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Nature-inspired Architectural Concepts for Challenging Spatial Boundaries

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Abstract

Architecture discipline is primarily concerned with spatial boundaries. Although this subject has been addressed from various scopes, the way in which these boundaries can be challenged, namely architectural concepts that are capable in this regard, has remained largely uninvestigated. Nature-inspired architectural concepts developed by Sou Fujimoto in the framework of his intellectual project, Primitive Future, aim to eliminate traditional spatial boundaries and, therefore, his architecture can be a didactic case in this context. The aim of this paper is therefore to unfold certain spatial boundaries that can be blurred by these architectural concepts and to evaluate their potential for the elimination of spatial boundaries. Ergo, this paper can be regarded as a qualitative documentary study founded on a descriptive-analytical method conducted by a literature survey and a case study. The requested data on the conceptual properties of the cases were obtained through a literature survey and a document analysis, and qualitative analytical techniques were used in the data analysis process. Findings have indicated that certain spatial boundaries, namely the established dualities between Architecture ─ Nature, Interior ─ Exterior, Architecture ─ Furniture, Object ─ Field, Figure ─ Ground, Public ─ Private, Architecture ─ City and Openness ─ Enclosure, may be blurred by architectural concepts developed as the Primitive Future. However, the potential of these concepts to challenge spatial boundaries is different, i.e. Tree Like Place and Garden have the greatest potential. Moreover, the Public ─ Private boundary is the most probable one that may be blurred by these concepts.

Keywords

Architectural Concept; Spatial Boundaries; Nature-inspired architecture; Primitive Future

1. Introduction

Throughout history, nature has inspired humans to make advances in science and technology. They came to realize that they were surrounded by genius, and therefore sought to learn from these geniuses, and to take guidance from them, and then put those lessons into effect, namely in the design of man-made products (Benyus, 2002). The main idea is that an ever-changing evolutionary process is preserved in nature in such a way that inefficient structures vanish, whereas those characteristics that are better adapted to prevailing or evolving environmental conditions can be reinforced (Pawlyn, 2011). Considering the nature of design as an attempt to respond to and solve a particular problem in a reasonable and efficient manner, it can be argued that nature provides designers with the perfect inspiring models, that every designer can take advantage of the mechanism and process of

natural systems and adapt it to their designs. In essence, whatever the designers are trying to solve, in nature it has already been solved in the best possible way.

Architects have always considered nature as a great source of inspiration that can help them create innovative concepts. They find nature as a perfect beauty in which they can find an endless variety of shapes, colors and species living together in a perfect, rational, unquestionable way (Senosiain, 2003). This mesmerizing beauty set the stage for an esthetic approach to nature; that is, focusing on the shape characteristic of natural organisms and phenomena resulting in superficial nature-inspired forms and architecture decoration. However, the potential of nature to motivate architectural concepts is not limited to merely simplistic biological analogies, but rather reflects a deeper understanding of nature as a mentor in terms of methods of creation and evolution.

In this context, a variety of architectural concepts have been developed, especially in recent decades with the emergence of a sustainable design agenda as a response to the environmental crisis. This spectrum range from bioclimatic architecture, which refers to the design of buildings and spaces based on local climate, designed to provide thermal and visual comfort, to the use of solar energy and other environmental resources, to Biophilic design as an approach to architecture that aims to bind inhabitants of buildings more closely to nature, to the incorporation of natural lighting and ventilation, natural landscape features and other elements for achieving a more sustainable and healthy built environment for people (Figure 1).

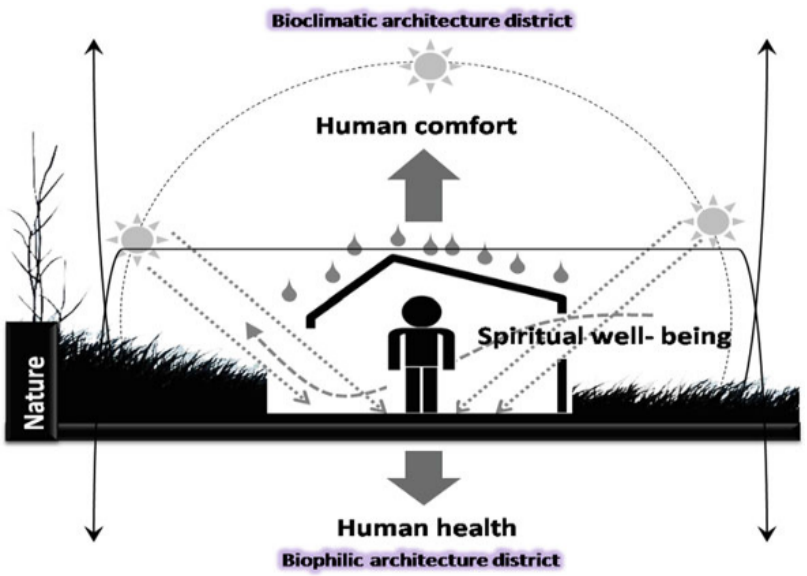


Figure 1. The interaction between the biophilic and bioclimatic architecture concepts. (Almusaed, 2011)

Traditionally, people have remained very close to nature. They had an intimate feeling about nature and used to learn how to communicate with it. However, as time passed on and they increased in number and gained scientific progress, their behaviors changed to their natural world. Their respectful approach to nature and their efforts to reconcile themselves with the surroundings gave way to a sense of competence and sought to overwhelm nature. This negligence of nature was exacerbated by the advent of architecture of modernism, focused on the machine as a metaphor. The machine was self-contained, and the fuller its environmental independence, the higher its performance and functionality (Ito, 1999). It can be argued that modern architecture has sought freedom from location and nature and, as a result of this break with the outside, a homogeneous and easy-to-control interior with high functionality has emerged. In this process, human beings have shifted further and further away from their origins and have made a boundary between themselves and nature. Forgetting about the

spatial freedom that they have in nature, they went on to build settlements that were alien to their nature, i.e. spiritless places that impose various boundaries on them.

