

The components of experiential architecture: An investigation into designing atmosphere.

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1. Introduction

Architecture can be justified by a multitude of requirements, whether that means functional, aesthetic or other design attributes. Nonetheless, whether it is by consequence or a conscious decision, architecture influences us in ways we are often not aware of. We feel it, but cannot always point out exactly the intangible elements that impact our perception of architecture. My interest lies in the technique and thought behind creating and identifying profoundly experiential architecture, such as the works of James Turrell, Steven Holl and Tadao Ando. In addressing the subject, the following research question will be addressed:

What constitutes experiential architecture?

The body of this paper will be split into research and a case study analysis. The research will take into account academic material, such as research papers, as well as books and research papers that deal with any of the subjects of relevance for the main theme.

The research will investigate a number of notable architectural examples of sensorial architecture, in order to understand why disciplines like art, design, psychology and literature are significant in creating it. These can help us understand why certain buildings have a strong emotional effect on humans. The underlying psychological layer will be provided by examining James J. Gibson's ecological psychology. In short, this branch of psychology considers perception and action as one, using a non-functionalist approach. The scope of the analysis is understanding exactly what design choices affect the experience and through which means. The examples included to support the research are representative architectural precedents or artwork that illustrate the concepts of the thesis.

The case study will be the sediment in explaining the implications of experiential architecture, through clear visual examples.

I will illustrate the findings of the research through a selection of architectural case studies that have been realized. In this way, I intend to express my findings in a visual manner. Authors, artists and designers will be analyzed in terms of their work, which will lead to the case study where all the qualities are combined into one building. The MKM Museum Küppersmühle, in Duisburg, Germany, will serve as a physical example that symbolizes all the aforementioned research and will be illustrated through analysis.

I aim to demonstrate that experiential architecture is not only inherent but it can also be constructed. Architects and designers have used techniques to shape and manipulate our perception of the built environment. My intention is to organize the existing information into a framework that describes the most crucial techniques.

2. Psychological and physiological implications

1.1 The biology of the eye

To understand the impact of experiential architecture, I started the research by addressing the human senses. Seeing architecture is one of the most common ways of perceiving spaces. Thus, understanding the biological structure of the eye is needed to explain the phenomena of seeing. The implications of the biological components of the eye affect how we perceive our environment and what our physiological limitations are.¹

Within the retina, there are two types of photoreceptors: rods and cones. Cones, which are faintly photosensitive, are located near the center of the retina. They are responsible for color vision in the daytime and they are activated by bright light. Rods, on the other hand, are highly photosensitive. They are located on the outer edges of the retina. Their primary role is night vision and peripheral vision. Hence, rods are usually activated by dim light.²

Lastly, the fovea is the region in the back of the eye that accounts for central vision. It has a high density of cones. During daytime, in order to examine an object closely and in detail, the eyes are oriented in a way that the image falls on the fovea. Although fovea is mostly active during day time, at night we use the edges of the retina, due to the fact that our peripheral vision contains more rods than the fovea.³

1.2 The psychological components of seeing

The process of seeing takes place through the eyes, yet to understand and perceive the projected images, the human brain reacts as well. An influential American psychologist, James Jerome Gibson, disagreed with the preceding theories that claimed that sensory inputs are converted into perceptions by operations of the mind. In his book “The Perception of the Visual World”, published in 1950, he criticized and rejected behaviorism, which claimed that sensorial stimuli are capable of evoking stimuli in humans and animals. Instead, James Gibson advocated for his own view - a different explanation for the phenomena of subjective perception. More explicitly, he did not agree with the previous theories which suggested that “sensory inputs are converted into perceptions by operations of the mind”.

While progressing with his study, James Gibson developed his own position towards cognitivism, emphasizing direct perception and direct realism, opposing cognitivist indirect realism. Subsequently, Gibson’s school of thought was named ‘ecological psychology’. The American psychologist has gained recognition after his influential work, called the theory of “Affordances”. This theory is based on the qualities of the objects found in our environment. Such an example can be seeing a couch and associating it with a comfortable setting.⁴

¹ See appendix 1 and 2 for a more detailed description of the eye

² Peate and Nair, “Anatomy and Physiology for Nurses at a Glance”, 128-130.

³ Peate and Nair, “Anatomy and Physiology for Nurses at a Glance”, 128-130.

⁴ Lobo et al., “The History and Philosophy of Ecological Psychology”.

To better understand the perspective of James Gibson, the psychological schools that Gibson had criticized in his work were studied; namely: behaviorism and indirect realism. Behaviorism was a movement in philosophy and psychology, introduced by an American psychologist John B. Watson, which emphasizes the outward behavioral aspects of thought, rather than investigating the inner mechanisms that are at play with our inward experience. In 1913, John Watson's manifesto focused on behavioral manifestations of intelligence.⁵ Behaviorists denied the utility of introspection as a source for empirical data. Wilhelm Wundt and Ivan Pavlov, predecessors of Watson's work, were the most renowned and influential figures among behaviorists.

Wilhelm Wundt, who is considered the father of experimental psychology, aimed to describe and record the science of experience by analyzing introspected data to identify the components of conscious experience.⁶ Subsequently, he associated patterns and laws to the occurrence of emotions. His experiments were later deemed to be flawed due to the unreliability of introspective observation by other scientists.

In 1890, Russian psychologist, Ivan Pavlov, discovered the classical conditional laws through his experiment on the stimulus response model.⁷ Essentially, he repeatedly fed selected dogs with meat while he was ringing a bell. After conditioning the dogs, which happened each time the bell was rung, even the times when meat was not present, the dogs would salivate.⁸

In contrast to behaviorism, indirect realism focuses on human introspective mechanisms, emphasizing a subjective view of the world. Indirect realism accepts that an object exists independently of one. Through perception one does not directly engage with an object, but there is a perceptual intermediary that comes in between. This intermediary was labeled as sense data. The sense data are objects and volumes that are stored in the memory, having the same properties as real objects, yet only existing in human imagination based on real experiences. Within indirect realism, the strongest argument is the illusion. Illusion occurs when human sense data does not coincide with the direct perception. For instance, when we see a pencil submerged in water and it appears to be bent. That is when we use our sense data, which signals that in reality the pencil is straight.

Meanwhile James J. Gibson strongly disagreed with the principles of behaviorism, he was in favor of direct realism's ideas. He believed that direct realism represented the 'common sense' that objects, such as tables, cups and lamps exist regardless of our visual perception. Nevertheless, when defining visual perceptions, according to perceptual realism, a distinction is made between naive realism and scientific direct realism. The theory of "Common sense", held by many philosophers and people outside the field, is also known as naive realism. This states that "in perception, we are directly acquainted with external physical objects."⁹ Naive realism claims that when we do not perceive objects, they continue to have the same attributes as they did when we saw them, namely features like mass, color, texture, etc. On the other hand,

⁵ Watson, "Psychology as the behaviorist views it".

⁶ Wundt and Judd, "Outlines of psychology".

⁷ See Appendix 3 for the full description of the experiment

⁸ Pavlov, "An investigation of the physiological activity of the cerebral cortex".

⁹ Smythies and French, "The Metaphysical Foundations of Contemporary Neuroscience: A House Built on Sand.", 5-12.

scientific realism states that some of the qualities of the objects we perceive are dependent on the viewer. Unperceived objects should not be considered to have the same attributes.

1.3 Indirect realism versus direct realism: comparing the two frameworks

Direct realism is the more scientifically validated epistemological theory compared to indirect realism. The reasons are the lack of probable justification while generalizing beliefs, as well as the assumption that there is an asymmetry of judgment of our perception and cognitive faculties. Firstly, the indirect realists cannot give a plausible explanation of how people outside of the realm of philosophical theories, possess knowledge and justify beliefs of the external world. That is because philosophers have unrealistic assumptions when it comes to what normal people base their assumptions on.

The second reason is that indirect realists bring forward a belief that there is an asymmetry in between our perception and other cognitive faculties. In their view, one should be skeptical towards their own perception until one acquires positive evidence that perception is reliable. However, they do not hold the same view towards introspection, intuition or memory.

