

**The Evolution of Spatial Understanding:
From Cubist Painting to Phenomenal Transparency in Architecture**

A Thesis

Submitted to the Faculty of Architecture and Built Environment

Delft University of Technology

Master of Architecture, Urbanism, and Building Sciences

by Wenxuan.Zhang

April 16, 2025

1. Introduction

In *Transparency: Literal and Phenomenal*, published in 1963, Colin Rowe and Robert Slutzky introduced the concept of phenomenal transparency, suggesting that transparency should be understood as a broader spatial order and a perceptual effect rather than merely an optical illusion. Their essay established an initial connection between Cubist paintings and early 20th-century Modernist architecture through examining the complexity of spatial experience. Building on this notion, this thesis aims to further explore the development of spatial understanding within Cubist paintings and its translation and effect in architecture.

This thesis will begin with a general overview of the transformation in spatial perception of the early 20th century artists, tracing its evolution from Post-Impressionism to Synthetic Cubism paintings. The second chapter will focus on the analysis of representative paintings from the Cubist movement, aiming to extract the fundamental interpretations of space during this period. This will be followed by an examination of architectural case studies, illustrating how these concepts were translated from the two-dimensional surface into the three-dimensional physical world.

2. Evolvement of Spatial Understanding in Cubist Artwork

2.1 From Impressionism to Cubism: The Disintegration of Colour and Line

Since the rediscovery of the rules of perspective during the Renaissance, the primary focus of painting has been the precise replication of natural landscapes. Artists sought to present their control over nature through the study and application of scientific and technological techniques (Gyorgy, 1944, p. 93). Impressionism, with its emphasis on intuitive perception and the freshness of appearances, is considered the initial step towards abstract art (Museum of Modern Art & Barr, 1936, p. 20). In Neo-Impressionism, the trace of brushstrokes became more visible, which could be interpreted as an early attempt to disintegrate colour and line, a notable example of this approach is Seurat's study draft for *Invitation to the Sideshow* (Fig.1). A few years later, such transformation was further developed in Gauguin's artwork, where the human body is flattened into simplified colour fields with clearly defined edges, emphasised by bold black outlines (Fig.2). Although the single-perspective rule still dominated paintings of this period, the distortion of form inevitably led to the corresponding distortion of space.



Fig.1 Seurat: Study for "Invitation to the Sideshow" (1888)

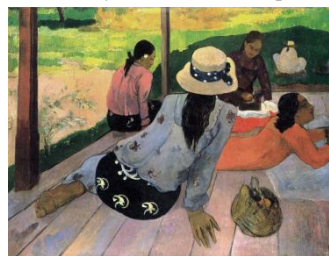


Fig.2 Gauguin: The Midday Nap (1894)

2.2 Breakdown of Perspective

In Paul Cézanne's late work he started to geometrize the disorder of nature, gradually abandoning the expression of deep space, which has made a great influence on the later Cubist artists (Museum of Modern Art & Barr, 1936, pp. 26 - 30). Under his influence, Cubist artists began to reconsider spatial relationships on the two-dimensional plane, the conclusion was reached that the single-point perspective was a constructed illusion that should be abandoned. This shift could be indicated by *The Terrace at the Hôtel Mistral* (Fig.4) painted by Barque in 1907 and *House on the Hill* painted (Fig.5) by Picasso in 1909, both of which show certain resemblance to Cézanne's *Montagne Sainte-Victoire* (Fig.3). During this transitional phase, a new spatial paradigm had not yet been fully established; instead, traces of experimentation with spatial interpretation can be observed in the artists' work. In *The Terrace at*

the Hôtel Mistral, linear perspective is entirely eliminated by flattening buildings and natural elements into colourful planes, outlined with bold contours. Meanwhile, in *House on the Hill*, created after *Les Demoiselles d'Avignon* (widely recognised as the first Cubist painting), the forms of houses are even more distorted.



