

Spatial Indeterminacy: Destabilization of Dichotomies in Modern and Contemporary Architecture

Adrian Lo

Abstract—Since the advent of modern architecture, notions of free plan and transparency have proliferated well into current trends. The movement's notion of a spatially homogeneous, open and limitless 'free plan' contrasts with the spatially heterogeneous 'series of rooms' defined by load bearing walls, which in turn triggered new notions of transparency created by vast expanses of glazed walls. Similarly, transparency was also dichotomized as something that was physical or optical, as well as something conceptual, akin to spatial organization. As opposed to merely accepting the duality and possible incompatibility of these dichotomies, this paper seeks to ask how can space be both literally and phenomenally transparent, as well as exhibit both homogeneous and heterogeneous qualities? This paper explores this potential destabilization or blurring of spatial phenomena by dissecting the transparent layers and volumes of a series of selected case studies to investigate how different architects have devised strategies of spatial ambiguity and interpenetration. Projects by Peter Eisenman, Sou Fujimoto, and SANAA will be discussed and analyzed to show how the superimposition of geometries and spaces achieve different conditions of layering, transparency, and interstitiality. Their particular buildings will be explored to reveal various innovative kinds of spatial interpenetration produced through the articulate relations of the elements of architecture, which challenge conventional perceptions of interior and exterior whereby visual homogeneity blurs with spatial heterogeneity. The results show how spatial conceptions such as interpenetration and transparency have the ability to subvert not only inside-outside dialectics, but could also produce multiple degrees of interiority within complex and indeterminate spatial dimensions in constant flux as well as present alternative forms of social interaction.

Keywords—Interpenetration, literal and phenomenal transparency, spatial heterogeneity, visual homogeneity.

I. INTRODUCTION

TRANSPARENCY is defined as the characteristic for things to be able to be transmitted or pass through, that is allowing for the passage through or being able to see through. Etymologically the term transparent comes from medieval Latin meaning to show through or show oneself [1]. The beginning of modern architecture is marked by buildings becoming more transparent. Joseph Paxton's Crystal Palace, where the Great Exhibition of 1851 was held in London, was a monument to the innovation of the industrial age, which saw the use of the new technologies and materials of its time, such as cast-iron and mass production of glass panes. However, transparency is not just a physical property likened to the clear see-through characteristics of glass, as the Modern movement

also suggested transparency as a spatial phenomenon, as seen in the interlocking or overlapping of spaces. In their seminal essay, Rowe and Slutzky differentiate between a literal and a phenomenal transparency, and describe literal transparency as a real transparency, inherent to substance, such as in a wire mesh or glass wall, whereas phenomenal transparency is a seeming or conceptual transparency inherent to spatial organization [2].

Since the advent of the Modern movement's 'free plan', the new spatial qualities of transparency, homogeneity, and openness contrasted to its preceding 'series of rooms' defined by load bearing walls of spatial heterogeneity and opacity. From houses to large multi-storey office buildings, the free-plan had triggered new notions of transparency seen today in modern glass-clad buildings.

A. Objectives and Methodologies

This paper seeks to compare and contrast differing notions of transparency in architecture and challenges the possible incompatibilities or distinctiveness of spatial orders since the Modern movement. Through diagrammatic analyses and comparative theoretical discussion of selected case study projects by Peter Eisenman, Sou Fujimoto, and SANAA, this research will aim to reveal their different spatial conditions and their ambiguous overlaps. The potential blurring and perceptual ambiguities will be uncovered in these case studies to reveal the destabilization of dichotomized notions of literal and phenomenal transparency as well as between spatial homogeneity and heterogeneity. The analysis aims to demonstrate how spatial transparency and interpenetration not only challenge our conventional understanding of inside and outside spaces, private or public zones; hence questioning ideas of spatial continuity or separation, but unveil alternative ways of perceiving and designing spaces, operating within the indeterminate and multiple degrees of in-between realms in the production of new forms of social interaction.

II. HISTORICAL BACKGROUND: TWO TYPES OF SPACES – HOMOGENEITY/HETEROGENEITY

Le Corbusier's Dom-ino House (1915) conceptually marked the end of load-bearing walls and the separation of rooms as heterogeneous spaces, whereby floor slabs were supported by columns rather than load-bearing walls. This freed the vertical

Adrian Lo is an International Expert at Thammasat University, Thailand (e-mail: adrianlo2011@gmail.com).

plane from opaque solid walls, and created a homogeneous indeterminate space between inside and outside, a condition of space which was open, flowing, and limitless.

