

# A Study on the Spatial Transparency: Focusing on Dominique Perrault's Projects

도미니크 페로의 프로젝트에 나타난 공간적 투명성에 관한 연구

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## Abstract

현대 건축은 시공 기술과 재료생산 및 개발의 발전을 바탕으로 점차적으로 투명성을 띄게 되었다. 이러한 건축적 투명성은 재료나 기술적인 발전도 많은 영향이 있었으나 그 보다 사용자들의 공간적 인지와 요구에 맞춰 생성되었다고 볼 수 있다. 본 논문은 도미니크 페로의 프로젝트를 바탕으로 건축 공간적 투명성의 근본적 요소들을 분석하여 프로젝트에 나타난 공간적 구획과 인지에 대해 알아보았다. 도미니크 페로는 투명성을 건축적 구축방법 및 표현방법으로 사용하는 것으로 나타났고, 건축물이 하나의 고립된 물체로 보기 보다는 대지와 건축물의 구분이 불분명하여 공간적인 경험이 건축물과 대지의 경험을 넘나들게 만들어 진 것을 볼 수 있다. 실내공간의 투명성은 공간 구획에서 표현이 되었는데, 도미니크 페로의 대부분의 프로젝트에는 매우 간단하고 개방된 구획을 추구한 것을 미뤄 볼 때 실내 공간구획과 외부와의 밀접한 관계를 동시에 설계한 것을 알 수 있었다. 공간적으로나 표피적인 투명도가 높은 공간의 사용하는 사용자의 생활패턴이나 공간적 인지에 미치는 영향을 살펴보았을 때, 개방된 공간이나 공간적 노출에 의식하지 않고 자연스럽게 적응하는 것을 알 수 있었다. 현대건축 공간에 나타나는 투명성은 물리적인 영향보다는 사용자의 공간인식과 시각적 인지에 큰 영향을 미치는 것으로 판명되었다.

키워드 : 투명성, 이중성, 공간적 경계, 도미니크 페로

Keywords : Transparency, Ambiguity, Spatial Boundary, Dominique Perrault

## 1. Introduction

### 1.1. Research Background and Objectives

Modern architecture, with the development of construction technology and material advancement has taken on the 'transparent' characteristic. The Egyptian Pyramids, one of the most well known architectural forms from the prehistoric times, illustrate the contrast between the 'mass' and the useable space that is deeply embedded in it. There is a clear distinction between the inside and the outside. However, when considering the modern architectural spaces, the boundary between the inside and the outside is visibly blurred and there is a continuous effort to achieve visual spatial extension.

The aim of this study mainly lies in the concept of

transparency in modern architecture and will be illustrated through Dominique Perrault's projects as case studies. Dominique Perrault deals with different issues of 'transparency' and by taking some of his projects, the affect of transparency on the spatial construct and the spatial experience will be discussed. Furthermore the impact on the spatial recognition and the pattern of use by, the users of spaces with such high level of transparency will be discussed.

### 1.2. Scope of Study and Method

After a close analysis of the definition of 'architectural transparency' as out lined by numerous academics, it was considered possible to divide the discussion into the following. Firstly, transparency in the skin of the space; secondly transparency as a spatial quality. Then the projects of Dominique Perrault were investigated on the basis of the above outline and thus illustrate how the 'transparency' was

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expressed as an architectural tool. Furthermore, the implication on the lives of the users of such 'transparent' spaces and the changes in spatial function will also be discussed. In this study, the transparency of facades will be dealt as material transparency and this will be discussed separately from 'spatial' transparency.

## 2. Definition of Transparency in Architectural Space

### 2.1. Concept of Transparency

In architecture, the concept of 'transparency' can be defined similarly to that of a Cubist's painting, that is to say, 'simultaneity', 'interpenetration' and 'superimposed'.<sup>1)</sup> The word 'transparent' comes from Latin, which means: Trans - Across and Parent - See, thus encompassing the meaning of seeing some things at the same time. The concept of 'transparency' set out by scholars such as Giedion and Rowe have been architecturally applied and developed. Gideon emphasized the 'simultaneity' of the material characteristics of transparency thus exposing the interior to the exterior, vis versa. But Rowe's concept, differed from that of Gideon, and divided the characteristics into material transparency and structural transparency.<sup>2)</sup>

<Table 1> Concept of Transparency by C. Rowe

Physical Quality of the Material	Structural Quality of the Material
Real Transparency	Virtual Transparency
Superficial Transparency	Phenomenological(Conscious) Transparency
Boundary between interior/ exterior	Conscious perception of two different conditions

G. Kepes on the other hand, focused on the spatial ambiguity that occurs visibly between the co-existence of order and ambiguity.<sup>3)</sup> When C.Rowe, G. Kepes and Moholy-Nagy discuss the concept of transparency, it is clear to note that the material transparency and the spatial transparency are separately defined. The diverse meanings of transparency in modern architecture is well illustrated in C.