The indirect realism fails in justifying the need for asymmetry, as all cognitive faculties, including perception, are capable of being incorrect. Bringing back the discussion towards direct realism. The way this school of thought avoids the problems that indirect realism faces is by employing the principle of Phenomenal Conservatism. In other words, this principle translates to: it is rational to presume that things are the way they seem, until one gains specific reasons for thinking otherwise. Right from the start, direct realism bases its assumptions on the fact that one perceives the world based on appearance, as the principle of Phenomenal Conservatism states.¹⁰

3. Justifying the use of color in the human environment

Perception of colors through human eyes represents both physiological and psychological sensation through the act of seeing. Color is a common element in the built environment. Thus, the impact of color on human experiences has been previously studied by many scholars of such fields as architecture, psychology, biology, and others. Godfried Semper was an architect,¹¹ art critic and professor of architecture in the Federal Polytechnic School in Zurich, as well as the Academy of Fine Arts in Dresden.¹²

Godfried's publications serve a useful tool to understand the earliest descriptions and investigations into the historically accurate color of ancient Greece. Godfried argued that the understanding of antique monuments cannot be separated from the question of the use of polychromy.¹³ In this sense, starting with the paintings inside caves, man gradually developed a sense of understanding his environment through the use of primitive arts and crafts, by working

¹⁰ Smythies and French, "The Metaphysical Foundations of Contemporary Neuroscience: A House Built on Sand.", 95-110.

¹¹ See appendix 4 for more details on the life of Godfried Semper.

¹² ETH Zurich, "Godfried semper".

¹³ Komossa et al., "Preliminary remarks on polychrome architecture and sculpture in Antiquity", 316-317.

with different local materials. The next step was the partial relief followed by the use of sculpture, in the quest to understand the surroundings and represent it through volumes and colors. Human artifacts, such as the etruscan figures illustrate the evolution towards sculpture, as Gottfried conveyed: “Painting remained within the sphere of sculpture, and sculpture intensified its effects through painting”.¹⁴

In the context of Gottfried’s writings, the architect was an important figure that remained in close relation to the arts, and could oversee the development of the monuments. He, or she, was a person with a sharp eye for details. Art, sculpture and architecture matured as time went on, styles were set in place, and the need of the artist to enrich his work with an abundance of decorative elements was slowly tamed.

Godfried Semper critiqued modern architectural productions for blindly following antique fragments. In his quest to validate and uncover the truth of the ancient use of color in Greece, there was an innate appreciation for the simplistic and unapologetic way in which architecture was built and ornate back in that period. Gottfried’s approach was motivated by an overarching desire to expose how color was used to reflect liveliness and cherish the object, without a regard for a specific style. His writings brought focus to the reality of ancient monuments and sculptures. My understanding of the issue resides in the fact that color was a response to the humans’ innermost desire and need for color. The use of bright tones and striking hues were merely a result of fascination of artists and artisans.¹⁵



Fig 1. Brinkmann’s version on the left and the original on the right, Emperor Caligula, AD 39-41, Sculpture, Art-Sheep, <https://art-sheep.com/the-true-colours-of-greek-and-roman-statues-by-archaeologist-vinzenz-brinkmann/>

On Figure 1, the two sculptured heads are depicting the Roman emperor Caligula. On the right, there is the original sculpture that has lost the layer of paint over the centuries. Although currently the original sculpture appears as a commonly accepted marble sculpture, small areas of paint were still found to be present on the piece. Over time, the paint had faded into light and dark gray spots in the area where the fresco had not fully deteriorated. On the left, there is an

¹⁴ Komossa et al., “Preliminary remarks on polychrome architecture and sculpture in Antiquity”, 320-321.

¹⁵ Komossa et al., “Preliminary remarks on polychrome architecture and sculpture in Antiquity”, 317-333.

accurate reproduction of the same sculpture, but in color. The difference between the two artifacts is astounding as the polychrome version follows Godfried Semper's claims that architecture and sculpture used to be vividly decorated. At first glance, there is an eerie impression as a result of the contrast in between the two statues. Even though it has been already proven that paint was used in antique monuments, our perception of the sculptures tends to only accept the monochrome version. That might be due to the fact that we fall back on commonly shared knowledge that ancient sculptures are perceived as non colored. In this light, we can speak of a contradiction between reality and the processes governing our understanding of our environments.

Traveling further in time, the change in ideology brings us to Charles-Édouard Jeanneret, known as Le Corbusier, was a Swiss-French architect of the modernist movement. His work reflected his philosophy that architecture should be deprived of unnecessary decorative elements and should in turn be focused towards addressing the human needs and the link between color and human psychology. Le Corbusier's work illustrates a shift in perspective, bringing the world of architecture towards a very rational view of what buildings should look like. The architect has proved that colors can produce endless combinations using basic elements. In his view, architects have a limited choice of color, namely, about three or four options to work with. Le Corbusier distinguishes the architect here from the painter in the fact that the limitation imposed onto the architect forces him to very carefully and sensibly consider the tones he uses.¹⁶

Le Corbusier's theory on color states that blue creates space, while red asserts the presence of the wall. Blue is also described as calming, while red is seen as arousing. The architect recognises that colors can be split into two opposing categories - warm and cold colors. Each of these categories is either oriented towards light (associated with heat, cheerfulness, joy, fierceness), or shadow (reminiscent of freshness, serenity, melancholy or sadness). Color is thus an extremely powerful trigger, and an intrinsic part of our lives.¹⁷

Apart from the personal psychological responses to various colors, single hues and sometimes a combination can allude to a particular quality, or a zeitgeist. Character of a society becomes apparent through color trends and preferences. For instance, Le Corbusier correlated youthfulness, vitality, strength and optimism with a stark white setting. He was an avid believer in stark white, yet he suggested that light should not be combined or coexist in the same space.

Le Corbusier has related colors to the three-dimensional shapes. In this way, he found that polychromy is natural on smooth surfaces, but not preferred on volumes designed in terms of light (such as shadow, half tone, and light). A surface that brings on elements of great detail or volumetric complexity should, in his view, be monochrome. To some degree we can understand in terms of synthesis. If we were to separate a sculpture into layers, one could distinguish three steps: the volumetric design, the surface material of the sculpture and the final layer, the painted surface. Let's suppose the object in this thought experiment is a mountain, then, we can reach the

¹⁶ Komossa et al., "Preliminary remarks on polychrome architecture and sculpture in Antiquity", 372-386.

¹⁷ Komossa et al., "Preliminary remarks on polychrome architecture and sculpture in Antiquity", 373.

conclusion that during winter, when a chain of mountains becomes monochrome, its shape becomes obvious and easy to perceive for us. But as the snow slowly starts to melt, new polychrome layers are revealed, leading us to get a lesser understanding of its shape.