Fig.3 Cézanne: Montagne Sainte-Victoire (1906) Fig.4 Braque: The Terrace at the Hôtel Mistral (1907) Fig.5 Picasso: House on the Hill (1909)

2.3 Simultaneity and Overlapping

Between 1906 and 1912, Analytical Cubist paintings underwent a series of explorations into spatial representation. The simultaneous depiction of multiple viewpoints resulted in an overload of spatial information and the chaotic composition on the picture plane. Such challenges demanded a more refined approach to spatial expression, marking a period in which investigation of spatial structure reached its peak. As a result, the techniques of overlapping and interpenetration were introduced (Gyorgy, 1944, p.100-102). As seen in Braque's *Still Life with Harp and Violin* (Fig. 6), the outlines of the instruments are almost unrecognisable at first glance, lines and planes were no longer directly derived from the physical contours of objects, instead, they were intentionally deconstructed and rearranged to construct a new spatial logic within the painting. Furthermore, as the subject matter shifted from natural landscapes to manmade objects, the use of colour was gradually reduced, allowing greater emphasis on spatial construction.



Fig.6 Braque: Still Life with Harp and Violin (1911)

2.4 Intuitive Presentation and Materialization

As Cubism transitioned from the Analytical to the Synthetic phase, artists no longer seemed satisfied with exploring space solely within the confines of the canvas. On one hand, Braque, Picasso, and Gris pioneered the use of collage, incorporating fragments of various materials (Fig.8, Fig.10). This technique can be seen as an introduction of real space into the painting, as there exists a tangible gap between the layered fragments (Kotob, 1991, p.21). On the other hand, artists such as Delaunay moved towards a more intuitive representation of space. His *Simultaneous Windows* (Fig.7) clearly demonstrates an intention to engage the spectator's perception as an integral part of the composition. At this stage, the boundary between the two-dimensional and three-dimensional worlds became increasingly ambiguous. Cubist paintings began to resemble architectural practices in their approach of spatial construction.

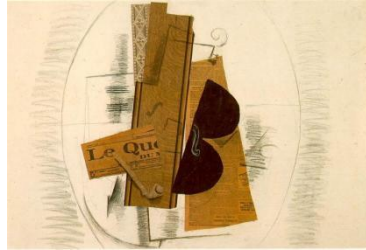
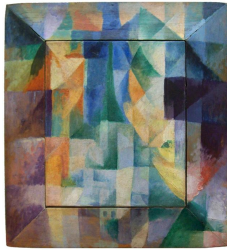


Fig.7 Delaunay: Simultaneous Windows (1912) Fig.8 Picasso: Guitar (1912) Fig.10 Braque: Violin and Pipe (1913)

3. From Transparency to Phenomenal Transparency

3.1 Space Analysis of Object

Around the turn of the 20th century, new technologies, devices, and products were evolving at an unprecedented speed. On one hand, the mechanical nature of social and economic structures gradually became overwhelming to humans. On the other hand, the popularization of technologies such as the camera and X-ray expanded the possibilities for painters to investigate themes beyond the precise depiction of reality. Consequently, fearing the loss of individuality, artists in the early 20th century sought to explore the spatial characteristics of industrial products to gain a deeper understanding of themselves (Gyorgy, 1944, pp.93-95).

During the process of exploration, artists came to realize that the literal depiction of the three-dimensional world, as developed during the Renaissance, was insufficient in conveying the essence of objects. Paul Cézanne, as a post-impressionist painter, is widely regarded as one of the most influential figures in the emergence of Cubism. Although Cézanne never intended for his work to be abstract, his efforts to convey the intuitive perception of objects led him to recognize that new principles of selection, emphasis and organization needed to be established to more accurately express their intrinsic nature (Donnell-Kotrozo, 1979, p.99). In his late work Mont Sainte-Victoire (Fig.3), a tendency toward extreme simplification is evident. Rather than depicting the landscape with precise forms, trees, houses, and the mountain are rendered through bold, opaque, and contrasting colors. The reduction of distinct linear outlines further suppresses the sense of depth compared to his earlier works, as the foreground, middleground, and background are fused into a cohesive composition. While Cézanne introduced crucial innovations in the rendering of space, according to Richardson and Braque (1959, p.10), he did not formalize his ideas into a systematic application. This is evident in the detailed depiction of houses in his paintings, which still adhere to traditional spatial rules. Nevertheless, Cézanne's approach to representing spatial relationships in nature had a profound influence on later Cubist artists, including Braque and Picasso.

