Reinterpretation of S. Giedion's Conception of Time in Modern Architecture
– Based on his book, Space, Time and Architecture

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Abstract
S. Giedion's Space, Time and Architecture is a remarkable accomplishment in that it provides a theoretical basis of modern architecture. The book plays a very important role in helping us understand modern architecture, even though it was written in 1941. In this book, Giedion presents a definition of modern architecture as the realization of a new space concept, "space-time." This is remarkable in that it tries to explain a change in the traditional notion of space; even more, it actually contains the notion of time in architecture. Giedion founded the new space concept; space-time in modern science, art and architecture on the basis of "Zeitgeist." He tried to explain the concept, space-time in modern architecture, in two respects; simultaneity and movement. However, considering the fact that the characteristics of time and the method of expression in art and architecture are different, simultaneity and movement cannot be regarded as the same notion in art and architecture. Thus, his new space concept, space-time, should be reconsidered as an expression of a new concept of space derived from the concept of a dimensional evolution, not as an actual adaptation of time. Finally, further critical and analytical approaches to time in architecture should be followed for more concrete development of this critical concept in architecture.

Keywords: Space-time; time; S. Giedion; Space; Time and Architecture; modern architecture

1. Introduction
Sigfried Giedion's Space, Time and Architecture formed the groundwork for building up a theory of modern architecture,1 addressing how modern architecture after 1910 has created a new tradition and corresponded to requests of the time, and accordingly has great significance in the history of architecture. In his book, Giedion asserts that a new space concept, "space-time," could be found in modern science, arts (particularly painting)2 and architecture since 1910. According to him, space-time is a fundamental concept that differentiates modern painting and architecture from earlier works (p.14).3 The space-time concept represents the combination of time and space, which previously were understood as separate concepts. This shows that architecture, which previously had its main emphasis on space, begins to focus on time as well.

In architecture, while "space" has been studied by numerous historians and theorists, "time" has received much less attention. In this respect, space-time not only functions as a fundamental concept for Giedion to understand modern architecture, but also as an initiator to highlight the importance of "time" in architecture. Despite the significance of the space-time concept, there have been few further studies of it, raising the necessity for it to be reinterpreted and evaluated. In particular, the way Giedion has interpreted time in modern architecture can be related directly to the way architecture deals with time. Accordingly, this study takes a closer look at Giedion's Space, Time and Architecture with its understanding of space-time, particularly with regard to how Giedion interprets "time."

2. Space-Time in Space, Time and Architecture
2.1 Background of Space, Time and Architecture
Giedion mentions the importance of "zeitgeist" to historians, particularly to architectural historians, in part I of Space, Time and Architecture (p.18). In the introduction, he divides the space concept into three levels, regarding each level as an evolutionary developmental process. As zeitgeist and dimensional evolution serve as backgrounds to Giedion's view concerning architecture, understanding zeitgeist and dimensional evolution is an essential prerequisite to understanding Space, Time and Architecture.

Giedion emphasizes zeitgeist in the viewing of history. According to him, people living in the same era are exposed to the same impact and stimulus of
the age, which eventually brings about similarities in distinct areas such as science, art and architecture. Based on zeitgeist, Giedion found the space-time concept in various fields, including the relativity theory of modern science, modern painting such as Cubism or Futurism, and modern architecture. He insists that space-time, which originated from modern science, affected modern painting such as Cubism and Futurism, and consequently influenced spatial concepts in modern architecture.

He considers the history of painting and architecture to be an evolutionary process and explains that painting before the Renaissance was two-dimensional, painting after the Renaissance, which was based on perspective three-dimensional, and modern painting such as Cubism four-dimensional, adding "time" to the previous three-dimensional forms. In terms of architecture, he classifies the process of evolution into three levels, focusing particularly on comparing the spaces of the Renaissance and modern art after 1910. He explains the differences of the two based on the dimensional evolution concept; that is, unlike the three-dimensional space of the Renaissance, which values depth and volume at a fixed point, the four-dimensional modern space after 1910 accompanies many-sidedness and interpenetration, where the space-time concept can be found. Giedion asserts that, due to the transparency and interpenetration of space that were produced by new technology and materials, modern architecture has a new sense of space, distinguishing it from the previous architecture based on perspective (p.435). Giedion interprets this as the "space-time" in which "space" and "time" are combined. Therefore, he says that there has been a dimensional evolution in architecture similar to the evolution of painting, by presenting the four-dimensional space-time concept in modern architecture.