Le Corbusier compares how forms in nature such as shellfish follow this model, where the smooth shells are polychrome, while the most sculptural shellfish is almost monochrome. There is an underlined rule of attributing a balance of color, specifically tailored for each volume.¹⁸

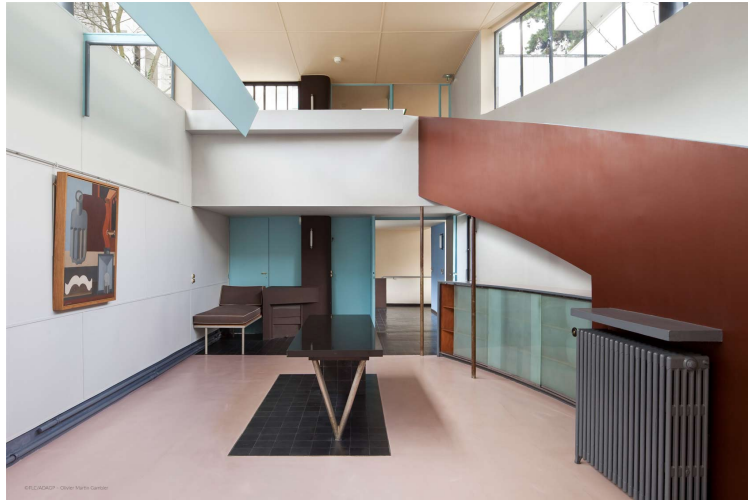


Fig 2. Le Corbusier, *Maison La Roche-Jeanneret*, 1925, building, Dezeen, <https://www.dezeen.com/2016/08/05/maison-la-roche-jeanneret-le-corbusier-paris-residence-france-house-villa/>

The example in Figure 2 shows an interior view of Le Corbusier's *Maison Roche-Jeanneret*. In this configuration, he applied his color theories into practice. Le Corbusier stated that polychromatic spaces should be planar and easy to be perceived. To achieve simplicity of perception, he cleverly used a color palette in order to influence human experience of space. The ceiling and the floor are both covered in warm and inviting half-tones. Thus they become subordinate in the hierarchy of experience of this room. Moreover, the architect considered red to be arousing and he takes advantage of that in the mezzanine floor view. The red staircase, located on the right side of the image, is arguably narrow, but the color exaggerates its presence to the viewer. Le Corbusier aimed to direct our view towards the upper level. By painting the lower level in blue, Le Corbusier achieves an illusion of the lower level appearing deeper than it is in reality.

Bringing the discussion towards the contemporary times, I chose to investigate the works of Steven Holl. His architecture tames the rational as seen in Modernism movement though the use of color sensibly and directly to the viewers. Steven Holl's techniques are not obvious to the person experiencing the space, yet the architect explores color not as a simple intentional element, but as one unique perceptual experience. His interest reaches beyond artificial lighting and paint. Holl builds color, in environments where form is secondary to hues. Color becomes an intangible area at the boundary in between the physical and the abstract.

¹⁸Komossa et al., "Preliminary remarks on polychrome architecture and sculpture in Antiquity", 372-386.

Cité de l’Océan et du Surf in Biarritz, built in 2011, is an example of Steven Holl’s projects that simulates an environment through artificial elements, such as lighting and a curved ceiling, as shown in Figure 3. Here, he introduces the visitor to an immersive experience which recreates the ocean as the interior gives the feeling of being underwater. This is a representative example of how Holl creates space through synthesis and a very limited color palette. Unassuming exteriors shelter the isolated and intimate experience of the interior. Together with the visual artist Solange Fabião, Steven Holl does not only create space through color but also creates a narrative through space. This project came as a result of the architect’s quest to investigate projected color. This process focuses on reflection of surfaces, cast shadows and creating ephemeral experiential spaces.¹⁹



Fig 3. Steven Holl, *Cité de l’Océan et du Surf*, interior view in different light conditions, 2011, building, *The architectural review*, <https://www.architectural-review.com/today/on-the-breach-in-biarritz-with-steven-holl>

Further on, Steven Holl investigated the unexpected nature of color. In the renovation of the NYU department of philosophy in New York, Holl creates everchanging and ephemeral light ray impressions which animate the stairway and interact with the materiality of the interior. He uses white as the support for the display of the flexibility, ephemerality and indeterminacy of colors. In this scenario, the architect welcomes and embraces the unpredictable reflections and arrays of hues that change continuously throughout the day.²⁰

4. Designing atmospheres for experiential architecture

Atmosphere is a substantial part of experiential architecture, and it is a component of the designed experience within the built environment. Thus, in this chapter, my intention is to discover how different buildings have created unique atmospheres, through the use of architectural elements such as material, color or light.

¹⁹ Holl, “Color Light Time”, 33-38.

²⁰ Holl, “Color Light Time”, 48-51.

The term atmosphere can be used for describing a feeling that is not empirically identifiable and belongs to the realm of phenomenology and cognitive psychology. The fascinating phenomena of feeling an atmosphere upon entering a space is indeterminate, one cannot tell what makes the atmosphere. Whether that is the smell, the sounds, the objects or everything as a whole. There is a wide range of possible atmospheres. Thus, in calling a space atmospheric, there is a whole spectrum of meanings described by the term: serene, melancholic, depressing, uplifting, imposing, inviting, or even arousing. The architect Peter Zumthor considers the most important aspect of architecture to be the way that architecture impacts people and affects their feelings. Architecture articulates space and brings our focus towards experiences such as narrowness and expansiveness. Although not an example that is directly tangent to the architectural world, Jonathan Borofsky's *Man Walking to the Sky*, shown in Figure 4, illustrates that the creation of atmosphere does not always require objects.²¹



Fig 4. Jonathan Borofsky, *Man Walking to the Sky*, 2004, sculpture, IGNANT, <https://www.ignant.com/2015/07/17/walking-to-the-sky-by-jonathan-borofsky/>

Of course, each atmosphere has its own context, but that is not the primary source of evoking a feeling. This is where the space of bodily sensing intervenes, it is a sense that reaches into the indeterminate immensity of our environment.

In European culture, there are two spatial concepts that describe space, coming from notable philosophers and mathematicians. Aristotle described the concept of 'topos', translating to place, while Descartes described 'spatium', or distance. 'Topos' can be thought of as the inner surface delimited by surrounding bodies. Thus it is a finite, delimited entity. In contrast to Aristotle's space, 'spatium' is the space in between bodies, or the distance traveled. Both of these descriptions deal with the human's relation to space. However, when trying to grasp our understanding of space, we find out that space is not always defined and structured by bodily relationships alone.²²

²¹ Gernot et al., "Atmospheric Architectures: The Aesthetics of Felt Spaces"

²² Gernot et al., "Atmospheric Architectures: The Aesthetics of Felt Spaces"



One such example can be, for instance, finding yourself in a dark street, under the light of a street lamp. Here, the light rays shining and lighting your body, create the experience of safety, security, but also exposure. Nonetheless, darkness is just as important, because we navigate through a space of contrasts between light and shadow. James Turrell's artworks establish this experiential state of atmosphere, without the presence of the body, shown in Figure 5. In the installation, Turrell built hovering color spaces that are synthetic in their appearance but deeply subjective and provoking. It is arguable that exactly the lack of human figures in his works is what causes our subconscious to perceive his works as hazy, serene and utopian.

Fig 5. James Turrell, Amrta, 2011, installation, JamesTurrell, <https://jamesturrell.com/work/amrta/>

Many religions have embedded into their belief an ideal and canonical approach to constructing space. For instance, the Protestant Church advocates for a space that awakens the feeling that one is with the Father, but it must also have a familiar character and inspire a warm environment of openness. The familiarity is however coexisting with sublimity and solemnity. In spite of the religious communities, people that do not hold religious beliefs might still feel the need to experience such a space and atmosphere. Thus the justification of the desire for particular conditions could be that factually, church spaces are considered to be artworks. German philosopher Georg Wilhelm Friedrich Hegel accorded art a higher importance in relation to church and spirituality, in terms of the development of the objective spirit, which is part of the group consciousness.²³

²³ Gernot et al., "Atmospheric Architectures: The Aesthetics of Felt Spaces"



Fig 6. Albert Speer, Cathedral of Light, 1937, stage, Rare Historical Photos, <https://rarehistoricalphotos.com/nazi-rally-cathedral-light-c-1937/>

The scenography of the church can be used outside of the religious context to re-create the atmospheres of transitioning spaces. It can be argued that there is a strong link between sacred architecture and scenography. The aspiration towards spirituality and higher lead to the creation of context specific scenography. In my opinion, the Cathedral of Light, seen in Figure 6, by Albert Speer shows how scenography and light relative to the context of cathedrals can create an atmosphere. During the event, the light was used as a demarcation for the physical boundary of the arena. However, light can also be interpreted as a symbol of authority, power and aspiration towards a higher standard. This atmosphere contributed to the propaganda, which was sold by using advertising, marketing, urban planning and design. The art of atmosphere, in the context of open air festivals is produced through the stage set, which itself is part of the staging for the political activists.

