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## TRACING THE EVOLUTION OF LIGHTING IN ARCHITECTURE

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### ABSTRACT

*The role of light has been studied, examined, and analyzed for the built environment from ancient times. The methodology was conducted by literature review and precedents study to determine shifts in viewpoints that become the basis of architectural lighting design practice. This paper will discuss four evolution viewpoints but understanding the sky with its properties is the first step before moving forward. The first evolution will focus on light's role from perception to narration; the second one will examine light from the point of development of aperture to performance; the third will investigate light from material to immaterial with a particular focus on light's immateriality from the point of view of J.J. Gibson, and the last part will have an overview of light's purpose from quantitative value to its contemplative tranquillity. All four evolutions will provide broad strokes from one extreme to the other to highlight the shift of lighting knowledge and applications.*

**Keywords:** *evolution, immateriality, light, narration,*

### INTRODUCTION

For any architect, designing with light has a particular disposition towards daylight and its properties. This section will look at a few examples of knowing your sky as a prerequisite for architecture with light. Except for artificial light, we cannot reproduce light but can control and manipulate daylight as designers, artists, and architects. However, to precisely do that, we need to understand our sky. We need to understand the character of the spaces that change continually according to the seasons, the time of day, the sun, and the clouds, according to Leiviskä (Brawne, 2005).

The act of seeing and understanding the sky, its light, spectrum, behavior, and nuances is an art beautifully captured and framed by some of the best Impressionist painters. A painting of the Entrance to Harbour of Trouville by Eugène Boudin shows a clear blue sky with patches of clouds up for grabs, it is clear, and still, water reflects the sky perfectly. Compared to Camille Pissaro's painting, Hoarfrost from 1973, it also shows a blue sky with clouds above with the distinctive reflection on the ground of the melting snow and its glare properties, which Pissaro managed to capture

perfectly. Pissaro's other landscape painting, *Two Women Chatting by the Sea in St. Thomas*, also showcased his understanding of the sky and its limitless properties. In this case, Pissaro wisely only showed the effect of the glare of the sun without showing the sun. The gesture of one of the women with her head basket perfectly covering her face intimated the sun's heat and clarity to us, the viewers.

Haymaking, done in 1887, also showed Pissaro's astute observation of what the sun gives off around high noon with the blue sky and sparse clouds, which provides the viewers with the determination of the workers and perhaps their exhaustion as well. The first place to experience light is the landscape, 'to paint both earth and sky in a blend of perception of a world in a continuous formation, which Ingold believed we should learn from the painters (Ingold, 2005). Steven Holl is one of the great architects who incorporates light into his designs. Extrapolating his tacit knowledge about the sky and its light through the means of sketching and watercolor painting is done by Holl to help him understand and predict the result of light behavior within his architecture. From the sketchbook, we can see the two sketches of an undetermined building with its jagged roof showing the penetration of daylight into the building from the north light, the south light, and the water light.

The progression of this design still includes the north light for its gallery. The addition of color for the elevation might indicate what the elevation would look like under the sun. The section shows additional cut-outs through the basement, hinting at the inclusion of daylight for the gallery space below. The sketches show a significant influence of lighting, especially daylight, in the early design phase for Holl. His understanding of light always takes priority for his architecture.

Our argument for dynamic, engaging, and spectacular architecture involves an understanding of the local sky, daylight, and its properties and the holistic integration of its whole spectrum into the design since, according to Meier, '*light is the best and most versatile building material*' (Brawne, 2005). Moving on from the understanding of the sky as the first step to trace the evolution of knowledge on lighting and its design application, the following sections will discuss the four viewpoints of lighting knowledge. The four categories were established based on the literature review and historical design precedents. The literature study and precedents were analyzed to identify the shifts of viewpoints, the diversity of design methods and technological advances with the careful consideration of local context, the questioning of our perceptual tools, become the basis of lighting design practice in architecture and spatial design.

## **THEORY / RESEARCH METHODS**

The methodology for this study was conducted concurrently between the literature review and the precedents study. Literature review regarding the thinking of light was not bound to the discipline of architecture only. However, it was also expanded into the theater, arts, ecology, and historical discourse. The expansion of discourse was to identify a broad platform where shifts occurred regarding the role of lighting. Based on the review, the collection of ideas and thoughts was organized into four different evolutions to highlight the impact of lighting.