In *Building in France, Building in Iron, Building in Ferroconcrete*, Giedion writes, "By their design, all buildings today are as open as possible. They blur their arbitrary boundaries. Seek connection and interpenetration [3]." Here, Giedion describes the transparent objects in Le Corbusier's paintings as interpenetrating, a spatial condition which is also found in his buildings, and elaborates that air flows through Corbusier's houses, such that there is only one indivisible and homogeneous space blurring interior and exterior [3]. Frank Lloyd Wright's Robie House in Chicago (1909) demonstrated this sense of a flowing space internally, as Wright's houses signified the end of the idea of a home as a sequence of distinct and separated rooms, rather spaces were made to flow and gathered under sweeping horizontal roofs. Then enters Mies van der Rohe. His German Pavilion at Barcelona (1929), more famously known as the 'Barcelona Pavilion', extends this idea of flowing open space where the walls are conceptualized as planes. Space within the pavilion is like a liquid, rather than conventionally demarcating inside and outside zones, spaces overlap and interlock within the interior and between the interior and exterior (reiterating the ideas of his Brick Country House, 1924) to the extent that there is no real interior space as such, but rather ambiguous zones between interior and exterior [4], [5].

Modern architecture's notion of spatial continuity is clearly seen in Mies' work, and none more so than his Farnsworth House in Illinois (1946). Here, the notion of rooms has been eliminated. Rooms are no longer separated by walls, instead there is a 'free plan', an idea inherent since Corbu's Dom-ino and Wright's Prairies. Like the Barcelona Pavilion, in Mies' Farnsworth House there is spatial ambiguity and continuity between inside and outside, the open limitless space of Modern architecture homogenizes space, such that interior and exterior become blurred. The Farnsworth condition is somewhat reenacted by Philip Johnson's Glass House in New Canaan (1949) – a glass box framing a brick cylinder. However, there are critical differences between Barcelona and Farnsworth. In the Farnsworth House, there is in fact a perimeter of glass, physically separating inside and outside, the transparency occurs only visually between inside and outside, whereas spatially the interior is one homogeneous space, and separated from the exterior environment. In contrast, the Barcelona Pavilion has less of a sense of an enclosed perimeter, where its intricate layering of walls starts to suggest a heterogeneous space, creating multiple yet indeterminate degrees of interiority or exteriority, both spatially and visually.

Concurrent to the Barcelona Pavilion is Adolf Loos' Villa Müller in Prague (1929-1930). Here Loos develops another form of spatial continuity, one where spaces are flowing but nevertheless demarcated and separated, however partial. Loos' notion of the *raimplan*, or space-plan, is produced by the layering of space, a condition where spaces overlook into each other, constituting a framed 'sequence of spaces'. The Villa Müller conceptualized architectural space as interlocking,

windows determined not by functional need but by visual links between exterior and interior, and within the interior.

For Loos, architecture is not conceived in plans or conventional levels, but rather continuous spaces where storeys and spaces are interrelated. In his Villa Müller, spatial interpenetration and contiguity between rooms are achieved by opening up walls to achieve framed views between them [6]. The viewer 'journeys' through the spatial continuum of the transparent and layered spatial-planes. Here, spaces are heterogeneous as they are divided horizontally and vertically, yet the openings between them allow the space to flow and be experienced as one homogeneous space.

III. DUALITY OF SPACE AND TRANSPARENCY: LITERAL AND PHENOMENAL TRANSPARENCY

To further understand modern architecture's conditions of layering, continuity, and transparency beyond the two types of spaces – homogeneous and heterogeneous space, is to interpret these conditions in terms of Rowe's and Slutzky's distinction between literal and phenomenal transparency. They describe 'literal transparency' as a condition inherent to substance or matter, such as in glass walls, mesh screens, translucency, etc., whereas 'phenomenal transparency' is a condition inherent to spatial or volumetric organization and interpretation [2].