1)David A Lauer, Design Basics, translated by Lee Dae Il, Mijin Publications, 1985, p.37

2)C. Rowe & Slutzky, The Mathematics of the Ideal Villa, and other Essays, Literal and Phenomenal Transparency, MIT Press, 1976, p.175

3)Kepes Gyorgy, Language of Vision, Chicago, 1944, p.77, 157, 159, 188, 194

Jenks' timely analysis. He summarized his analysis that during the 1920's -60's, transparency took a very simple role of structural liberation, from the 60's as literal transparency through the use of materials and from the 80's as ambiguous and duality in transparency.<sup>4)</sup>

<Table 2> Concept of Transparency by C. Jenks, categorized by periods

Modern (1920-60)	Late Modern (1960-)	Post Modern (1980-)
Transparency	Literal Transparency	Ambiguity
Structural Clarity, transparency achieved as the result	Use of Material	Duality, ambiguity
Simple, Clear	Amusement and Complexity	

Transparency in architecture occurred since the separation of structure and facade thus the facade took on the surface - transparent characteristic that was supported by the development of material technology. With this, various ways of expression was made possible that enabled the interior to be clearly seen from the exterior. Therefore, what was perceived as 'void' was now possible to be constructed as 'solid', which illustrates the 'duality' that is a fundamental phenomena in modern cultures.

The concept of 'transparency' in architecture evolved from the simple transparency of surface to the ambiguity of spatial boundaries and immateriality which describe the concept in more detail and in a more structured categorized method.

### 2.2. Transparency of the Building Skin

In modern architecture, what is regarded as 'skin' originated when the facade became independent of the main structural system that supported the building. Previously, the walls were the main structures as well as the final layer that defined the space. However, with the development of separate structural system, within a very short period of time, the development of material and design of the 'skin' can be witnessed.

For the expression of transparency of the skin, glass is most widely used. With the current level of glass production technology, the material takes on 'crystal clear' quality with a high strength and the maximum size of a single 'sheet' is

4)Charles Jencks, The New Moderns, Translated by Cho Chul Hee, Space + Art Publications, 1992, p.67

determined by the possibility of transportation, not by the material limitation. With this, the need for bulky horizontal or vertical structural elements is being eliminated thus enabling the 'skin' to be more transparent than ever before.

Through the use of glass, a new spatial experience can be achieved and by taking on the transparent characteristic simultaneously with other degrees of transparency and color may emphasize the spatial transparency as the different material will show various textures and degrees of transparency. At the same time, the spatial depth that is contained in the facade can be suggested and various spaces can be formed with the use of appropriate levels of openness and screening.

One of the most noticeable characteristics of glass is that it can be perceived differently throughout the day. During day time, the surface of the glass plane will reflect the surrounding thus visually protecting what is contained inside. However, at night, the lighting of the interior transforms the space and turn it into a self contained 'lantern'. In the case of 'mirror' glass, when it reflects the surrounding during daytime, it almost becomes 'immaterialized' but during night time, due to the artificial lighting one may be able to see the interior space from outside. Therefore, it can be said that glass can express 'solidity' during daytime and 'void' at night time. The degrees of transparency of the facade is determined by and perceived with the lighting condition of the interior/ exterior and day/ night.

When considering the transparency of facade, the application of glass has been synonymously used but recently a variety of other materials have been newly developed and experimented, such as metal mesh, fabric and plastic, which illustrate the variety that is now available.

### 2.3. Spatial Transparency

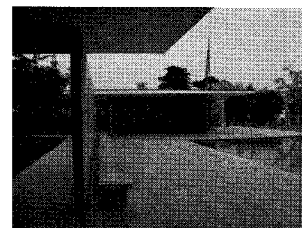
The spatial transparency can be categorized into the following and these categories are not independent from each other, but simultaneous phenomenon. The significant characteristics of spatial transparency are: the ambiguity of spatial boundary; mutual interpenetration of exterior/ interior by extension of visual boundary; spatial continuity and spatial exposure.