## From Perception to Narration

Our first viewpoint of evolution highlights the role of light, where our participation with light stands from a fixed, disengaged point of view to interpret our surroundings to complete body immersion combined with a gait to guide our sensory experience. As a perception tool, light is generally used to help us navigate our surroundings, giving information about what to see, where to go, and how to go to our destination, and to determine any potential danger. Light reflected through our environment gives us data that we process in our brain through our vision, and yet the use of light is so much more than just a narrow function of perception (Russell, 2012).

Light, as a bonfire, is the point of gathering where stories are told, shared, and re-told. The art of storytelling or narration starts with light at its center, where communal activities surround it, suggesting that our life, values, and needs intersect heavily with light and its capacity for us to create narration (Hough, 1932). One extreme example of this was the notorious Nazi regime at Nuremberg to use light as a propaganda tool for self-grandeur perception while twisting its meaning as "cathedrals of light" with 130 giant searchlights (Ebbensgaard & Edensor, 2021). The evolution of this storytelling with light can be found in West Sumba, Indonesia, in the form of fired-up football (Figure 1). Made from coconut fruit shaped into a football, dipped into oil, and lit up with fire. It is an annual ritual before Ramadhan which requires one-month fasting to cleanse your body and mind, avoidance of food cooked by fire, and special chanting and prayers before the game.

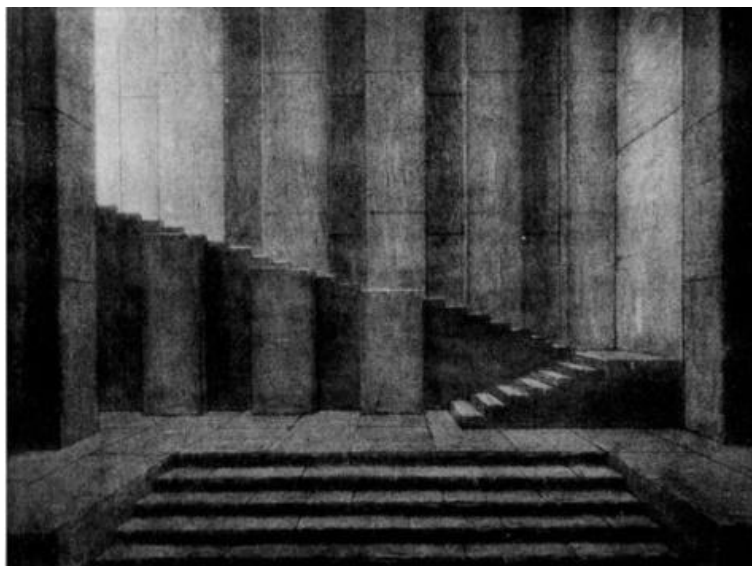


**Figure 1.** A game of Laliang in West Sumba, Indonesia.

*Source:* <https://www.sonora.id/read/422995355/seperti-bertanding-di-neraka-ini-fakta-sepak-bola-api-milik-orang-sumba-barat>

Light is one of the elements contributing to forming a narrative environment that offers the embodied experience through space over time (Austin, 2018). Shifting from perception to narration, the light was integrated into theatre and set design by Adolphe Appia (1862-1928); in which Appia's contribution is "the recognition of power and potential of light as both a unifying and expressive force that could be modulated like music, a dramaturgy, with light at its center, to draw attention to the

materiality of light, its effect upon stage space and the actor's body within it" (Palmer, 2015). His sketch (Figure 2) shows what Palmer said are passive light and active light, where the former refers to the general light of the stage area and the latter to intense, focused, or 'shaping' light that allows distinct shadows to be created and when choreographed, could become a co-player in the drama (Palmer, 2015). Passive light in Appia's scenography is the general illumination for the stage. The source is a fixed fixture on a batten. In contrast, active light is a new technique that Appia used to create 'choreography' and modulation of light, as in music, to transform the stage by varying its intensity, color, direction, and beam quality. This was a paradigmatic shift in theatre practice regarding lighting as a participant, making a fluid space choreographed through light and shadow (Palmer, 2015).



**Figure 2.** Appia's stage design for Orpheus, Hellerau in 1913, with active and passive light  
Source: Lucarelli, 2013

In our reading, the knowledge regarding light, shadow, and materiality of light affected architecture, especially in Le Corbusier and Scarpa, as suggested by Steane (Steane, 2012). There is an inherent difficulty in strategizing with daylight in Venice due to the narrow streets and alleys, blocking most of the natural light penetrating the buildings. The evolution from Appia to Scarpa involves using light as a co-player in narrating the architecture, specifically Scarpa's project Fondazione Querini Stampalia in Venice. Coincidentally, Palmer stated that Appia contributed to the term *mise en scène* (Palmer, 2015), precisely what Steane used to describe the strategy that Scarpa implemented in Fondazione (Steane, 2012).

