings and expectations.

4. Memory: Memory stores information after the above-stated steps. Not only information is not stored continuously, but it can also be lost or distorted due to inconsistency with what our memory holds. Actually, memory and perception processes seem to be based on the same system in involving the brain regions or sharing the resources. It is therefore believed that perception influences memory processes and vice versa.

   As a subset of this step of perception, visual working memory is a broader term that describes two very different functions including visual short-term memory and visual working memory. Visual short-term memory describes the storage aspect of memory which allows us to hold a visual picture in our mind for a few seconds after it disappears from our sight. During this time span of a few seconds, a small subset is transferred into visual working memory (Johnson, 2016).

Visual working memory is used to describe both the memory storage function and the manipulation of the information held in memory. Consequently, visual working memory may increase with age because due to the increase in the perceiver's knowledge and experiences, the manipulation of data will increase over time. It is important to note that the information, which needs to be recalled and transferred to long-term memory, must first be stored in working memory.

5. Recall: Memory is not reproductive. It is reconstructive based on our schema and scripts which was explained in the previous step.

Developing a model of visual perception is a relevant issue for architectural design, as it may help to increase awareness for perceptual implications of design decisions (Akin, 2019). Modelling human perception is challenging mainly because it involves not only the eye but also the brain and the final 'seeing' event occurs in the brain (Bittermann and Ciftcioglu, 2008). Therefore, environmental stimuli are processed and aligned with mental templates that develop through personal experience. This is how we come to understand that a rectangular plane recessed in an opening in a vertical surface is a door (Gjerde, 2010).

Additionally, visual perception is grossly dependent on natural or man-made physical objects, which comprise various physical parameters. Often these parameters are changed and iterated by the designers to suit a particular need, for example, in the case of architecture or built environment. The inclusion of a door fenestration on the approach way or road is preferred since it would indicate a quick entrance to the building visually (Basu and Ghosh, 2017). Now, this door has a height, width, texture, etc. which are its physical parameters. A designer may choose to increase the height of the door to make it look pronounced and well defined and inviting. Or the width of the door is increased to accommodate more people to pass through at the same time with ease in case the building serves to a busy pedestrian influx such as a railway station building. Now, in contrast to a normal residential building, in this case, what has been changed are the physical parameters of the door. Nevertheless, the resultant effect is established through visual communication of the same (Techsmith, 2021).

The visual perception of the door plays a major role in establishing necessary decision making on the users' part (Psu, 2021). However, the door is essentially comprised of a set of physical parameters (Basu and Ghosh, 2017). These parameters create the concept of a door to human beings (Bittermann and Ciftcioglu, 2008).

Sometimes, low visual perception is quite commonly required, for instance, in residential or office architecture. This is the reason why large spaces, which generally have a lower degree of perception along their spatial envelope, are in demand. Requirements for low perception presumably stem from the fact that a high degree of perception of the environment entails a mental effort that may conflict with other mental activities (Bittermann and Ciftcioglu, 2008). This probably explains why the visual experience from a mountain-top or the view of a distant landscape may be considered 'uplifting' or 'freeing the mind'. In other situations, a high degree of perception of a scene is demanded. This applies for example in the case of a stadium or a concert hall.

Accordingly, the act of seeing includes two steps: the first step is to perceive an undetailed pattern and the overall relationships between the different elements in space; and the second step, which proceeds according to personal needs and interests, is to analyse and elaborate the overall pattern for details. It is quite similar to the process when an architect starts drawing a sketch for designing a space (Kiroff, 2002).

Based on Morgan and Welton's opinion (Kiroff, 2002), when we enter a space, our brain seeks to organise and group certain features of the environment into a meaningful whole and ignore the ones that look irrelevant. In this process, the brain closes all gaps in the space in order to create a simple or satisfying form (the law of prägnanz) which is consistent with the principle of closure in the Gestalt theory. This process also applies to colour, texture, pattern and so forth. For example, in the process of organisation, when one sees three different colour tones of blue in one space, their brain prefers to see all three of those colour tones in one (blue) colour.

Visual perception in architecture involves many factors such as dimensions of space, the geometry of an object, the influence of colours, texture contrast and patterns, and aesthetic pleasure. The need to examine these factors individually or collectively varies from one architectural project to another.

3.3.2. Architectural Examples Depicting the Process of Visual Perception

As mentioned, each individual can perceive the space in a unique way. This uniqueness of perception is based on the individuals' previous knowledge, experiences, and interests in certain features of the space that they perceive. To better understand this process, two examples will be introduced in this part. The first example is based on the author's personal perception of a historical site, the Naqsh-e-Jahan Square, in Isfahan-Iran and the second one is based on a survey which was carried out by the author on Konak Square, in Izmir-Turkey. Both examples are based on the perceivers' memories as well as the pictures of these spaces that can be referred to during the perception process.

3.3.2.1. Naqsh-e-Jahan Square

This example is based on the author's perception of the Naqsh-e Jahan Square. In the first step, the perceiver starts to select all the relevant data from the space based on her preferences and experiences in the field of architecture. In the second step, all the gathered information is organised according to the Gestalt principles. In the third step, the organised information is manipulated by the perceiver's visual working memories which are very much associated with architecture and history. Due to the reciprocating nature of these steps, it is not easy to investigate them separately.

Meydan-e Naqsh-e Jahan or "*the Image of the World Square*" which is one of the biggest squares in the world, was built by Shah Abbas I or Abbas the Great (reign 1588-1629), who was the most potent dynast of the Safavid period (1502-1736). In 1598, he decided to move the capital of the Empire from Qazvin to the more central Isfahan, which had been the former capital of the great Seljuq Empire (1038-1194) stretched from Central Asia to Syria (Sexton, 2002). By doing so, he initiated what would become one of the greatest programs in Persian history; the complete remaking of the city (Naqsh-e Jahan Square, 2020). Commerce was so important to the Safavid polity that Shah Abbas I effectively re-routed the Silk Road through Isfahan so that his empire would enjoy a trading monopoly (Sexton, 2002). He appointed the prominent

Persian architect, poet, mathematician, and astronomer, Shaykh Baha ul-Din al-Amili (1537-1621), as the leading architect of the project (Apochi, 2020; whc.unesco, 2020).

The square is bordered by two-storey arcades and anchored on each side by four magnificent buildings (Fig.37): to the east, the Sheikh Lotfallah Mosque (Fig.38A); to the west, the pavilion of Ali Qapu (Fig.38B); to the north, the portico of Qeyssariyeh (Fig.38C); and to the south, the celebrated Royal Mosque (Fig.39) (whc.unesco 2020).

Figure 37. Naqsh-e-Jahan Square, Isfahan, Iran (Source: isfahaninfo, 2020)

Figure 38. Left (A): the Sheikh Lotfallah Mosque; middle (B): the pavilion of Ali Qapu; right (C): the portico of Qeyssariyeh (Source: whc.unesco, 2020)

Figure 39. The celebrated Royal Mosque and two-storey arcades (Source: whc.unesco, 2020)

In terms of the location of the buildings, this square is like a human body, which may represent the then Iranian society as a whole. The celebrated Royal Mosque characterises the head at the top of the human body; the Sheikh Lotfallah Mosque and the pavilion of Ali Qapu resemble the upper limbs of the body and the portico of Qeyssariyeh represents the lower limbs of the body.

The layout of the four main buildings evokes a special meaning in mind. The position of the Royal Mosque at the top of the square signifies the power and prominence of religion in the society. The other two buildings of the square, the Sheikh Lotfallah Mosque, and the pavilion of Ali Qapu, are precisely placed in front of each other. This demonstrates the equal power shared by the monarchy and the religious establishment in the fundamental decision-making process of the society. Quite interestingly, the pavilion of Ali Qapu protrudes slightly over the square boundary. This is perhaps an important reminder that ultimately it is the monarch's ruling with divine right that prevails over the religious authority. Finally, the portico of Qeyssariyeh, as a commercial hub, embodies a significant driving force for the society.

These four anchored buildings are linked by a series of two-storeyed arcades that are shown in Figures 40, 41, and 42, respectively. It seems that these repeated modules symbolise people who function as a bonding element between the monarch and the elite. Furthermore, the spatial positioning of these entities, especially their low height, emphasizes their lesser importance and further asserts the importance of the central elements, i.e., the monarch and the religious establishment.

There is a figure-ground relation between a series of two-storey arcades and the main buildings in the square, which, due to the enormity of the square, is difficult to show in a single frame. As it was mentioned in chapter two, these arcades serve as negative space (the background) to highlight the importance of the main buildings (a figure or positive space). To give further emphasis to this process, there are height restriction regulations in place in Isfahan that restrict the maximum height of structures within a radius of few kilometres so as not to block views of Naqsh-e Jahan Square.

Figure 40. A series of two-storeyed arcades linking four anchored buildings (Source: Google image 2021)

Figure 41. A repeated form of arcades creates a background that removes distractions from the space and draws more attention to the main buildings (google image 2021)

Figure 42. Height restriction regulations that restrict the maximum height of structures within a radius of few kilometres (Source: Shams, 2021)

Another noteworthy feature of the Naqsh-e-Jahan Square is the perception of colour. Despite the presence of a huge volume of green space in the square, interviews with over 50 visitors from different countries in 2015 revealed that the dominant colour was actually blue (Gholipour and Soomro, 2015). According to the law of prägnanz, although many colours are used throughout the square, visitors' attention is drawn to blue, which is the dominant colour in the space to create a simple or satisfying image. Additionally, the perception of blue colour can perhaps be attributed to the vast dimensions of the square (160 meters wide by 560 meters long) that visually facilitates the blue sky overlap onto the large pool in the middle of the square (Fig.37).

Evidently, in the above example, apart from the interviewees' ability to use light reflected by the constituting elements of the square in their visible range, factors such as context, motivation, emotional state, culture, and past experience would also influence their ability to interpret their surrounding environment. Additionally, this research would perhaps generate a different result if conducted at night-time or in a different season.

3.3.2.2. Konak Square

The second example is the Konak Square in Izmir, which is an important urban centre and popular international tourist destination. It is surrounded by various governmental,

cultural, and commercial buildings, residential areas, and the Aegean Sea. The square serves as a transportation hub connecting the seashore with the city through waterfront development. At the centre of the square is the Izmir Clock Tower (Fig.43), an old landmark built in 1901. A labyrinthine traditional bazaar stretching from Konak Square through to the ancient Agora, Kemeraltı Market dates back to the 17th century and is home to shops, eateries, artisans' workshops, mosques, coffeehouses, tea gardens and synagogues (Can, 2007; Seyedalipour, 2019).

Figure 43. Konak Square 1940s, Izmir (Source: Google image, 2018)

Although a large proportion of empty space in the square is well-defined, the design and placement of buildings around the Clock Tower poses various architectural issues. One of the main issues is the height of the buildings that creates visual distractions (Fig.44). This makes it difficult for the first-time visitors to spot the Clock Tower in daytime. To investigate regular users or locals' perception of the space, a total of 54 people in and around the Konak Square were approached randomly by the author to participate in a survey on the integrated spatial analysis of the square (Seyedalipour, 2019).

Figure 44. Left: distraction-free background; right: the Clock Tower in front of a complex crowded background (Source: Google image, 2021)

They were asked to draw a picture of whatever recalls them of the square. Based on the collected information, the participants were divided into two equally-numbered groups of under and over 50 years of age.

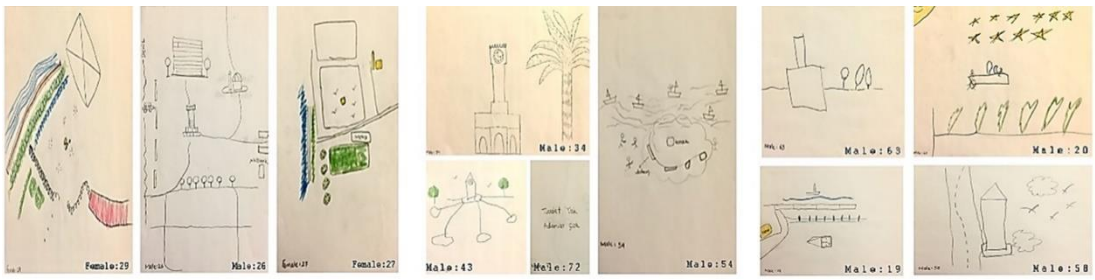

Figure 45. Some of participants' drawings of Konak Square (Source: Seyedalipour, 2019)

It was naturally expected that the Clock Tower would be a fixed element in all the drawings, but the participants' drawings led to some unexpected results. The drawings created by the under 50-year participants were generally in the form of architectural plans and some of them took notice of the green space in the square. Ironically, the over 50-year participants showed more interest in the history of the square, lack of tree cover in summer, and the difficulties they faced using the square, such as shortage of public toilets and lack of public litter bins. Surprisingly, only 9 of the entire 54 participants drew the Clock Tower (Fig.45).

The participants' lack of recognition of the Clock Tower, as the landmark with national and international visual impact, can be due to the fact that the existing cluster of tall buildings positioned in the local context has significantly overshadowed the Tower. The modern surrounding of the square offers an alternative perception to its users in the daylight, which is inconsistent and, somehow, undesirable with its historical appeal. As night falls, the Clock Tower emphatically regains its traditional status thanks to modern lighting solutions.

Another noteworthy point of the survey is that almost all of those who were over 60 years of age showed interest in giving more information about the past features of the square which have largely disappeared—such as the proximity of the sea, the old

tramway line, and the absence of tall buildings around the square. Most of them also expressed their feelings about the past image of the square and how car horns and many other sources of noise pollution replaced the sight and sounds of birds.

As discussed in the second section of this chapter and according to the findings of Julean (2013), the Konak Square survey reveals how some of the participants' mental representation is based on the image they have seen but is fundamentally different from that initial image with a higher degree of abstraction and creativity. This abstraction is affected by their visual working memories which manipulate their data based on their preferences and experiences to create a simple or satisfying form for them.