The Notion of Spatial Boundary

Architecture discipline is primarily concerned with spatial boundaries, because once architects have erected a structure, the artificial object establishes certain dualities, whether as an interior organization or as a relationship to an exterior surroundings. Each of these dualities involves a certain division, separation or restriction of space. Challenging spatial boundaries and creating more fluid spaces is therefore one of the main concerns of architects and scholars studying the spatial characteristics of human dwellings in terms of physical and psychological aspects. The key question is whether the immensity of the architectural space is possible? If so, how can architects develop architectural concepts that have the potential to eliminate spatial boundaries as much as possible? This critical challenge motivates architects to come up with effective ideas that could blur established dualities such as interior versus exterior, artificial versus natural, architecture versus city, and similar boundaries that architectural discipline must address.In order to better understand the precise meaning of the notion of boundary, it would be worthwhile first of all to reconsider the common meaning of the term based on dictionary entries. According to *Oxford online dictionary*, boundary is "a real or imagined line that marks the limits or edges of something and separates it from other things or places". According to *Webster online dictionary*, boundary is "something that indicates or fixes a limit or extent". On this account, boundary can be regarded as a double-sided phenomenon. There are many tacit or overt boundaries in the physical or psychological context of daily life. In addition, there are different potential interactions within the micro-macro scales defined by these boundaries or between the separate domains defined by them. It can therefore be argued that boundary, in essence, has the characteristics of separating, distinguishing and explaining, thereby necessarily having duality in its condition of being, and thus generates oppositions such as interior/exterior, private/public,openness/enclosure,artificial/natural while at the same time creating its meaning through these dialectical poles. As a consequence, boundary can be expressed as an active range that creates/incorporates relationships formed via duality.It is important to remember that the definition of separate spatial boundaries is not always unfavorable. The specification of precise spatial boundaries for the provision of determined dualities, and even the accentuation of these dualities, is part of the design in some cases. As Graves put it, the definition of proper boundaries will establish a space that is not homogeneous, and will also distinguish a place from a place to consider our individual and specific domains (Graves, 1982). However, the argument in this paper concerns those undesirable spatial boundaries which are imposed on the design without any specific advantage and can therefore be regarded as an imperfection of the architectural design. In this case, finding appropriate solutions to overcome these undesirable spatial boundaries is a major challenge for architects and motivates them to come up with effective architectural concepts that have the potential to blur spatial boundaries.

Study Background

The literature review revealed that the notion of spatial boundary in architecture has been addressed in some studies, although in a limited number, yet from various theoretical approaches. Mousavi et al. (2018) considered the boundary to be an essential component of spatial structures and addressed the existing boundaries between humans and the surrounding environment as well as those between various phenomena on the basis of a phenomenological approach. As they argued, by establishing an enclosure, boundaries transform space to place and affect the character and landscape of the place by creating spatial order. Their study concluded that certain spatial boundaries are important for the creation of meaningful places. Dori et al. (2018) addressed the notion of boundary as a finite and infinite spatial structure of Islamic architecture in the mosques of the Safavid era. As their findings suggest, space is perceived in different ways in Iranian architecture, i.e. space is finite in terms of physical perception, but it is infinite in terms of

rational perception. As they put it, in rational and intuitive perception, space is continuous, eternal and infinite. But in sensory perception, space is finite, interrupted and separated. In several studies, the notion of boundary has also been considered as an issue of spatial continuity, especially continuity between inside and outside. In this context, Kiani et al. (2016) considered spatial continuity to be a feature of extending a restricted area and connecting spaces to other adjacent spaces in order to have more physical-visual or intellectual-moral movements. As they have maintained, the boundaries of spaces establish spatial order and determine the quality of space; on the other hand, continuity, which leads to dynamism and motion, is another characteristic of architecture. Mahboobi et al. (2018) addressed the notion of spatial continuity in the form of inside and outside symbiosis through spatial and physical analysis of the unique buildings of Naqsh-e-Jahan Square, one of the most renowned examples of Iranian architecture as a heritage of the Safavid period. As they argued, the concept of boundary and inside-outside relationship have a major role to play in the architecture of this period. The integration of the bazaar with the public buildings in an innovative form and the combination of columned porches and monuments in broad and multi-story dimensions, and the particular design of the entrance as an essential element of the transition area in which the interior and the exterior are intertwined, can be regarded as a special challenge for achieving spatial continuity.In the same vein, Bonyani et al. (2018) addressed the boundary between inside and outside space with the idea that these spaces are not simply empty space or residual space, yet they have unique features as connecting space passing from open space to close space that enjoys a hybrid characteristic from both sides. In a study conducted by Golestani et al. (2018), the concept of spatial integration was introduced as an approach in Iranian architecture to minimize spatial boundaries. As suggested in this reference, visual integration (spatial transparency) that deals with visual connections between different spaces, structural integration (spatial continuity) that implies a gradual conversion of space to another space, and visual-structural integration (expansion) that deals with the complete fading of spatial boundaries by eliminating walls and creating new spaces around a spatial core can be considered as a derivative of spatial integration.Moreover, in a different approach, Colomina (1996) articulated the boundary between publicity and privacy with a focus on modern architecture. That is, an era in which mass media have a representation mechanism that has led to the building being understood in the same way as all the media that frame it. As she explained, this era of publicity is leading to a change in the status of the private, i.e., in reality, modernity is the publicity of the private. In this sense, modern architecture rearticulates the conventional relationship between public and private in a way that fundamentally alters the perception of space. In a relatively similar line, Stojnić and Novljan (2011) discussed the transformation of the physical boundary of the house as a key issue in modern architecture. On the basis of this reference, while in Victorian culture the external boundary of the house was explicitly defined as separating the private and public spheres of life, modern architecture created several domains of private and public life, assigning a variety of new meanings to that boundary and dramatically altering its physical appearance.