There are different ways in which religious architecture is constructed in terms of atmospheres. The Japanese architect, Tadao Ando, who created enticing examples of religious architecture, uses very few materials in order to communicate his architectural vision. “I always believed that architecture should exhibit both qualities of substance and abstraction simultaneously”.²⁴

²⁴ Brownell and Erickson, “Matter in the Floating World: Conversations with Leading Japanese Architects and Designers”

In the project built in 1991, the Water temple, seen in Figure 7, Tadao Ando carefully composes the routing through the building in a theatrical way. Every step of the way to the destination point is representative of the feeling of reaching the temple with the right mindset and physical feeling in order to reach a spiritual state. The series of rooms are meant to allude to leaving the material world behind and entering a state of inner peace. Architecturally, Tadao Ando's design tackles the challenge through great respect and appreciation for Japanese culture. That is why even if the stylized elements, such as the translucent walls and entryways, are a synthesis of their traditional counterparts, paying respect to the Japanese heritage and culture. Figure 7 below shows how space becomes subtle and obscure. As the visitor walks along the journey towards the temple, the more they start feeling as if they are leaving the physical realm. Light and shadow, abstraction and texture, all play together in separating the viewer from reality, bringing the observer towards spirituality. The figure also shows how the intensity of light and the atmosphere of the building is overwhelming and intrusive. Furthermore, it illustrates a very ephemeral space, where the atmosphere alludes to the unknown and sacred, with a sense of urgency and unease, given by the use of prominent red lighting.²⁵



*Fig 7. Tadao Ando, Water temple interior, 1991, building, visuallexicon,
<https://visuallexicon.wordpress.com/2017/10/04/water-temple-tadao-ando/>*

Juhani Pallasmaa, Helsinki-based architect, argues that only through engagement with the human peripheral vision, architects and designers can engage their sixth sense - the atmospheric sensibility for a space. On the other hand, Frank Lloyd Wright states that "[w]hether people are conscious of it or not, they actually derive countenance and sustenance from the 'atmosphere' of

²⁵ Qin et al., "Analysis of Tadao Ando Building Humanism"

the things they live in or with. They are rooted in them just as a plant is in the soil in which it is planted.”²⁶

I would like to investigate how atmosphere could also be the product of a design process outside the man-made and one’s preconception of what experience should feel like. Architect and artist Michael Hansmeyer uses computational design in order to arrive at synthetic realities transposed in architecture. Oddly enough, even though the human interference factor within his design process is reduced to a minimum, I find his works to be still deeply influential and mystical. Here, Hansmeyer’s spaces create atmosphere through objects rather than typical architectural elements such as columns, walls and windows.²⁷



Fig 8. Michael Hansmeyer, *Michael Hansmeyer: Building Unimaginable Shapes*, 2012, video, Youtube
<https://www.youtube.com/watch?v=dsMCVMVTdn0&t=41s>

In order to provide the input for the algorithms he uses, Hansmeyer starts by taking a close look at natural order and patterns that he found in the biology of plants. The main process of creation in nature, morphogenesis, essentially translates to the splitting of one cell into two cells. The two new cells can be identical, or asymmetric. This model was simplified and abstracted in order to be translated into an algorithm. Through an iterative process, one exercise led to the creation of 400.000 surfaces that started from folding the volume of a cube. The results of this experiment can be seen in Figure 8. He brought the digital process to the world of architecture by choosing to design a column. The columns were exhibited in the Gwangju Design Biennale in 2011, as seen in Figure 9. What is fascinating is that, through the use of mirrors and ever changing details of the columns, their reflection is never the same. Each viewing angle around the column results in a new unexpected profile.

²⁶ Del Campo, “Evoking through Design: Contemporary Moods in Architecture”, 126

²⁷ Hansmeyer, “Building Unimaginable Shapes”



Fig 9. Michael Hansmeyer and Benjamin Dillenburger, *Digital Grotto*, 2013, sculpture, michael-hansmeyer, <https://www.michael-hansmeyer.com/digital-grotto-1>

Hansmeyer, together with the artist and architect Benjamin Dillenburger, produced a series called *Digital Grotto*, shown in Figure 10. Here, the two artists explore morphology and form through the same process used for the columns. “Any references to nature or existing styles are not integrated into the design process, but are evoked only as associations in the eye of the beholder.”²⁸ In this sense, my interpretation of this work is that I perceive it as a sanctuary, or religious space that is free of the laws that normally govern our environment. It seems as a space that would exist in a purgatory as a transitional space with its inspiring purity and intricacy. There is also a sense of urgency, as the lateral planes are bringing the viewer towards a darker and more threatening space, the center of the composition. As an analogy, one could compare this work to the deep sea and its ecosystem. The deeper one wanders into the abyss, the less control the observer has of the environment, one could be surprised at any time by a creature lurking behind a shadow.²⁹



Fig 10. Michael Hansmeyer and Benjamin Dillenburger, *Digital Grotto*, 2013, sculpture, michael-hansmeyer, <https://www.michael-hansmeyer.com/digital-grotto-1>

²⁸ Hansmeyer, “Building Unimaginable Shapes”

²⁹ Hansmeyer, “Building Unimaginable Shapes”

5. Deception: understanding optical illusions

We might take the appearance of buildings at face value, unassuming of the true nature of a volume, but there are examples throughout history, when architects meant to hide illusions in plain sight. In this chapter, I intend to research the mechanisms through which architects simulate and trick one's mind into viewing an illusion as reality. Here, I use deception as an umbrella term that encapsulates all techniques used to distort our perception.

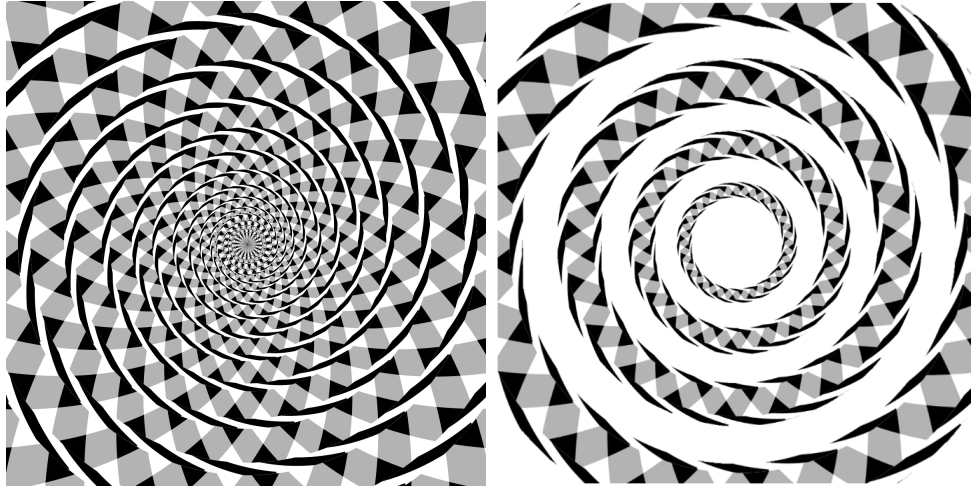


Fig 11. Sir James Fraser, *Spiral*, original on the left, demonstration of separated circles on the right, 1908, drawing, Wikipedia, https://en.wikipedia.org/wiki/Fraser_spiral_illusion

One of the most recognizable illusions is the spiral of Sir James Fraser, shown in Figure 11. The effect takes place partly due to the fact that our mind is tricked into reading the lines before realizing the true image, expecting the continuation of a series that is more complex than it looks. What is fascinating about this image is that in reality, it is not a spiral, rather, a series of concentric circles that slowly reduce their size. That can be only observed by following the circle with a pencil or a finger. The effect is occurring due to a number of spiraling elements that cross each other and direct our eyes towards the center. As a result, we experience it as a spiraling tornado seen from above, when we look at the corners, it stops, but when we look in the center, the rest becomes a vibrating moving blur.³⁰

Similarly to the previous experiment, there is another optical illusion that experimental psychology refers to as “Thiéry’s figure”. Ernst Gombrich considered this effect to be the quintessence of cubism.³¹ We analyze the image, we read every detail but cannot complete it consistently, which in turn leads us into a continuous loop of impressions. It is impossible for the viewer to see it in only one way due to the fact that it continues to reverse the orientation of the planes.³²

³⁰ Gombrich, “Art and Illusion”, 219-221

³¹ Gombrich, “Art and Illusion”, 284

³² Gombrich, “Art and Illusion”, 283-285.