3.4. Conclusion

It seems that architecture is more than just a spatial or volumetric composition. The product of architecture can be judged by how it is perceived in its context. Between architecture and its users, there is a level of non-verbal, physical communication (Tran, 2015).

The approach of architects is often paternalistic, and their language is rhetorical which is typically ignored by the public. Civil society demands a bottom-up approach that considers living realities, values, and perceptions of the public (Ijmras, 2021). The public requirements are primarily functional and are perceived and judged in terms of serviceability. It seems that there is a fragile relationship between designing and dwelling space, imagining, and creating space, perception and practicing perception in the real, immediate space (Bianco, 2018; Julean, 2016).

For example, in the case of Konak Square, the participants, who pointed to the Clock Tower in their drawings or those who did not, were not conscious of why they were doing what they were doing. Perception is by and large an unconscious process that occurs hundreds of thousands of times a day in human lives (Kiroff, 2002). Individuals react to the stimuli, which are important to them at a given moment in a given situation. Equally, their perception influences their emotions that cause individuals to have different responses depending on the state of the environment (Tran, 2015).

In fact, architects cannot expect users to see what they desire. In other words, architecture does not move itself, but it enables people within a given space to move in a certain way and see certain objects. Scale, materials, and colours have the ability to trigger innate responses (Tran, 2015). In the case of Konak Square, by preventing the construction of tall buildings around the square, the architect could create the conditions for the Clock Tower to be seen more actively. When architects remove visual distractions from a space, the space is naturally etched in the users' mind due to the creation of a given proportion of emptiness. It shows that architects can effectively manipulate the unconscious process of perception.

The key to developing visual thinking and visual perception lies in the exploration of the world around us as a whole and of its components. Having taken into account the complexity of visual perception in architecture, it can be concluded that architects' success or failure is tied more to the public perception than sheer architectural aesthetic principles. According to Kiroff (2002), turning this experience into regular practice will yield representative drawings depicting the reality as accurately as possible and thus imposing further demands for careful scrutiny.

CHAPTER 4: CASE STUDY

4.1. Introduction

The main objective of this study is to investigate the concept of negative space in architecture and how it perceived by space user in relation to their experience and orientation in the built environment. To achieve this, FFAD building of IUE, namely D Block (Fig.46), has been selected as a case study. Case studies in architecture are one way to investigate different spaces in real-life situations. Conducting a case study is a preferred strategy to provide an answer for a bounded subject that is either very representative or extremely atypical (Kiroff, 2002).

Figure 46. Left: site plan of the IUE; right: the FFAD building (Source: Google image, 2021)

The data analysis techniques that have been used in this research are two-fold: first, document analysis (scholarly articles on negative spaces in architecture) and second,

observational analysis (on-campus data gathering and observations based on the author's own experiment).

This chapter is organised into four sections. The first section focuses on introducing the case of the FFAD building. In the second section, a number of selected negative spaces in the FFAD building will be categorised according to the broad theoretical framework discussed in the literature review section (Chapter Two). The selection criterion for these spaces is mainly due to the author's familiarity with them and the ease of access. In the third section, the information gathered on these spaces will be juxtaposed with the author's visual working memories that are associated with the concept of negative space. In the fourth section, the author will investigate whether these negative spaces have the properties and characteristics of intentional design, or they are the results of random design process.

4.2. The Story of the FFAD Building, IUE

The design of the FFAD building began in 2004 and completed in 2011 (Arkiv, 2021). The design team consisted of academics and design students, who probed minute details of the building (Şen, 2010). The layout of the plan is logical and user-friendly. Its overall design, integrity, harmony, modernity, transparency, openness, visual communication, and climate responsiveness is remarkable. Spatially, the building is quite easy legible and easy to read and navigate for both visitors and users in an efficient manner.

At first glance, the building stands as proof of modernity with an admirable touch of Brutalism due to its bare concrete structure that is also visible in the interior design of the building. Compatible with the exterior, the handrails of the many stairs, bridges, and walkways with metal and concrete features recall the industrial-looking buildings. Some of the characteristics of modern architecture of the FFAD building are (Fig.47):

1. Emphasis on open floor plan with few or no interior walls.
2. Eliminating ornament and decoration based on form follows function approach rejecting influences of history and tradition.

3. Extensive use of materials in their rigid and formulaic forms like raw concrete, glass, and pipes.
4. Emphasis on rectangular forms, horizontal and vertical lines in design indicating visual simplicity.
5. Extensive use of large expanses of glass providing natural light and seamless connection of interior and exterior spaces.
6. Maximising transparency by displaying wiring conduits, cable trays, air conditioning ducts, and sprinkles.
7. Logical use of colours based on reflective properties such as green walls and roof in the building.

Figure 47. The FFAD building of Izmir University of Economics (Source: Arkiv, 2021; Google image, 2021)

With the integrated design approach, five art and design departments including architecture and interior architecture; environmental design; industrial design; textile and fashion design and visual communication design are united under one roof in the building (Biçer, 2011; Arkiv, 2021). The entire building provides various closed, semi-open and open spaces including studios, classrooms, office areas, relaxation and reading areas, multi-purpose exhibition areas, art gallery, green wall, green roof, archive, copy-shop, computer labs, and workshops.

The idea of interdisciplinary communication, cooperation and teamwork among the academics, administrative staff and students is evident through the accessible and open shared spaces including activity hubs, lounge, café, two outdoor amphitheatre, exhibition areas and jury corridors. Offices for faculty members and department heads are symbolically located on the last floor, which serves as a leadership area and reinforces the idea of integrity in the building.

There is an interesting idea behind the section design of this building. It is planned in a way that the first-year students start their education on the upper floor, in the co-design studio which offers a panoramic view of part of the city of Izmir. It is contemplated that the students descend one floor each year until they complete their

last year of studies on the first floor and leave the university as "down-to-earth designers" in symbolic expression (Biçer, 2011; Arkiv, 2021). With the same level of intrigue and attention to detail, the designers have planned the studios in a way that allows all five departments to be able to share the lobby area for presenting their products, thus promoting interaction, collaboration, communication, and innovation.

The exterior design of the building addresses climatic design tools. To provide efficient shading, the glass facades are clothed in a perforated copper screen that generates a patina of green through oxidisation. It is planned to save energy by making the most of sunlight. Moreover, the orientation of the building block is such that it creates natural ventilation and shading opportunities. Complemented with green exterior features, the building is one of the distinctive examples of recent climate responsive design efforts in Turkey.

4.3. Analysing Selected Negative Spaces in the FFAD Building, IUE

To analyse the concept of negative space in the selected spaces in the FFAD building, it is more constructive to categorise the selected spaces based on the theoretical framework of negative space. Before doing so, a summary of two approaches to negative space is outlined below, which was discussed at length in Chapter Two.

4.3.1. A Summary of Two Approaches to Negative Space

As a useful perspective, negative space provides an effective tool to interpret space, mass, and volume. Within fine arts and architecture, negative spaces are designed and formed to support and elevate (visually or structurally) the positive spaces. These spaces can be varied from an architectural element to control the amount of light entering the building or a spandrel in a vault that supports it structurally to that of defining a pattern on the floor to grab the user’s attention or completely distract them intentionally. In architecture, two main approaches were defined towards the concept of negative space: the tectonic and the qualitative approach.

Based on tectonic approach, the negative space can be classified in three subcategories: 1) by-product space, 2) space within the walls and 3) habitable poché.

- By-product negative space: it is a secondary space that derives during the production of the positive space (Portella, 2020; Luenendonk, 2014). They are negative spaces that create the necessary support for the larger geometric volumes. The spaces that resist form and imposition and yet a good design is not possible without them (Gould, 1997; López-Marcos, 2017a).

- Space within the walls: tectonically, the second type of negative space can be identified as "the specific design of an apparent solid to serve the formation of space, both inside and outside itself" (Peterson, 1980). However, being empty internally can create a hidden space within itself. This hidden and unexpected space in Peterson's words (1980) is "the space within the walls" which can create an illusion of walls.

- Habitable pochés: they are supportive structures that engage various architectural elements defining them as a unit. A habitable poché can then be a space for absorbing or echoing the sound, to control the light entering the space, to hold aesthetically pleasing objects like statues, candlesticks, and paintings. In all these examples, negative spaces offer solutions and add new value to architectural design.

The qualitative approach to negative space is about having the knowledge of classifying and arranging the empty spaces between the design components by defining a structure for different layouts in the design. It concentrates on various aspects of design ranging from the most general items (arrangement of all architectural elements like walls, ceilings, floors, staircases, the location of doors, windows, and so forth) to the most detailed ones (selecting the patterns for tiles, cushions on the sofas, the texture of covering materials, and so forth). This approach enables the architect to achieve themed connections across space and help create an overall balance, unity, and harmony within the design. According to this approach, negative space was divided in

two main subcategories: 1) macro, micro, and nano negative space and 2) active, passive, and left-over negative space.

- Macro, micro, and nano negative spaces:

Macro negative space focuses on the distance between the main architectural elements like the locations of natural lights, doors, height of the ceiling, openness of the space, and organising the main furniture around the space.

Micro negative space focuses on the distance between smaller items in a space. It can include the space between sofas, chairs, desks, and walls, as well as the space between cushions on the sofa, candlesticks, and the clock on the fireplace and so forth.

Nano negative space focuses on almost every element of design including textures, patterns, colours, contrast, and harmony. By paying attention to minute details, it also underlines compositional, symmetrical, and asymmetrical balance in the space.

- Active, passive, and left-over negative space:

In active and passive negative space, the architect makes a conscious effort to incorporate negative space into the design to emphasize positive space. Therefore, the proportions of negative space are well-defined in both of these classifications. However, in active negative space, architects also apply other architectural rules and elements. For example, through an effective use of contrasting colours, visual effects of light and shadow, specific patterns or textures, the architects disrupt or create a balance, harmony, or symmetry in space, which can consciously activate the negative space and thus create an attention grabber space. Left-over negative space is achieved when architects mainly focus on designing a positive space. In this case, the negative space is very much dominated by positive forms in the design.

4.3.2. Classification of Selected Negative Spaces in the FFAD Building

In the following sections, the selected negative spaces in the FFAD building will be categorised based on three subcategories of the tectonic approach— namely by-product space, space between the walls and habitable poché. Then, in each category, these examples will be explained based on two types of the qualitative approaches to

negative space, i.e. macro, micro, and nano negative spaces as well as active, passive, and left-over negative spaces.

4.3.2.1. By-product Negative Spaces

Based on tectonic approach to negative space, the defined boundaries in the red rectangles, in this section, are by-product spaces — secondary spaces that are derived during the production of positive spaces.

In Figure 48, the gap between the partition and the staircase, as a by-product space, was created through the production of the main architectural elements, namely the classroom, the staircase, and the location of the column. Therefore, according to the qualitative approach to negative space, this gap is a macro negative space. Since this space has no well-defined proportion, it seems that the design team largely focused on creating positive spaces. So, this gap can be also described as a left-over negative space.

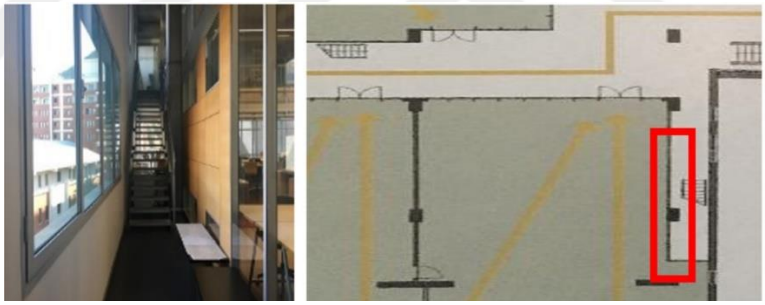

Figure 48. The gap between the partition and the staircase (Photo by: Seyedalipour, 2020)

The gaps between the glass façade and the column in Figure 49; between the ramp and the façade in Figure 50; between the column and the diagonal wall in Figure 51; between the wall and the staircase in Figure 52 and between the column and the wall in Figure 53 were created during the production of positive spaces as explained in Figure 48.

According to the qualitative approach to negative space, all the narrow gaps were created between the main architectural elements. Therefore, they can be considered as

macro negative spaces. Since these gaps have no well-defined proportions and in some cases like Figures 50, 52, and 53 are not even easily accessed for maintenance and cleaning, it seems that the design team mainly focused on creating positive spaces. Therefore, these gaps can be defined as left-over negative spaces.