Problem Statement and Objective

As the existing literature points out, while the notion of spatial boundary has been approached from various perspectives, the manner in which these boundaries can be challenged, and spatial emancipation can be accomplished has remained relatively unstudied. That is to say, there is a gap with respect to studies that address the elimination of spatial boundaries, focusing on architectural concepts that are capable of challenging them.In this context, the architecture of the renowned Japanese architect Sou Fujimoto can be considered as an appropriate case study. Inspired primarily by nature, his major intellectual project, titled "Primitive Future" has put forward some innovative architectural concepts, aiming to challenge the spatial boundaries established in architecture and to ensure greater integration between man-made and nature. Accordingly, the main objective of this paper is to unfold certain spatial boundaries that can be blurred by the nature-

inspired architectural concepts proposed by Fujimoto. In this sense, the potential of these concepts will be evaluated in terms of eliminating spatial boundaries.

2. Materials and Methods

In order to achieve the objective of this paper, it was necessary to take certain steps. First, the nature-inspired philosophy of Fujimoto that shapes his architectural meta-project, i.e. the Primitive Future, has been explained and the architectural concepts proposed in this intellectual project will be elaborated. This can be considered to be the theoretical foundation of the paper. In the next step, to investigate the potential of these concepts to challenge spatial boundaries, some of his remarkable works as a case study were investigated in order to make a casual correspondence between blurred spatial boundaries and occupied architectural concepts pertaining to each work.On this account, this paper can be considered as a qualitative documentary study based on a descriptive-analytical method carried out by means of a literature survey and a case study. For the case study part, six works have been selected in two different groups in such a way as to represent the essential characteristics of Fujimoto's architecture; three of them relate to residential buildings and the other three to public buildings. The required data on the conceptual properties of the cases were collected through a literature survey and a document analysis, mostly from primary sources produced by Fujimoto himself. Qualitative analytical techniques have been used in the procedure of data analysis, namely to create a casual correspondence between certain blurred boundaries and architectural concepts used. Figure 2 provides a diagrammatic outline of the overall study process, including the logical structure and the methods employed.

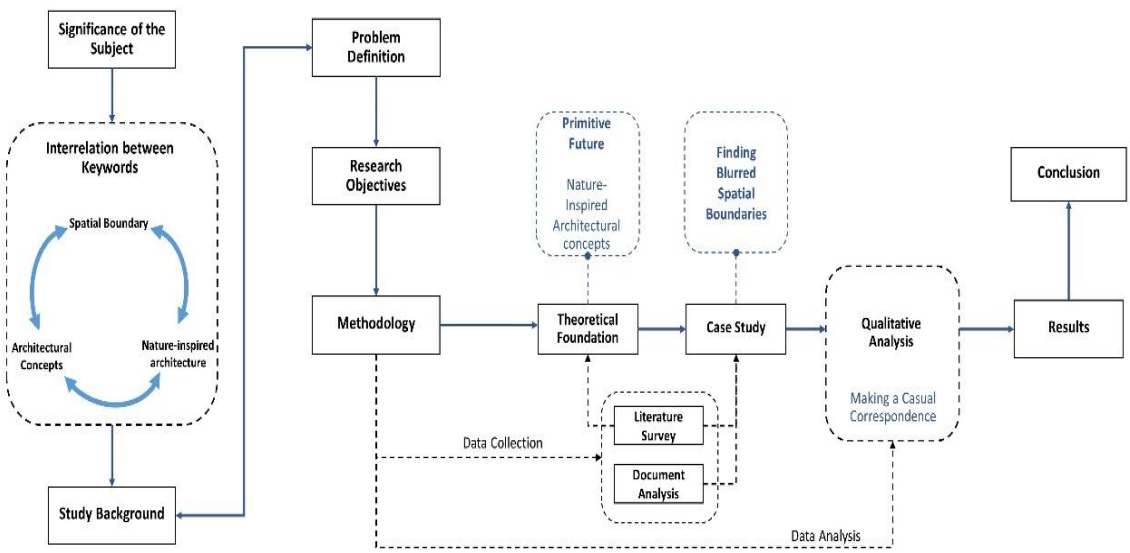


Figure 2. Diagrammatic illustration of the overall process of research. (Developed by the author)