2.2 Space-Time in Modern Science and Painting

According to Giedion, space-time in modern science appeared along with the discovery of non-Euclidean geometry in 1830 and Einstein's theory of relativity in 1905. Previously, time and space had been separated. However, in the theory of Einstein, time is a relative thing that varies depending upon the position of the viewer, becoming a concept combined with space. Giedion cited Hermann Minkowski's Spacetime in order to explain space-time. Minkowski stated in his book Space and Time, published in 1908, "Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality" (p.14). Giedion pointed out that Minkowski had recognized time and space as an indivisible continuum, characterizing this as the space-time of modern science.

Giedion also found space-time in modern painting, as well as in modern science. He points out that space-time can be found in both Cubism and Futurism, two of the main schools of modern painting. Cubism, represented by Picasso and Braque, presents the new space-time concept through several studies on a plane, while Futurism by Boccioni and Balla explains the new space-time concept through studies of movement. Giedion insists that those attempts brought revolutionary changes in traditional Renaissance painting that was based on perspective. These shifts are meaningful in that the Cubists and Futurists tried to express the new space concept, space-time, on a single plane.

In those days, the space-time concept in modern science, such as four-dimension and non-Euclidean Geometry, provoked great interest among painters. However, the space-time concept found in modern painting was not exactly the same as that in modern science. Guillaume Apollinaire said in his book The Cubist Painters that "geometry is to the plastic arts what grammar is to the art of the writer, thus painters have been led, quite naturally, and one might say intuitively, to take an interest in the new possibilities for measuring space which in the modern artist's studio were simply and collectively referred to as the fourth dimension." He also pointed out that "the fourth dimension is engendered by the three known in dimensions. It thus represents the vastness of space stretching eternally in all directions at any given moment. It is space itself, the dimension of infinity." This could be understood as the difficult to apply concepts such as relativity or space-time, which had proved to be scientific facts, to painting. Space-time in painting is used to produce four-dimensional-like images in two-dimensional media, while that in science defines space and time by themselves. Although the space-time concept in both modern science and painting is based on the idea of adding "time" to three-dimensional space, the interpretation and expression of these two are inevitably different.

2.3 Space-Time in Modern Architecture

Giedion asserts that the new space-time concept was found in modern architecture as well as in modern science and painting. He mentions the space-time, or time, in the chapter 6 – Space-Time in Art, Architecture, and Construction – of Space, Time and Architecture. Table 1 shows what he said in the book. First, he points to the transparent glass curtain of the Bauhaus building as the new space-time element, showing a variety of cognitive levels. That is, the transparent walls of the Bauhaus building seem to be piled up one on another, just as in Cubist paintings, resulting in the experience of various viewpoints at once. In the Villa Savoye, Giedion found two features which express space-time: the first is the interrelation of spaces through ramps that penetrate the upper and lower levels, and the other is the transparency between the inside and outside through glass walls. These features of the Bauhaus building and Villa Savoye are related to the simultaneous experience that comes
from transparent glass windows or spatial voids. That is, this new space concept – which is expressed as transparency, overlapping and penetration of spaces – enables spaces, which could not be seen together before, to be viewed at the same time. Accordingly, they have "simultaneity" in common. The simultaneity of Giedion in modern architecture is also applied to modern painting; that is, Cubism. Giedion compares Picasso's "L'Arlésienne" and the Bauhaus building as follows:

Picasso, L'Arlésienne (1911-12) – "In the head may be seen the Cubist device of simultaneity – showing two aspects of a single object at the same time, in this case the profile and the full face. The transparency of overlapping planes is also characteristic."

The simultaneity found in Cubism is intended to show a single object from various viewpoints, and to Giedion, it means seeing simultaneously the various aspects of an object that originally could not be seen at the same time. In his explanation comparing the Bauhaus building with Picasso's "L'Arlésienne," we can see how he recognizes the simultaneity in both areas of modern painting and modern architecture.

Walter Gropius, the Bauhaus building, Dessau (1926) - In this case it is the interior and exterior of a building which are presented simultaneously. The extensive transparent areas, by dematerializing the corners, permit the hovering relations of planes and the kind of "overlapping" which appears in contemporary painting.