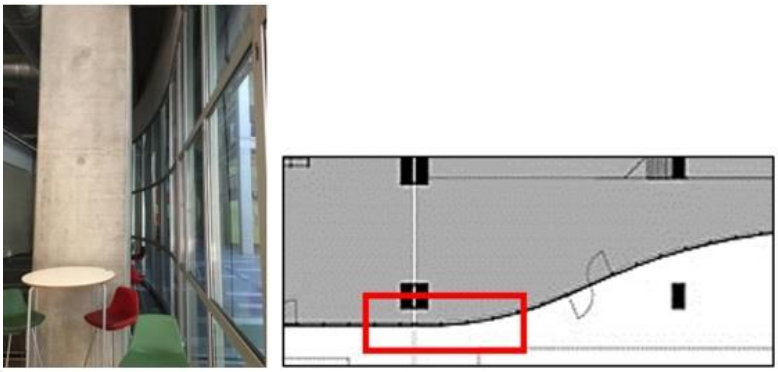

Figure 49. The gap between the column and the façade (Photo by: Seyedalipour, 2020)

Figure 50. The gap between the ramp and the façade (Photo by: Seyedalipour, 2020)

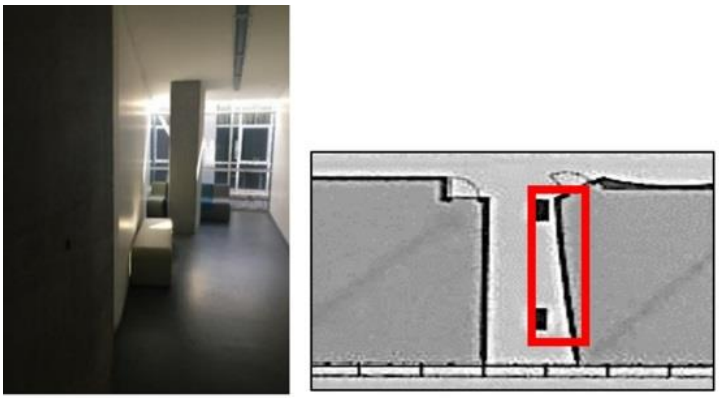

Figure 51. The gap between the column and the wall (Photo by: Seyedalipour, 2020)

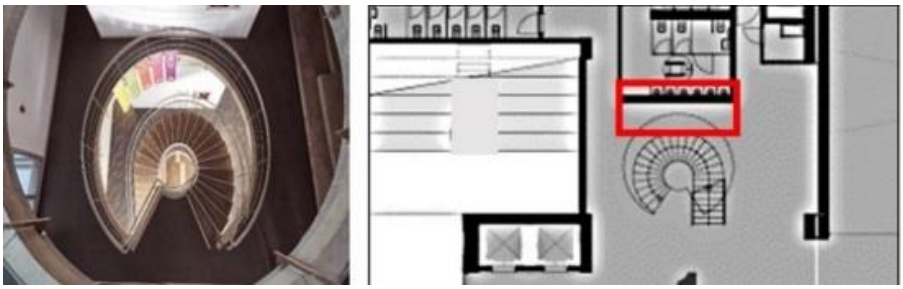

Figure 52. The gap between the restroom wall and the staircase (Photo by: Seyedalipour, 2020)

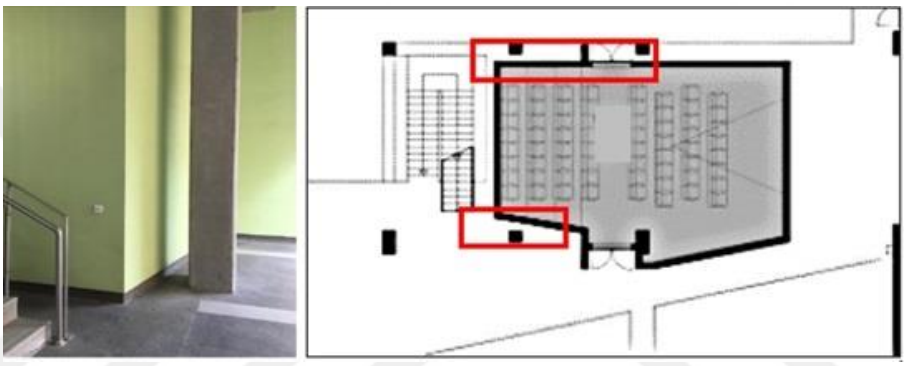

Figure 53. The gap between the column and the wall (Photo by: Seyedalipour, 2020)

Similar to other by-product spaces in this section, the triangular shape (spandrel) between the floor and the staircase in Figure 54 is also a by-product space. Based on the qualitative approach to negative space, the triangular shape was created when the design team arranged the location of the staircase as the main architectural element on the floor. So, this can also be defined as a macro negative space.

The distinguishing feature of this space is the creation of a well-defined line on the floor which due to the difference in the colour tone between the floor and the lower part of the stringer, the use of patternless material and adequate daylight, can be described as an active negative space. Additionally, the emptiness under the staircase has created an artistic form in the building, which is a distinctive feature of modern architectural style.

Figure 54. The triangular shape between the floor and the staircase (Photo by: Seyedalipour, 2020)

4.3.2.2. Space between the Walls

Based on tectonic approach, the white-painted area of the ceiling in Figure 55 is the second type of negative space, which forms a positive space from outside and a hidden empty space from inside. According to the qualitative approach to negative space, this area of the ceiling is a main element of design, which accommodates heating, ventilation, and air conditioning (HVAC) systems. So, it can be considered as a macro negative space.

The design team consciously created demarcation lines to make boundaries quite noticeable which are emphasised by colour contrast with the grey background. Due to this reason as well as having well-defined dimensions, this space can be described as an active negative space.

Figure 55. The white area of the ceiling as the second type of negative space (Photo by: Seyedalipour, 2020)

Similar to Figure 55, the painted area of the ceiling in Figure 56 is the space between the walls which accommodates the HVAC system. Due to being a main element of design, it can also be observed as a macro negative space. It seems that this space is an addition to the original design. Contrary to the previous example, it has given a disproportionate visual load to the building. So, it can be considered as a passive negative space.

Figure 56. The painted area of the ceiling as the second type of negative space (Photo by: Seyedalipour, 2020)

According to the tectonic approach, the gap between the double-skin façade in Figure 57 is the space between the walls which creates an illusion of walls or barriers. The design team created the gap between two main architectural elements. So, based on the qualitative approach to negative space, this is a macro negative space. In addition, designing lattice patterns for the exterior layer of the façade controls admission and penetration of natural light. This also creates different visual patterns on the interior plain floors during daytime and offers protection to the inner layer of the glass façade. Thus, this gap can be described as an active negative space.

Figure 57. The gap between the double-skin façade as the second type of negative space (Photos by: Seyedalipour, 2020)

4.3.2.3. Habitable Poché

According to the tectonic approach to negative space, the recessed area of the ceiling in Figure 58 is a habitable poché. This is a creative design with a minimalistic approach to modern architecture. The space creates an ample amount of room for the ceiling-suspended acoustic panels. Therefore, based on the qualitative approach, it can be described as an active negative space.

Figure 58. The recessed ceiling as a habitable poché for the suspended acoustic panels (Photo by: Seyedalipour, 2020)

Based on the tectonic approach, the niche between the double-skin façade in Figure 59 is a habitable poché. Not only does the niche strengthen the joints between the façade layers, but it also provides optimised daylight and energy control. According to the qualitative approach, it can be considered as an active negative space.

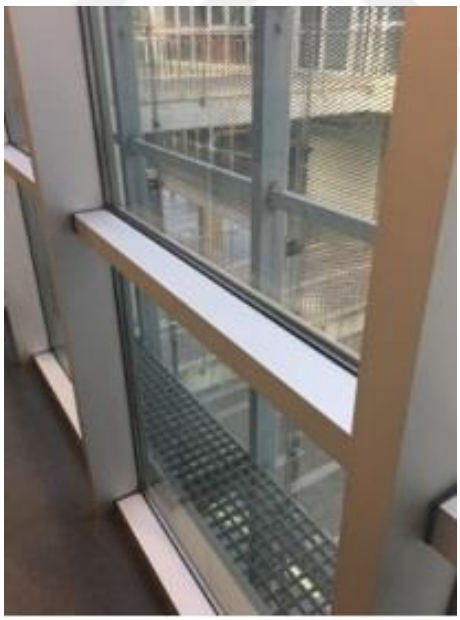

Figure 59. The niche between the double-skin façade of the FFAD building (Photo by: Seyedalipour, 2020)

The angular relationship between the ramp and the stairs in Figure 60 and the stairs in Figure 61 are habitable pochés. The habitable poché in Figure 60 features a minimalist outline giving an artistic merit to the ramp. Through effective use of a specific form, the design team created an attention grabber space. Based on the qualitative approach, this space can be described as an active negative space.

In contrast, in Figure 61, the design team created a well-defined habitable poché with no extra design elements (such as a specific colour, texture, lighting feature, and so forth) to accentuate that. Therefore, it can be considered a passive negative space.

Figure 60. Angular relationship between the ramp and the stairs (Photos by: Seyedalipour, 2020)

Figure 61. The stairs as habitable pochés (Photos by: Seyedalipour, 2020)

The protrusion of the horizontal concrete slabs in Figure 62 creates niches that present habitable pochés. Based on reductive design principles, these slabs both shade the lower floors from the sun and add an aesthetic appeal to complement the overall simplicity of the FFAD building. It seems that the design team has made a conscious decision to create an active negative space.

Figure 62. The protrusion of the concrete slabs as a habitable poché (Photo by: Seyedalipour, 2020)

4.4. The Author's Visual Perception of the Selected Negative Spaces in the FFAD Building

According to Robinette (1972), space can be perceived in more than one way. It can be seen as two-dimensional space such as paintings, three-dimensional convex like sculptures, or three-dimensional concave and kinetic space such as architecture. The viewer, from vantage points within the space, experiences and comprehends it subconsciously as spatial sensation . Julean (2016) believes that although space perception is varied based on users' cultural, psychological, philosophical, and social differences, architects can modify and effect space perception through the process of designing and, in return, the built environment can modify users' perception and behaviour.

Perception is a complex process of gathering information, then organising, interpreting, and explaining them based on a person's priorities, beliefs, and values. So, it is a highly creative process. In fact, after observing a space, all the real information of that space will be decomposed in their elementary components and then placed in different parts of our memory which can be recovered through different events (Julean, 2013). As discussed in Chapter Three, human visual perception, as an

essential tool in architectural design, is broken down into five steps of stimulation or selection, organisation, interpretation-evaluation, memory, and recall.

While the previous sections focused on analysing and organising relevant data about the designated negative spaces in the FFAD building, in the following section, the organised information will be manipulated by the author's visual working memories which are associated with the concept of negative space. The selected spaces will be analysed based on three subcategories of the tectonic approach. Then one of them, which is a corridor on the third floor of the FFAD building, will be highlighted based on the qualitative approach.

4.4.1. By-product Spaces

As discussed in the second section of Chapter Three and according to the findings of Julean (2013), it can be understood that the viewer's mental representations are based on the images that they have seen but with a higher degree of abstraction and creativity. Morgan and Welton claim that our brains seek to organise and group certain features of a space into a meaningful whole and ignore the ones that look irrelevant. In this process, for instance, the brain closes all gaps or manipulates them to a good proportion in space in order to create a simple or satisfying form (Kiroff, 2002). For example, based on the law of prägnanz (explained in Chapter Three in detail) when the author wanted to recall the red rectangle in Figure 63, the gap between the partition and the staircase was simply overlooked. Since the gap was not recalled, the author assumed that maybe the initial plan was not accurately drawn.

In this location, due to the grey colour tone of the column, staircase, and floor, the lack of sufficient natural light in the marked space and the shadow of the staircase on the partition, the gap as a by-product negative space was overlooked by the author.

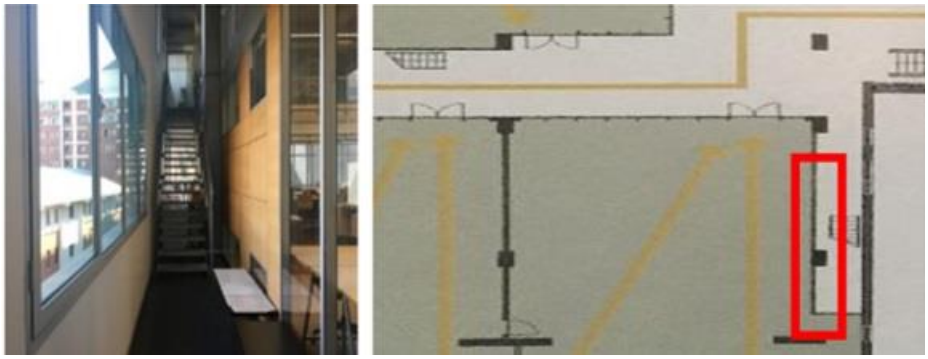

Figure 63. The gap between the partition and the staircase (Photo by: Seyedalipour, 2020)

On the contrary, in Figures 64, 65 and 66, at first, the author took notice of these spaces as design strengths associated with the concept of negative space. Based on the author's perception before revisiting these locations, the design of architectural elements like the ramp, column, staircase in Figures 64, 65 and 66 respectively, and the dimensions of gaps between these positive spaces and the adjacent walls, were all well-defined.

After scrutinising these locations, the author was confronted with a new perception of the dimensions of gaps. According to the law of prägnanz, her mind manipulated the data to create a new form under the influence of her visual working memories, which were rooted in her preferences and experiences in architecture.

In Figures 64 and 65, the walls beside the ramp and the column are mostly covered by glasses. Due to the abundance of natural light through the glass walls, and the placement of the positive elements of design (the ramp and the column), the dimensions of the gaps appeared larger than they actually were. This might be a different experience during night time.

In Figure 66, the staircase, as a positive space and an impressive design, etches on the author's mind. Therefore, the positive space could manipulate the undefined dimensions of the gap between the restroom wall and the staircase to defined ones. Specifically, a remarkable positive space in design can influence spaces through both physical and illusory means to create a unique dynamic aesthetic identity as well as offer a variety of views for the users.

Figure 64. The gap between the ramp and the façade (Photo by: Seyedalipour, 2020)

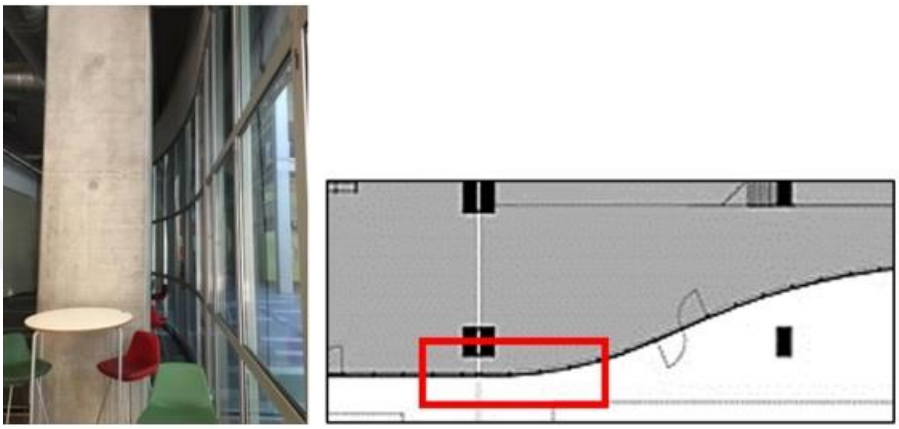

Figure 65. The gap between the column and the façade (Photo by: Seyedalipour, 2020)

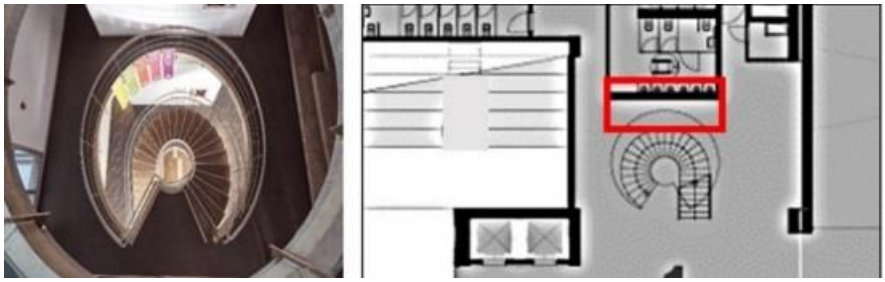

Figure 66. The gap between the restroom wall and the staircase (Photo by: Seyedalipour, 2020)

Concerning the selected spaces in Figures 67 and 68, the author could recall them clearly before revisiting the locations. The first thing which was recalled about the

space in Figure 67 was the green colour of the wall and the undefined dimensions of the gap between the grey column and the wall. Indeed, the odd green colour tone of the wall, the contrast between the green wall and the grey column and the location of this space, nearer the entrance to the FFAD building, drew the viewer's attention to the fact that the gap had no defined proportion.