#### (1) The Ambiguity of Spatial Boundary

The spatial transparency can be more easily read in the ambiguity of the boundary between the two differing spaces.

Before the construction methods were so extensively developed, different rooms were almost always, divided by solid walls that also served as structural elements which could not have been eliminated. However, with the introduction of a separate structural system, the need for a 'solid' boundary became almost irrelevant. Therefore, the programmatic division continues to exist but visually the entire space is perceived.

The Spatial transparency is most effectively used in the boundary ambiguity of inside and outside. The physical properties of glass which has the properties of being visible and invisible, allows this spatial transparency to occur. Through the glass plane, the view of the interior is extended towards outside and vis-versa thus allowing a continuous spatial extension as well as an ambiguous spatial boundary. An architectural project which symbolically illustrates this is Mies van der



<fig 1> Barcelona Pavilion, 1929

Rohe's Barcelona Pavilion(1929). This building is a prime example of the 'flow of space' and visible transparency produce the condition of ambiguity in the spatial boundary of interior and exterior. The simultaneous use of transparent glass with the opaque marble creates the continuous quality of 'open and close' in terms of space and at the same time suggests what is to follow, an ambiguity in the depth of space thus making the observer to anticipate the experience to come.

#### (2) Mutual Interpenetration of Exterior/Interior by extension of Visual Boundary

Philip Johnson who had been influenced by Mies van der Rohe, built the Glass House(1949) which can be taken as a good example for the illustration of the phenomena of mutual interpenetration of exterior/ interior by extension of visual boundary. With the exception of the toilet, there are no interior walls, what remain are the steel structure with the glass. The house which has been situated in nature, continuously visually connects the outside to the inside and the differing visual and spatial recognition at day and night is emphasized. The visitor experiences the continuous



<fig 2> Glass House, Interior, 1949

visual movement between the inside and outside. The interior of this house seems to have been designed with the nature as it's walls and thus demonstrates the importance or the strong existence of mutual interpenetration.

### (3) Spatial Continuity

Spatial Continuity entails the visible connection between the two or more 'rooms' that are physically divided. This concept emphasizes the visual 'openness' which differentiates itself from the physical division and the visual separation that existed. The perception of spatial continuity, which depends entirely on the visual 'simultaneity', is affected by the use of different materials as well as the time of the day.

### (4) Spatial Exposure

The other phenomenon that occurs with the ambiguity of spatial boundary is the spatial exposure. By exposing the happenings of the interior to the exterior is both physically and phenomenologically 'honest'. In Dominique Perrault's ECC, at Ewha Women's University, the lecture rooms and seminar rooms are now in the realm of 'public' space. These spaces which required solid partitions to ensure 'privacy', are now demarcated by glass screens. The different degrees of etching on the glass screens provides appropriate level of programmatic separation but maintains the transparency. The users of such spaces may require some 'adjustment' both mentally and physically.

## 3. Dominique Perrault & Transparency

### 3.1. Architecture of Dominique Perrault

Dominique Perrault was born in 1953, in France, and is one of the famous French architects who has worked on various projects world-wide. His design began to be noticed globally from the late 1980's which coincides with the commissioning of the National Library of France. His design is extremely 'French', with a less emphasis on the hightech, with an overall 'grid theme'. This is due to his architectural ideals and his interest in 'geometry', resulting as the method of architectural representation. A few of his best works, which includes the National Library of France, ECC at Ewha and Berlin Olympic Swimming Stadium and Velodrome, Perrault's strongest ambition seems to be in the interweaving of ground and the building and integrating the concept and the built form. What seems most important for Perrault is

the use of material transparency to achieve a building that has no final 'exterior' layer but a space or a territory that is absorbed into the territory of the cityscape.

Perrault called himself an architect as well as a 'geo-couturier'.<sup>5)</sup> What he means is that he designs his buildings, and the space within, to be connected to the ground condition of the site. He uses the transparency of the space to achieve this tight connection between the building and the ground. In the case of Ewha University's ECC, he refers it as 'nature that becomes architecture and architecture that becomes nature', and the 'valley' that is created between the huge glass facades appear as two rock faces as well as an extension of the sky, through the reflection on the surfaces. The use of glass serves well as a material to achieve the result Perrault seeks, in terms of architectural expression as well as conceptual expression.