To experience the Fondazione, one must use a bridge from the *campo* and enter through the entry hall with a raised walkway, designed by Scarpa, to permit the occasional flooding (*acqua alta* in November) into the building but only up to that point. The entry is the darkest room but offset with bright tiles, representing a choppy

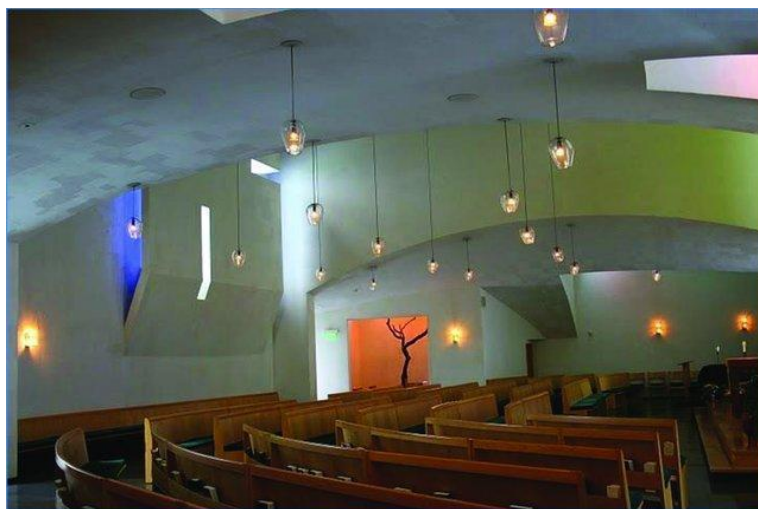
sea and a dark reflective ceiling acting as a subdued mirror. From the entry hall, one can choose between going left into the main exhibition hall with a brighter light or going right into the library stairs and the southwest room with a corner light in front of the portal and a hint of light behind it. The main exhibition hall is a low, dark room lined with stone and strips of zig-zagging copper on the floor and the walls. The idea of "borrowing light" from the garden is prominent in this space when the artificial lights on the wall are turned off. The choreography of light by Scarpa is subtle and accommodated to the Venice light and its city, creating a narration for Fondazione infused with its selection of materials and details.

### **From Aperture to Performance**

In *Five Points toward a New Architecture*, Le Corbusier stated that the whole history of architecture revolves exclusively around the wall apertures (Conrads, 1975; Murphy, Sosa, and Ahmad, 2021). This second shift of viewpoint focuses on the lighting knowledge where apertures initially are employed as a negation of material by transparent-material application (void) to permit light into a data collection, data-driven decisions in aperture design, and applications in architecture. One of the most striking aperture applications can be found in various Gothic churches by installing stained-glass windows. The windows were designed as such to carry narratives from the Holy Bible as well as to create architectural and lighting effects on the interiors of the church. The evolution of this strategy has been re-interpreted by Corbusier for his Chapel at Ronchamp. Corbusier's final design shows a shift in using light to show the window's stained glass and its reflection into the interior using light and colors as its narration without ornamentation. Aside from the fluid shape of the church, one of its most impactful design decisions from Corbusier is the design of the apertures on the south wall. One of his early sketches shows the study of the south wall with its different-sized apertures from the interior (Pauly & Le Corbusier, 2008). Another study of the apertures shows a section of the south wall colored black in contrast with the windows with different color hues. This interpretation of apertures by Corbusier as a response to side apertures from Gothic churches conveys a new spiritual meaning without a literal translation but using light as a medium of narration. Together with the form, the resulting dynamic light throughout the year creates a plastic relationship that focuses on the tension between asymmetry and balance, a tension between surface and space, and a tension between Interiority and spatial non-containment (Walker, 2012).

Springing off of Ronchamp, Holl's idea is to use reflected colors behind the apertures to convey his interpretation of Gothic churches apertures while at the same time using artificial lighting to convey meaning, not only from a specific wall location such as Ronchamp but spatially throughout. Using color as interpretation, Holl sketched a preliminary design for St. Ignatius Chapel in Seattle with the concept of "Seven Bottles of Light in a Stone Box." From the sketch, we can infer a different strategy from Holl regarding apertures for the chapel. Light not only penetrates from the side but from the top as well. From the interiors (Figure 3), we can only see the luminous effects on the wall since the actual apertures are blocked by another offset wall from the interior and painted with different colors corresponding to the Seven

Bottles of Light concept. A different spiritual dynamic was achieved using light as an integral part of the design from the early phase.