As the third floor of the FFAD building is allocated to graduate students, the location in Figure 68 has been more familiar to the author in the building. Therefore, it should be easier to recall the details but apart from remembering some general features (such as white wall and ceiling, dark grey floor, and the gap between the column and the wall), the author had no recollection of the extent of the gap. This visual error is probably due to the use of white paint on the column, wall, and ceiling as well as the provision of ample natural light through the glass wall into the space.

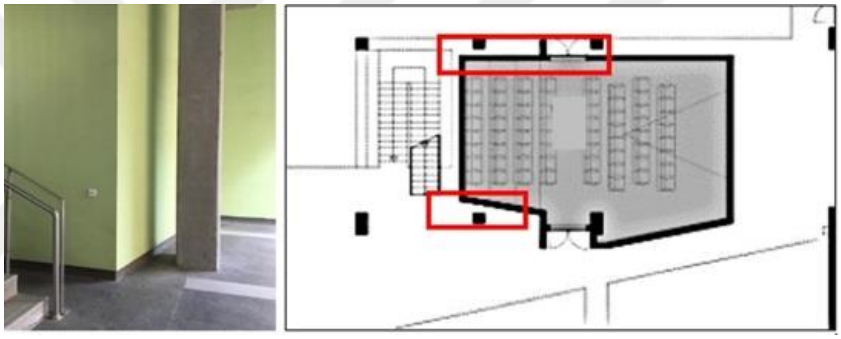

Figure 67. The gap between the column and the wall (Photo by: Seyedalipour, 2020)

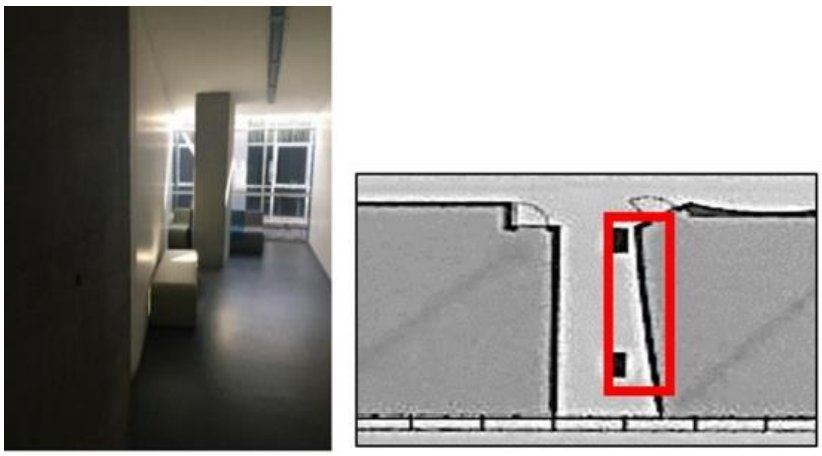

Figure 68. The gap between the column and the wall (Photo by: Seyedalipour, 2020)

The red rectangles marked in Figures 64, 65, 66, 67, and 68 are the by-product spaces that were materialised during the production of positive spaces. As discussed earlier in section 4.3.1, it seems that the design team mainly focused on creating positive spaces in these locations, so the existing negative spaces are left-over, which may be easily overlooked.

Like the other spaces in this section, the triangular shape between the floor and the staircase (spandrel) in Figure 69 is a by-product space. The staircase as a positive design element has added an aesthetic touch to the space. Also, the location of the staircase next to the glass façade with plenty of daylight in the background; the smart distinction in the colour tone between the floor and the lower part of the stringer; and the use of exposed concrete have created an overall unity and harmony to the interior increasing spatial legibility. The design characteristics have led to the formation of an active negative space that could easily be recalled by the author even before revising the location.

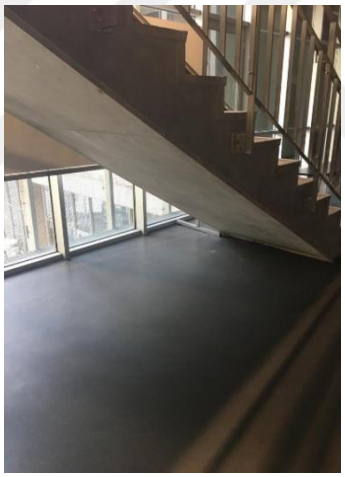

Figure 69. The triangular shape between the floor and the staircase (Photo by: Seyedalipour, 2020)

4.4.2. Space between the Walls

The red rectangles marked in Figures 70 and 71 are the second type of negative spaces. They form positive spaces from outside and hidden empty spaces from inside which accommodate the HVAC system.

In Figure 70, with the exception of the mural started from the bottom of the wall to the ceiling, the viewer overlooked the multi-level ceiling heights, colour differentiation in the upper and lower parts of the ceiling, and the cluttered ceiling with exposed pipes. The mural and the height of the ceiling might have contributed to the lack of focus on visual attention to other features of the space. In addition, the concrete grey tone that is used for the elevated part of the ceiling, as a neutral background, let the lower part to take primary focus. The author could just remember the mural because as the positive space manipulated the undefined part of the design, i.e., the asymmetrical multi-level ceiling height.

Figure 70. The painted area of the ceiling as the second type of negative space (Photo by: Seyedalipour, 2020)

In Figure 71, unlike the previous example, the design team created an integrated form of multi-level ceiling on the third floor of the FFAD building, which has always caught the author's attention. There are a number of factors that may account for this location including multi-level ceiling heights; colour differentiation in the upper and lower parts of the ceiling; provision of grey area in the elevated part of the ceiling creating a neutral background to the white area; and exposure of concrete beams and columns, HVAC facilities, red pipes, and the expansion joint. The well-defined, white-painted area of the ceiling, deployed along the demarcation lines with the grey background,

has visually created an active negative space that helped the author to recall the details of the space even before revisiting it.

Figure 71. The white area of the ceiling as the second type of negative space (Photo by: Seyedalipour, 2020)

In Figure 72, the gap between the double-skin façade is also the second type of negative space that creates an illusion of walls or barriers. Before revisiting this space, the author could recall the double-skin façade from the reflection of its patterns on the plain floor (Fig.73) during daytime. By selecting a lattice pattern for the exterior layer of the façade and plain flooring, the design team has created a combination of kinetic patterns in the space.

The double-skin façade with daylight control and sun-screening system offers protection to the inner layer of the glass façade. While the analysis of the extent of the gap is beyond the scope of this study, the gap between the double-skin façade, as an active negative space, is an example of sustainable architecture to minimise the negative environmental impact of the FFAD building by efficient use of materials, energy, and the ecosystem at large.

Figure 72. The gap between the double-skin façade as the second type of negative space (Photos by: Seyedalipour, 2020)

Figure 73. Various patterns on the plain floor during daytime (Photos by: Seyedalipour, 2020)

4.4.3. Habitable Poché

The red rectangles marked in Figures 74, 75, 76, 77 and 78 are the third type of negative spaces, or habitable pochés. This type of spaces are supportive structures that engage with various architectural elements, offer solutions and/or add new value to an architectural design.

In Figure 74, the author had no recollection of the marked area, where the suspended acoustic panels are placed in the recessed ceiling, in spite of visiting this classroom dozens of times. The reason for this lies in the ratio of the height of the ceiling to the width of the perimeter. Furthermore, the exposed pipes, HVAC system, wiring

conduits and cable trays create a cluttered visual impression, which may lead to overlooking the negative space.

On the upper level of the classroom, the marked area is visible from the mezzanine floor, which leads to the Senior Common Room. It should be emphasised that even though the ceiling is in the cone of vision, it had not come to the attention of the author from the mezzanine floor. The recessed ceiling, as a habitual poché, has provided an ample amount of room for the suspended acoustic panels. This is predominantly in line with the minimalistic design approach throughout the FFAD building.

Figure 74. The recessed ceiling as a habitable poché for the suspended acoustic panels (Photos by: Seyedalipour, 2020)

In Figure 75, similar to Figure 72, the author could clearly recall the niche located between the double-skin façade. One of the first images that she could remember was the reflection of the lattice patterns of the exterior layer on the plain floor next to the staircase and parallel to the niche (Fig.75B).

This area, as a habitable poché, plays a supportive role to strengthen the joints between the façade layers. Also, the niche, as an active negative space, provides daylight control and sun-screening system for the interior of the FFAD building. Any technical analysis of the niche is beyond the scope of this study.

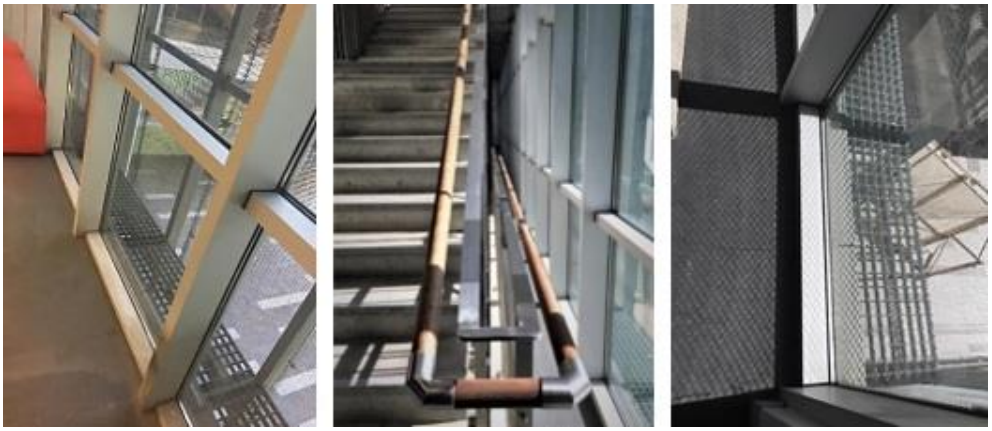

Figure 75. Left (A): the niche between the double-skin façade of the FFAD building; right (B): reflection of the lattice patterns of the exterior layer of the façade on the floor (Photos by: Seyedalipour, 2020)

The protrusion of the concrete slabs in Figure 76 creates a powerful niche on the façade of the building. Since joining the University in 2018, the author has been attracted to the engraved D Block on the wall below the niche and the showcased textile and fashion design students' works. Therefore, the marked space was remembered easily.

As discussed in the first section of this Chapter, the FFAD building is an example of the modernist architectural style with a touch of brutalism. The protruded horizontal concrete slabs has given way to a clean aesthetic where the building produces highly expressive forms.

Figure 76. The protrusion of the concrete slabs as a habitable poché (Photos by: Seyedalipour, 2020)

In Figure 77, the design team has created an integrated form of ramps and staircases with an angular relationship between them. A subtle differentiation in the colour tone of the ramp and the floor has added an artistic merit to the space. Also, careful choice of raw concrete has removed distractions from the space. This part of the building has served as a point of interest to the author.

Figure 77. Angular relationship between the ramp and the stairs (Photo by: Seyedalipour, 2020)

In Figure 78, the unusual size of the stairs and the fact they did not lead to an active space made it difficult for the author to comprehend the logic behind the design. After revisiting the space, the author found out that these stairs were designed to serve as an exhibition area for presenting students' works. The choice of colour and material used in the stairs and other components of the design has created a harmonic focal point with the least distraction and the most aesthetic deliverance.

Figure 78. The stairs as habitable pochés (Photos by: Seyedalipour, 2020)

4.4.4. The Author's Perception of the Selected Negative Space through the Qualitative Approach

In this section, some detailed aspects of the qualitative approach will be discussed. In the qualitative approach, certain features, which exist in a presumably empty space, can influence our perception of negative space. Such features include texture, colour and pattern of walls, ceilings, and floorings; location of windows and doors; lighting (natural or artificial); and commonly accepted architectural design principles (symmetry or asymmetry, contrast, or harmony). By selecting a location on the third floor of the FFAD building (Fig.79), these features will be analysed based on two main subcategories of the qualitative approach: 1) macro, micro, and nano negative space; and 2) active, passive, and left-over negative space.

Figure 79. The selected corridor on the third floor in the FFAD building (Photos by: Seyedalipour, 2020)

In macro negative space, designer concentrates on the position and the distance between main architectural elements. In this corridor:

- There is a left off-centre window at the end of the corridor. The asymmetrical position of the window regulates the direction of movement on the right side of the corridor. If the window were centred, it would give equal weight to the sides of the corridor. As there is an emergency exit and a smoking area on the right side of the corridor (Fig.80), a good proportion of negative space (empty space) on the right side of the window implies

that there is something more in the composition. In fact, this can inspire the imagination of the user as our brain will complete the image to make it meaningful. This is a clear example of how negative space helps to create harmonious relationships between design elements.