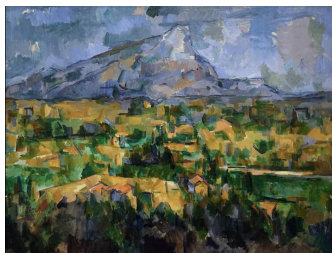


Fig.3 Cézanne: Montagne Sainte-Victoire (1906)

As the Cubist movement entered its initial phase, the idea of representing the essence of objects became increasingly clear among artists. As Braque (1959, p.10) stated, "Scientific perspective is nothing but eye fooling illusionism. Perspective is too mechanical to allow one to take full possession of things." In contrast to Impressionism, which sought to capture the freshness of the painter's view, Cubism artists aimed to eliminate all the accidental factors from their work. Consequently, transient elements in nature gave way to more enduring

subjects, such as architecture and still-life compositions (Kahnweiler, Gris and Cooper, 1947, p.110). This transition could be observed from Picasso's early work *House on the Hill*.

During the summer of 1909 in Horta de Ebro, Picasso took a series of photographs to explore the composition and spatial relationships of the landscape (Statton, 2012, pp.10-13). The resulting painting, *House on the Hill* (Fig.5), bears a strong resemblance to Cézanne's work, particularly in its flattened elements and the merging of foreground houses with the background mountain. However, unlike Cézanne's approach, where trees and mountains tend to dominate more than half of the canvas, the natural landscape was pushed to the upper marginal area of the painting. Moreover, the houses were distorted and intersect at various angles, completely breaking away from the unifying principles of linear perspective, as if Picasso was trying to present every surface of the houses as much as possible.



Fig.5 Picasso: *House on the Hill* (1909)

This painting represents Picasso's early attempt to depict three-dimensional objects on a two-dimensional plane by integrating multiple viewpoints. While the use of multiple perspectives later became a fundamental technique among Cubist artists in their pursuit of representing the objects' truth, it also introduced challenges. As Gyorgy (1944, pp.98-102) asserts, breaking conventional spatial rules resulted in two major difficulties: an overwhelming abundance of spatial data and the chaotic plastic energies. These issues were later addressed through the overlapping of planes and the rhythmic linear control of surfaces.

The Cubist movement introduced a new perspective on the aesthetic qualities of architectural space. With the idea of pursuing clarity in spatial expression, space was no longer regarded as unbounded volume; instead, the interwoven relationships between different building elements started to be emphasised by architects. For instance, Josef Gočár, who is considered to be one of the earliest architects to employ the conceptual method of the Cubism movement, proposed that the structural framework should be highlighted clearly within a complex geometric volume of a building (Chizzoniti, 2017). Such notion is further enabled by the advancements in glass and steel construction technology, a notable example is the Bauhaus building in 1926, where the large glass façade provides a direct and objective presentation of the interior information of the building.

Furthermore, the architectural exploration of spatial relationships was not limited to the indoor-outdoor connections achieved through literal transparency. Le Corbusier, the pioneer of modern architecture, held a contradictory attitude towards Cubism. On one hand, he dismissed the distortion and overlapping planes as ornamental techniques that should be eliminated in architectural project. On the other hand, as the founder of the Purism movement, he acknowledged the analytical approach to spatial representation developed by Cubist artists, as expressed in his 1918 manifesto *After Cubism*. This influence is evident in his paintings, such as *Still Life* (Fig.11). The simplification of object into basic geometric form, the suppression of depth and the arbitrary color choice are all typical Cubist techniques. However, unlike the irregular grids often found in traditional Cubist compositions, a more regulated axonometric view is applied to create a more logical spatial arrangement. The circular top of the white cylinder overlaps with the round opening of the guitar, demonstrating Le Corbusier's

deliberate consideration of objects' placement and hierarchy, such emphasis on spatial sequencing is also reflected in his architectural work, Villa Savoye (Kotob, 1991, p.43-45).



Fig.11 Le Corbusier: Still Life (1920)

3.2 Space-Time Thinking

As Michelis (1949, pp.75-77) suggested, the concepts of space and time are inherently inseparable from each other for artists. The isolated demonstration of either concept would result in chaos or impenetrability, but it was not until the Cubist movement that this coexistence was systematically recognized in artistic practice. As previously discussed, the desire to capture the spatial essence of objects led to the adoption of multiple perspectives. This technique of simultaneity can be categorized as either "representing different moments within the same space" or "depicting multiple spaces at the same time".