3. Theoretical Foundation

Architectural intellectual project

Some architects, usually those interested in both theoretical and practical aspects, have worked on a variety of projects throughout their careers. Yet, some others are following the same project for their whole career. In other words, the architectural project does not relate to a specific building or a commission of any kind. In addition, there is no indication of the ideas or concept of a particular building; some of the

architect's works may have been created as the same project, but with different ideas and concepts. The Architectural Project has more to do with intellectual endeavors than with any design or commissioned work, and its intention is to challenge the major issues of discipline.Ashtari and Yeganeh (2020a) provided informative descriptions and properties of the notion of an architectural project. Here are some important aspects relevant to the subject:

- Architectural project is an intellectual pursuit carried out as a critical meta-narrative that may engage the world at large.
- Architectural project is always acting as a critic of the status quo, thus it should be ideological and intellectual. Ergo, it is involved with theory.
- Architectural project is the outcome of the zeitgeist; it favors advances and challenges boundaries.
- Architectural Project is more related to intellectual endeavors that go beyond certain design or commissioned work, and its objective is to challenge the major issues of discipline.

The architectural intellectual project can therefore be seen as an intellectual initiative that has been developed over time on the basis of theoretical and ideological concerns of the architect and can include a set of architectural concepts. On this account, since an architectural project is capable of conveying in itself a variety of different architectural concepts, but with certain similarities, it is important not to confuse it with the notion of architectural concepts. It will therefore be worth providing a brief description of what architectural concepts mean exactly. Generally, any architectural work in itself conveys the underlying logical structure that transcends the material condition which can be called 'architectural concept' (Ashtari & Yeganeh, 2020b). The significant point is that the architectural concept corresponds to an evolutionary process in which 'formative idea' (subjective realm) has evolved into 'preliminary formal configuration' (objective realm). This evolutionary process is called the 'process of conceptualization' (Ashtari & Yeganeh, 2020c).

Evolution of architectural projects that challenge spatial boundaries

The desire to liberate space from imposed boundaries and to achieve further spatial emancipation has been an enduring anxiety in architectural history. Architects in every age have sought to leverage the latest techniques to conquer established obstacles. In Gothic architecture, for example, due to the use of skeletal stone structures, the ratio of mass to void in cathedrals is much less than in Roman or Byzantine cathedrals.However, with the emergence of the modern movement, thanks to the use of steel and concrete skeletons, architects have found more opportunities to maneuver around this approach and to create major architectural projects, each of which seeks to eliminate the space constraint, whether as vertical or horizontal layers. The famous Dom-Ino structure developed by Le Corbusier can be seen as a clear manifestation in this regard (see Figure 4). This revolutionary diagram consisted of three rectangular horizontal slabs, six slender columns supporting each of the upper two slabs and six blocks at the bottom as pedestals, and stairs as a link between slabs (Curtis, 1996). The key characteristic of the Maison Dom-Ino, widely known as an emblem of modern architecture, was the complete independence of the structure (reinforced concrete skeleton) from the slabs.However, a paradoxical approach to the issue of boundary can be understood by analyzing the agenda of modern architecture. It can be argued that, while modern architecture was primarily aimed at subverting the interior spatial boundaries of buildings by removing excessive vertical and horizontal space constraints, on the other hand, it amplifies the boundary between the building and its surroundings. This can be explained as a result of the lavish reliance on the technical achievements of the period, followed by the prevalent tendency to present abstract, pure geometric forms that clearly emerge and capture the attention of the mass media, which led to the development of distinctive architectural objects delineating obvious boundaries with their surroundings.To clarify the matter, it is necessary to explain a little more about the factors that helped to strengthen the spatial boundaries in modern architecture. Banham (1999) explained the critical role of technology in the modern era in creating a "well-tempered environment". The significance of Banham's argument for this paper is that it has clearly revealed that, while the celebration of

technological achievements in the modern period has been effective in providing thermal comfort for the interior spaces of the building, at the same time it has induced negligence in the natural potential of the surroundings, which has somehow resulted in an accentuated boundary between the interior and exterior spaces. Moreover, one of the trends in the modern milieu was to influence a large number of people with the photographic appeal of a building. The architectural methods of some leading figures of modern architecture, such as Le Corbusier and Mies van der Rohe, were ideally suited to this approach. They created pure, easily identifiable geometric shapes that can be relayed via mass media (Colomina, 1996). Table 1 summarizes some of the influential factors commonly used by Corbusier and Mies to cut off buildings from their surroundings by analyzing two of the clearest examples in this regard.

Table 1. Influential factors that accentuate spatial boundaries in some prominent cases of modern architecture. (Developed by the author)

Architect	Basic Info (Name, Image)	Factors that have Contributed to Strengthen Spatial Boundaries
Le Corbusier	**Villa Savoye** 	• Pure Geometrical Formal Configuration • Elevating the mass of the building off the ground (piloties) • Use of monochrome color (typically white)
Mies van der Rohe	**Farnsworth House** 	• Simple formal composition • Readable structural layout • Placing the building on the podium • Use of monochrome color (typically white)

Aside from those trends that step towards accentuated spatial boundaries as a response to what was in vogue, however, the continuous line of thought aimed at spatial emancipation and challenging undesired spatial boundaries has been developed and reinforced by the aid of technological innovation that enables architects to have considerable maneuvers in space with less structural concern. As proposed by Ashtari and Yeganeh (2020a), the Free Plan accompanying the Open Plan, the Free Section and the Boundless Space are three major architectural projects that not only make a significant contribution to spatial emancipation as a general approach, but also have meaningful and didactic interrelationships in the process of historical evolution (Figure 3).