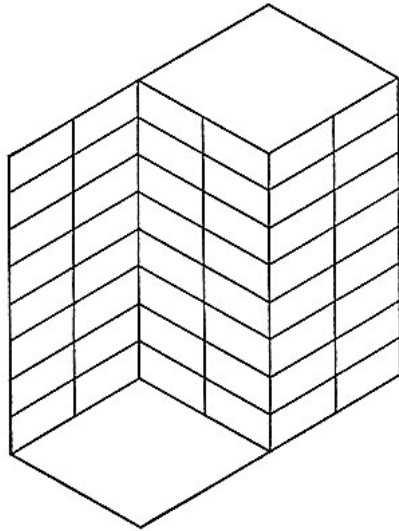


Fig 12. Thiéry's figure, 1895, drawing, Gutenberg, <https://www.gutenberg.org/files/36297/36297-h/36297-h.htm>

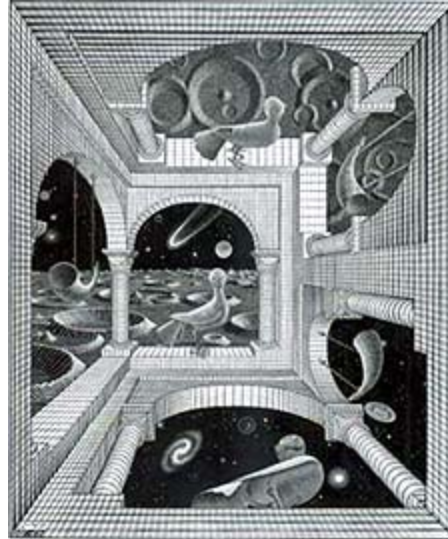


Fig 13. M.C. Escher, *Autre Monde*, 1947, drawing, journalofseeing, <https://journalofseeing.wordpress.com/category/m-c-escher/>

Furthermore, we find elevated and intricate works of art by Maurits Cornelis Escher. There is one particular example which I would like to discuss. The aforementioned artwork is a woodcut, titled “Autre Monde”, and can be seen in Figure 13. From the first glance, the perspective of the drawing appears correct, but once the viewer scans the image piece by piece, the message of the artist gets clear. There is no “left”, “right”, “up” or “down”, the more we look, the more complex it gets. This attempt represents the artist’s meditation on space, but also the beholder’s view, which is aiming to understand the paradoxes of his imaginary universe.³³

I would now like to discuss one of the paintings of Carlo Crivelli. Here, illusions are hidden in plain sight. Most people would observe in Figure 14, the image on the right as being part of a sphere, or part of Newton’s cenotaph. However, in actuality is the conch above Saint Mary's figure. We can see that on the left side, in “Madonna and Child Enthroned with Donor”, this is only a piece of the puzzle. Due to the painting’s abundance of decorative elements, coupled with complementary colors, the viewers fail to fully perceive or “read” the full picture.³⁴



Fig 14. Carlo Crivelli, *Madonna and Child Enthroned with Donor*, full painting on the left, conch on the right, 1470, painting, nga, <https://www.nga.gov/collection/art-object-page.41616.html>

³³ Gombrich, “Art and Illusion”, 243-244.

³⁴ Gombrich, “Art and Illusion”, 270-271.

In order to go back to the matter of scenography, I will use stage design as an example for deception. Stage design aims to frame the view of the spectator, the aim here is to create a visual experience when the curtain rises, showing the actors in a physical environment that is framed by the proscenium. The proscenium can be seen as the architectural equivalent of a canvas, it is the invisible plane which projects the scenes of a play. Figure 15 delineates where the spectator's "canvas" occurs.

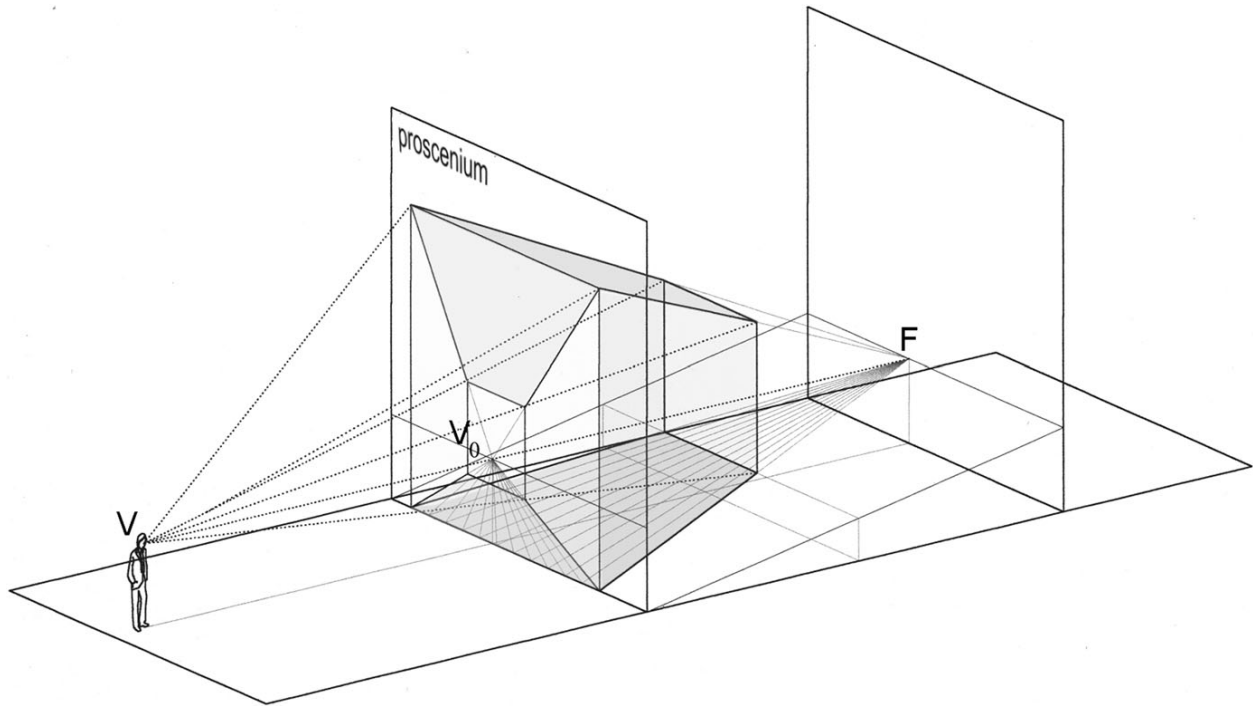


Fig 15. Fernando Galli Bibiena, *The proscenium as the "spectator's canvas"*, 2016, drawing, Pagliano Alessandra - "Architecture and Perspective in the Illusory Spaces of Ferdinando Galli Bibiena.", fig 2 pg 4

However, there is a limitation of the stage, it is possible that the scene should portray a space that is larger than the physical footprint of the stage. Thus, the scenographers resort to using scenic perspective. Since the 15th century, this subject area, also known as relief perspective, gave birth to substantial experimentation. This illusion is a tool that capitalizes on one's physiological deformations due to vision, which allow the spectator to perceive the simulated set as being perpendicular to the proscenium. The practical technique for this effect is to gradually reduce the size of the objects and create convergence towards the background.³⁵

Figure 16 shows the planometric view of the stage for "Le Nozze di Figaro" (1980), which took place in Teatro alla Scala, Milan. The figures show how forced perspective was used to create a sense of depth, as well as how the light source is positioned in order to reinforce the length of the set. In the upper left corner, the stage is depicted through a sketch, while in the bottom left corner we see the real inhabited space, framed by the proscenium. These two views exhibit how the

³⁵ Pagliano, "Architecture and Perspective in the Illusory Spaces of Ferdinando Galli Bibiena.", 697-721.

scenographer translates a two dimensional sketch into a three dimensional volumetric composition, by employing relief perspective.