**Figure 3.** Interior of St. Ignatius Chapel, Steven Holl, 1997  
Source: Poon, 2018

Evolution from side to top aperture, almost no shift can be detected. While one conveys a particular narration from a particular religion, the top aperture conveys a majestic and powerful entity through the light without subscribing to any deity if one presumes that was the case. One magnificent example is the oculus of the Pantheon, which Robert Adam somewhat replicated in Kedleston Hall in 1765. Although using the same strategy, the light result and intention are pretty different for the two projects. Pantheon, with its scale, managed to convey a grand and almost mythical space through its light and Kedleston Hall, on the other hand, conveyed the aristocratic status of its occupants. Contrary to both projects, Kazuyo Sejima and Ryu Nishizawa from SANAA created two top apertures for Teshima Art Museum with a low and human scale for the visitors and combined with no furnishings and decorations; the architects successfully created a space for contemplating for oneself between the space and the visible sky above.

The evolution of the top aperture is carried further by Jean Nouvel for his Louvre Abu Dhabi, where the *entire roof* of the museum acts as a sunlight filter. This functional feature can be traced back to his previous project in Paris, the Arab Institute, which uses the pattern "mashrabiyya" as a device to block and filter sunlight as a side aperture. The effect from this roof aperture is an astonishing play of light and shadow where one can imagine the slow and poetic movement of the sun throughout the day, involving striations, idiosyncrasies, the sound of silence, synchronized harmony, ephemeral senses, and space in flux (Musfy, Sosa and Ahmad, 2021).

What if the aperture can have performative properties to the local sky condition of where it is located? It might be dynamic or designed to be wise, interacting, and adapting when and where it needs to. For Raffles City Hangzhou, U.N. Studio

designed ten different-sized apertures, creating four sets of patterns to withstand exposure to radiation and heat. The firm called it "façade fins," and analysis was done to study the shading depth and orientation of rotation of the fins. We argue that each fin might have its own "micro context" regarding its performative duties, an evolution of aperture from void to a calculating and calculating device.

Taking a cue from the previously mentioned "mashrabiyya," Aedas Architects designed Al Bahar Tower's façade to respond to Abu Dhabi's local climate. This case study shows how an aperture reacts and adapts to its locale environment, predicted and calculated beforehand to achieve the desired thermal comfort, an evolution of light transmission through apertures. An exoskeleton standing on its frame two meters away from the curtain wall, the façade was created by a triangular module with an origami-like module that can be opened and closed (Figure 4).



**Figure 4.** The module of Al Bahar Tower, Aedas, 2012

*Source:* <https://www.klcbs.net/2018/03/al-bahar-tower-abu-dhabi/>

The adaptability of the modules corresponds contextually with Abu Dhabi's climate, where the temperature can go as high as 37 degrees Celsius with zero chance of rain. Wrapping around the building, the modules create a dynamic representation of the tower while, at the same time, maintaining a responsive and performative layer throughout. From aperture to performance, light is a prime instigator for the advancement of architectural thinking and designing. As Brawne stated, light's effects are a palpable and inseparable component of architecture (Brawne, 2005), a playmaker (Palmer, 2015), and a sculptor (Graham, 2020).

### **From Material to Immaterial**

In this section, the evolution of light highlights the use of light as material in architecture to the effect of light in giving dis-information and misinformation to our process of seeing, whereas what we see might not be what we interpret, which this gap is manipulated by light. Using light as a building material is expected. Meier used that particular concept for his practice. In contrast, Holl used it for his project Kiasma

Art Museum in Helsinki (Descottes & Ramos, 2011), an evolution in design thinking by using something immaterial such as light as a material.

Holl's complete understanding of Finland's sky and light and his deft implementation of it as a building material created a space where there is a dialogue between the walls, the skylight, and the light permeating the space. Holl's complete trust in light as a material is also applied to Nelson Atkins Museum in Kansas City, Missouri. Completed in 2007, Holl envisioned the museum as shards of glass in a landscape. A system of "lenses" broken down as a T-wall shows Holl's light strategy and integration into the museum. It shows an idea of *focused light* under the glass façade on the upper left and non-focused inner light for the space below. The T-walls are elevated slightly to allow reflected light into the gallery below the garden. At the same time, the ceiling's border shows artificial uplight, which helps light up the lens during the night. Integrating natural and artificial light within architecture is consistent with Holl's philosophy: "*We conceive the space, light, and concept of work from the very beginning. Often in concept watercolors, the aspects of light are there in the first sketch, integral to the concept of architecture, unique to the site and place*" (Descottes & Ramos, 2011). The resultant interiors capture the light beautifully while maintaining a layered presence between the galleries, a capacitive light to reveal "materials as such" (Poerschke, no date). Complemented by soft, warm spotlights for the artwork, contrasted with the dark floor with subtle highlights and reflection with the white walls and the diffused exterior wall, the natural light in the space creates a sublime atmosphere and experience.