According to the explanation above, through the extensive transparent wall of the Bauhaus, the interior and exterior of a building are presented simultaneously, and the spaces that were not seen at the same time before now are seen as overlapped. Giedion points out that this is the simultaneity of the space-time concept found in modern architecture, relating it to the overlapping planes seen in Cubism. He intentionally placed Picasso's "L'Arlésienne" and the Bauhaus building on facing pages of his book to emphasize the connection between the two.

According to Giedion, the Bauhaus complex is an arrangement of cubes, one juxtaposed against another, that suggests a movement in space that has been seized and held (pp.496–497). Unlike earlier buildings, the eye cannot sum up this complex from one viewpoint; it is necessary to view the building on all sides, and to see it from above as well as from below. Giedion says this represents new dimensions for the artistic imagination, an unprecedented many-sidedness. He asserted that the Bauhaus building has movement in that it emphasizes many sides, not only the front, and must be seen from various viewpoints in order to be understood. Additionally, he says that architecture that needs to be perceived by movement involves time, as he explains in regard to the buildings of the Illinois Institute of Technology (IIT) designed by Mies van der Rohe.

Twenty-four buildings stand in a rectilinear relationship to one another, but they are so disposed that an all-embracing space in created through not visible at one glance – a space that can only be slowly perceived by including the dimension of time; that is, by movement. (p.603)

If the simultaneity in modern architecture is related to Cubism, movement is considered to be connected with Futurism. Unlike Cubism, which values spatial expression by presenting simultaneity through many-sidedness and transparency, Futurism expresses the movement and speed of modern society directly. However, while Giedion explains that the simultaneity of modern architecture is related directly to Cubism, he connects the movement of modern architecture with Futurism more indirectly. Giedion mentioned the term "movement" of Futurism as simply a keyword of the space-time concept in modern architecture.

Giedion's direct mention of the space-time concept or time only is found in the explanation of the three buildings noted above in the chapter 6 – Space-Time in Art, Architecture, and Construction – of Space, Time and Architecture. His explanation of these buildings is categorized by two characteristics: Simultaneity and Movement. Simultaneity means to see various aspects of an object at the same time without moving, while Movement means to understand an object by moving around it slowly, not from one viewpoint only. Simultaneity and Movement represent the expression and composition of time, respectively.

3. The Expression and Composition of Time
3.1 Simultaneity and Expression of Time

As discussed before, Giedion connects the simultaneity of modern architecture directly to that of Cubism. Simultaneity is found in both distinctive areas – architecture and painting – on the premise that the two share zeitgeist. As Giedion pointed out, the overlapping planes and transparency in Cubism are similar to the overlapping interior and exterior space of the Bauhaus building through the glass curtain. It seems plausible to some degree that Giedion connects...
Cubism and modern architecture with the keyword, "simultaneity," considering that the overlapping planes through transparent walls are characteristics of modern architecture that were not even imagined due to lack of materials and technical limits in the past. The simultaneity found in Cubism is a simultaneous experience on a fixed plane that results from its nature. The simultaneity found in modern architecture, as explained by Giedion also means a visual experience on a fixed plane, in that an observer sees the overlapping planes and interior and exterior through transparent walls at the same time, while standing motionless.

However, it is doubtful that simultaneity, a visual experience at fixed points, can be defined as an expression of the space-time concept, which extends beyond the previous space concept by adding time, in modern architecture, though in Cubism, a painter adds time to the previous three-dimensional space by reflecting the time that he experienced at several points on a fixed plane. This comes from the different meanings of time in painting and architecture. In painting, time is essentially motionless, since its medium is a two-dimensional plane. But time in architecture is different from that in painting. As Bruno Zevi said, in architecture, time is an indispensable element in every work of architecture, which needs actual movement.  

Giedion's time experience as simultaneity depends on the transparency of the material "glass," and the development of a technique that enables an open relationship between spaces. It has the limit of a visual experience at a fixed point, not the tangible experience of moving around inside a building. Experiencing interior and exterior or above and below at the same time from a fixed point is similar to the time experience in Cubism, but not as much can be said of the experience of architecture.