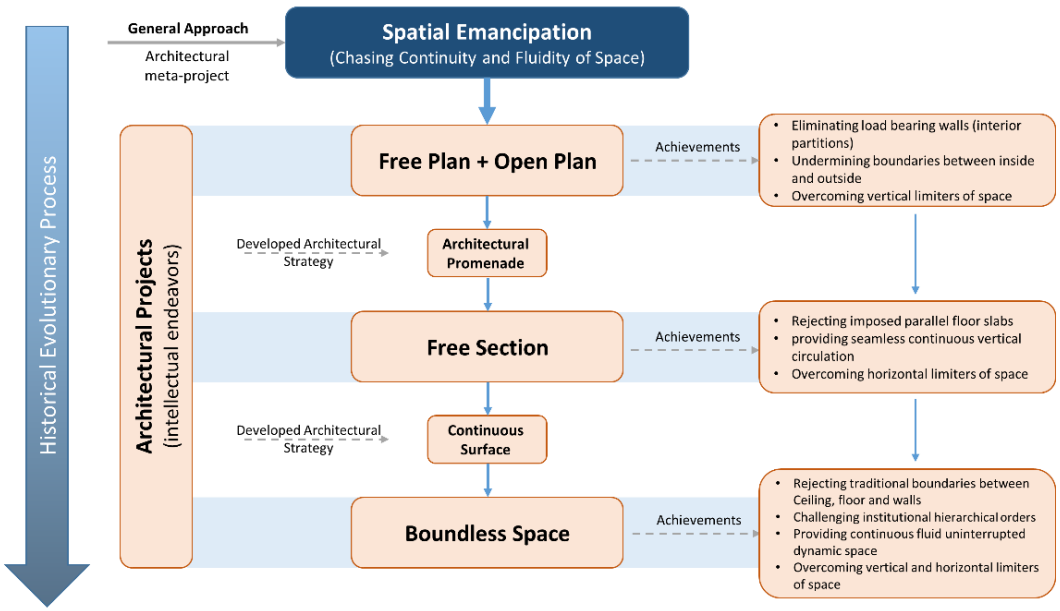


Figure 3. The diagram illustrates the interrelationships of architectural projects seeking spatial emancipation in the historical evolutionary process. (Ashtari &Yeganeh, 2020a)

Primitive Future: Fujimoto's Architectural meta-project

Contemporary Japanese architecture, particularly after the Second World War, enjoys influential innovative concepts stemming from the fusion of Western architectural thought with the nature of traditional Japanese reflections. As Mrduljaš et al. (2012) argued, "these concepts are equally a consequence of the rapid processes of modernization, as well as of an attitude which observes modernization from a critical point of view". Sou Fujimoto is one of the leading members of the new generation of Japanese architects, and his research is focused on putting together an empathic relationship with contextual features and a radical questioning of norms (Liotta, 2017). Essentially, this unusual contrast between super-modern impulses and the kind of naivety is the foundation of Fujimoto's effort to create a new connection between the physical space of corporeality and the perception of the space of a dematerialized networked environment. According to Worrall (2009), since his early work, Fujimoto has tried to transcend the binary logic of fundamental oppositions that characterize architectural thought, oppositions such as public and private, interior and exterior, house and city. Rather than looking for the significant features of each of these realms, Fujimoto focuses on the indeterminate logical realm of opposing ideas. The notion of "in-between" with its inherent consistency of uncertainty is fundamental to him. This very idea, in his reflections on architecture, as Worall argued, presented designs with boundaries that are convoluted, folded or blurred to integrate a man-made entity with its natural surroundings.Growing up on the Japanese island of Hokkaido, influenced by organic and natural structures such as forests and caves, Fujimoto draws inspiration from these for an ambiguous understanding of space and form in a design philosophy described as the "primitive future", a concept that seems to be contradictory at first glance (Kraf, 2013). As Fujimoto argued, "primitive and future are contradictory. Every architect thinks about the future, but the future is not a 'future-like' future. ...I like to start from this simple, fundamental point" (Mrduljaš et al., 2012). For Fujimoto, humans are somehow primitive, since they have an animal-like body and instincts, and thus the relationship between space and body can be very primitive.

In fact, the Primitive Future can be considered Fujimoto's architectural meta-project, which seeks to develop concepts inspired by nature, to go back to the very fundamental relationship between space and the body, to challenge the existing boundaries between people and their environment, and to help make their living space more harmonious and integrated with nature. Fujimoto maintains that he always wants to render "weak architecture". The notion of weak architecture, as he put it, is about "not making architecture from an overall order but from the relationships between each of the parts" and, as a result, "an order can be made that incorporates uncertainty or disorder" (Ito, 2008). The relations of objects in the natural world are all dependent. They are loose, but subtly and delicately intertwined. As Ito has argued, through his own delicate sensitivity, he seems to feel the relationship of things in the natural world and seeks to describe them as architectural diagrams.In this way, Fujimoto began to develop some creative architectural concepts to rethink fundamental architectural issues. One of the very first concepts he came up with was cave-like architecture based on his careful comparison of a cave and a nest. For Fujimoto, the nest is a well-prepared space, like the functional architecture of the 20th century, whereas the cave is not a prepared space, but a landscape in which people can act or react. He assumes that both the cave and the nest are the very beginnings of architecture, but they are very different. In fact, for Fujimoto, the cave represents a raw space where the function was defined on the basis of human behavior. The cave inhabitants assimilate themselves to the environment, improvising, adapting, and discovering numerous latent capacities in their environment. He claimed that this unplanned, unconscious mode of occupation is that of our primitive, animal selves through which we seek our most comfortable locations.