As evident from the dictionary definitions, the term transparency implies the optical or observational concepts of showing or seeing through. Rowe and Slutzky, in their essay "Transparency: Literal and Phenomenal," refer to Gyorgy Kepes in further elaborating that transparency is a simultaneous experience of multiple spatial positions, resulting from the overlapping and interpenetration of figures without optical destruction. Nevertheless, transparency suggests something more than an optical effect, as it also affects space in the way it recedes and continuously fluctuates [2]. Thus, transparency is an in-between condition of ambiguity and spatial contradiction produced by the overlapping of figures. These notions of transparency and spatial interpenetration in the industrial, art, and architectural movements of the era, and of which Sigfried Giedeon has described in his writings on Le Corbusier's buildings are parallel to the scientific thinking of the early 1900s, particularly the fascination with the theories of relativity, space-time continuum, and the fourth dimension [3]. Spatio-temporal relativity implies multiple objects that can co-exist simultaneously in the same space and time just as transparency is a perception of simultaneity, interpenetration, and ambivalence [2].

Though transparency is commonly defined in physical or material terms as permitting transmission, passage, and diaphaneity, the architectural and spatial condition of transparency can suggest other interpretations, such that there could be something more than just a real, physical, or literal transparency. Rowe and Slutzky describe this other mode of seeing-through as phenomenal, that is, a seeming or implied transparency, which is interpretive or conceptual [2]. Furthermore, they describe Walter Gropius' Bauhaus (1925-1926) as an example of literal transparency, whereas Le Corbusier's Villa Stein in Garches (1927/28) is a case of

phenomenal transparency. The layering or stratification of interior space in Corbusier's villa produces a succession or sequence of spaces in ambiguous spatial dimensions and continuous fluctuations of perception – an implied or phenomenal transparency [2]. As opposed to a real or literal transparency, this fluctuation of simultaneous spatial layers produces an ambiguity of depth and an oscillating perception of multiple overlapping planes. Hence, stratification and layering, as design strategies or devices to construct, articulate, and arrange spaces, are fundamental to the production of phenomenal transparency [2]. Referring back to Loos' notion of the *raimplan*, this can be also seen as a case of phenomenal transparency, that is, a transparency achieved through the composition and articulation of sequential and continuous spaces, divided by layered or stratified planes or frames. Inside Loos' Villa Müller the subject engages in a theatrical voyeuristic gaze which journeys through the sequentially layered planes-spaces in phenomenal transparency [7]. The passing through of the gaze, key to the concept of transparency, is articulated here as a seeing or penetration through successive frames of view, that is, through the various decisively located wall openings forming a framing of frames.

IV. CASE STUDIES: EISENMAN, FUJIMOTO, AND SANAA

Notions of spatial indeterminacy and ambiguity are hallmarks of modern and contemporary architecture. Through analyzing a selection of case study buildings by Peter Eisenman, Sou Fujimoto, and SANAA, it could be possible to reveal the destabilization of dichotomized notions of spatial homogeneity and heterogeneity as well as literal and phenomenal transparency. The following discussion analytically compares and elaborates on the peculiarities of the different means of achieving spatial ambiguities and visual transparencies in these case studies, and in so doing, elucidates the possible incompatibilities or distinctiveness of spatial orders. In parallel, the graphical analysis aims to dissect the various constituent layers or volumes of these selected projects to reveal their alternative ways of seeing, understanding, and designing spaces, as well as their ambiguous interpretations which challenge conventional ideas of spatial continuity or separation.