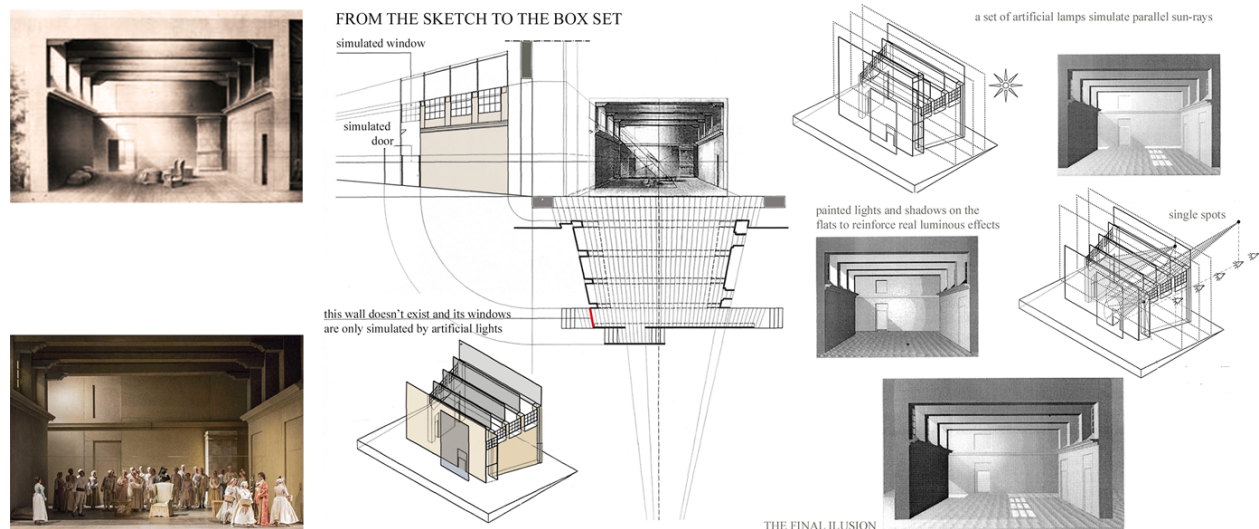


Fig 16. Fernando Galli Bibiena, Stage for “Le Nozze di Figaro”, 2016, drawing, Pagliano Alessandra - “Architecture and Perspective in the Illusory Spaces of Ferdinando Galli Bibiena.”, fig 3 pg 4

The complexity and implications of stage design were described and explained in detail by the Italian architect, Ferdinando Galli Bibiena. His treatise dealt with architecture and perspective. His first treatise was entitled “L’architettura civile preparata su la geometria e ridotta alle prospettive”.³⁶ This work was split into five parts, each detailing the components necessary for creating buildings destined to be on a stage set. The first part contains geometry and teaches the student how to construct volumes using basic shapes, as well as calculating areas. The second part synthesizes teachings of Vitruvius, together with describing the five classical orders. The third part tackles planes, projections, all through linear perspectives. This is where Ferdinando recognizes and defines this as deceptions of the eye. The fourth part serves as an example of how to emphasize perspective through drawing figures with decreasing heights to illustrate a lifelike atmosphere.

We turn now, to an example outside the world of theater, where we can see the ideas of Galli applied in an architectural setting. The location is the Palazzo Spada in Rome, where the architect Francesco Borromini designed the Colonnade Spada, shown in Figure 17. This transitional space was designed as a corridor which would connect the entrance of the gallery to a statue that was located in the background, where the corridor ended. The Colonnade is made up of arches that are grouped and separated into four parts along the length.

³⁶ Pagliano, “Architecture and Perspective in the Illusory Spaces of Ferdinando Galli Bibiena.”, 703



Fig 17. Francesco Borromini, Palazzo Spada, 1540, building, Nan-Ching Tai - "Investigation on light effect on spatial illusion resulting from forced perspective", fig 1 pg 2

Each set of these arches is supported by four columns, all within the sight of the viewer. Moreover, both the ceiling, as well as the floor are patterned, further enforcing the effect of direction and perspective. In Figure 17 above, we can see that light is also a crucial element of the force perspective effect. Lighting distribution contributes to how we perceive space, the lower the contrast of the statue against the background, the farther we perceive the object to be. The higher the contrast of the statue against the background, the closer it appears. When dealing with natural light, a diffuse source of light is always preferred, because direct light gives more context and might alter the effect of the illusion. The distance in between the sets of arches might suggest that there would be a source of light separating each one of them, however, in the execution of the Colonade, there are no additional openings besides the end and the beginning viewpoint.³⁷

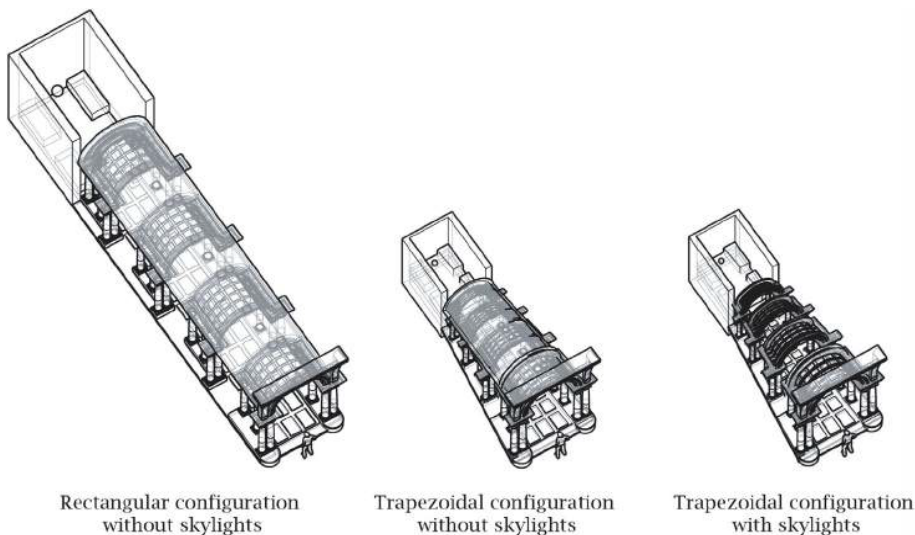


Fig 18. Palazzo Spada, recreation of the corridor in three distinct configurations, 2016, 3D model, Nan-Ching Tai - "Investigation on light effect on spatial illusion resulting from forced perspective", fig 2 pg 3

³⁷ Tai, "Investigation on Light Effect on Spatial Illusion Resulting from Forced Perspective.", 221-227.

When looking at the configuration of the space, our natural instinct is to believe that the configuration is that of a rectangular space. Figure 18 illustrates three possibilities, out of which, the one in the middle is the actual configuration. Again, just as the practices in stage design, the architect uses a trapezoidal configuration, where the arches and columns are gradually reduced in size. This leads to the illusion that the statue at the end of the corridor appears to be bigger than it actually is in real life.