Based on the concept of cave, Fujimoto introduced the "Primitive Future House" and deliberately placed it against the Dom-Ino structure in order to make a critical comparison between them (Figure 4). In this sense, he criticized modern architecture for its spirit of division and separation, and considered the concept of cave as an acceptable alternative to the rigorous modern functionality that separates human activities. He also differentiated between the concept of cave and the concept of universal open space that was prevalent in modern architecture. As he argued, if we plan or render a fully open space, it's a kind of 20th-century flexibility, but I don't think it's that flexible. At the end, it is just a big space, and people would be embarrassed of how to use it. Primitive Future House is not like a universal open space, but more like a landscape, consisting of many different areas.

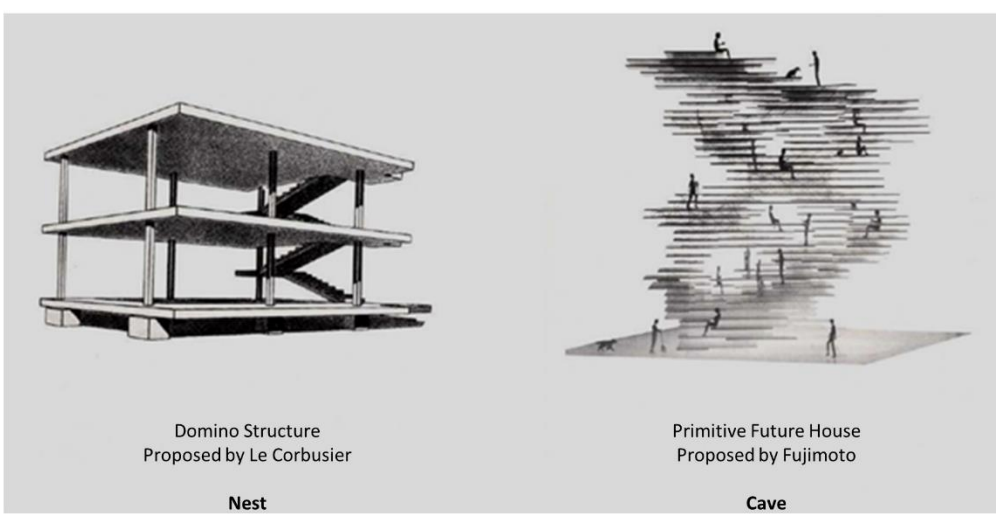


Figure 4. Primitive Future House versus Dom-Ino structure. (Developed from Fujimoto, 2008, pp. 22-23)

In the same way, he gradually put forward some other innovative architectural concepts, including Nest or Cave, Notes without Stave, Separation and Connection, City as a House – House as a City, In a Tree Like Place, Nebula, Guru-Guru, Garden, Before House and City and Forest and Before Matter and Space. Table 2 outlined these concepts in a brief summary of their properties. There are some critical points in Fujimoto's innovative concepts that make them essential to this paper; firstly, the common feature of these concepts is that they derive mainly from nature, that is, they can be considered nature-inspired concepts, and secondly, they have a significant potential to challenge traditional spatial boundaries. Furthermore, it should be remembered that these concepts are by no means related to superficial imitations of natural forms in architecture. As Fujimoto mentioned (as cited in Mrduljaš et al., 2012), "I don't want to use the shape of the tree itself, or the system of natural situations. Instead, I try to somehow mistranslate natural things to architecture, so a tree is not a tree but I try to take each space on each branch and to create new, more networked relationships".

Table 2. Primitive Future as architectural meta-project and its constituent architectural concepts. (Adopted from Fujimoto, 2008)

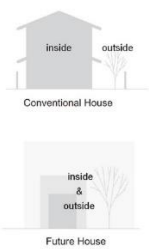
Primitive Future (architectural meta-project)	
Architectural Concepts	**Conceptual Properties**
Nest or Cave	A nest as a functionalist archetype is prepared according to the sense of comfort of its inhabitants. A cave exists regardless of its convenience and remains indifferent to its inhabitants.
Notes without Staves (The new geometry)	Like groups of notes relate directly to each other rather than to an overarching temporal or tonal structure, group of figures can relate to each other rather than to an abstract and transcendent spatial order.
Separation and Connection	Space is relationships and architecture is to generate various sense of distances. Rather than erecting a definite separation, a space must have rich gradations between two conditions.
City as a House – House as a City	Spatial condition in which a city developed as an erratic extension of a domestic house which is neither a city nor a house; condition as if a city and a house became nested within each-other.
In a Tree Like Place	To live in a house is akin to live in a tree. They are not hermitically isolated rooms, but connecting and continually redefining each other. Totality formed by interrelationships. People can discover a new coordinate system with a space impregnated by chaotic and uncertain elements comparable to trees and forests.
Nebulous	Field of distances and interactions emerges from nebulous conditions and rejects any predilection for totalizing or all-encompassing systems. Established dualities between differentiated phenomena, such as interiority versus exteriority, or house versus city, can be dissolved in unlimited gradations depending on differences in local densities.
Guru-Guru (spiral)	Specific form of spiral which externalizes all interiority and internalizes all exteriority. There exists infinite depths and expansion. Continuity and discontinuity coexist. Centripetal and centrifugal forces co-occur.
Garden	A garden is the initial state of architecture. In a garden, everything is left indeterminate. Countless interactions persist that surpass our faculty of comprehension; each of them is spectacular but totally ambiguous in its entirety. Architecture is a garden with a roof. Garden is architecture without a roof.
Before House and City and Forest	Back to the moment when a human's "place to be" was yet in the undifferentiated state, then it will be possible to envision a place that is at the same time a house, a city and a forest. It is a place like a small Earth.
Before Matter and Space	Undifferentiated state of matter and space in which ambiguities blur the distinction between the space produced by the mass and the mass produced by the space.