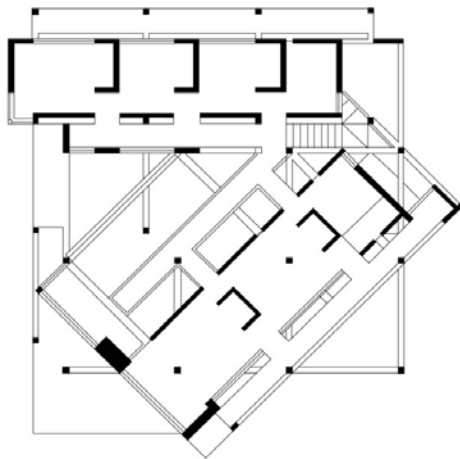


Fig. 1 Plan of Peter Eisenman's House III, 1969-1971

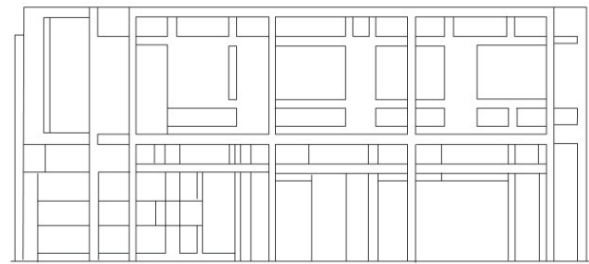


Fig. 2 Elevation of Eisenman's House III

A. Two Houses by Peter Eisenman

Central to the work of American architect and educator, Peter Eisenman, is the idea of the in-between, and this is not less so of his design for House III (1969-1971, Connecticut, USA). As part of his early houses phase of his career, his interests were in the conceptual-perceptual bi-valency between elements of architecture, questioning their meaning, as well as their form-function relationship. In Post-modernist fashion, Eisenman sought for new ways to read architecture and explored betweenness by blurring actual and implied perceptions as well as by producing traces of the design process [8].

The concept of the in-between is evident in House III in the superimposition or overlapping of geometries, whereby there is a transparent interlocking of an orthogonal grid and a rotated grid in plan. Here there is a literal transparency through the overlapping of cubic figures, which is limited to the plan. The elevation of House III does not capture the rotational quality. It is only in the design for the unbuilt project of the Guardiola House (1988, Cadiz, Spain) that Eisenman explores the overlapping of volumes in rotation in three-dimensions [9].

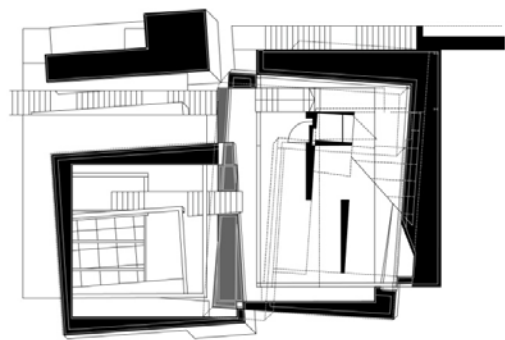


Fig. 3 Plan of intermediate level of Peter Eisenman's Guardiola House, 1988

Initially conceived as half of his design of the former House X project, Eisenman's Guardiola House sought to break down traditional dialectical pairs of figure and ground, container and contained, as well as frame (edge) and object (volume). It is visible from his published transformational process diagrams that Eisenman sought to record the traces and imprints of the oscillating, additive, and subtractive movement of the constituent el-form figures. For the Guardiola House, he was interested in producing a figure-figure relationship, whereby

traces and imprints recorded the blurring of orthogonal and rotated geometries in three-dimensions, likened to his foot-in-sand metaphor. This is what constituted his notion of an interstitial condition, referring to the hybrid geometry of the thickened structure which incorporates the double geometries of orthogonal and rotated el-form figures [10]-[12].

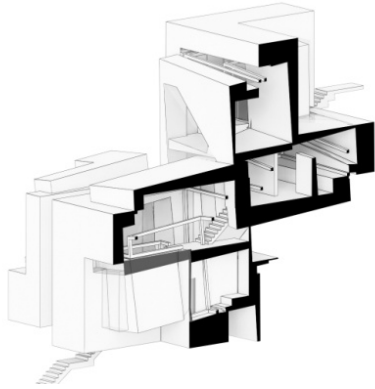


Fig. 4 3D section of Eisenman's Guardiola House

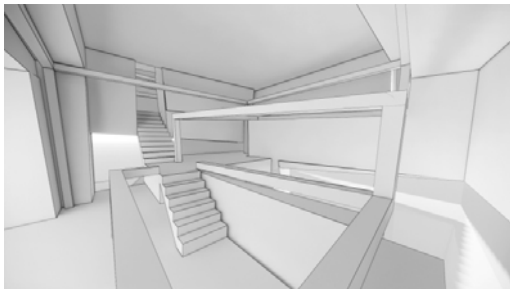


Fig. 5 Interior perspective of the living space in Eisenman's Guardiola House, showing indeterminate spaces produced by the interstitial traces and imprints