To begin with, in Picasso's *L'Arlésienne* (Fig.9), the figure's body parts are simplified into geometric shapes and fragmented into interpenetrating pieces. Rather than using solid lines to define contours throughout the painting, Picasso relies on the interplay of opposing light and shadow to create a sense of transparency in the overlapping forms, giving the impression of multiple figures superimposed on the canvas. The only solid lines appear in the depiction of the woman's face, which simultaneously presents both a profile and a frontal view. The use of multiple perspectives in this painting extends beyond a comprehensive visual analysis of the figure. Picasso sought not only to depict her physical form but also to convey her personality to the spectators. As a result, what the viewers see is a carefully selected sequence of moments from the subject's life by the painter, integrated into a single symbolic composition to express her psychological complexity (Michelis, 1949, p.83).



Fig.9 Picasso, *L'Arlésienne* (1912)

In *The Musician's Table* (Fig.12), the composition can be understood as two interrelated layers. The guitar, vase, and statue form the first composition, while the table, chair, and canvas constitute the second, integrating with the first. If space and time are experienced through bodily movement, the structure of perception could be described using the concept of foreground and background (Pedragosa, 2014, pp.750-751). From one perspective, the first composition appears as the dominant form, functioning as the foreground, while the second composition represents what the spectator has perceived or will perceive, serving as the background. As the viewer's perspective shifts, the relationship between foreground and background dynamically changes. Through Gris's spatial sequencing, the depicted objects simultaneously function as both the subject of the painting and its contextual elements. Such conceptual approach is closely aligned with circulation design in architectural projects.



Fig.12 Juan Gris, The Musician's Table (1926)

The exploration of space and time in Cubism also made an impact on architectural design of the same period. As the imaginary movement in two-dimensional plane became realistic in three-dimensional world, the focus of architects was put on the movement of visitors within the building. While glass facilitated an expanded visual experience, spatial perception was not solely dependent on direct sight—memories of previously encountered spaces allowed vision to metaphorically pass through walls. The overlapping impressions of spaces experienced along a circulation path created a layered perception of the environment (Michelis, 1949, p.81). Consequently, it became essential for architects to carefully control what could be seen from each vantage point within a building.

Taking Le Corbusier's Villa Stein as an example, its façade initially appears as a single flat plane when viewed from a distance (Fig.13). However, as the spectator approaches, the extending stairs and first-floor platform, along with the depth of the double-height space, becomes apparent. Upon entering the building, it is revealed that the double-height space is not merely a cubic volume carved out of the overall mass but rather a courtyard illuminated by a skylight. Various spatial elements are arranged within the compact volume of the building, and their interconnections gradually unfold through the movement of the spectator (Simic, 2006, p.65). Moreover, similar to his use of a single contour line to define two distinct geometric forms in his paintings, Le Corbusier was highly conscious of the fact that a wall could simultaneously belong to two entirely different spaces (Simic, 2006, p. 64). This awareness is evident in his frequent use of curved walls in architectural projects. As visitors move around these spaces, they experience overlapping impressions of contrasting spatial qualities between interior and exterior.



Fig.13 Le Corbusier: Villa Stein (1928)

3.3 Complexity of Perception

Due to its fundamental emphasis on fragmentation and movement, Cubist artwork tends to increase the complexity of perception. The technique of defamiliarization requires spectators to use their intellectual tools to reconstruct the image through a logical path, the memory and personal experience is also engaged into the process of interpretation (Toschi, 2016, pp.43-45). Compared to earlier artistic styles, Cubism fosters a deeper emotional connection between artists and audiences. Many Cubist artists had expressed the intention to make their work more approachable to viewers. For instance, Barque (1959, p.10) once criticised the linear perspective for "forcing the objects in a picture to disappear away from the beholder instead of bringing them within his reach".

Delaunay's *Simultaneous Window* (Fig. 7) serves as a case in which the perceiver plays a crucial role in shaping the spatial construction of the painting. When observing the artwork, the first recognisable element emerging from the mosaic of colours is the Eiffel Tower, followed by the residential buildings with small windows in the lower part of the canvas. Eventually, the outline of a face—defined by one ear, the lips, and the chin—becomes apparent, which raises a question in the spectator's mind: Is this painting a depiction of the cityscape viewed through a window? During the process of interpretation, the viewer attempts to combine what is seen with previous knowledge, allowing memories of past experiences to interweave with the information provided in sight. As the brain supplies the spatial context implied within the painting, the two-dimensional image transforms into a three-dimensional experience of everyday vision (Hughes, 2002, pp. 88-91). Thus, *Simultaneous Window* is not merely a representation of the transparent quality of glass, rather, it is a depiction of the act of looking itself. In addition, Delaunay extended his painting beyond the boundaries of the canvas onto the frame itself. By doing so, he simultaneously emphasises and negates the presence of the frame, as the cityscape continues onto it, creating the illusion of transparency. Through this approach, Delaunay establishes a shifting position for the spectator. The world he depicts could be independent of the viewers and actively engaging with them at the same time (Hughes, 2002, pp. 96-99).