From the exterior, the translation of shards of glass creates a truly magnificent play of light against the backdrop of the landscape when viewed at night. The uniformity of artificial light from the "lenses" stands out as a beacon. While the light itself is immaterial and changes the materials of building (Brawne, 2005) and revealing their "ekstases of things" (Graham, 2020), it can be manipulated to challenge our perception of it, an evolution where light in its capacity to help navigate our surrounding but instead has a way to make us question what we see, to make us wonder, evaluate and re-evaluate what we encounter and sometimes, what we believe. We will examine light as immaterial based on J.J Gibson's definition of medium, substances, and surfaces and some examples to examine light's evolution from material to immaterial (Gibson, 1979). The characteristic of the medium, as defined by Gibson, is that a solid body can move through it without resistance. Thus it is a *medium for locomotion*. It is usually transparent and capable of transmitting light, and when it is homogenous, it affords vision.

Regarding light in the medium, *not as a medium*, Gibson states that the medium allows light to be transmitted *and* reverberated. That reverberation should reach a steady state since light is transmitted through the medium and absorbed by substances in the environment. That steady state is what Gibson calls *illumination*. Thus, as long as there is light (ambient at any point), then illumination *fills* the medium.

In the medium, *substances* do not transmit light freely and do not allow movement or locomotion. More or less rigid due to its resistance to deformation, impenetrable by solid bodies, and primarily permanent in shape. Although substances share the same characteristics mentioned above, they differ in hardness, viscosity, density, cohesiveness, elasticity, and plasticity (Gibson, 1979). As for surfaces,



Gibson defines them as the layout between medium and substance and proposes nine laws to characterize them (Gibson, 1979). Chromosaturation from Carlos Cruz-Diez provides a starting point for our discussion regarding light as medium, substance, or surface. Cruz-Diez's installation is a series of rooms with different colors of light that envelope the spaces, and the leakage of color from one room to another creates another combination. In this instance, we might rationally conclude that light is a medium due to our availability of locomotion.

By defining the light and the space with colors, Cruz-Diez attempts to alter our perception of space with the dichotomy of materialization and dematerialization. The walls create an exact boundary, but the combined colors between the spaces create shifting and ephemeral thresholds. The colors will affect viewers' perception since their retinas must adjust constantly. From Cruz-Diez, we can define the walls as space boundaries with our perception, but what if we define the boundaries through sound and light? An evolution without physical boundaries needed? However, the light is used to create the boundaries themselves. An *architect-ed* light, if we will, creates an irrational or ambiguity of form (Ando, 2016). This is what was investigated by Usman Haque with his installations Marling and Primal Source. Marling used the visitors' voices to invite spectators as actors to create a dynamic lighting performance showcasing an "intricate ceiling of animated color." The visitors can see planes of blue lights, a half-cylindrical tunnel (Figure 5), and strands of color floating in the air. The results were lighting effects that could be characterized as medium *and* surfaces, regardless of how fleeting the surfaces were.



**Figure 5.** Marling

Source: Haque, 2012

Marling is a different interpretation of sound and light, but a previous installation done by Haque in 2007 titled Primal Source tried to engage the visitors with the same strategy. Screams of the visitors were the primary source of power for Primal Source. Added with the music and large-scale outdoor water-screen/mist projection system, the visitors/voice actors created a light performance through the night in the City of Santa Monica, California (Figures 6, 7, 8).