### 3.2. Transparency in Dominique Perrault's Projects (Spatial)

When examining the floor plans of Perrault's designs, the plans come across as simple and open. Most frequently, the building is a 'box', whether transparent or not, in which smaller boxes are placed. The spatial clarity is most evident in his planning. It is therefore not difficult to envisage the spatial organization from the drawings. The rooms which require partitioning, or the services are grouped together in a linear or rectangular organization and other areas are sub-divided by moveable furniture which allow flexibility and adaptability of the space.

From the outside, most of Perrault's buildings appear vacant and closed, like a structure that is protecting, but from the interior it is permeated by light, open to the city and landscape.

### 3.3. Transparency in Dominique Perrault's Projects (Building Skin)

In most of Perrault's buildings, the building skin plays one of the most important roles, as it is the design of the building skin which gives Perrault's buildings their special characteristics. It is through the use of material, he usually employs a combination of totally transparent glass panels to opaque or reflective panels and metal mesh that achieve the

5)정지성, Architects & Design Dominique Perrault, CA Press 2006, p.15

<Chart 1> Perrault's projects: Categorized into three groups

Type	Small project/ Single program	City/ Multiple program	Landscape
Project Images			
	M-Preis Supermarket Austria (1999-2003)	Media Library Venissieux (1997)	Velodrome & Olympic Swimming Pool Berlin (1999)
	M-Preis Supermarket Austria (1999-2003)	Town Hall, Innsbruck (1996-2002)	Ewha Campus Center Seoul (2008)
Spatial Transparency	It is 'Open Plan', to serve the spatial program, with repeated aisles which lead the flow of the customers.	Within the open planned interior, each required spaces are partitioned and there are moveable furniture that can flexibly make boundaries for different spaces.	Integrated with the existing landscape, by using glass or etched glass, the spaces are divided but the visual connection is maintained. The degree of transparency changes according to the viewing angle.
Transparency of the Building Skin	The main material being glass, the surrounding is reflected during the day which makes the building less conspicuous and more conspicuous at night.	The combination of transparent glass, opaque panels and reflective glass mirror glass panels controls the degree of transparency of the facade	The level of transparency changes, according to the viewing angle and the spaces behind the facade seem to appear and disappear.
Relationship	With the use of open plan, the interior is visually extended to exterior during the day but perceived at night as a separated and isolated space.	The level of transparency is controlled according to the needs of the interior program thus offering the appropriate level of spatial 'openness'	The use of different degrees of transparency in this large public building, not only divides the interior space but also is a key element that integrates the building to the existing landscape

geometrical grid which is so identifiable in his design. Perrault not only uses a combination of materials but also sometimes uses in several layers - allocating a functional role is each layer, thus enabling the overall appearance to change. The spatial requirement of the interior is also transmitted to the exterior facade, thus when the requirement for the interior environment changes, the facade changes accordingly. As with all architectural projects, Perrault uses the movement of the viewer and the change of time of day to the maximum to achieve the ever changing and ever alive structure.

#### 4. Analysis of Transparent Characteristics in Key Projects of Dominique Perrault

##### 4.1. The National Library of France 1998

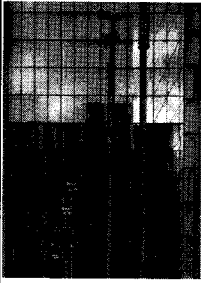
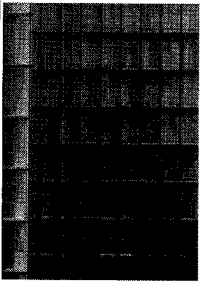

The exterior glass facade of the French National Library has the appearance of maximum transparency that serves as the enveloping skin but at the same time not being perceived as a physical matter. What is more visibly conspicuous is

the horizontal layers of the floor slabs and the movement of the users inside. This is in fact the ultimate result or the affect that is strived after by using the 'transparent' glass, the exposure of the interior without any screening. This is made possible only when the exterior facade is visually transparent, as if non existent, but physically present. The glass layer is very quiet, simultaneously existent and non existent, and the second layer in wood can be flexibly opened and closed thus appearing as a 'breathing' layer. The level of flexibility is determined by the user and has a close relationship with the control of interior environment and the archives for books. The choices that are made to serve the interior is clearly exposed to the exterior and this demonstrates 'physically honest space' which was discussed before. Perrault's French National Library, with a transparent skin and an opaque layer, appears as a 'box within a container' during the day and as 'light towers' at night<sup>6)</sup>, as can be seen in many of his other projects. What appeared as materialistic 'solid and void' or a layer of transparent envelop

6) Jean Nouvel, Biblioteque national de France, Artemis, 1996, p.35

and the wooden screens are absorbed into the darkness. And the wooden screens are now a layer that protects the interior from the darkness of the exterior.