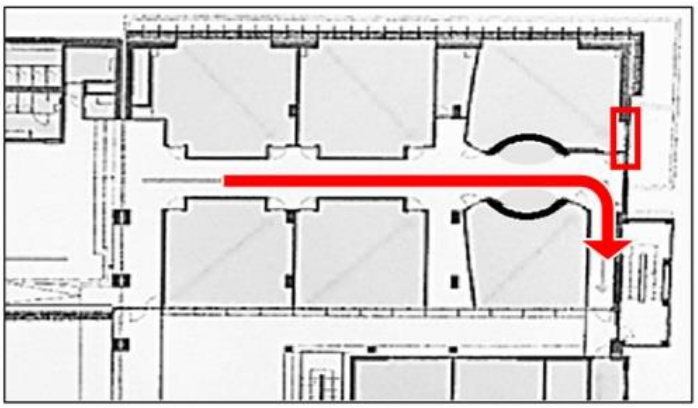

Figure 80. The location of the window at the end of the corridor (Photo by: Seyedalipour, 2020)

- The design team has created two curved recesses in the straight walls of the corridor (Fig.81). Although the curved walls have created more room for the furniture in the corridor, due to the protrusion of the walls in the classrooms have not necessarily improved the functionality of the space in the classes (Fig.82). In fact, the arrangement of furniture around these walls makes the flow of traffic less efficient.

Figure 81. The curved recesses in the corridor walls (Photo by: Seyedalipour, 2020)

Figure 82. The protrusion of walls in the classrooms (Photos by: Seyedalipour, 2020)

- The ceiling height in the lobby area on the third floor is quite high. But about the selected corridor, the design team by accommodating the HVAC system under the ceiling has reduced the ceiling height and created a user-friendly space (Fig.83). The considerable reduction in height has enhanced and sustained a sense of focus thus avoiding sensory overload. There is evidence to suggest that, in a room, the way people think, feel and act is affected by the ceiling height. Research shows “When a person is in a space with a 10-foot ceiling, they will tend to think more freely and abstractly" (Sciencedaily, 2007). They might process more abstract connections between objects in a room, whereas a person in a room with an 8-foot ceiling will be more likely to focus on specifics (MeyersLevy, 2007).

Figure 83. Multi-level ceiling height in the lobby area and the corridor on the third floor (Photo by: Seyedalipour, 2020)

In addition, as was mentioned in Chapter Two, the amount and location of negative space can visually generate a sense of direction (Fig.84). So, if the corridor were as high as the lobby space, due to the creation of maximum empty space above the users' head, it could decrease the sense of movement and increase the users' desire to stop.

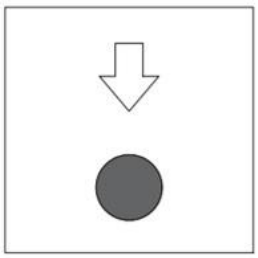

Figure 84. Negative space on the top emphasises downwards (Photo by: Seyedalipour, 2020)

In micro negative space, designer concentrates on the distance between small design items in a given space. In this corridor:

- The artificial light position is designed along the central axis of the ceiling in a linear form. The linear form of light helps to signal direction and guide flows in the corridor (Fig.85). The conscious decision not to use downlights or spotlights has reduced distraction and thus removing the ultimate curb and glare.

Figure 85. The linear form of light along the central axis of the ceiling (Photo by: Seyedalipour, 2020)

In nano negative space, the designer pays attention to the minute details and focuses on almost every single element of design including textures, patterns, colours, contrast, and harmony as well as compositional, symmetrical, and asymmetrical balance. In this corridor:

- The colour coordination of the doors and the floor (grey) creates spatial cohesiveness. It increases space legibility and creates a visual connection with people to guide them towards the classrooms, a sense of movement.

- The use of patternless material on the floor reduces distraction from the space, increases spatial legibility, and helps users to perceive the overall design more easily.

- Painting walls and ceilings in the same colour is a bold design idea. Using pure white paint is an extension of a balanced flow in the corridor which makes a visual contribution to a good proportion of negative space in the design. This is achieved by maintaining an overall balance between occupied and unoccupied spaces. In this corridor, the colour contrast between the white walls and ceilings (as unoccupied spaces) and the dark grey floors and doors (as occupied spaces) creates a sense of visual gravity and promotes continuity and symmetry in the space.

A balance between negative and positive space should be achieved so the architectural design becomes a focus of attention. It seems that a good amount of negative space has not only eliminated clutter and confusion in this corridor but has also created a moving path through which students are smoothly ushered into the classrooms.

Careful application of certain design elements such as the patternless grey colour of the floor and the doors; pure white paint colour of the walls and the ceiling; an off-centre window at the end of the corridor and the artificial lighting system at the centre of the ceiling indicate a thoughtful approach to the negative space that has led to the design of an active negative space.

4.5. Evaluation

Some of the spaces, which were analysed in the previous three sections, fit the concept of negative space in architecture. There is some evidence to suggest that these spaces were either designed unintentionally or were based on the designers' experience and skills. Based on their active or passive and perceptible or less-perceptible features, the selected negative spaces in the FFAD building can be categorised under five groups:

1. Active and perceptible
2. Active but less perceptible
3. Not active but perceptible
4. Not active and paradoxically perceptible
5. Not active and neglectable

4.5.1. Active and Perceptible

The first group consists of those spaces that are mainly designed based on negative spaces features and are fully perceptible. For example, in Figure 86(A), the design team have used raw concrete for the ramp and the staircases to improve spatial legibility.

In Figure 86(B), the protrusion of the concrete slabs, the use of raw concrete, the engraved D Block on the wall, the size, and the location of the niches at the main entrance of the FFAD building have increased spatial legibility. And in Figure 86(C), the multi-level ceiling, as negative space, and harmony between architectural features (section 4.4.2; Fig.71) create balance and flow in the design.

According to Julean (2013), there is a bidirectional relationship between architects' design and users' perception—by modifying space through the process of designing, architects can impact the way that users can perceive the space. Thus, in Figures 86A, 86B, and 86C, the design team by largely removing distractions due to the designing active negative spaces has diverted the user's attention to the core elements of the spaces. It is yet to be established whether the design team created these spaces based on their skills and preferences or they had prior familiarity with, and technical knowledge related to negative space.

Figure 86. Left (A): angular relationship between the ramp and the stairs; middle (B): protrusion of the concrete slabs; right (C): white part of the ceiling (Photos by: Seyedalipour, 2020)

4.5.2. Active but Less Perceptible

The second group of the spaces are designed based on negative space features. The design features of the staircase in Figure 87 could be recalled by the author before revisiting the location. However, designing a less-cluttered pattern for the exterior façade of the building (in the background of the staircase) could improve spatial legibility.

Figure 87. The triangular shape between the floor and the staircase (Source: Google image, 2020)

Although the recessed ceiling in Figure 88, as a habitual poché, is an active negative space, it does not attract the user's attention. The exposed pipes, HVAC system, wiring

conduits, and cable trays have created a visually cluttered space. Whether the design team has been intentional with their design is debatable but evidently the space is designed to function to meet the needs of the users and facilitate maintenance routines more efficient.

Unlike Figure 88, in the example of the music hall in the Ali Qapu Pavilion in Isfahan, Iran (Fig.89), a number of unique geometrically designed decorative plasters have separated, divided, and structured the space, thus creating spectacular active negative spaces.

Figure 88. The recessed ceiling as a habitable poché for the suspended acoustic panels (Photos by: Seyedalipour, 2020)

Figure 89. The music hall in Ali Qapu Pavilion in Isfahan, Iran (Source: Origiran, 2017)

Although the negative spaces in Figures 87 and 88 are well-designed, increased awareness on the part of the design team to envisage the user's perception of these

spaces and thus remove visual distractions could further boost the appearance of these locations.

4.5.3. Not Active but Perceptible

The gaps between the ramp and the façade in Figure 90A and the gap between the wall and the staircase in Figure 90B are left-over negative spaces. Due to design considerations and material selection, these spaces are likely to be recalled by the user.

The design team has unintentionally drawn the user's attention from the undefined gaps to strong elements of design such as natural light in Figure 90A, and the staircase in Figure 90B. This process implies that the design team has had impact on the user's perception of these spaces.

Figure 90. Left to right: (A): the gap between the ramp and the façade; (B): the gap between the restroom wall and the staircase (Photo by: Seyedalipour, 2020)

In Figure 91, the continuity of the stairs and the ramp, which forges the limits of space and makes the paths of access to another level easier for the users, is quite perceptible. However, the use of angular shape of the ramp, as a strong element in design, has dominated the stairs, which serves as passive negative space.

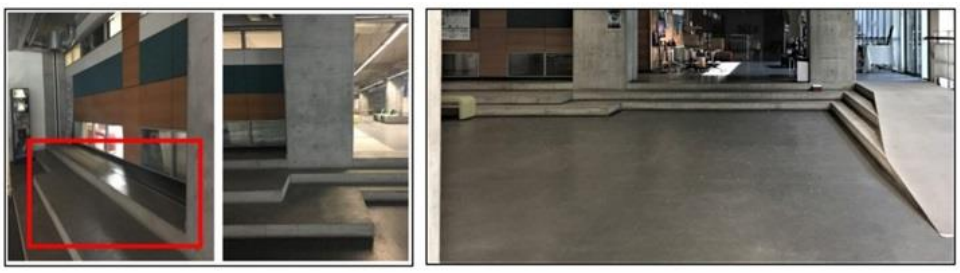

Figure 91. Continuity of the stairs and the ramp (Photos by: Seyedalipour, 2020)

4.5.4. Not Active and Paradoxically Perceptible

In Figure 92, the gap between the column and the wall is a left-over space. The green walls accentuate the grey colour of the column, and vice versa. Evidently, the choice of contrasting colours has made the space more legible for the users thus facilitating the recall of the gap. However, using same colour tones to create a seamless look would visually cover the gap between the column and the wall. This indicates that the design team did not actively engage in creating negative space in this area.

Figure 92. The gap between the column and the wall (Photo by: Seyedalipour, 2020)

4.5.5. Not Active and Neglectable

The gap between the column and the wall in Figure 93A and the gap between the partition and the staircase in Figure 93B, is a left-over negative space. Unlike Figure 92, some of the reasons for overlooking the design weakness in Figure 93 (A and B) can be the use of the same colour on the wall, column, and the ceiling with sufficient natural lighting in Figure 93A; and the use of the same colour on the column, staircase, and the floor, with insufficient natural lighting in Figure 93B. Despite frequenting these spaces, due to visual errors, the author had no recollection of the extent of these undefined gaps.

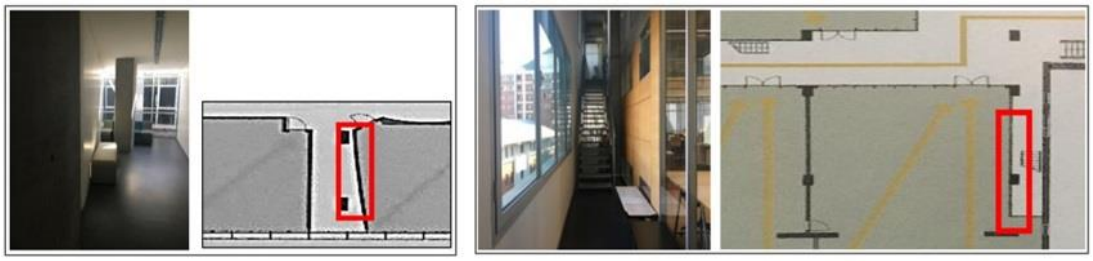

Figure 93. Left (A): the gap between the column and the diagonal wall; right (B): the gap between the partition and the staircase (Photo by: Seyedalipour, 2020)

In Figure 94, the design team largely removed distractions from the space by using the mural which extends from the wall to the ceiling. In the author's opinion, the mural can divert the users' attention from the design weaknesses. Similarly, the concrete grey colour on the elevated area strikes a particularly blank backdrop to the design strengthening the mural as a primary focus of interest. Despite the design team's lack of engagement with the concept of negative space, certain intended modifications have had impact on the user's perception of the space.

Figure 94. Painted area of the ceiling (Photo by: Seyedalipour, 2020)

Basically, perception is an unconscious process that occurs hundreds of thousands of times a day in human lives (Kiroff, 2002). Upon observing a scene, information is placed in different parts of our memory and based on our interest towards certain architectural features, particular areas can be registered more or less detailed and retrieved on demand (Julean, 2013). When architects remove visual distractions to

create a reasonably well-defined negative space, that space is highly likely to be recalled by the users without much effort. It means that architecture has the ability to influence the entirety of space thus articulating the users' relations to the environment and to themselves (Knesl, 1984).

An exaggerated example of negative space, and its impact on the viewers, is given in Chapter Two, where Nicholas Africano's painting depicts a vast field of empty space to draw the viewers' attention to the figure and the text (Fig.95). Having a single object to look at in the middle of a considerable amount of empty space is an effective way to make a user stop, look, and read what is on the screen (Cousins, 2013; Suler, 2013). Design has the ability to materially affect outcomes.

Figure 95. Painting by Nicholas Africano (Source: Infinite dictionary, 2015)

As discussed in Chapter Three, the significance of emptiness can be seen in the example of the Naqsh-e-Jahan Square in Isfahan, Iran. There are a series of two-storey arcades and the four main buildings in the square (Fig.96). These arcades serve as negative space to create a pure background that removes distractions and highlights the prominence of the main buildings. In other words, the architecture can lead the viewers to what needs to be seen by effective manipulation of their unconscious process of perception.

Figure 96. A series of two-storeyed arcades linking four anchored buildings (Source: Google image, 2021)

A quick glance at the selected negative spaces in the FFAD building indicates that most of them are left-over spaces. There are also a few well-defined negative spaces which seem to be, in essence, the products of spontaneity.

Understanding characteristics and effective implementation of negative space in architecture is more complex than other types of fine arts; because the creation of the architectural space is not only linked to decorative arts, but it is also connected to the configuration of the environment, within which humans can experience seemingly limitless perspectives.