Hence, there is an essential difference between the simultaneity of painting and architecture. In painting, where time is expressed only as an image or impression added to a two-dimensional plane, the sum of several dimensions of time can be recognized as an inclusion of time in space, but it is problematic to say that simultaneously seeing the transparent interior and exterior is an inclusion of time in space as in Cubism. It is only possible with the help of transparent glass and the technology that makes it; while at the same time, it is merely an artistic expression of time, as in Cubism. Therefore, the simultaneity that Giedion explained could be a characteristic of Cubism, but it is too much to interpret it as an inclusion of time in space in architecture, considering the essential differences between painting and architecture. Ultimately, it is a misunderstanding of simultaneity in that the achievement of technology and material are interpreted as an inclusion of time in space.

3.2 Movement and the Composition of Time

Giedion explained that the Bauhaus and IIT

Table 1. Giedion's Explanation of the Space-time Concept, Found in Modern Architecture Written in Space, Time and Architecture

<table>
<thead>
<tr>
<th>Simultaneity</th>
<th>Movement</th>
</tr>
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<tbody>
<tr>
<td>Bauhaus</td>
<td>Bauhaus</td>
</tr>
<tr>
<td>-Walter Gropius</td>
<td>-Walter Gropius</td>
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<tr>
<td>Villa Savoye</td>
<td>L.I.T</td>
</tr>
<tr>
<td>- Le Corbusier</td>
<td>- Mies van der Rohe</td>
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<table>
<thead>
<tr>
<th>Building</th>
<th>Giedion's explanation</th>
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<tbody>
<tr>
<td>Bauhaus</td>
<td>The glass curtain flows smoothly around the building, the corners showing no vertical supporting or binding members. There is the hovering, vertical grouping of planes which satisfies our feeling for a relational space, and there is the extensive transparency that permits interior and exterior to be seen simultaneously, en face and en profile, like Picasso's &quot;L'Arlésienne&quot; of 1911-12: variety of levels of reference, or of points of reference, and simultaneity—in short, the concept of space-time. (p.493)</td>
</tr>
<tr>
<td>Villa Savoye</td>
<td>Due to the glass walls of the terrace and living room, the occupant can be brought into connection with both the interior and the outdoors. The use of a ramp links different horizontal levels with the interior and exterior spaces. It is impossible to comprehend the Savoye house by a view from a single point; quite literally, it is a construction in space-time. The body of the house has been hollowed out in every direction: from above and below, within and without. A cross section at any point shows inner and outer space penetrating each other inextricably. (p.529)</td>
</tr>
<tr>
<td>Bauhaus</td>
<td>These cubes are juxtaposed and interrelated. Indeed, they interpenetrate each other so subtly and intimately that the boundaries of the various volumes cannot be sharply picked out. The views from the air show how thoroughly each is blended into a unified composition. The eye cannot sum up this complex from one position; it is necessary to go around it on all sides, to see it from above as well as from below. This represents a new dimension for the artistic imagination, an unprecedented many-sidedness. The Bauhaus was the only large building of its time that was so complete a crystallization of the new space conception. (p.497)</td>
</tr>
<tr>
<td>L.I.T</td>
<td>The twenty-four buildings stand in a rectilinear relationship to one another. At the same time, they are so disposed that an all-embracing space is created, though not visible at one glance—a space that can only be slowly perceived by including the dimension of time; that is, by movement. (p.603)</td>
</tr>
</tbody>
</table>
buildings present space-time concepts because they are fully recognized only by movement. In other words, while previous buildings were perceived from one viewpoint the Bauhaus and IIT buildings, having many-sidedness, require the viewer's movement to be fully recognized, which means they have time added to space. Basically, the Bauhaus and IIT buildings have different compositions and scale. The Bauhaus is a single building and its composition and form are not perceived from one viewpoint, while the IIT is a complex of several buildings and the composition of these connected buildings is not recognized at a glance. However, Giedion interprets the element of time in the two buildings in the same way, without considering their differences. He regards "going around the building to perceive it" as a characteristic of the space-time concept both in a building and a complex. It is true that it takes time to go around the buildings, and it is a distinct difference from the previous architectural composition based on perspective. But, we need to reconsider the meaning of movement. The movement in Futurism is not a real one, rather the sense of movement of an object expressed on a two-dimensional plane. However, the movement in architecture is different. It is the movement created by human beings in the space and, accordingly, there is no architecture without movement. Consequently, even if the assumption is right that Futurism contains time in that it expresses movement by painting a sense of movement on a two-dimensional plane, which makes it look four-dimensional and viewers imagine and reinterpret by themselves, it is not the same as the movement of architecture. Once the movement of architecture is defined as one created by human beings in the building, it is doubtful to conclude that only modern architecture has movement, as Giedion insists.