<Chart 2> Three layers of the National Library of France

Exterior facade(Layer)	Image	Programmatic Function	Result
Glass		As the final layer between the interior and exterior: protects the interior from the elements.	The fixed fire proofed glass panels with a low level of reflectivity, the interior is more clearly exposed to the exterior.
Wooden Screen		Must be flexible to accommodate the variable functions of the interior.	Screen panels are flexible to be opened and closed according to the needs of the user thus providing a suitable environment.
Spatial Layer		Office/ Library/ Archive	The combination of the two exterior layers controls the interior environment




The buildings appear vacant which offers maximum programmatic flexibility. It is a composition and juxtaposition of 'fullness' and 'emptiness' 'solid and transparent' that takes a different appearance by day and night.

#### 4.2. Super Market M-Preis, 2000, 2003

The three supermarket projects in Austria are relatively small in size and share the common quality of being visibly very quiet. The main reason behind this lies in the use of 'transparency'. All three projects have a large glass front facade which reflect the surrounding environment thus the building being perceived as 'absorbed' into its site. However, when observed on approach, the products displayed and the movement of the people are more clearly exposed. In contrast, when seen from the inside, the outside nature or the city scape become a part of the interior without a clear boundary.

The three projects can be summarized as below:

<Chart 3> Exposure of space and spatial interpenetration in the M-Preis Projects

Project Location	Effect of Transparency	Interior and Exterior Relationship
Wattens I, Austria 2000	Enables the built form to be in more harmony with the surroundings /the user perceives the interior space without any boundary	
Zirl, Tyrol, Austria 2003	The open spatial organization helps to achieve a closer relationship between the interior and the exterior	
Wattens II, 2003	At night time, the program of the interior is exposed to the outside, with artificial light, the spatial interpenetration that occurred during day cannot be read	

In contrast to the daytime condition, at night, with the use of artificial lighting, the space becomes an independent 'object' where the interior and exterior are clearly defined. The transparency and reflection made through the interrelation of glass and steel panels, create a flood of natural day light in the building. The result is the production of an optical continuation of the external landscape to inside - such as the rich vegetation of the riverbank are brought into the market.

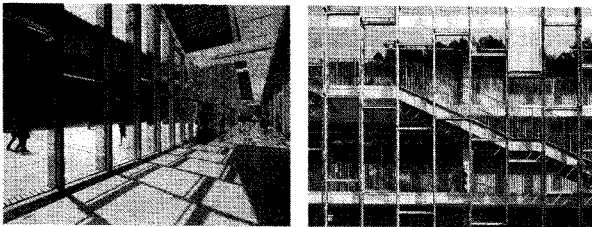
#### 4.3. Ewha University Campus Center, 2008

'Transparency' in ECC can be discussed in many aspects. The function of this building is of a very public nature which is constantly used by a large number of students and visitors. However, it's spatial openness or the transparency takes on a new meaning which cannot be compared to the average 'academic' buildings. The transparency of the skin, which is noticeable in the facades that face the valley, is very unique. Even with the use of the glass, much of the interior is not exposed immediately as the space behind it is darker thus the surface of the glass reflects the outside. The impact is such that at first the facade are perceived as mirror glass surfaces. As a result, the interior is visually 'protected' from the outside. The two huge glass facades, made up of glass panels set in aluminium structural framing,

change in terms of degrees of transparency depending on the angle of view point. As illustrated in <fig 5>, during the day the facades can be perceived as almost black and opaque. The lecture rooms and seminar rooms located parallel to the facades with the parallel walls in etched glass sheets. Although not entirely transparent, the level of privacy inside is maintained and at the same time the presence of what goes on outside can also be read from the inside.