**Figure 6.** Primal Source  
*Source:* Haque, 2008

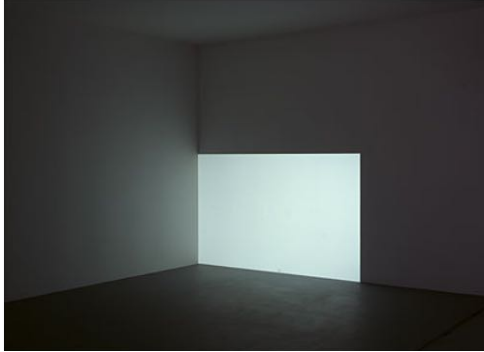


**Figure 7.** Primal Source  
*Source:* Haque, 2008

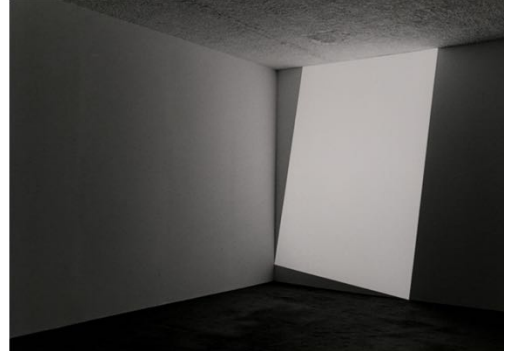


**Figure 8.** Primal Source  
*Source:* Haque, 2008

We argue that, with Marling and Primal Source, the visitors as voice actors created an architecture of surfaces through light and sound, which are quasi-materials according to Sadar (Sadar, 2018), however ephemeral. Shifting from challenging our physical boundaries of surfaces, an evolution from surface to the substance of immateriality through light is our next focus. Turrell's Projection Pieces actively questions and proposes light as surface or substance, although Adcock leans toward the latter (Adcock, 1990). In Ashby (1967), we see a rectangular and luminous surface, hinting at a source of light behind it (Figure 9). Projected onto an interior corner, visitors were confronted with a defined outline or geometric shapes. The same strategy was also used for Decker (1967), a rectangle positioned upright at an oblique angle (Figure 10).



**Figure 9. Ashby**  
*Source: Turrell, 1967*



**Figure 10. Decker**  
*Source: Turrell, 1967*

Turrell projected a white light in the middle of the intersection between the two walls, and its radiance shoots a pink color on the surface of the walls, ceiling, and floor. As for *Aurum* (Pale Pink), our eyes see a white hexagon with a line in the middle of the wall intersection, but our perception tells us that it is a perspectival cube floating in the space, anchored to the corner (Figure 11). Like *Aurum*, *Carn White* employs the same strategy with a slightly different twist: the light does not float but rests on the floor. Fooling our perception further, the reflection on the dark floor strengthens the illusion that a substance rests on the floor (Figure 12). This is where Turrell shines in his manipulation of light as described by Adcock; "his work is visual sensing, and he uses light not to disclose the observable structures of the world, but to demonstrate light's presence and power (Adcock, 1990).



**Figure 11. Aurum (Pale Pink)**  
*Source: Turrell, 1968*



**Figure 12. Carn White**  
*Source: Turrell, 1967*

By Coates' definition, the binary narrative is the one investing the object or 'situation' with a parallel identity – trans-function – that is a function of the mind, a transgression, a sublimation (Coates, 2012). The *Weather Project* best describes one such narrative, and a strong one, in our reading (Figure 13). One result that was so strong in suspending their function of the mind some stopped and laid down on the floor to enjoy the installation's sunset atmosphere, an evolution where light, however artificial, can impact and change behavior, behaving as a natural substance.



**Figure 13.** Visitors at Tate Museum during the Weather Project installation  
*Source: Jonze, 2018*

Conceived by Olafur Eliasson in 2003 and installed in Tate Modern in the Turbine Hall, it was created by hundreds of mono-frequency lamps in a semi-circular shape and mirrored on the border of the ceiling. The light produced is a substance in a conversation with its surroundings and influences its audience.

Light as a substance can be used to remember loss and tragedy. Every year around September 11th in New York, two powerful sets of lights were turned on to commemorate the event. Two beams of substantive light shoot upwards to the sky six blocks from the site of the World Trade Center attack, which act as a beacon and a hopeful reminder.

Light as a material or light as medium, substance, and surface, it is evident that light, its manifestations, including plasticity (Walker, 2012) and its capability to generate atmosphere (Graham, 2020), can create, challenge, and affect our vision, behavior environment, and perception to the fullest.

### **From Quantitative to Contemplative**

The final viewpoint argues for the role of light as a source of environmental information where safety and security are required to perform general and specific tasks at the optimum illuminance to the emotional experience that transcends the space and the architecture users. Once artificial lighting was discovered, there were attempts to rationalize and systemize lighting for productivity. One way to achieve this is by creating lighting standards. It has been determined that specific illuminance for certain tasks should be achieved, creating a theory of lighting uniformity based on

its quantitative measures. Those standards were used where people often spend the most during the day, such as offices, or where there is high traffic with high-velocity vehicles, such as roads. Security and safety lighting quantity for roads should be a premium affordance, while uniformity of brightness and visibility for productivity is valued for office spaces.

The evolution of quantitative lighting has progressed along with the advances of personal computers in office spaces. Guidelines and new standards have been developed regarding the orientation of desks to the lighting layout to diminish the glare from lighting reflected on the computer screen.