As Giedion pointed out, movement necessarily requires time. Regarding this, he insists that the Bauhaus and IIT are perceived with movement and, as a result, the buildings include the concept of time in their space. However, the meaning of time should be considered again carefully. That is, it is an issue of what is constructed through the additional dimension — time. It should be considered that moving around the Bauhaus and IIT campus could make a story of experiencing time, not just allow the viewer to recognize the buildings themselves. It is the human beings' experience of time, which extends beyond the mere flow of time itself. Giedion however, simply focused on the physical time that is needed to perceive the buildings. Moreover, according to him, being perceived from one viewpoint is determined by the kind of building shape: simple or complicated. Then, there is the question of degree in determining the necessity of time. Actually, time is not only necessary for perceiving modern architecture, it is also needed in order to experience fully earlier architecture, which means viewers should look around a building, not only view it from the front; therefore, it is reasonable to say that there is no building that does not need time.

It is true that modern architecture such as the Bauhaus and IIT have distinct characteristics in terms of spatial composition and form. For this reason, Giedion insists that the two are time-inserted architecture. He interprets the composition and form of modern architecture based on a time concept, but this does not mean the time that makes a story, but simply a physical and objective time flow. This is not time itself, rather a created concept in order to explain a new space concept.

4. Giedion's View of Time in Modern Architecture

4.1 The Difference between Painting and Architecture

Giedion explains architecture by comparing it with painting in the same period under the frame of zeitgeist. However, there are essential differences between painting and architecture, so it is impossible to compare the two directly, particularly regarding the concept of time. Painting is a two-dimensional art; therefore, Cubism and Futurism, which tried to reflect time in painting, could present only three or four dimensions on their two-dimensional plane. That is, Futurism and Cubism present not time itself, but time reflected in objects, which is an indirect symbol.11 The difference between architecture and painting is related to symbol and the experience of time. Painting has been traditionally regarded as the art of space.12 As analyzed before, in modern painting such as Futurism and Cubism, time is still a symbol. However, time as a symbol is not an important issue in architecture. Thus, it is hard to conclude that architecture and painting express the space-time concept in the same way. In architecture, time functions not as a symbol, but as an experience. However, a simultaneous experience at a fixed point, as in Cubism, and the composition and form of modern architecture that necessarily require the viewers' movement in order to perceive it, which
Giedion points out as the characteristics of space-time, are hard to consider as an experience of time, though it is possible to be meant as a symbol of time as in painting. The experience of time is continual, which is a flow of changes, not of physical time. It is the result of applying the time concept as a symbol in painting to architecture in the same way.

Besides the difference of painting and architecture regarding time as a symbol and experience, the way time is considered by the two areas is not the same. As mentioned before, space-time and the time concept were of great concern to modern artists. They studied the space-time concept in modern science and concentrated on the philosophy of Bergson and time or the four-dimensional concept in modern literature. For instance, Metzinger introduced his intention to include the time concept in his work in the explanation of his painting, "Le Goûter." Like Metzinger, many artists attempted to express time in their works. But this is not easily found in modern architecture. Even in his space-time concept in modern architecture, Giedion found its meaning as a new space concept rather than as time. The Bauhaus building, about which Giedion mentioned the space-time concept most frequently, is called a building that "completes a crystallization of the new space conception perfectly" (p.497). The reason why Giedion relates modern architecture and Cubism is to explain that the new space concept is not limited to its infinity regarding sight, as in the gardens of Versailles, but because of its many-sidedness, with infinite potential for relations within it (p.435). Consequently, modern architecture attempted to create a new space rather than introduce the time concept into it, but Giedion interpreted the attempt as an inclusion of a time concept. In other words, unlike modern artists, modern architects concentrated on maximizing the value of space and creating new space, but Giedion related this to the characteristic of modern painting, and concluded it as a time or space-time concept.