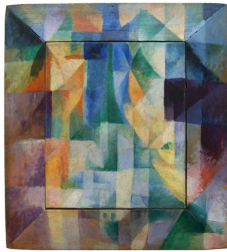


Fig.7 Delaunay: *Simultaneous Windows* (1912)

In the case of Villa Stein, there is a deliberate intention to enhance the complexity of perception. Different from the previously discussed idea that a spectator's experience changes through movement, this building also offers visitors the opportunity to actively interpret its spatial composition. On the façade, Le Corbusier incorporated a longitudinal glazing with almost the same height as the wall surface, leading spectators to assume a horizontal spatial extension within the interior. However, an examination of the second-floor plan (Fig.14) reveals that the internal wall divisions are positioned perpendicular to the direction of the window's expansion. The spatial structure of the building proves to be more complex than it initially appears. As visitors' assumptions are continuously challenged, they are encouraged to further explore and reinterpret the spatial composition (Rowe & Slutzky, 1963, pp. 50-51).

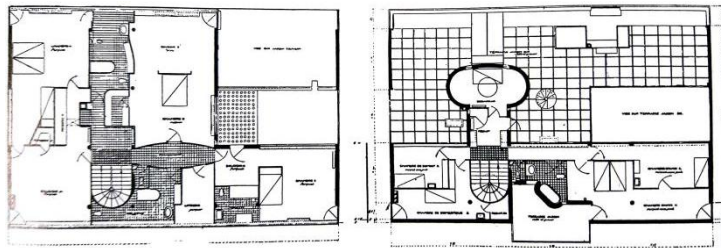


Fig.14 Le Corbusier: Villa Stein (1928) Plan

Although the use of colour was minimised during the Analytical phase of Cubism to emphasise experiments with spatial composition, it was reintroduced into Synthetic Cubism with greater intentionality. Artists such as Delaunay and Juan Gris believed that coloured, luminous planes could be used to break the homogeneity of objects as a solid physical entity, dissolving their physical boundaries and reintegrating them with their surrounding

space (Chipp, 1958, p.59). Under the influence of Cubism, the role of colour in shaping space began to attract increasing attention from architects, though their attitudes towards its application varied. Architects such as Charles Gwathmey used bright colours to enhance the planar quality of façades. In contrast, Le Corbusier believed that colour could disrupt the stability of basic geometric forms. As a result, he primarily only applied colour to interior spaces in his work to indicate spatial hierarchy and emphasise the sequence of movement (Simic, 2006, pp.67-68). However, in his later work, Ronchamp Chapel, the curved roof was left in its natural brown concrete rather than painted white like the other building elements, thereby enhancing the sense of interpenetration of the whole building complex.

3.4 Phenomenal Transparency

As the Cubist movement faded with the onset of war, its influence on architecture persisted. Inspired by the optical techniques in Cubist paintings, Colin Rowe and Robert Slutzky published the essay "Transparency: Literal and Phenomenal" in 1963. In this work, they draw parallels between Cubist paintings and modernist architecture, particularly in their manipulation of spatial perception. However, the article defines a clear distinction between literal and phenomenal transparency, describing the former as purely objective and lacking potential to interpretate, while the latter allows multiple layers of reading. However, based on previous discussion, the spatial innovation of Cubist paintings is not solely dependent on whether there is expression of materiality. Transparent material could also engage with the depth of spectators' perception. Three fundamental concepts underpin the interpretation of space in Cubist paintings: the spatial analysis of objects, the exploration of the space-time relationship, and the interaction between the spectator and the artwork. Phenomenal transparency can be considered an outcome of these interwoven concepts, translated from two-dimensional representation in painting to three-dimensional architectural design.