**Figure 14.** Viipuri Library, Alvar Aalto  
Source: Grozdanic, 2015



**Figure 15.** Bagsvaerd Church, Jorn Utzon  
Source: Jesydesigns, 2018

Aside from office space, there are spaces where quantitative lighting is required, such as a library. What is good reading light? One explanation is 'enough light from the right direction so that the fine detail of a text is intelligible and the page is sufficiently bright to be the reader's natural focus' (Steane, 2012). In addition, there are four principles of visual tasks in a library offered by Steane. One of them is 'looking but not seeing (daydreaming, inwardly reflecting)' (Steane, 2012), a slight evolution where lighting is not only used for the task at hand but reaching into an inner experience within a generic environment. We also define inwardly looking as contemplating. A library is partially a space for contemplation via the activity of reading. One such library project worth exploring is Viipuri Library from Alvar Aalto. Aalto defined his lighting for Viipuri as shadowless light to help with the visual concentration on a text (Steane, 2012) (Figure 14), which he pursued with the help of primitive sketches. According to Steane, the library was designed as 'an instrument for the interception and redistribution of light' (Steane, 2012). The same idea about shadowless light might have been what Utzon was thinking of for his Bagsvaerd Church, an evolution from an inner reflection within a simple task of reading to another where one contemplates his relationship to his Maker. While Aalto used uniform roof openings for Viipuri, Utzon used curved surfaces on the ceiling to manipulate the subtle graduations of light to achieve the effect of lightness (Brawne, 2005) (Figure 15). The inspiration for this design is the continuation of the Sydney Opera House using the idea of "roof vs. earthwork juxtaposition, where the pillars were omitted" and influenced heavily by the dualism aestheticism from Chinese architecture, inspired by the writing of Lin Yutang (Chiu *et al.*, 2019).

While shadow is seen to be 'extinguished' in Viipuri Library and Bagsvaerd Church, there is a concept of shadow that is worth highlighting, an evolution of thinking where shadow plays a prominent part in the culture and one's perception of his surroundings with one perfect example of umbral or threshold as a place of shadow in Portuguese (Steane, 2012). In his book, Tanizaki stated, 'If the light is scarce, then light is scarce, we will immerse ourselves in the darkness and discover its own particular beauty' (Tanizaki, 1977). In Japanese culture, shadows dominated society's perception before the invasion of modern electrical lighting. Tanizaki mentioned the firm idea of shadows within a Japanese temple, how an intense and spacious shadow occupies a significant part of a temple, making 'the entryway, doors, walls, and pillars all but invisible' (Tanizaki, 1977). According to Tanizaki, the pervasive inclusion of shadow in Japanese culture extends to the standard Japanese room, the theatrical performance of Nō and Kabuki, its paper selection for walls, its tea ceremony and lacquerware usage, and even its mythical ghost showing no feet.

Shadow is a place for contemplation to achieve tranquility, an evolution of thought regarding light as the opposite spectrum from previous case studies in Viipuri and Bagsvaerd. The idea of shadow is to allow our minds to fill in the gap, to fill in what is not seen or seen partially, to enhance the notion of suggestion, to have its independence as unreal (Graham, 2018), and combined, in our opinion, a powerful tool. This led Tanizaki to propose 'heavy shadows against light shadows' (Tanizaki, 1977). What is interesting is how Tanizaki put a quantitative measure for something that is not quantifiably possible. We have invented devices to measure the quantity of light, but currently, we need something to quantify the absence of light. We can, however, put our modern lux meter in a shaded or shadowy area but what we measure is the lesser quantity of light as opposed to measuring shadow itself. Within the Japanese temple, Tanizaki also suggested that shadow is where one loses oneself and forgets the passage of time, where dark and light are indistinguishable. Shadow is a place for contemplation to achieve tranquility, an evolution of thought regarding light as the opposite spectrum from previous case studies in Viipuri and Bagsvaerd.

An idea of 'half-light' emerges between shadowless light and heavy shadows vs. light shadows (Steane, 2012). This evolution tries to identify a balance, if any, of any potential lighting scenarios where it may contribute to the contemplative experience. On that has been mainly investigated by Steane for Siza's library at Viana de Castelo, Cruz's Los Pajaritos Chapel, and Poole House, while Hoffman did it for the characteristic of a sacred space: 'the semi-darkness that glimmers in vaulted halls, or beneath the branches of a lofty forest glade, strangely quickened and stirred by the mysterious play of half-lights, has always spoken eloquently to the soul' (Crosbie & Hoffman, 2010).