The plans for Eisenman's House III suggest the lower floor as being more spatially homogeneous with living and dining spaces composed in a free plan. However, the upper floor suggests a more spatially heterogeneous arrangement of bedrooms. The literal transparency of overlapping figures appears predominantly in plan, but due to its 3x3 gridded organization, it could be possible to read a phenomenal transparency in the layered sequence of grid lines manifested as elements of architecture. The Guardiola House, however, is more sophisticated. At the level of the volume, it could be read as a literal transparency of overlapping cubes in three-dimensions, but at the level of the surface, phenomenal transparency takes over as the surfaces are produced by the blurred geometries of the cubes in the form of the interstitial condition, whereby the transparency is more interpretive and implied. Due to its more complex configuration and necessitated by function, the Guardiola's interiors display both spatial homogeneity and heterogeneity. The middle levels of entry and living spaces suggest more of a flowing homogeneous space, yet divided heterogeneously into different platforms created by the el-forms. Moreover, the Guardiola House suggests a notion of phenomenal interstitiality or betweenness in its interpenetration of volumes whereby the constituent

figures are merged into a hybrid geometry, unlike the preceding House III which is only a condition of literal interstitiality where the gridded figures are overlapped, but not yet blurred [9]. Thus, Eisenman's House III and Guardiola House show how both homogeneous and heterogeneous spaces as well as both modes of layering, that is, literal and phenomenal transparencies can simultaneously occur.

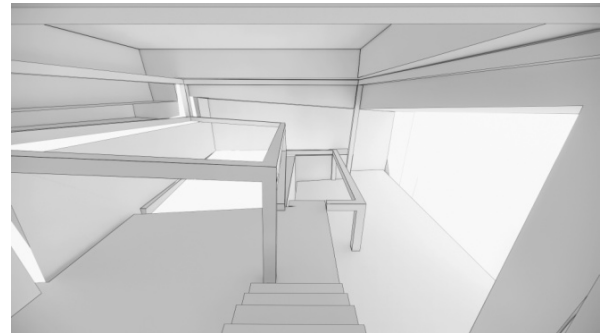


Fig. 6 Interior perspective of Eisenman's Guardiola House showing phenomenal transparency

B. Two Houses by Sou Fujimoto

The ideas of interstitiality and transparency are manifested altogether in a different form in Sou Fujimoto's House N (2008, Oita, Japan). Here, the architect sought to question and destabilize the idea of a house being separated from the street and the city by a single wall. The design innovatively produces what the architect refers to as a 'graded domain' [13, p.70].

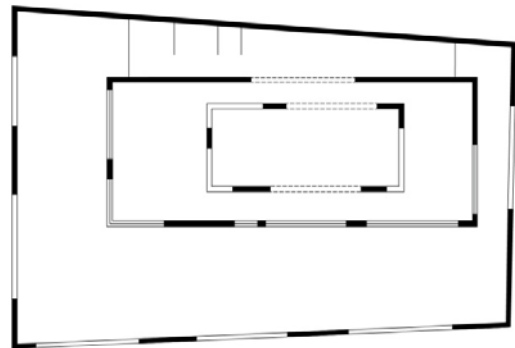


Fig. 7 Plan of Sou Fujimoto's House N, 2008

Recognizing the continuum or gradation between city and house, the idea of House N is about expressing this 'in-between'. Like a Russian doll, the house is composed of three nested quadrangular shells inside one another. Encompassing the entire premises, the outer larger shell acts as a buffer zone between public and private spaces in the form of a semi-indoor garden. This is followed by an intermediate second shell containing a 'bedroom' and guest zone. The third and last innermost shell creates an intimate space for living and dining [13, pp.68-83]. The house is hence three houses within one another, a house inside a house inside a house, effectively establishing three zones which range from public to private, and exterior to interior. The first exterior shell acts as an intermediary between exterior and interior – the first interior

space, whereas the second shell is an interior within the interior – the second interior space, whilst the third shell becomes an interior within the interior within the interior – the third interior space.