CHAPTER 5: CONCLUSION

In an increasingly urbanised world, in which land is extensively being acquired, built, and occupied, it is imperative to find new ideas that would advocate for reuse and requalification of the built environment, thus paving the way for a more sustainable world (López-Marcos, 2017a). Addressing the concept of negative space in architecture can provide new opportunities to use space more efficiently.

The first objective of this study was to investigate the concept of negative space in architecture. Chapter Two identified two approaches to negative space: tectonic and qualitative. The tectonic approach had three subcategories: (1) by-product space, (2) space within the walls and (3) habitable poché. Also, the qualitative approach addressed the categorisation of empty spaces within the design components by defining a structure for different layouts in design. The qualitative approach had two main subcategories: 1) macro, micro, and nano negative space and 2) active, passive, and left-over negative space.

The two approaches to negative space concentrate on various aspects of design from general items (such as arrangement of all architectural elements like walls, ceilings, floors, staircases, the place of doors, windows, and so forth) to detailed ones (such as selecting the patterns for tiles, cushions on the sofas, texture of covering materials, and so forth).

The findings of Chapter Two provide insights for the question raised in Chapter One: "Can it be claimed that the empty space in the centre of Saint Peter's Square in Rome represents negative space and the buildings surrounding the empty space are positive space?" To answer this question, the Square can be examined in two ways:

1. Based on what can be seen in Figure 97, the obelisk and the surrounding buildings are positive spaces and the empty space around the obelisk serves as negative space.

Figure 97. The obelisk in the middle of the Saint Peter's Square in Rome, Italy (Source: Google image 2021)

2. However, walking through the Square gives a different perspective of negative space. From this perspective, the surrounding recurring module of the buildings are designed to draw viewers' attention to the centre of the square— functioning as negative spaces to highlight the importance of the obelisk in the centre. Based on this viewpoint, the empty space in the middle of the square in Figure 98 is positive space (the active space used by visitors) and the surrounding recurring module of the buildings are negative space.

Figure 98. An aerial view and ground level views of the Saint Peter's Square (Source: Google image 2021)

Also, it appears that the Square and its components, as historic landmarks, are protected by the building height control regulations which allow them to be viewed from all sides and angles.

Despite their complex nature, positive and negative spaces are interdependent and complementary to one another. They cannot exist in isolation, and each contains the essence of the other. Space, both positive and negative, ties a design together. Design is about balance; there is a ratio of positive to negative space that influences, supports, and delineates how the design is perceived. A right balance between them can give the design process its depth and vitality, enabling the designer to influence the things around us. The intelligent usage of them draws the eye away from a focus on mere positive or negative, and instead, it can create a harmonious, coherent, complete, and seamless story (Ambreen, 2019). Finding the precise location of these blank spaces in the design, with varying levels of accuracy, requires experience and skill. Negative space is like the experience of hearing a note in a piece of music when none is being played.

The second objective of this study was to investigate a selected number of negative spaces in the FFAD building by the author. This objective was achieved in Chapter Four of the thesis. It employed a qualitative method to analyse how negative space has enhanced or otherwise has modified the elements of design at those selected negative spaces.

These experiments confirm that architecture is more than just a spatial or volumetric composition where the product of architecture can be judged by how it is perceived in different contexts. These examples illustrate that there is a level of non-verbal, physical communication between architecture and its users. Architects cannot expect the users to see what they desire. The findings of this objective show that architecture does not move but enables people within a given space to move in a certain way observing certain objects (Tran, 2015). The challenge of remembering the details of these spaces and the role of architecture was discussed in Chapter One.

An example of this is the study carried out by Morgan and Welton, who hold the view that when we enter a space our brain seeks to organise and group certain features of the environment into a meaningful whole and ignore the ones that look irrelevant. In this process, the brain closes all gaps in the space in order to create a simple or satisfying form (the law of prägnanz) (Kiroff, 2002). A similar process can also apply to clustering objects such as colours, textures, and patterns into natural groups by

finding the class of objects. For example, when we see three different shades of blue colour in one place, our brain prefers to simplify the shades so that we see the whole or outline of the blue colour before we see all the individual shades.

In architecture, this discrepancy could be due to the irrelevant, scattered, and disconnected spaces in our designs. Sometimes, what architects perceive is far from the realities of the designed spaces. One possible implication of this is reflected in the author's perception of some of the selected negative spaces in the FFAD building, which proved different from the reality of these spaces. The results of this particular experiment do not rule out the influence of other factors, but it may explain why we experience difficulty remembering some of the most frequented spaces.

There is evidence to suggest that majority of the selected negative spaces in the FFAD building are left-over negative spaces. The present study raises the possibility that these spaces were mainly created due to structural limitations, maintaining a cohesive form throughout the building, and lack of coordination between the architectural design team and the construction design team.

The findings of this study indicate that scholars in the field of architecture have rarely reached a consensus on defining negative space. Therefore, architects have mainly applied this concept in their designs based on their own understanding adding further complexities to the analysis of this concept which has been posited in architectural studies. Challenging commonly held assumptions, it can be assumed that applying negative space to design is not merely instinctive or intuitive but, in fact, it is a logical process.

As mentioned in the literature review, there are many debates and theories that focus on the architects' understanding of space. However, very little was found in the literature on the question of negative space and an even smaller proportion examine the relations between negative space and positive space in architecture. The bottom line, as became clear over the course of this study, is that the existing literature surrounding negative space in architecture, for the most part, does not adequately address shortcomings.

The reason for this research gap may lie in the very nature of architectural training and the theory and history of architecture. On the one hand, it is not viable to change academic training and practice, which has evolved over centuries of research and undergone countless tests. On the other, it is also not possible for everything to remain static. What is evident is that theoretical approaches and methods in training the next generation of architects need to be modified to a lesser or greater extent.

In order to make good use of negative space in design, architects need to be trained to see the negative space as much as the positive one. They need to participate in evidence-based spatial experiments. The present study raises the possibility that analysing the constructed projects based on the concept of negative space can be nevertheless a constructive step forward. Sometimes viewing negative spaces through a different medium like photography (analysing the space frame by frame) can enhance the creative thinking process (Smith, 2020).

While prior studies have noted a general definition of negative space in architecture, the present research is significant in at least three major respects. First, it presents a novel classification of negative space and its various types in architecture. Second, it offers a practical analysis of a selection of negative spaces through a case study. Third, it implies that the efficient accumulation and exchange of knowledge about negative space is key to the quality of spatial design education in architecture and beyond.

Further work is required to investigate the inception and evolution of negative space in architectural styles throughout history.

REFERENCES

17seven. (2017). *Why is Negative Space Important in Design?*. [Online]. Available at: https://medium.com/17seven/why-is-negative-space-important-in-design-16cc9c1c251b. (Accessed: 5 December 2020).

Adams, P. (2015). *Gregor Schneider, invisible dead room.* 33rd October. The Architectural Association Art and Architecture: rooms, buildings, peninsulas. [Online]. Available at: https://klasse.gregor-schneider.de/news/20151030_aa_school_flyer.pdf. (Accessed: 19 May 2021).

Adler, R. (2014). *Why is there something rather than nothing*? 6th November. Earth. [Online]. Available at: http://www.bbc.com/earth/story/20141106-why-does-anything-exist-at-all. (Accessed: 25 December 2020).

Akin, S., Ergun, O., Dino, I., and Surer, E. (2019). '*Improving Visual Design Perception by an Integrated Mixed Reality Environment for Performative Architecture'. eCAADe RIS 2019. Virtually Real. Immersing into the Unbuilt: Proceedings of the 7th Regional International Symposium on Education and Research in Computer Aided Architectural Design in Europe*. Aalborg, Denmark. Volume: 1

Alexander, C., Ishikawa, S. and Silverstein, M. (1977). *A Pattern Language: Towns, Buildings, Construction.* New York: Oxford University Press. [Online]. Available at: http://www.sze.hu/~nemethi/V%C1ROS%20szakirodalom/cristopher%20alexander_a_pattern_language.pdf. (Accessed: 7 October 2019).

Ambler, J. (2020). *Roman wall painting styles.* [Online]. Available from: https://www.khanacademy.org/humanities/ancient-art-civilizations/roman/wall-painting/a/roman-wall-painting-styles. (Accessed: 8 October 2020).

Ambreen, A. (2019). *Negative vs Positive: How To Use Space To Create Seamless Design Compositions?* [Online]. Available at: https://medium.muz.li/negative-vspositive-how-to-use-space-to-create-seamless-design-compositions-c9236eadee04. (Accessed: 4 October 2020).

Apochi. (2020). *Naqsh-e Jahan Square, UNESCO World Heritage*. [Online]. Available at: https://apochi.com/attractions/isfahan/naghshe-jahan-square/. (Accessed: 23 April 2020).

Archdaily. (2021). *Less is More: Mies van der Rohe,* a Pioneer of the Modern Movement. [Online]. Available at: https://www.archdaily.com/350573/happy-127th-birthday-mies-van-der-rohe. (Accessed: 10 May 2021).

Architizer. (2020). *Cultural institution of non-visual perception space*. [Online]. Available *at:* https://architizer.com/projects/cultural-institution-of-non-visualperception -space/. (Accessed: 15 February 2020).

Arkiv. (2021). *İzmir Ekonomi Üniversitesi Güzel Sanatlar ve Tasarım Fakültesi*. [Online]. Available at: https://www.arkiv.com.tr/proje/izmir-ekonomi-universitesi-guzel-sanatlar-ve-tasarim-fakultesi/541. (Accessed: 7 March 2021).

Arnheim, R. (1977). *The Dynamics of Architectural Form: Based on the 1975 Mary Duke Biddle lectures at the Cooper Union*. Berkeley and Los Angeles, California: University of California Press.

Ashkan, M. and Ahmad, Y. (2010). *Discontinuous Double-shell Domes through Islamic eras in the Middle East and Central Asia: History, Morphology, Typologies, Geometry, and Construction.* Nexus Network Journal 12. 12(2), pp. 287–319.

Baha' al-din al-'Amili. (2020). *Baha' al-din al-'Amili*. [Online]. Available at: https://en.wikipedia.org/wiki/Baha'_al-din_al-'Amili. (Accessed: 15 November 2020).

Barnes, S. (2019). *How Artists Use Negative Space to Say a Lot with Nothing*. [Online]. Available at: https://mymodernmet.com/negative-space-definition/. (Accessed: 4 December 2019).

Barry, S. (2014). *Negative Space: The Power of 'Nothing' in Design.* [Online]. Available at: https://www.sitepoint.com/negative-space/. (Accessed: 7 October 2019).

Basu, T. and Ghosh, M. (2017). *Visual Perception of Space and Parametric Design: A Brief Discussion.* GSTF Journal of Engineering Technology (JET). 4(2).

Beckers, B. (2009). Geometrical interpretation of sky light in architecture projects. AVENUES Research Team, GSU Department Compiègne University of Technology, France. 1(1), pp. 1-9. [Online]. Available at: https://www.researchgate.net/publication/228826705_Geometrical_interpretation_of_sky_light_in_architecture_projects. (Accessed: 12 December 2019).

Bermudez, J., and Smith, A.C. (2005). *Visualising the non-visual nature of architecture*. CAADRIA. 2(A), pp. 510-515. [Online]. Available at: http://juliobermudez.com/papers/caadria2005.pdf. (Accessed: 11 February 2020).

Bianco, L. (2018). *Architecture, values, and perception: Between rhetoric and reality*. Frontiers of Architectural Research. 7(1), pp. 92-99. [Online]. Available at: https://www.sciencedirect.com/science/article/pii/S2095263517300730. (Accessed: 7 February 2020).

Biçer, S. (2011). *İzmir Ekonomi Üniversitesi Güzel Sanatlar ve Tasarım Fakültesi*. 28th November. Arkitera. [Online]. Available at: https://www.arkitera.com/proje/izmir-ekonomi-universitesi-guzel-sanatlar-ve-tasarim-fakultesi/.
(Accessed: 7 March 2021).

Bittermann, M.S and Ciftcioglu, O. (2008). *Visual perception model for architectural design*. Journal of Design Research. 7(1), pp. 35-60.

Britannica. (2019). *Architecture*. [Online]. Available at: https://www.britannica.com/topic/architecture/Space-and-mass. (Accessed: 10 May 2019).

Can, I. (2007). *Transformation of public space: A case of Konak Square, Izmir*. Master of Science. Izmir: Izmir Institute of Technology.

Carmona, M., Heath, T., Oc, T. and Tiesdell, S. (2003). *Public places - urban spaces: The Dimensions of Urban Design*. 1st edition. British Library Cataloguing in Publication Data: Architectural Press.

Cass, J. (2009). *Negative Space*. [Online]. Available at: https://layersmagazine.com/negative-space.html. (Accessed: 19 October 2020).

Causey, T.M.G. (2020). *Positive and Negative Spaces.* [Online]. Available at: https://www.murderati.com/positive-and-negative-spaces/. (Accessed: 23 December 2020).

Cherry, K. (2020). *Figure-Ground Perception in Psychology*. [Online]. Available at: https://www.verywellmind.com/what-is-figure-ground-perception-2795195. (Accessed: 7 October 2020).

Cherry, K. (2019). *Gestalt Laws of Perceptual Organization*. 5th November. Verywell mind. [Online]. Available from: https://www.verywellmind.com/gestalt-laws-ofperceptual-organization-2795835#:~:text=The%20word%20 pragnanz%20is%20a,appear%20as%20simple%20as%20possible. (Accessed: 10 February 2021).

Cipriani, L, fantini, F and Bertacchi, S. (2017). *The Geometric Enigma of Small Baths at Hadrian's Villa: Multilinear Plan Design and Complex Roofing Conception.* Nexus Network Journal. [Online]. 19, pp. 427–453. Available at: https://doi.org/10.1007/s00004-017-0344-x. (Accessed: 9 October 2020).

Cook, D. (2007). *Space/Anti-Space: Revisiting a Relationship of Opposites*. Master's Thesis, University of Tennessee.