Fig. 4. Metzinger, "Le Goûter", 1911

4.2 The Spatialization of Time

Giedion considers the space-time concept as the dominant zeitgeist since 1910. This concept, in which time is more valued than before, has been prevalent in almost every area of modern society, not just in science, painting and architecture. In modern society, time became an essential part of modern life, as the mechanical clock came into wide use in the 1900s. The mechanical clock was intended to measure time through its spatial feature, since it divides time uniformly into discrete segments. It affected people's perception of time so that they began to see time as a divided and homogeneous object, just like a clock. This time perception means to regard time as space, which is the characteristic of the modern time view, "the spatialization of time." The spatialization of time also could be a fourth dimension, where time is added to the three-dimensional view. Henri Reichenbach stated in his book The Philosophy of Space & Time, "One might think that time can now be conceived as a kind of space and try in vain to add visually a fourth dimension to the three dimensions of space." He points out that even in four-dimension theory, time is perceived as a kind of space.

Time cannot be conceived through a simple visual experience, such as a photograph, but through synthesis, which is a combined sense of sight, hearing and touch. However, transparency, like simultaneity and many-sidedness requiring movement, which Giedion asserts are the main characteristics of space-time in modern architecture, are all based on visual experience. In this respect, Giedion's interpretation of visual experience as space-time can be regarded as a product of the modern time view, which perceives time as a kind of space. Moreover, Giedion mentioned time in order to explain a new space, not to interpret the meaning of time or apply time to the design of buildings.

The art of time, such as music or play, counts the story developed according to the flow of time, which is contrary to the art of space, like painting. In this respect, the IIT campus and the Bauhaus, as explained by Giedion present a new spatial feature, not the story developed in the flow of time. Accordingly, it pursues a spatial variety, not time.

Therefore, in the modern time view, time is emphasized more than before, but space-time of a four-dimensional concept in the modern age still views time as a kind of space. Similarly, Giedion perceives time as a kind of space and applies it to architecture, and uses the time concept to explain the new spatial concept of modern architecture. The space-time concept by Giedion is a product of the modern time view that conceives time as space.

4.3 Conception of Dimensional Evolution

As discussed before, Giedion's space-time concept was made to conceive time as space instead of adding the characteristic of time to the previous three-dimensional space. So, there is doubt concerning his assertion that architecture has evolved from a three-dimensional to a four-dimensional concept since 1910. The evolution from three to four dimensions requires the addition of time, the fourth dimension. As previously discussed, the space-time characteristics of modern architecture, such as simultaneity or movement, come from attempts to introduce an unprecedented "time" element in architecture, but
the problem is that the introduced time is based on a spatial concept that is expressed in the transparency of modern materials or composition and features of the buildings. Thus, it is difficult to reasonably establish the dimensional evolution concept, although it shows the many changes of composition or features of modern architecture. In other words, the changes in the modern age are explained by Giedion as a dimensional evolution, where time is added to space, but actually they are the development of space, since time is still conceived as a kind of space. Therefore, it is not sufficient to define it as a dimensional evolution.

As discussed in Chapter 1, Giedion regards the history of painting as a dimensional evolution, defining the modern painting as four-dimensional. However, there is a truth that stands forever regardless of whether artists in the Renaissance painted a three-dimensional world or modern Cubists expressed a four-dimensional world based on a new space-time concept. It is that all paintings are expressed on a two-dimensional plane. That is, it is problematic to simply classify the history of architecture and painting into two, three and four dimensions. After all, Giedion's dimensional evolution is a product of a way of thinking in the Western world that seeks irreversible and linear progress rather than an actual progressive process of architecture and the arts. Consequently, his attempt to define modern architecture and painting as four-dimensional has the limit of being bound by Western thinking.

5. Conclusion

Giedion asserts that modern architecture realizes an unprecedented new space-time concept in his book, *Space, Time and Architecture*. Initially, he points out that the new space-time concept is found in modern science and art, particularly in painting. The space-time concept found in modern science is related to non-Euclidean geometry and Einstein's theory of relativity, and that found in modern painting is presented in the simultaneity of Cubism and the movement of Futurism. In modern architecture, Giedion insists that simultaneity and movement show the new space-time concept.

Simultaneity as the space-time concept in modern architecture implies the transparency and overlapping of spaces, which enables the simultaneous observation of interior and exterior spaces through a glass wall. However, simultaneity in architecture depends on the material—transparent glass—and it has a limitation in that it is a visual experience at a fixed point. The movement that requires time as the space-time concept is a characteristic caused by the necessity to move around buildings in order to perceive them because they possess many-sidedness. However, according to Giedion's viewpoint, time represents physical and objective time in order to explain a new space, with the limitation that its purpose is not to create a meaningful story in the flow of time.