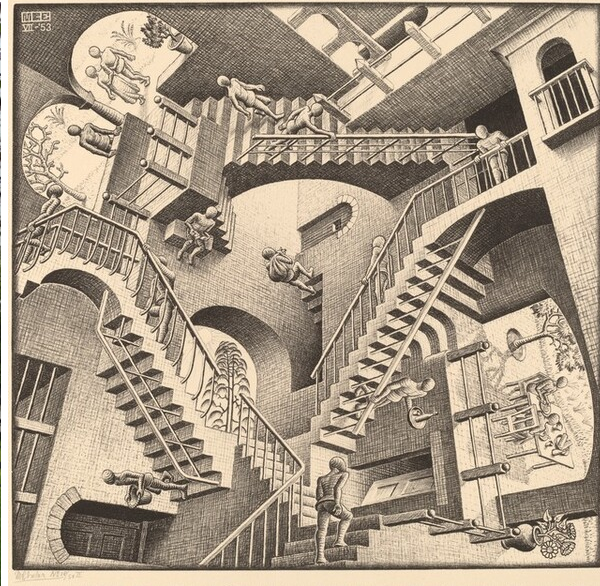


Fig 19. dRMM, *Endless stairs*, 2013, art installation, Dezeen, <https://www.dezeen.com/2013/09/13/endless-stair-by-drmm/>

Fig 20. M.C.Escher, *Relativity*, 1953, drawing, Moma, <https://www.moma.org/collection/works/61398>

The reason I discussed M.C.Escher's drawing previously is because I would like to compare them to real life examples of "escheresque" architecture. The resemblance is shown in Figures 19 and 20. I find it fascinating that attributes used in the paintings, which are synonymous with impossibility and non gravitational worlds, can be applied into real architecture. Thus I would like to start with a project by dRMM, titled "Endless stairs", which is made up of a conglomeration of planes that intersect at seemingly random points. It is quite literally, the world of imaginative structures translated into reality. Looking at Figures 19 and 20, dRMM besides Escher's "Relativity", we see the resemblance and controlled chaos to be present in both.

Rotterdam house renovation called "Black pearl", by Studio Rolf, shown in Figure 21 is another example of M.C.Escher's influence. Here, there are instances where the line between reality and imagined is even harder to distinguish. The exterior of the house is in striking contrast to the rest of the typical dutch row house buildings adjacent to it, painted top to bottom in black, hence the name.



Fig 21. Studio Rolf, Black pearl exterior, 2008, building, Dezeen,
<https://www.dezeen.com/2011/12/19/black-pearl-by-studio-rolf-fr-with-zecc-architecten/>

The facade has blacked out windows which block most of the daylight, however, the architects are suggesting clues as to what the interior could be like. There is a clear disregard for rationality, also an almost upsetting and eerie sensation on the outside. The interior is where the magic happens. Below, we can see how the stairs look almost upside down, the cabinet in front of them seems to be levitating. I found the following picture to be very similar to Escher's drawing "Konkav und Konvex". Just when you think you understand it, you find an additional dimension to the space.



Fig 22. Studio Rolf, Black pearl interior, 2008, building, Dezeen,
<https://www.dezeen.com/2011/12/19/black-pearl-by-studio-rolf-fr-with-zecc-architecten/>

Fig 23. M.C.Escher, Konkav und Konvex, 1955, drawing, Internet archive,
<https://archive.org/details/EscherMetamorphosisMachine>

6. All in one

In the final chapter of the research, my intention is to bring all the previous mentioned works into light by discussing the case study of a building that combines all the characteristic attributes of experiential architecture. More specifically: psychology and physiology, color, atmosphere and deception. The building shown in Figure 24, is the MKM Museum Küppersmühle, located in Duisburg, Germany. The museum is an enticing 19th century industrial monument that was in use for over 100 years.³⁸



Fig 24. Herzog & De Meuron, MKM Museum Küppersmühle, 2016, render, Museum-Küppersmühle, <https://museum-kueppersmuehle.de/>

Looking at the history of the site, we are presented with the rich history of the building. In 1860, the building was designed by the local architect and industrialist Wilhelm Vedder, to house and facilitate milling and storage for grains. In the 1900's, the mill was provided with state of the art technology of the time and went into operation in the Inner Harbor, also known as the Ruhr district. Throughout the course of its use, additional structures have been constructed, such as a boiler house and a chimney, in 1912, by Werner & Nicola company. Later on, the silos were realized in the 1930's. In 1969, the company merged with Kupper company, from Homburg, thus the name of the museum.

The activity of the mill came to a halt in 1972, when it was closed down.

The Museum Küppersmühle was then conceptualized into a fragment of an emergent urban transformation of the Inner Harbor. The focus was to create a pleasing and inviting urban space which would revitalize the life of the site. This was all possible through the initiative of Herzog & de Meuron architects who finished the transformation project in 1999, based on a masterplan by Norman Foster. Ever since, the building became a multi-use location that had a substantial impact on the city.

³⁸ MKM Museum Kuppersmuehle, "From the grain silo to the museum".

The main use was, however, the art museum. In its collection, one will find some of the most prized collections of German art from 1950 onwards. In 2019, the building celebrated its 20th anniversary since the restoration.³⁹

The extension of the museum was planned to start in 2008, by the same team of architects. Due to financial issues of the beneficiary, as well as faulty work conducted on the steel structure, construction ceased. Thankfully, in 2013, with the Sroher family as new clients, the vision was revived once again. The architects were very ambitious and daring, proposing that on top of the silos, there would be a cube standing in equilibrium. Their initial proposal was scrapped. The new proposal was much more in tune with the existing history and qualities of the site. Instead of developing the building vertically, they devised a plan for an additional building that would conclude the row of already existing factory structures. At first sight, one might not even notice that it is a contemporary structure due to its appearance and the fact that it blends in with its surroundings.



Fig 25. Herzog & De Meuron, MKM Museum Küppersmühle interior, 2016, building, herzogdemeuron, <https://www.herzogdemeuron.com/index/projects/complete-works/426-450/433-mkm-museum-kueppersmuele-extension/image.html>

Corridors cutting through the silos, shown in Figure 25, connect the historical building with its modern counterpart at the first and second upper levels. This ensures that visitors have a seamless experience and are instinctively directed through a sequence of rooms. It also means that as you walk on the bridge, you are overwhelmed with the sheer height of the silos. The addition contains three new parts: two parts house the exhibition areas, while the third is a technical space for utilities and logistics. The architects cherish and respect the original materials

³⁹ Herzog and De Meuron, “433 MKM Museum Küppersmühle, Extension”.

of the silos, maintaining the patina that occurred with years of exposure. They consider it to be a crucial sculptural component of the museum. Another striking component of the museum are the stairs located at the end of the row, which were part of the project in the version from 1999. The role of the staircase is to create a fluid arrangement of all the exhibitions in a consecutive manner.

When looking at the striking staircase, we can understand Gibson's theory of affordances. We see an earth tone interior which makes us feel at ease, and signals our mind to associate it with all the qualities of the ground: calm, soft, grounded and connected. In terms of our physiological response, the architects created a routing layout that works in strong contrasts, the adjacent spaces to the exhibition rooms, all use shades of gray and the monochrome palette based on burnt sienna. Dimly illuminated spaces activate our peripheral vision and that is why we perceive the space to be ephemeral and atmospheric. This allows our eyes to relax and adjust to a non intense environment, but as soon as we step into the galleries, the rooms are bright and white, which in turn means that we can perceive the full spectrum of colors used in the artworks.

In terms of color, the architects pay homage to the initial configuration of the building and its surroundings, more specifically, the use of brick and earth tones in the city of Duisburg. What is interesting is that we can see a resemblance and affirmation to Le Corbusier's color theory. He believed that the more complex structures and buildings should use a monochrome pallet of materials in order to allow the user to fully perceive and comprehend the volume. Burnt Sienna and shades of gray are present all throughout the industrial building, this color even comes up in Le Corbusier's personal palettes, which were created in order to synthesize and mimic the colors of nature. There is however a certain subtlety to the use of color in terms of materials. The exterior presents us with a number of historical layers of brick construction. The new additional structure is meant to mimic the old, while still maintaining a modern character. On the interior however, is where we see an interesting effect. Rust, dust and grime built over the years of existence in the building are now transposed into stucco textured concrete on the interior which resembles the fired terracotta hue. The slight variations in the tone of this material embrace and show the imperfections, while complementing the worn out bricks and corroded steel silos.