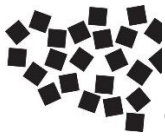
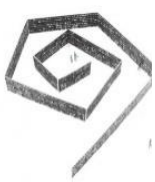
Consequently, given the instructive explanations of the architectural project and Fujimoto's range of creative architectural concepts, it can be argued that Fujimoto's Primitive Future is precisely in line with the features of the architectural meta-project; since it is an intellectual endeavor, namely a long-standing concern, it covers his entire career, which has been established as a critic of the status quo. It is a critical meta-narrative, as the outcome of the zeitgeist, reflecting a critical attitude towards the extravagant inclination of the modern agenda towards machine-like architecture. Moreover, it transcends a certain building or even a particular architectural concept, yet it encompasses a series of architectural concepts that have been developed with the aim of challenging the major issues of the discipline.

4. Case Study

In order to unfold the potential of Fujimoto's innovative architectural concepts for the elimination of spatial boundaries, a case study based on the investigation of his work is needed to make a casual correspondence between blurred spatial boundaries and occupied innovative architectural concepts. Accordingly, six cases were selected in this section, three residential houses and three public buildings. The selection of cases was based on the premise that they should reflect the essential characteristics of his architecture and that they should also cover his creative architectural concepts. Table 3 provides a detailed analysis of the cases concerning the elaboration of the concept, the conceptual diagram and the blurred spatial boundaries for each case.

Table 3. Investigating the casual correspondence between the architectural concepts employed and the blurred spatial boundaries in Fujimoto's work. (Developed by the author)

Type	Name	Concept Elaboration	Conceptual Diagram	Blurred Boundaries	Image
Single Houses	House N (Oita, Japan 2008)	A box within a box within a box. (1) The house is comprised of three shells of progressive size nested inside one another. No real exterior, and no real interior. There is neither city nor house, just gradations of betweenness. (2), (9)		Interior ─ Exterior Object ─ Field Public ─ Private Architecture ─ City Openness ─ Enclosure	
	House before House (Utsunomiya, Japan, 2008)	A village structure, with individual buildings, open areas and stairways. (1) Indoors and outdoors, the house and the garden, form a spatial continuum. (3), (9)		Architecture ─ Nature Interior ─ Exterior Object ─ Field Figure ─ Ground Public ─ Private Architecture ─ City	
	House NA (Tokyo, Japan 2011)	House like a Single Tree. (4) As "a unity of separation and coherence", the house acts as both a single room and a collection of rooms. (3), (5)		Architecture ─ Nature Interior ─ Exterior Architecture ─ Furniture Object ─ Field Public ─ Private Architecture ─ City Openness ─ Enclosure	

Public Buildings	Children's Centre For Psychiatric Rehabilitation (Hokkaido, japan, 2006)	Group of cube figures relate to each other rather than to an abstract and transcendent spatial order. (4) A Collection of 24 two-story white cubes of nearly identical size that appear to have been scattered at random. (2), (9)		Interior ─ Exterior Object ─ Field Public ─ Private Openness ─ Enclosure	
	Serpentine Pavilion (London, England, 2013)	Cloud-like form that would melt into the green. (6) Integrating the natural surrounding plant life with a man-made constructed geometry. (7), (8)		Architecture ─ Nature Interior ─ Exterior Architecture ─ Furniture Object ─ Field Figure ─ Ground Public ─ Private Architecture ─ City Openness ─ Enclosure	
	Musashino Art University Museum and Library (Tokyo, Japan, 2010)	Forest of books. (4) Single continuous bookshelf in the form of a spiral with many openings. (3)		Architecture ─ Nature Interior ─ Exterior Object ─ Field Public ─ Private Architecture ─ City Openness ─ Enclosure	

Sources:

1. Fujimoto (2010)
2. Worrall (2009)
3. Pollock (2016)
4. Fujimoto (2008)
5. Scaroni (2017)
6. Quintal (2013)
7. Portilla, (2013)
8. Fujimoto (2012)
9. Daniell (2015)

5. Results and Discussion

Investigating the cases revealed that certain spatial boundaries have been blurred through occupying Fujimoto's innovative architectural concepts. These spatial boundaries can be counted as dualities between Architecture ─ Nature, Interior ─ Exterior, Architecture ─ Furniture, Object ─ Field, Figure ─ Ground, Public ─ Private, Architecture ─ City and Openness ─ Enclosure. Table 4 illustrates the potential of Fujimoto's innovative architectural concepts, which have been developed as an architectural meta-project called the Primitive Future, for the elimination of spatial boundaries.