Giedion explains the space-time concept and directly compares this concept in modern painting and architecture. However, although painting succeeds in expressing time in two-dimensional planes by representing a sense of movement or several objects simultaneously, it is insufficient to explain the space-time concept in architecture in the same manner as that in painting because architecture values the experience of time more than its symbol. Regarding the time view of the modern age, we can deduce that the space-time concept or a new combination of space and time in modern science, painting and architecture is based on the spatialization of time, which conceives time as a type of space, and not as an equal element to space. The space-time concept in architecture explained by Giedion also presents time that is conceived as a type of space because 'time' is introduced in order to explain a new space, which is physical and objective, and a visual experience at a fixed point. Furthermore, the dimensional evolution by Giedion is an expression of four dimensions, which is merely established with the aid of the materials and technique of modern buildings, and not by practically adding time to three-dimensional space. This is problematic in that Giedion simplified the history of painting and architecture by classifying it into two, three, and four dimensions.

Giedion attempted to introduce 'time' in architecture in his book, *Space, Time and Architecture*. He attempted to explain the features of time, which is a new element as the fourth dimension, relating the features of modern painting - simultaneity and movement - as the expression and composition of time. However, the time he mentioned is physical and objective time, and not a continual experience that creates stories. After all, his space-time concept could only explain the new spatial characteristics of modern architecture. As discussed previously, the time in architecture is an experience that is designed to cause meaningful changes, and not a flow of objective and physical time. After all, the architecture that designs time is worthy only when the time in the architecture functions in accordance with the experience of humans, and not as space alone. Even though time is a very important element in architecture, thus far, it has not been studied extensively. However, considering its significance, further studies of it should be continued.

References


Notes
2. In this paper, I use the term "painting" instead of "art" because most of the artworks that Giedion mentioned are limited to painting.
3. This page number refers to that of Giedion's Space, Time and Architecture, 5th ed. Cambridge, Mass.: Harvard University Press.
4. Giedion defines perspective as one of the constituent facts from the fifteenth to nineteenth centuries. He explains that in linear perspective, objects are depicted upon a plane surface in conformity with the way they are seen, without reference to their absolute shapes or relations. Giedion, S. (1967), Space, Time and Architecture, 5th ed. Cambridge, Mass.: Harvard University Press, p.31.
5. There are three stages of architectural development. During the first stage – the first space conception – space was brought into being by the interplay between volumes. The second space conception began in the midst of the Roman period when interior space and with it the vaulting problem started to become the highest aim of architecture. This second space conception persisted for more than 500 years. The third space conception embraces both the first and the second space conception. And new elements have been introduced: a hitherto unknown interpenetration of inner and outer space and an interpenetration of different levels, which has forced the incorporation of movement as an inseparable element of architecture. – Ibid. Introduction, p.iv–lvi.

8. The special theory of relativity, known as "Minkowski spacetime," in which time and space are not separated entities but intermingled in a four dimensional space-time.
9. For the cubist group, including Duchamp and Metzinger, the "Fourth Dimension," "the 'Golden Section," and "non-Euclidean geometry" were the topics of excited speculation. And such speculative realms inspired their works. – Cox, N. (2000), Cubism, London; Phaidon Press, p.174.
12. Bruno Zevi points out that time is indispensable to architecture and no work of architecture can be experienced and understood without the fourth dimension, without the time needed for our walk of discovery within it. – Bruno Zevi (1974), Architecture as Space: How to look at Architecture, New York: Horizon Press, p.27.
14. Lessing claimed that literature is an art of time, whereas painting is an art of space in his book Laocoön. Ibid. p.95.
15. Metzinger argued, Cubists have allowed themselves to move round the object, in order to give, under the control of intelligence, a concrete representation of it, made up of several successive aspects. Formerly a picture took possession of space, now it reigns also in time. Cox, N. (2000), Cubism. London: Phaidon Press, pp.179–180.
19. Heynen addressed that "Modernity, Octavio Paz says, is an exclusively Western concept that has no equivalent in other civilizations. The reason for this lies in the view of time that is peculiar to the West, by which time is regarded as being linear, irreversible, and progressive." Heynen, H. (1999), Architecture and Modernity, London: MIT Press, p.9.