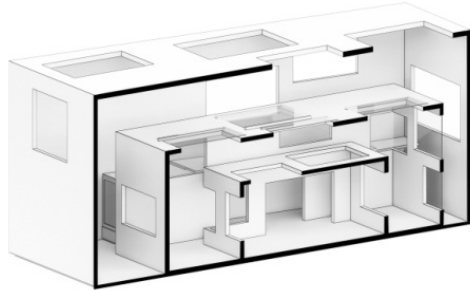


Fig. 8 3D section of Fujimoto's House N

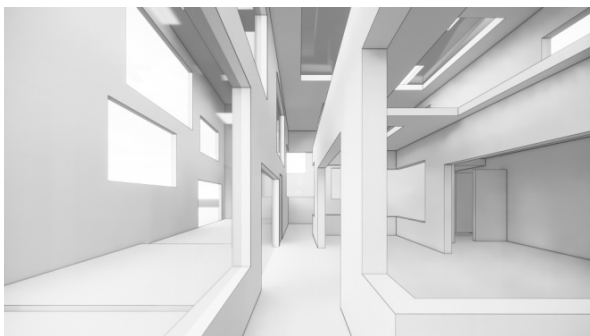


Fig. 9 Interior perspective of Fujimoto's House N, showing layering of spaces



Fig. 10 3D section of Fujimoto's House N, showing the idea of a house inside a house inside a house

Fujimoto's House N is particularly interesting in its interpretation of space and transparency due to its articulated nesting of walls with decisive openings between each zone defined by the three shells. The openings between the shells achieve spatial continuity between inside and outside as well as between each shell – a form of spatial homogeneity. However, the walls of the shells effectively divide the space of the house into three distinct zones – a form of spatial heterogeneity. Like Mies' Farnsworth House, Fujimoto's House N employs a free plan, with no 'rooms' as such, the bed and other furniture define how the space is to be used, and the spaces are inherently flowing and interpenetrating. Yet different from the Farnsworth is House N's multiple degrees of interiority and framed sequence of spaces. Hence, the space within the house is

simultaneously both homogeneous and heterogeneous. House N displays a phenomenal transparency in regards to the layered sequence of spaces overlooking into each other. A literal transparency could be seen at eye level, in the potential overlapping of openings between each shell, however, this type of transparency does not occur in plan, as the house displays a nesting rather than a superimposition of figures.

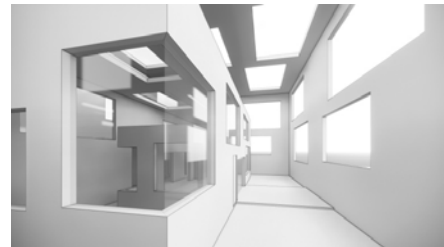


Fig. 11 Interior perspective of Fujimoto's House N, showing nesting of spaces

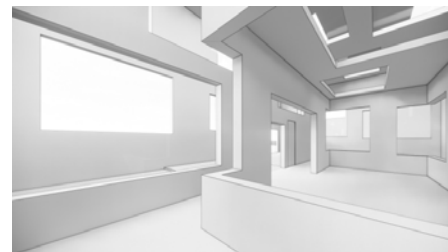


Fig. 12 Interior perspective of Fujimoto's House N, showing spatial heterogeneity and homogeneity

Fujimoto's innovative and unconventional designs extend into his House NA (2011, Tokyo, Japan) which further sought to eliminate the concept of separate rooms. Here, the free plan of Mies' Farnsworth is once at work at play, but with the added vertical dimension. Fujimoto sought to make a house like an artificial forest reflecting the dense condition of Tokyo, but at a human scale [14, p.112]. Where the Farnsworth House has all the activities predominantly on one slab supported by columns, House NA breaks, destabilizes, and extends this to multiple smaller slabs at different heights, with each slab constituting individualized spaces for activities and interactions to take place. The thin slabs constitute floating spaces, like living in a white artificial tree-house, and at times the slabs start to take on a furniture-like scale, becoming tables and places to sit [14, pp.110-115].