Cousins, C. (2013). *Negative Space is an Important Design Tool: Here's Why*. [Online]. Available at: https://designmodo.com/negative-space/. (Accessed: 5 November 2020).

Diachenko, A. (2018). *Effective Use of Negative Space in Web Design.* 25th September. Speckyboy. [Online]. Available at: https://speckyboy.com/negativespace-web-design/. (Accessed: 1 May 2021).

Dinani, A.T., Sadeghi, S. and Lourenco, P.B. (2018). *`A Double Dome Through the Ages: Building Technology and Performance of Esfahan Shah Mosque's Dome`*. 11th International Conference on Structural Analysis of Historical Constructions (SAHC 2018), September 2018, Iran, pp. 87–95.

Dunkin, C. (2018). *How do commercial HVAC systems differ from residential systems?* [Online]. Available at: https://www.portableac.com/blog/commercial-hvac-residential-hvac/. (Accessed: 14 November 2020).

Dunn, J. (2017). *The Power of Negative Space in Interior Design: A design element that is not even there can forever change how you view your home*. 30rd Dec. Houzz. [Online]. Available at: https://www.houzz.com/magazine/the-power-of-negative-space-in-interior-design-stsetivw-vs~97343035. (Accessed: 7 December 2020).

Eastgate, T. (2018). *Useful Emptiness: Conceptualisation Of Space In Japanese Art*. 14th Dec. The Oxford Student. [Online]. Available at: https://www.oxfordstudent.com/2018/12/14/useful-emptiness-space-japanese-art/. (Accessed: 9 December 2020).

Etd. (2008). *Phenomenon of Visual Perception Seen Over Wexner Centre for Visual Arts and Knowlton School of Architecture*. [Online]. Available at: http://rave.ohiolink.edu/etdc/view?acc_num=osu1229295464. (Accessed: 10 May 2020).

Faulkner, N and Hosch, W.L. (2018). *The Foundation of Math: Geometry*. New York: Britannica educational publishing in association with the Rosen publishing group.

Fauziah, R. (2016). *Master Degree's Obsession in Indonesia: The Difference of Interpersonal Communication between X Generation and Y Generation*. Advances in Social Science, Education and Humanities Research (ASSEHR). 81, pp. 404-409.

Fieandt, K.V.J.; Korkala, P.Y.; Järvinen, E.J. and West, L.J. (2019). *Space perception.* [Online]. [9 February 2020]. Available at: https://www.britannica.com/ science/space-perception. (Accessed: 10 May 2020).

Framer. (2020). *Negative Space in Design: What It Is and Why It Matters.* [Online]. Available at: https://www.framer.com/dictionary/negative-space/. (Accessed: 5 December 2020).

Frichot, H. (2013). *The non-visual perception of space.* [Online]. Available at: https://archandphil.wordpress.com/2013/12/04/the-non-visual-perception-of-space/. (Accessed: 14 February 2020).

Galotti, K.M. (2017). *PERCEPTION: Recognizing Patterns and Objects.* In: Cognitive Psychology In and Out of the Laboratory. London: SAGE. [Online]. Available from: https://www.sagepub.com/sites/default/files/upm-binaries/53259_ch_3.pdf. *(*Accessed: 8 February 2021).

Gatzia, D.E. and Brogaard, B. (2020). *The Epistemology of Non-Visual Perception (Philosophy of Mind Series).* England: Oxford University Press.

Gellner, A. (2000). *ARCHITEXT: Positive versus negative space as architectural concept.* [Online]. Available at: https://djcoregon.com/news/2000/12/04/architext-positive-versus-negative-space-as-architectural-concept/comment-page-1/#comment-956854. (Accessed: 7 October 2019).

George, J. (2012). *A Solid Understanding of Negative Space.* [Online]. Available at: https://www.sitepoint.com/a-solid-understanding-of-negative-space/. (Accessed: 8 December 2019).

George, J. (2012). *A Solid Understanding of Negative Space.* [Online]. Available at: https://www.sitepoint.com/a-solid-understanding-of-negative-space/. (Accessed: 8 December 2019).

Gholipour, M. and Soomro, A. (2015). `*Perception of colorscape in Naghsh-e-Jahan Square (Isfahan Iran)*`. [Online]. Available at: https://www.semanticscholar.org/paper/Perception-of-colorscape-in-Naghsh-e-Jahan-Square-GholipourSoomro/b032_f8957a636de0b3e029629f44cb041b0c68dd#related-papers. (Accessed: 23 April 2020).

Gjerde, M. (2010). `*Visual aesthetic perception and judgement of urban streetscapes*`, in Barrett, P., Amaratunga, D., Haigh, R., Keraminiyage, K. and Pathirage, C. (Ed.) Proceedings W101—Special Track 18th CIB World Building Congress. May 2010 Salford, United Kingdom, CIB. [Online]. Available at: https://www.irbnet.de/daten/iconda/CIB18896.pdf. (Accessed*:* 9 February 2020).

Gould, S. J. and Lewontin, R. C. (1979). "*The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme,"* proceedings of the royal society of London, series b, vol. 205, no. 1161, pp. 581-598.

Gould, S.J. (1997). *The exemptive excellence of spandrels as a term and prototype*. Proc Natl Acad Sci USA: Museum of Comparative Zoology, Harvard University, Cambridge, MA 02138. 94, pp. 10750–10755. [Online]. Available at: https://www.pnas.org/content/pnas/94/20/10750.full.pdf (Accessed: 13 November 2020).

Hamstech. (2018). *Interior design elements: positive about negative space*. 6th April. Hamstech. [Online]. Available at: https://www.hamstech.com/blog/interior-design-elements-positive-about-negative-space. (Accessed: 21 December 2020).

Handgraaf, S. (2020). *The Principles Of Interior Design Week 6: Using Negative Space Design.* Worthing Court. [Online]. Available at: https://www.worthingcourtblog.com/negative-space-design/. (Accessed: 25 December 2020).

Harvey, D. (2006). *Space as a Keyword. In: Castree, N and Gregory. David Harvey: A Critical Reader*. USA, UK, and Australia: Blackwell Publishing Ltd.

Harvey, D. (2009). *Social Justice and the City: revised edition.* United States of America: The university of Georgia press, Athens, and London.

Horowitz, J. (1980). *Harvard Architecture Review, Beyond the Modern Movement*. Harvard Architecture Review. Volume 1.

Ijmras. (2021). *Architectural Values And Perception Between Rhetoric And Reality.* [Online]. Available at: https://ijmras.com/article/architectural-values-and-perception-between-rhetoric-and-reality/. (Accessed: 10 May 2021).

Infinite dictionary. (2015). *Design: A Beginner's Handbook; Nothing is Something: The Importance of Negative Space (part1,2 and 3)*. [Online]. Available at: http://infinitedictionary.com/blog/2015/07/11/nothing-is-something-the-importance-of-negative-space/. (Accessed: 6 October 2019).

ISFDN. (2019). *Positive/Negative Space*. [Online]. Available at: http://isfdn.org/positive-negative-space-reference-page/. (Accessed: 7 December 2019).

Jagyasi, P. (2019). *Why negative space in interior designing is a positive idea?* 24th May. Dr Prem. [Online]. Available at: https://drprem.com/guide/why-negative-space-in-interior-designing-is-a-positive-idea/. (Accessed: 21 December 2020).

Jerrold , M.G. (2018). *The Japanese words for "space" could change your view of the world*. 18th Jan. Quartz. [Online]. Available at: https://qz.com/1181019/the-japanese-words-for-space-could-change-your-view-of-the-world/. (Accessed: 7 December 2020).

Johnson, R. (2016). *Visual Working Memory*. 11th November. Advanced vision therapy centre. [Online]. Available at: https://www.advancedvisiontherapycenter.com/about/blog/e_961/Signs-of-a-Vision-Problem/2016/11/Visual-WorkingMemory. (Accessed: 10 February 2020).

Julean (Pop), D. (2013). *Space Perception and Its Implication in Architectural Design*. Acta Technica Napocensis: Civil Engineering and Architecture; Special Issue: First International Conference for PhD Students in Civil Engineering, CE-PhD 2012. 56(2), pp. 211-221.

Julean, D. (2016). *Why Architects See Things Differently an Architectural Approach on Teaching Space Perception.* European Scientific Journal (ESJ). [Online]. Available at: https://eujournal.org/index.php/esj/article/view/7351. (Accessed: 5 February 2020).

Kabir, F.Q. (2010). *Phenomenon of Visual Perception in Architecture: Seen Over Wexner Centre for Visual Arts and Knowlton School of Architecture.* LAP Lambert Academic Publishing.

Kay, P. (2020). *Applying intentionality to our images through negative space in photography*. 1st Jun. Negative space and minimalism . [Online]. Available at: https://patkay.com/negative-space-minimalism-photography/. (Accessed: 3 December 2020).

Keefe, J. (2013). *Negative space. 4th Sep. Research Subject 1 (Interest) - Negative Space.* [Online]. Available at: https://j-keefe1215-sb.blogspot.com/2013/09/research-subject-1.html?showComment=1607182810864#c3013913204933425387.
(Accessed: 4 December 2020).

Kiroff, L. (2002). *Visual language in architectural design.* Master thesis, UNITEC institute of technology, Auckland, New Zealand.

Kisaki , Y. (2011). *When Less is More: Japanese Concept of "MA", Minimalism and Beyond.* 15th Aug. WAWAZA. [Online]. Available at: https://wawaza.com/blogs/when-less-is-more-Japanese-concept-of-ma-minimalism-and-beyond/. (Accessed: 5 December 2020).

Knesl, J.A. (1984). *The Powers of Architecture. Environment and Planning D: Society and Space*. 2(1), pp. 3-22. [Online]. Available at: https://journals.sagepub.com/doi/abs/10.1068/d020003?journalCode=epda. (Accessed: 19 April 2021).

Koolhaas, R. (2002). *Junkspace*. The MIT Press. 100, Obsolescence, 175-190. [Online]. Available at: https://www.readingdesign.org/junkspace. (Accessed: 11 May 2019).

Kurmann, D., Elte N., and Engeli M. (1997). *Real-Time Modelling with Architectural Space*. In: Junge, R (ed.) CAAD futures 1997. Dordrecht: Springer.

Lath, A. (2019). *Importance of negative space in design*. 5th September. BBN Times. [Online]. Available at: https://www.bbntimes.com/companies/importance-of-negative-space-in-design. (Accessed: 23 December 2020).

Lefebvre, H. (1991). *The Production of Space.* 1st edition. Oxford, UK, and Cambridge USA: Basil Blackwell Ltd.

López-marcos, M. (2017a). *Inhabiting leftovers — Architectural incursions in negative space.* Idea Journal. pp. 148-163.

López-marcos, M. (2017b). *Revisiting anti-space Interview with Steven K. Peterson*. Risco. 15(1), pp. 141-150.

Low, S. (2009). *Toward an Anthropological Theory of Space and Place. Semiotica.* 175, 21-37. [Online]. Available at: http://www.urbanlab.org/articles/Low%20S%20anth%20theor%20of%20space%20place.pdf. (Accessed: 17 May 2019).

Luenendonk, M. (2014). *By product*. [Online]. Available at: https://www.cleverism.com/lexicon/byproduct/. (Accessed: 11 November 2020).

Luo, Y., He, J., Zeng, Z., Zhao, J., Zhang, Y and Lan, C. (2012). `*Study of investigating and improving negative space in an old urban block of Nanning city: Characteristics and formation causes of negative space*`. 2nd International Conference on Consumer Electronics, Communications and Networks (CECNet). Yichang, China. Dept. of Architecture and Urban Planning, College of Civil Engineering and Architecture, Guangxi University, Nanning, China: IEEE. 2102-2105.

Madanipour, A. (1988). *Design of Urban Space: An Inquiry into a Socio-spatial Process*. United Kingdom, British Library Cataloguing in Publication Data, University of Newcastle, Newcastle upon Tyne.

Madanipour, A. (1996). *Urban design and dilemmas of space.* Environment and Planning D: Society and Space. 14, pp. 331 -355.

Maddalo. (2015). *Three Notes on Henri Lefebvre.* [Online]. Available at: http://maddalo.blogspot.com/2015/07/three-notes-on-henri-lefebvre.html. (Accessed: 21 March 2019).

Mansourifar, S. , Rezaei jamalouei, H. and Emami dehkordi, S. (2021). *Modelling structural relationships of with perceived pain life in inflammatory bowel patients (IBD).* Journal of Anaesthesiology and Pain. 12(1), pp. 55-67.

Mastroeni, T. (2020). *Why You Need to Incorporate Negative Space in Your Design.* 18th Nov. My Move. [Online]. Available at: https://www.mymove.com/home-inspiration/decoration-design-ideas/need-incorporate-negative-space-design/. (Accessed: 8 December 2020).

Mathison, L. (2018). *Designing Better Interiors with Negative Space.* 10th Oct. Mathison Interiors. [Online]. Available at: https://mathisoninteriors.com/blog/designing-with-negative-space/. (Accessed: 10 December 2020).

Maulden, R. (1986). *Tectonics in architecture: from the physical to the meta-physical*, Master's Thesis, Massachusetts Institute of Technology, Dept. of Architecture, Massachusetts. [Online]. Available at: https://core.ac.uk/download/pdf/10130365.pdf. (Accessed: 10 October 2020).

Melisbaloglu. (2015). *Fine Art and Design Faculty İzmir Ekonomi Üniversitesi*. [Online]. Available at: https://maerpartners.com/2015/06/16/042/. (Accessed: 7 March 2021).

Memarian, A and Niazkar , N. (2014). *The Lost Space of Architecture in the Context of Urban Lost Space* . International Journal of Engineering and Advanced Technology (IJEAT)-ISSN: 2249 – 8958. 3(5), pp. 311-321

Milliyet. (2021). *Geleceğin binası nasıl olmalı?* 7th January. Milliyet. [Online]. Available at: https://www.milliyet.com.tr/ege/gelecegin-binasi-nasil-olmali-6399461. (Accessed: 4 March 2021).