Table 4. Blurred spatial boundaries concerning the potential of each of the architectural concepts proposed by Fujimoto. (Developed by the author)

Primitive Future (architectural meta-project)								
Architectural Concepts	**Blurred Boundaries**							
	Architecture Nature	**Interior Exterior**	**Architecture Furniture**	**Object Field**	**Figure Ground**	**Public Private**	**Architecture City**	**Openness Enclosure**
Nest or Cave	●	–	●	–	●	●	–	●
Notes without Staves	–	–	–	●	–	●	–	–
Separation and Connection	–	●	–	–	–	●	●	●
City as a House – House as a City	–	●	–	●	–	●	●	●
In a Tree Like Place	●	●	●	●	–	●	–	●
Nebulous	–	●	–	●	–	●	●	●
Guru-Guru (spiral)	–	●	–	●	–	●	–	●
Garden	●	●	●	–	●	●	–	●
Before House and City and Forest	●	●	–	–	–	●	●	●
Before Matter and Space	–	●	–	●	●	●	–	●

6. Conclusion

As indicated in the findings, it can be argued from a holistic point of view that all Fujimoto concepts have the potential to blur spatial boundaries on their own terms. However, in order to make a comparison between concepts and in view of the proposed classification of spatial boundaries, it can be inferred that certain concepts, namely Tree Like Place and Garden, have the greatest potential for blurring spatial boundaries, while Notes Without Staves have the least potential for overcoming spatial boundaries.

Moreover, it can be deduced from a casual correspondence between blurred spatial boundaries and Fujimoto's architectural concepts that all concepts are potentially capable of blurring the Public ─ Private boundary. Also, the boundaries of Interior ─ Exterior, and Openness ─ Enclosure can be blurred by using most of the concepts. However, the least potential of the concepts for blurring boundaries is attributed to the dualities between Architecture ─ Furniture and Figure ─ Ground.

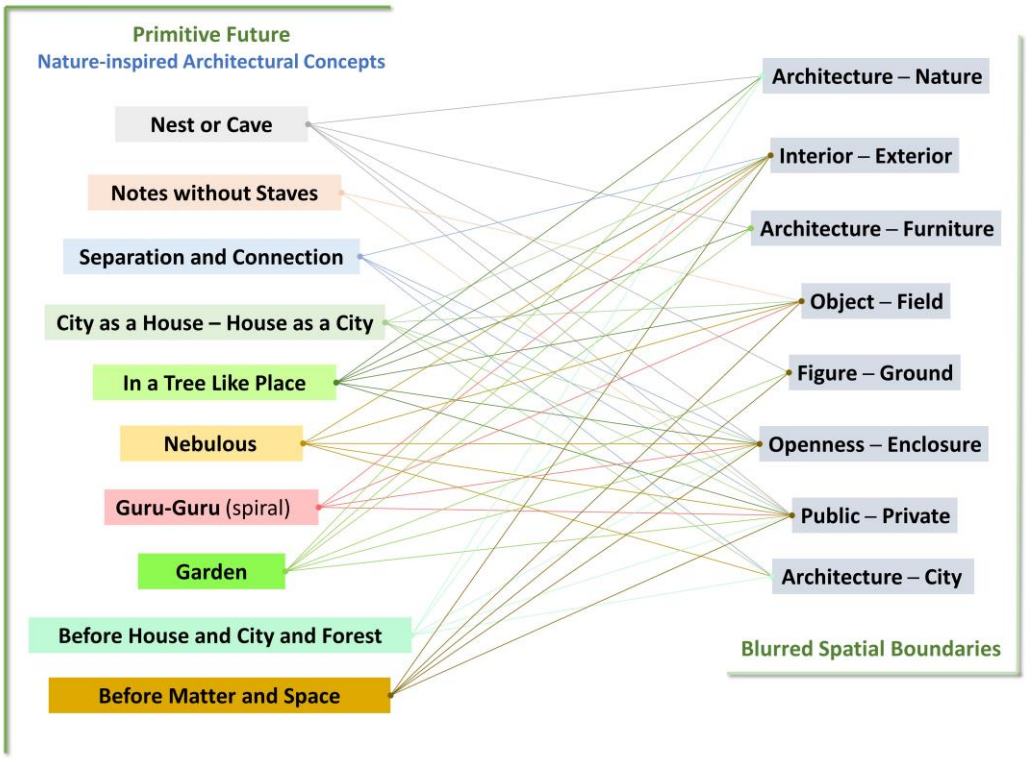


Figure 5. Graphical representation of the potential of Fujimoto's concepts to eliminate spatial boundaries. (Developed by the author)

It is important to keep in mind that, as discussed earlier in this paper, the challenge of spatial boundaries has been a critical issue for Fujimoto throughout his entire career, and thus, when he developed his concepts, he was likely aiming to overcome all established spatial boundaries. It is therefore not so far-fetched that all of these concepts have the potential to challenge the classified dualities suggested in this paper. Nevertheless, the findings of this study are based on the analysis of selected cases and have been achieved by investigating the spatial characteristics of the cases as an objective consequence of the concepts developed.

Accordingly, this study set the stage for a more comprehensive investigation of spatial boundaries. That is to say, the logical structure of this paper, i.e. making a casual correspondence between the occupied architectural concepts and the resulting blurred boundaries, can be used as a model for the investigation of other thoughtful architectural projects developed by theorists and architects. In addition, the dualities proposed in this study as a type of spatial boundary classification may be further developed, and each of these dualities may also be subject to further investigations in future studies.

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