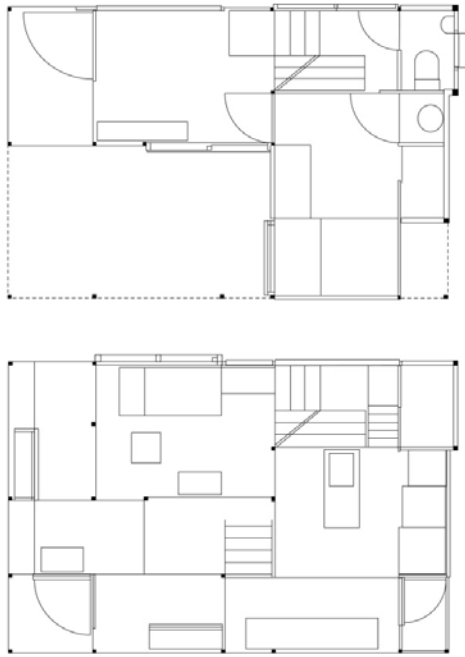


Fig. 13 Plans of Sou Fujimoto's House NA, 2011, showing juxtaposition of platforms of different heights



Fig. 14 Sections of Fujimoto's House NA, showing spatial heterogeneity and homogeneity

The space within House NA is certainly layered, but in three-dimensions, horizontally and vertically. There is spatial homogeneity, such that the different platforms are open to each other, creating an open flowing interior space. Simultaneously, the house plays on thresholds and small level differences, such as a couple of steps between each platform, which creates a sense of spatial heterogeneity. Rather than rooms, there are platforms separated from each other by a threshold which provides for various interactive settings. Rather than designated spaces in the design, here, the spaces are activated by people. Like House N, spatial homogeneity and heterogeneity simultaneously coexist within House NA, but achieved through interlocking layers of slabs permeating the height of the building rather than wall openings across one level.

Phenomenal transparency occurs in the layered space of House NA and its series of platforms. Like Loos' Villa Müller, there is a passing through of the gaze between the different zones, but here multiplied exponentially throughout the interior of the house. Hence, both of Fujimoto's houses explore spatial and visual homogeneity and heterogeneity through articulate

relationships of the elements of architecture. Both houses destabilize the dichotomy of interior and exterior in the production of multiple degrees of interiority within a continuum of indeterminate space. Whether it is the walls of House N or the slabs and thresholds of House NA, Fujimoto achieves an unconventional proposal to the idea of dwelling and questions the potential for alternative kinds of spatial-programmatic interactions.

C. Glass Pavilion by SANAA

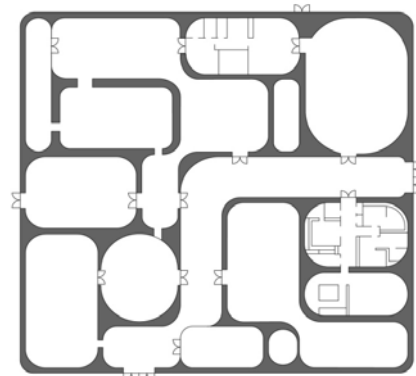


Fig. 15 Plan of SANAA's Glass Pavilion at the Toledo Museum of Art, 2001-2006

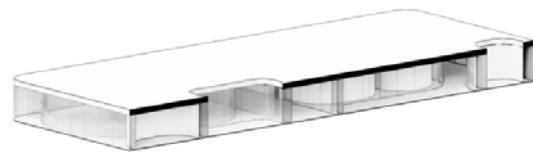


Fig. 16 3D section of SANAA's Glass Pavilion

Glass is a key component of modern architecture's literally transparent open and flowing spaces, and in SANAA's Glass Pavilion at the Toledo Museum of Art (2001-2006, Ohio, USA), the space could be considered hyper-transparent due to the multiple layering of glass walls, achieving a sense of translucency with reference to the thin translucent walls of traditional Japanese architecture [15]. The single storey museum consists of a grid of bubbles which contains the served zones for exhibitions, foyers, and courtyards. These rectilinear shaped bubbles with curved corners are defined by double glazed walls which constitute interstitial cavities and buffer zones, a kind of transparent *poché*, for more unconventional displays of artwork [16].