Mohammadi, G. (2016). *Heirloom Tech: The Old-World Acoustics of Ali Qapu.* [Online]. Available at: https://makezine.com/2016/12/29/heirloom-tech-old-world-acoustics-ali-qapu/. (Accessed: 16 November 2020).

Mosaik homes. (2018). *The Power of Negative Space in Interior Design.* 31st Aug. Mosaik Homes. [Online]. Available at: http://www.mosaikhomes.com/blog/the-power-of-negative-space-in-interior-design/. (Accessed: 7 December 2020).

Naqsh-e Jahan Square. (2020). *Naqsh-e Jahan Square*. [Online]. Available at: https://en.wikipedia.org/wiki/Naqsh-e_Jahan_Square. (Accessed: 23 April 2020).

Nitschke, G. (2018). *MA: Place, Space, Void. 16th May. Kyoto Journal.* [Online]. Available at: https://www.kyotojournal.org/culture-arts/ma-place-space-void/#_ftn1. (Accessed: 20 May 2021).

Oberlin. (2019). *Vocabulary: Elements of Art.* [Online]. Available at: http://www2.oberlin.edu/amam/asia/sculpture/documents/vocabulary.pdf. (Accessed: 11 May 2019).

Olson, M.E. (2019). *Spandrels and trait delimitation: No such thing as "architectural constraint". Evolution and Development.* 21(2), pp. 59-71. [Online]. Available at: https://onlinelibrary.wiley.com/doi/10.1111/ede.12279. (Accessed: 13 November 2020).

Oosterling, H. (2005). *Ma or sensing time-space: Towards a culture of the inter.* Lecture notes, "Japanese Inter-Esse: 'MA' as In-Between" voor Transmediale. 05 BASICS Berlin. Haus der Kulturen der Welt. Delivered 5 February 2005.

Origiran. (2017). *Isfahan Ali Qapu Palace*. [Online]. Available at: https://origiran.com/isfahan-ali-qapu-palace/. (Accessed: 16 November 2020).

Oyamatsu, K., (2013). *The presence of absence*, Thesis. [Online]. Available at: https://dogtime.org/wp-content/uploads/2014/06/KEIKO-The-thesis-the-presence-of-absence-Keiko-Oyamatsu-for-DGT-publication.pdf. (Accessed: 8 December 2020).

Pellegrino, P., and jeanneret, E. (2009). *Meaning of space and architecture of place*. Semiotica. 175(1/4), pp. 269–296. [Online]. Available at: https://www.researchgate.net/publication/311454048_Meaning_of_space_and_architecture_of_place. (Accessed: 28 November 2019).

Perren, C. and Mlecek, M. (2015). *PERCEPTION in Architecture: HERE and NOW*. (1st ed.). Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK: Cambridge Scholars Publishing.

Peterson, S.K. (2018). *Space and Anti-space: Revisited*. [Online]. Available at: https://petersonlittenberg.com/Architecture-UrbanDesign/Space_Anti-Space_TOC.html. (Accessed: 2 December 2019).

Peterson, S.K. (1980). *Space and Anti-space. In: Classical vs Modern Space Making*. The Harvard Architectural Review: Beyond the Modern Movement 1, pp. 89-113

Portella. (2020). *Negative Space in Architecture*. [Online]. Available at: https://portella.com/negative-space-in-architecture/. (Accessed: 11 November 2020).

Portella. (2020). *Negative Space in Architecture. 31st January*. *Portella*. [Online]. Available at: https://portella.com/blog/negative-space-in-architecture/#:~:text=It's%20used%20in%20reference%20to,to%20serve%20a%20specific%20purpose. (Accessed: 24 December 2020).

Powell, D. (2020). *How to use negative space in interior design.* [Online]. Available at: https://darlapowell.com/blog/blog-posts.php?permalink=how-to-use-negative-space-in-interior-design. (Accessed: 9 December 2020).

Przybylek, S. (2017). *What is a Spandrel?*. [Online]. Available at: https://study.com/academy/lesson/what-is-a-spandrel.html. (Accessed: 13 November 2020).

Psu. (2021). Chapter 4 – *Sensation, Perception and Vision*. [Online]. Available at: https://psu.pb.unizin.org/intropsych/chapter/chapter-4-sensation-perception-vision/. (Accessed: 10 May 2020).

Psynso. (2018). *Visual Perception*. [Online]. Available at: https://psynso.com/visual-perception/. (Accessed: 10 May 2020).

Puleo, S.M. (2012). *Under Construction: Positive-Negative Space in Faulkner and Beyond.* A Thesis Submitted to the Faculty of The Dorothy F. Schmidt College of Arts and Letters, Master of Arts, Florida Atlantic University, Boca Raton, Florida.

Rafailidis, G. and Davidson, S. (2017). *Processes of Creating Space: An Architectural Design Workbook.* Devon, UK: Routledge Taylor and Francis group.

Reynolds, G. (2013). *Presentation Zen Design: Simple Design Principles and Techniques to Enhance Your Presentations.* (2nd ed.). USA: New Riders.

Riou, B., Lesourd, M., Brunel, L. et al. (2011). *Visual memory and visual perception: when memory improves visual search. Memory and Cognition* . 39(E), pp. 1094–1102.

[Online]. Available at: https://doi.org/10.3758/s13421-011-0075-2. (Accessed: 1 February 2021).

Risi, V.D. (2019). *Modern Geometry and the Concept of Space: Max Planck Research Group (2010–2016).* [Online]. Available at: https://www.mpiwg-berlin.mpg.de/research/projects/MRGdeRisi. (Accessed: 10 May 2019).

Robinette, G.O. (1972). *Plants/people/and Environmental Quality: A Study of Plants and Their Environmental Functions*. United States: US department of the interior, national park service.

Sciencedaily. (2007). *Ceiling Height Can Affect How A Person Thinks, Feels And Acts*. 25th April. ScienceDaily. [Online]. Available at: https://www.sciencedaily.com/releases/2007/04/070424155539.htm. (Accessed: 5 April 2021).

Şen, B. (2010). *Kendi yaptıkları binada okuyorlar. 20th November. Milliyet.* [Online]. Available at: https://www.milliyet.com.tr/cumartesi/kendi-yaptiklari-binada-okuyorlar- 1316014. (Accessed: 4 March 2021).

Sexton, K.S. (2002). *Isfahan -- Half the World.* [Online]. Available at: https://depts.washington.edu/silkroad/cities/iran/isfahan/isfahan.html. (Accessed: 23 April 2020).

Seyam, S. (2018). *Types of HVAC Systems*. [Online]. Available at: https://www.intechopen.com/books/hvac-system/types-of-hvac-systems. (Accessed: 14 November 2020).

Seyedalipour (2019). `An Analysis of Urbanity: The Case of Konak Square, Izmir`. ARCH 562, *Integrated Spatial Analysis.* Izmir University of Economics. Unpublished essay.

Sheppard, E. (2006). *David Harvey and Dialectical Space-time*. In: Castree, N. and Gregory, D. eds. David Harvey: A Critical Reader. USA, UK, and Australia: Blackwell Publishing Ltd.

Smith, A. (2020). *Effective Use Of Negative Space In Web Design.* [Online]. Available at: https://usabilitygeek.com/effective-use-negative-space-web-design/. (Accessed: 5 December 2020).

Sorento, B.A. (1967). *Impact and Tensions Created by Negative Space.* Master's Thesis, Faculty of the College of Arts and Sciences of The American University, Washington D.C.

Souza, R.C.F. (2015). *Case Studies as method for architectural research*. [Online]. Available at: https://www.researchgate.net/publication/314147521_Case_Studies_as_method_for_architectural_research. (Accessed: 12 May 2019).

Spandrel. (2016). *Spandrel*. [Online]. Available at: https://simple.wikipedia.org/wiki/Spandrel. (Accessed: 13 November 2020).

Suler, J. (2013). *Negative space*. In: Richard, Zakia ed. *Perception and Imaging*. Oxford: Focal Press (Elsevier), pp. 18-23.

Suvanajata, R. (2001). *Relations in Architectural Space: Designs and Effects in Space of the Traditional Thai Houses and Temples.* Doctor of Philosophy, The Bartlett, University College London. [Online]. Available at: https://core.ac.uk/download/ pdf/1882853.pdf. (Accessed: 25 May 2021).

Szatek, K.P. (1995). *The Discourse of Space and Perception in the English Renaissance Pastoral Dramas.* Doctor of Philosophy, Indiana University of Pennsylvania.

Tate, J. (2010). *What is Space?*. [Online]. Available at: https://www.universetoday.com/57734/what-is-space/. (Accessed: 10 May 2019).

Techsmith. (2021). *How To Use Visual Communication and Why It Matters*? [Online]. Available at: https://www.techsmith.com/blog/why-visual-communication-matters/. (Accessed: 10 May 2020).

Tran, V.H. (2015). *Falling into memories: the evocation of emotions and recollection of memories through architectural design*. PhD thesis, University of Hawai'i, Manoa.

Trancik, R. (1986). *Finding Lost Space: Theories of Urban Design*. The United States of America: Van Nostrand Reinhold Company. [Online]. Available at: https://www.academia.edu/36900297/finding-lost-space_1_.pdf. (Accessed: 6 December 2019).

Trautmann, V. (2016). *A Brief Look at Negative Space. 7th February*. The ARCHive: A Collection of Works by Victor Trautmann. [Online]. Available at: http://victor.oucreate.com/studio-works/a-brief-look-at-negative-space/. (Accessed: 6 December 2019).

Turnbull, C. (2011). *Using White Space (or Negative Space) in Your Designs.* 19 July. Envato Tuts Plus. [Online]. Available at: https://webdesign.tutsplus.com/articles/using-white-space-or-negative-space-in-your-designs--webdesign-3401. (Accessed: 5 December 2019).

Vangoghgenova. (2020). *Negative Space In A Painting.* [Online]. Available at: https://www.vangoghgenova.it/negative-space-in-painting.html.(Accessed: 7 October 2020).

Visual perception. (2014). *Visual perception*. [Online]. Available at: https://en.wikipedia.org/wiki/Visual_perception. (Accessed: 22 April 2021).

Vitracagdasmimarlikdizisi. (2014). *İzmir Ekonomi Üniversitesi Güzel Sanatlar Ve Tasarım Fakültesi.* [Online]. Available at: https://www.vitracagdasmimarlikdizisi.com/projeler/Izmir-Ekonomi-Universitesi-Guzel-Sanatlar-Ve-Tasar.aspx. (Accessed: 5 March 2021).

Vivid vision. (2018). *Vision Science (Psychophysics).* [Online]. Available at: https://www.seevividly.com/info/Fields_of_Study/Vision_Science. (Accessed: 10 February 2020).

Voorthuis , J. (2020). *Towards a descriptive tectonics: making a relation.* [Online]. Available at: http://www.voorthuis.net/Pages/Towards_a_descriptive_tectonics_jctv.pdf. (Accessed: 10 November 2020).

Wcourt, S. (2020). *The Principles Of Interior Design Week 6: Using Negative Space Design*. [Online]. Available at: https://www.worthingcourtblog.com/negative-space-design/. (Accessed: 7 December 2020).

West, E. (2019). *Negative Space Can Have a Positive Effect*. [Online]. Available at: https://photodoto.com/negative-space-can-have-a-positive-effect/. (Accessed: 7 October 2019).

Whatis. (2016). *Space*. [Online]. Available at: https://whatis.techtarget.com/definition/space. (Accessed: 10 May 2019).

whc.unesco. (2020). *UNESCO*. [Online]. Available at: https://whc.unesco.org/en/list/115/. (Accessed: 15 April 2020).

Yalanska, M. (2019). *Negative Space in Design: Tips and Best Practices.* [Online]. Available at: https://tubikstudio.com/negative-space-in-design-tips-and-best-practices-2/. (Accessed: 6 December 2019).

Yari et al. (2016). *The Stability of Dome Structures in the Iranian Traditional Architecture, Case Study: Dome of Taj-al-Molk. Journal of Architectural Engineering Technology*. 5(2), pp. 2168-9717. [Online]. Available at: https://www.omicsonline.org/open-access/the-stability-of-dome-structures-in-the-iranian-traditional-architecture-casestudy-dome-of-tajalmolk-2168-9717-1000164.pdf. (Accessed: 15 November 2020).

[Archive]. (2020, October 4). Visual elements and principals [Web-based visual]. Available at: http://archive.artsmia.org/artists_toolkit/encyc_shapeposneg.html.

[Buildwith5th]. (2020, May 14). How To Use Paint To Change The Look And Feel Of A Room [Web-based visual]. Available at: https://buildwith5th.com/blog/how-to-use-paint-to-change-the-look-and-feel-of-a-room.

[Calder]. (2020, October 7). Calder's Work in Calder Foundation [Web-based visual]. Available at: http://www.calder.org/work/by-category/wire-sculpture.

[Cultivar]. (2019, December 13). *Rebekah Vallance and Casey Vallance Architects* [Web-based visual]. Available at: https://www.cultivar.net.au/drawings.

[De Combo]. (2021, January 2). *Bohemian Interior Design Style and Boho Room Decor Ideas* [Web-based visual]. Available at: https://decombo.com/bohemian-interior-design-style/.

[Furuto]. (2013, December 12). *'Live Between Buildings!': New Vision of Loft 2 Competition Entry / Mateusz Mastalski + Ole Robin Storjohann.* Arch daily [Web-based visual]. Available at: https://www.archdaily.com/412590/live-between-buildings-new-vision-of-loft-2-competition-entry-mateusz-mastalski-ole-robin-storjohann.

[IEU]. (2021, March 3). *Photo Gallery* [Web-based visual]. Available at: https://www.ieu.edu.tr/tercih/tr/foto-galeri.php.

[Shams]. (2021, February 10). *Isfahan Naghsh-e Jahan Square* [Web-based visual]. Available at: https://www.irangazette.com/en/12/173-isfahan-naghsh-e-jahan-square.html.

[Ytterberg]. (2005, March 15). *The perambulations of Hadrian: a walk through Hadrian's Villa*, Ph.D. University of Pennsylvania, Pennsylvania.