We believe that 'half-light' is particularly essential for contemplation, and two such spaces are Krematorium Baumschulenweg and Bruder Klaus Chapel. The atrium of the Krematorium, consisting of columns with irregular spacing and light openings, presents a space where we are invited into the silence of the walls and the contemplative nature we are ushered into (Figure 16). The cavernous tranquility of the space and the solemnity of the light creates a space suited for contemplation.

In a much smaller scale project, Bruder Klaus Chapel integrates the half-light concept by top aperture as with Krematorium, albeit a singular one, and it is set at the



end of the space as opposed to the central space in the Krematorium. The sliver of light from the opening leads to a circular room a few steps away, where one can sit and contemplate the light above (Figure 17).



**Figure 16.** Krematorium Baumschulenweg  
*Source:* Gunawan, 2008



**Figure 17.** Bruder Klaus Chapel  
*Source:* Divisare, 2017

## RESULTS AND DISCUSSION

From the four evolutions above, we have seen the light's power, dynamic, and serenity. The knowledge gap identified as the use of lighting to create plastic happenings with the addition of the thinking of light as a medium, surface, or substance can provide a new platform for idea exploration in architectural spaces. Sky knowledge is pertinent as one's understanding of the sky provides a foundational approach to design and architecture. Brightness, contrast, reflection, and shadows dominate in inventing a space full of dynamic narration, where one's participation is anticipated and encouraged. Light is viewed as a medium; substance and surfaces are a basis for challenging our perceptions and questioning the gap between what we see and interpret—using light as a material and immaterial as material produces poetic spaces that are etched in our memory due to our incomplete understanding, which forces us to re-evaluate our reading and interpretation constantly. Technological advances give us a performative aperture from its beginning as a simple opening to transmit light and air into adapting and manipulating light to give better thermal comfort and modulation of light as needed. Application of lighting standards to have a minimum platform for quantitative lighting is required from standard tasks to high intensity, high concentration procedures evolve into light and the play of shadow, which can also sweep and ushers us into a state of contemplation, losing oneself in a passage of time or even elevating one's spiritual repose into another dimension previously untouched.

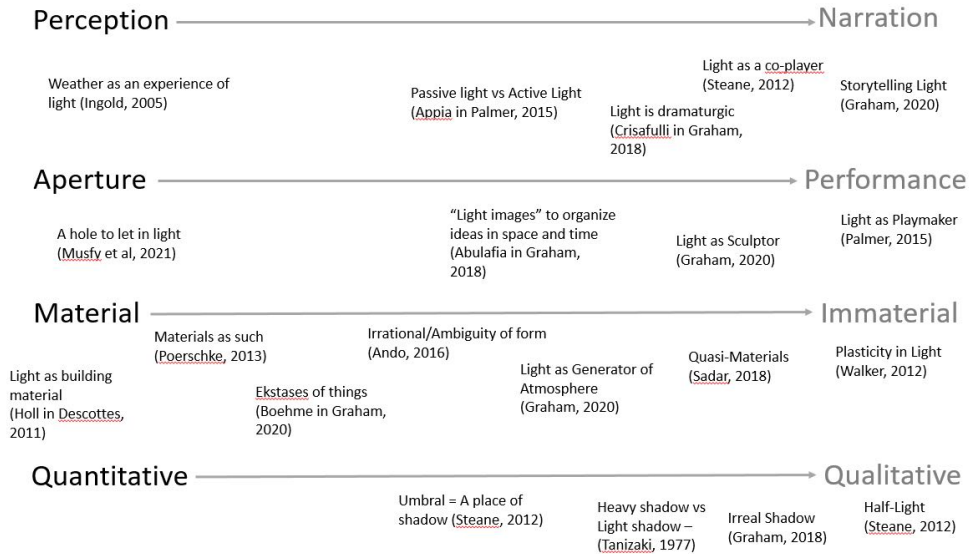


Figure 18. Diagram of tracing of lighting design evolution in architecture.

Source: Authors, 2021

## CONCLUSIONS

The findings reveal the many manifestations of light and shadow as part of the design discourse in architecture. Lighting can be regarded as a subject matter for inner reflection on our perception and spirituality, as an object to be manipulated, and as a tool to create atmospheres, narration, and multiple interpretations, in addition to the performative value of lighting for everyday tasks, safety, and security.

This study expands the current understanding of light by showing that the eternal calibration and tension between light and shadow provide many approaches in architectural design. In addition, this study also raises further questions on the multitude of expressions of architecture based on its play of light and shadow that have yet to be explored and discovered.

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