The Gwathmey Residence and Studio (Fig.15), designed by Charles Gwathmey in 1965, serves as a notable example of the application of phenomenal transparency. Strongly influenced by the work of Le Corbusier, the residence shares several similarities with Villa Stein (Deamer, 2001), including the extended entrance stairs and the double-height void on the façade. At first glance, the building appears as a composition of geometric forms, generating various superimposed views. Although true multiperspectival representation is impossible in the physical world, Gwathmey made deliberate efforts to present the composition as a unified whole. Two cylindrical volumes are inserted into the cubic form, with their curved surfaces blurring the boundaries of the structure. By situating one of these cylinders at the eastern corner (Fig.16), it is visually attributed to two adjacent surfaces, reinforcing the continuity between the south-east and north-east façades (Apostolou, 2016). To further minimise the perception of depth, a prominent column was strategically placed within the double-height space above the terrace, while the wall on the left side of this void was partially removed. This design choice allows the column to be visible from both the south-east and south-west façades, strengthening the sense of spatial integration.

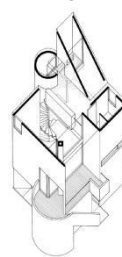


Fig.15 Charles Gwathmey: The Gwathmey Residence and Studio (1965) Fig.16 Charles Gwathmey: The Gwathmey Residence and Studio Axonometric Drawing (1965)

In addition to formal composition, the materiality of the façade was carefully considered to enhance the complexity of perception. Glass was employed not for its transparency but for its reflective planar quality, which contrasts with the solidity of the structure. The presence of the living room is subtly hinted at through the large reflective surface on the façade, while a bold yellow window frame, penetrating the middle of the glass plane, appears to suggest a division between floors. Other bright colours, such as white and red, were also applied to further emphasise the planar quality of the design.

In general, the enduring influence of Cubism on architecture is evident in its spatial explorations, which were later conceptualised through phenomenal transparency. Gwathmey's Residence and Studio exemplifies this transition, integrating the layered perspectives and perceptual complexity into built form.

4. Conclusion

In the first chapter of the thesis, a chronological examination of the Cubist movement reveals a clear evolution in the representation of space. Cubist artists explored the translation of spatial relationships from the three-dimensional world onto a two-dimensional plane, beginning with the abstraction of geometry, progressing into the rebel against the linear perspective, and ultimately culminating in techniques such as overlapping and distortion, which were reintroduced into reality through experiments with collage. Among the many innovative ideas and lasting influence brought by Cubism to the art world, 'phenomenal transparency' is the most representative one when concerning architectural space, as 'transparency' represents an optical phenomenon that cannot be fully replicated within the two-dimensional plane, just like perspective. Although Cubist artists rejected the linear perspective system developed during the Renaissance, their effort at that period could similarly be viewed as an attempt to deconstruct visual perception, which eventually inspired the new way of examining and reconstructing the three-dimensional built environment.

Then, through a more detailed examination on the representative Cubist paintings, three conceptual ideas could be extracted: the spatial analysis of objects, the exploration of the space-time relationship, and the interaction between the spectator and the artwork. Paintings by architects, along with architectural case studies from the same period, provide evidence that these conceptual ideas also played a dominant role in the architectural design process of the early 20th century. While Cubism was a stylistic movement confined largely to the 1910s and 1920s, its spatial logic endured in architecture through continuous reinterpretation. Influenced by advancements in building technology and the demands of contemporary contexts, they were continuously adapted by architects. As a result, the three key concepts were merged into a singular idea "phenomenal transparency" which was later interpreted in various ways by architects across different periods.

Reference:

1. Apostolou, M. A. (2016) "Phenomenal Transparency in Architecture : The case of Victor Horta," *ICTA 2016-International Conference on Transparency and Architecture-Emerging Complexities*. pp.310-319. Available at: <https://shs.hal.science/halshs-01798534>
2. Chipp, H.B. (1958) "Orphism and Color Theory," *The Art Bulletin*, 40(1), pp. 55–63. Available at: <https://doi.org/10.2307/3047747>.
3. Chizzoniti, D. G. (2017) "The structure of space: cubism and modernism. Figures and icons in Josef Gočár's work," *Journal of Architecture and Urbanism*, 41(1). Available at: <https://doi.org/10.3846/20297955.2017.1296793>.
4. Deamer, P. (2001) "Structuring Surfaces: The Legacy of the Whites," *Perspecta*, 32, p. 90. Available at: <https://doi.org/10.2307/1567286>.
5. Donnell-Kotrozo, C. (1979) "Cézanne, Cubism, and the Destination Theory of Style," *Journal of Aesthetic Education*, 13(4), pp. 93–108. Available at: <https://doi.org/10.2307/3331753>
6. Hughes, G. (2002) "Coming into Sight: Seeing Robert Delaunay's Structure of Vision *," *October*, pp. 87–100. Available at: <https://doi.org/10.1162/016228702320826461>.
7. Kahnweiler, D.H., Gris, J. and Cooper, D. (1947) *Juan Gris : his life and work*.
8. Kepes, G. (1944) *Language of vision*. Chicago: Theobald.
9. Kotob, B. (1991) *Spatial layering, an effect of Cubist concepts on 20th century architecture*. dissertation. [Massachusetts Institute of Technology]. Available at: <https://dspace.mit.edu/handle/1721.1/67730>
10. Le Corbusier (1937), "The Quarrel with Realism," *Circle international survey of constructive art*. New York: E. Weyhe.
11. Michelis, P.A. (1949) "Space-Time and Contemporary Architecture," *The Journal of Aesthetics and Art Criticism*, 8(2), pp. 71–86. Available at: <https://doi.org/10.2307/426589>.
12. Museum of Modern Art (New York, N.Y.) and Barr, A.H. (1936) *Cubism and abstract art : painting, sculpture, constructions, photography, architecture, industrial art, theatre, films, posters, typography*. New York, Boston: Museum of Modern Art ; Distributed by New York Graphic Society.
13. Richardson, J. and Braque, G. (1959) *Georges Braque*. [Harmondsworth, Middlesex]: Penguin Books.
14. Rowe, C. and Slutzky, R. (1963) "Transparency: Literal and Phenomenal," *Perspecta*, 8, pp. 45–54. Available at: <https://doi.org/10.2307/1566901>.
15. Simic, A. (2006) *Le Corbusier's purist period and the concept of truth in architecture*. dissertation. University of Cincinnati. Available at: http://www.ohiolink.edu/etd/view.cgi?acc_num=ucin1155728763.
16. Pedragosa, P. (2014) "Multiple Horizons: Phenomenology, Cubism, Architecture," *The European Legacy*, 19(6), pp. 747–764. Available at: <https://doi.org/10.1080/10848770.2014.949970>.
17. Statton, D. (2012) *The 'anti-photographic' photography of Pablo Picasso and its influence on the development now known as Cubism*. dissertation. [Louisiana State University]. Available at: <http://etd.lsu.edu/docs/available/etd-11152012-113952/>.
18. Toschi, C. (2016) "The Role of Time in Art Reading: Cubism and Futurism," in *Time, Space and the Human Body*, pp. 41–52. Available at: https://doi.org/10.1163/9781848884922_006.

Reference Artwork

1. Seurat: Study for 'Invitation to the Sideshow' (1888-1889)



2. Gauguin: The Midday Nap (1894)



3. Cezanne: Montagne Sainte-Victoire (1906)



4. Braque: The Terrace at the Hôtel Mistral (1907)



5. Picasso: House on the Hill (1909)



6. Braque: Still life with harp and violin (1911)



7. Delaunay: Simultaneous Windows (1912)



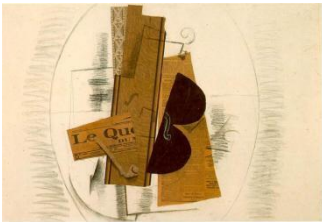
8. Picasso: Guitar (1912)



9. Picasso, L'Arlesienne (1912)



10. Braque: Violin and Pipe (1913)



11. Le Corbusier: Still Life (1920)



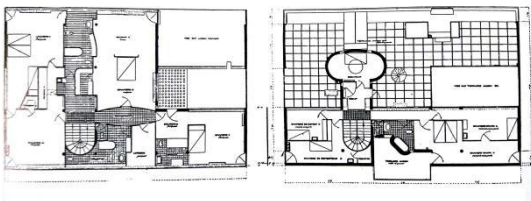
12. Juan Gris, The Musician's Table (1926)



13. Le Corbusier: Villa Stein (1928)



14. Le Corbusier: Villa Stein (1928) Plan



15. Charles Gwathmey: The Gwathmey Residence and Studio (1965)



16. Charles Gwathmey: The Gwathmey Residence and Studio (1965) Axonometric Drawing