Tension and relief are present all throughout the museum. This feature is illustrated in Figure 26, where the contrasting experiences are shown. Looking up to the ceiling of the stair structure creates a feeling of claustrophobia, as if the staircase is suffocated by the room. But there is relief, and it comes from light, shadow and color. A single tall and narrow window opens up the room to the exterior. Consequently, this window is placed close to the corner, which allows the light to softly flow into the space and create pleasant gradients. Another space where we can find this contrast is the corridors in between the silos. As it was mentioned before, the gallery rooms are bright and lively, but at some point during the route, the visitor passes through the silos. Here

is where tension occurs yet again, the perceiver has the feeling of being suspended at a high altitude, which is heightened by the sheer verticality of the steel structure.

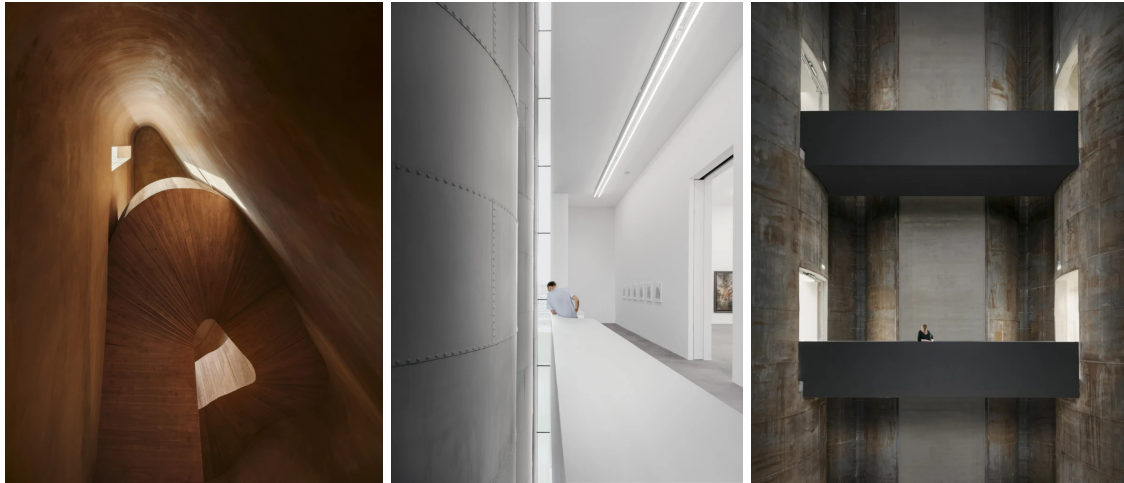


Fig 26. Herzog & De Meuron, MKM Museum Küppersmühle interior elements, 2016, building, herzogdemeuron, <https://www.herzogdemeuron.com/index/projects/complete-works/426-450/433-mkm-museum-kueppersmuele-extension/image.html>

The facade, seen in Figure 27, simulates a very interesting effect. From far away, it resembles a typical brick construction, and there seems to be somewhat of a blur regarding the direction of the bricks. As you get closer and closer, you realize that the bricks are angular and faceted, they are displaced 45 degrees relative to the plane of the facade. The closer the perceiver is, the higher the building seems, the perspective is enhanced by repetition and verticality, which in turn exaggerate the real height of the construction.



Fig 27. Herzog & De Meuron, MKM Museum Küppersmühle exterior details, 2016, building, herzogdemeuron, <https://www.herzogdemeuron.com/index/projects/complete-works/426-450/433-mkm-museum-kueppersmuele-extension/image.html>

7. Conclusion and Discussion

The subject of designing in order to influence our perception is very broad and encapsulates a multitude of disciplines. In order to uncover its essence, the paper tackled psychology, art and color. I believe that the fusion of these elements, together with the chapter on deception, which is closely related to our psychological response, represent the basis upon which experiential architecture is created. What I was seeking throughout the process was examining a number of writings that explain how architecture can influence the human senses and which are the tools needed to achieve that.

In conclusion, I found that every subject discussed is interlinked with our innate psychological understanding of the world, and our ability to process it. Perception is deeply rooted and researched in psychology, by authors such as James J. Gibson, which emphasized his view through the theory of affordances. Moreover, taking a look at the perspective of color perception, the human response to color in the immediate environment is also a psychological and biological phenomenon. Day and night conditions affect our vision and the way we perceive color, and architecture responds to these changes too. However, what is achieved with the fusion of color and light in spaces is frequently referred to as ‘atmospheres’, where an atmosphere is a combination of three-dimensional space and color. It deals with creating an emotional response based on how we interact with architecture and associations we create with our past experiences. For instance, James Turrell is one of the most prolific artists when it comes to exploring the spatial composition and atmospheric sceneries. Furthermore, in my findings deception explores the conditions when architecture and art warp our understanding of the environment. To address the theme of optical illusions in art, I referred to the work of M.C. Escher is possibly one of the most well known artists for creating his work based on deceiving and bending our understanding of three dimensional space. I find it fascinating that his ideas and imaginative worlds can migrate into realized architecture. For that, I referred to the project “Black Pearl” by Studio Rolf, which proves that ideas illustrated through art can surpass the two-dimensional plane of a drawing into a three-dimensional space of “visual trickery”.

One can argue that in every building there are qualities that relate the space to experiential architecture, but only some examples separate themselves from the mundane structures. Experiential buildings create a deeper feeling of immersion that resonates with our emotional state, which in turn leads us to connect on a more personal level with the built environment, bringing buildings to life.

8. Appendix

1. The retina is a thin layer of cells on the inner surface, located at the back of the eye. It contains photoreceptor cells, which account for the process called phototransduction. This process converts light into electrical signals, through the rod cell, cone cells and photosensitive ganglion cells of the retina. When entering the eye, light must first go through a series of components in order to reach the retina.

Within the eye we can distinguish structures such as the cornea, iris, lens, and fovea. These mediums process the light so that it can later be analyzed by the retina. Amongst the components of the eye, the aqueous humor and the vitreous humor maintain the shape of the eye. The retina converts light into neural signals which are later sent to the brain.

2. The crystalline lens, as well as the cornea, are the first layer of light filtering. They refract light in order to focus the image on the retina. Further on, light passes through the aqueous humor, which connects the lens to the cornea. The iris, which is a circular muscular ring, regulates the amount of light that the eye is receiving. The size of the iris varies depending on the light condition, in order to keep a constant amount of light coming through. As such, in low light conditions, the iris opens and the pupil enlarges. The following component, the lens, focuses light on the retina and fovea centralis. The lens is convex, transparent, and it is operated by a set of muscles which allow it to contract or stretch, in order to change the focal length and focus the light sharply on the retina.

3. Ivan Pavlov's experiment that was focused on the stimulus response model led to the discovery of classical conditioning laws. In Pavlov's experiment, dogs were offered meat as the stimulus while corroborated with a neural stimulus, the ringing bell. After a number of trials, the dogs were conditioned to respond to the bell by salivating, even in the absence of the food. Thus, in accord with Pavlovian theory, considering the history of the conditioning of a given animal, the behavioral response can be predicted and even controlled, based on the stimulus response pattern.

4. Formally trained as an architect in Germany in the Academy of fine arts in Munich. His studies directed him towards pursuing a number of journeys to some of the most influential countries in terms of architectural heritage. Amongst his travels, he spent three years in Italy and Greece in a study tour, where he investigated monuments and culture.

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Images

Cover Page: Patrick Tighe Architecture, *Out of Memory*, 2021, building, [tighearchitecture](https://www.tighearchitecture.com/out-of-memory), <https://www.tighearchitecture.com/out-of-memory>

Fig 1. Brinkmann’s version on the left and the original on the right, Emperor Caligula, AD 39-41, Sculpture, Art-Sheep, <https://art-sheep.com/the-true-colours-of-greek-and-roman-statues-by-archaeologist-vinzenz-brinkmann/>

Fig 2. Le Corbusier, *Maison La Roche-Jeanneret*, 1925, building, Dezeen, <https://www.dezeen.com/2016/08/05/maison-la-roche-jeanneret-le-corbusier-paris-residence-france-house-villa/>

Fig 3. Steven Holl, *Cité de l’Océan et du Surf*, interior view in different light conditions, 2011, building, The architectural review, <https://www.architectural-review.com/today/on-the-breach-in-biarritz-with-steven-holl>

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