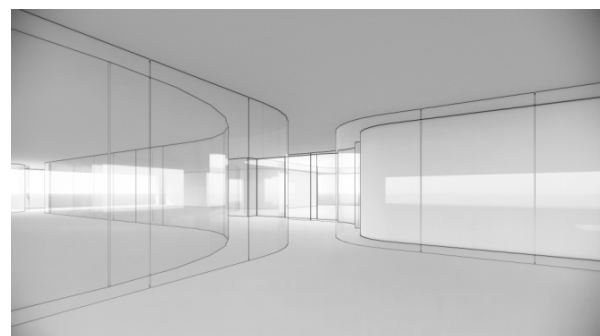


Fig. 17 Interior perspective of SANAA's Glass Pavilion, showing visually transparent walls dividing spatially heterogeneous bubbles

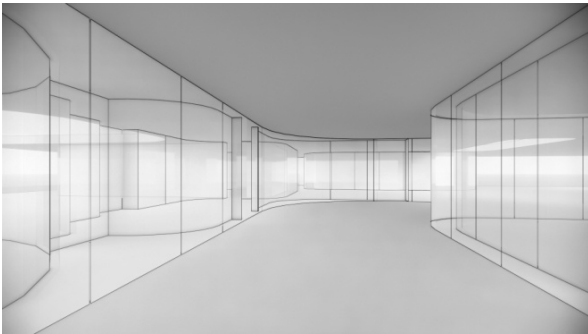


Fig. 18 Interior perspective of SANAA's Glass Pavilion

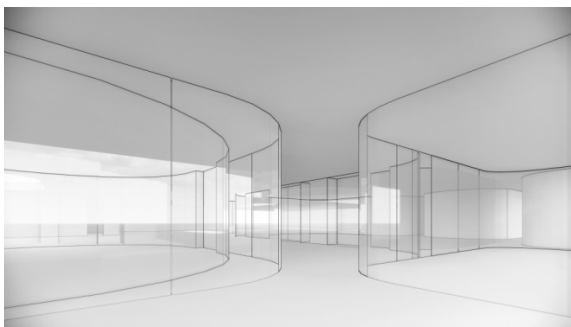


Fig. 19 Interior perspective of SANAA's Glass Pavilion

SANAA's Glass Pavilion is a paradox of modern architecture as it is visually interconnected, homogeneous, open, flowing, and limitless, yet its various layers or inhabitable strata of clear glass form a hierarchical nesting of heterogeneous 'bubbles' of served zones, such that visual homogeneity blurs with spatial heterogeneity [17]. Moreover, the layering of glass walls constitutes a literal transparency, whilst the formal organization of the bubbles and their spatial indeterminacy produces a phenomenal transparency. With multiple degrees of interiority produced by the nesting of glazed bubbles, the space in this building is in a state of continual flux, constantly blurring the conception of a boundary, achieving an indeterminate and complex sense of space.

V. CONCLUSION

This paper investigated the different conceptions of spatial transparency in modern and contemporary architecture, particularly the dichotomized notions of literal/phenomenal transparency and homogeneous/heterogeneous space. The results reveal these ambiguous spatial perceptions or qualities are not necessarily incompatible, but rather they could happen simultaneously within the same building or space.

Projects like Peter Eisenman's House III clearly illustrate a literal transparency through the overlapping of grids, whereas his Guardiola House shows how literal and phenomenal transparencies can be simultaneously achieved through intersecting geometries manifested in the interstitial condition. Sou Fujimoto explores alternative kinds of threshold conditions through intricate relationships of the elements of architecture.

By nesting a series of walls (House N) and articulating a series of platforms (House NA), Fujimoto produces spaces which are inherently separated and heterogeneous yet still providing the opportunity to overlook each other, framing sequences of spaces. Likewise, both visually homogeneous and spatially heterogeneous, SANAA's Glass Pavilion at the Toledo Museum of Art is also simultaneously literally and phenomenally transparent, but achieved altogether in a different way, through layering glass bubbles and transparent *poché*.

By revealing the destabilization of literal/phenomenal transparency and homogeneous/heterogeneous space, this research offers potential reinterpretations of spatial perceptions and conceptions in the historical-theoretical discourse on modern and contemporary architecture. The case studies elucidate alternative notions of transparency and spatial orders by demonstrating different ways of reading and perceiving space which are not necessarily mutually exclusive. Rather, dichotomic concepts, perceptions, and experiences of space and transparencies can be blurred, producing inter-transparencies and spatial indeterminacy in architecture. The case studies present various novel design strategies of achieving ambivalent spatial effects within a potential continuum of indeterminate spaces, which not only combines visual interpenetration with spatial differentiation, but also challenges the concept of a boundary and conventional classifications of interior and exterior, producing new conditions of spatiality for various forms of social encounters and interactions.

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