Such type of spatial organization in an academic facilities cannot be found else where in Korea, and there was a worry over the suitability of material and the visual relationship hence the possibility of conducting a class. However, to a generation of students who are very much used to the level of spatial exposure, the problems did not surface.

The two facing facades were designed reflect the daylight



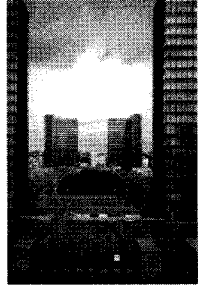
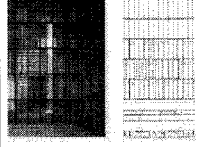
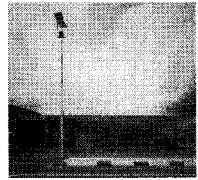
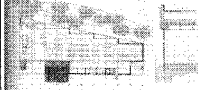


<fig 3> Interior of ECC/ Overlapped layers. 2008

so that natural lighting is introduced into the underground space. When seen from the corridor, there are multiple layers of reflected images and spaces that condenses the spatial volume and thickness thus creating a new spatial experience that is very ambiguous.

This spatial exposure, which is very common in projects in the West, is only being introduced in Korea and its suitability in terms of function and emotion will be proved in time. The choice of material for ECC and its adaptability to the landscape brings about its 'non-physical presence' as a result. where the building disappears. This 'presence-absence' is repeatedly used in Perrault's projects and even the shining mullions in the facades of the ECC reflects the sky thus physically disappearing into air. The polished stainless steel mullions are not at all transparent but due to the high degree of reflectivity, they have a non physical existence, depending on the angle of view point.

#### 4.4. Comparison Analysis

<Chart 4> Comparative summary

Project	Spatial Transparency & Transparency of the Skin	Key Detail and Distinction
 National Library of France 1998	<p>Interior spatial planning is simple, but most visible are the flexible wooden screens that accommodates the visual extension of the interior.</p> <p>Low reflectivity, fixed facade &amp; flexible wooden screen layer that is controlled by the users.</p>	 The spatial layout, use of material and the layering of the skin work together.
 Wattens I, Austria 2000	<p>Simple, open planning of the interior helps to create an ambiance of 'fluid' space that is constantly negotiating between the interior and the exterior</p> <p>Crystal white glass with high reflectivity, fixed facade that reflects the surrounding environment</p>	 Overall simplicity, in plan and use of material with the changing light condition achieves the transparent effect.
 ECC Ewah Women's University 2008	<p>Many overlapping layers of different levels of transparency and reflectivity</p> <p>Large faceted glass facades and aluminium mullions create the effect of reflection and transparency</p>	 The use of material and the complex patterning make the most impact further supported by the 'layering' of the spatial planning

#### 5. Conclusion

'Transparency' in architectural space seems to be a very useful tool for achieving the effect of visual extension where the actual physical floor area are becoming more depleted. As discussed in earlier chapters, the use of transparency in architecture can be categorized in to two main groups: in terms of spatial transparency and the transparency of the building skin. Dominique Perrault's projects can also be categorized into these main groups but at the same time his projects have the following characteristics:

1. Flexibility to accommodate constantly changing requirements of the interior program, as in the National Library of France. This project also illustrates several characteristics of 'transparency of the building skin'; by having multiple layered building skin, the user is able to control not only the 'visual extension' of space but also the 'relationship between the interior and exterior' as well as directly controlling the interior environment.

2. Open planning of the interior space; as illustrated in the Wattens Supermarket projects, the simple transparent layer with the simple open spatial planning compliment each other to create the 'ambiguity' in spatial division as well as the 'visual extension of space'.

3. Less distinction between the interior and the exterior; as can be seen in ECC at Ewha Women's University. The separation of interior and exterior was previously understood as the separation of the private and public. However, in contrast to the preference for the definitive separation (i. e. solid wall or opaque partitions) in the past, the division of space is becoming more ambiguous thus bringing necessary changes in the programs of interior/ exterior. Furthermore, it is worth a note that the users of space with high level of exposure are quickly adapting to the new environment and that they are not consciously bothered by being seen.

The use of transparency as a key element in the design, the result is a building that is not an isolated object but as an active participant in the context of landscape. The aforementioned qualities are not only evident in Perrault's works but also in other contemporary architects' projects. The use of transparency covers a vast range of study and deserves to be examined more closely in depth in future studies.

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