ORIGINAL ARTICLE

Architectural Kansei of 'Wall' in The Façade Design by Le Corbusier

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Abstract: The purpose of this paper is to discuss the modern architect Le Corbusier's architectural Kansei (sensitivity) on wall in site environment through the analysis of his façade design, using *Œuvres complètes* (1910-1965, 8 vols., Les éditions d'architecture, Artemis, Zurich) and *Le Corbusier Archives* (1982-1984, 32 vols., Garland Publishing, Inc. and Fondation Le Corbusier, New York, London, Paris). At first, I arrange five façade types, according to the explanation by Le Corbusier; 'fenêtre en longueur (strip window)', 'pan de verre (glass wall)', 'brise-soleil (sun-breaker)', 'loggia' and 'claustra'. Through the analysis of the relationship between these types and the design process of each building, we find that Le Corbusier's façade design includes the affirmation and the negation of the 'wall' at the same time. In fact, the nature of façade modification during design process is divers: increase in transparency, decrease in transparency and spatialization of façade. That means, Le Corbusier studied the environmental condition by these façade types, and tried to realize the phenomenal openness. This trial bases on the function of architectural Kansei as correspondence between body and environment beyond the physical design.

Keywords: *Le Corbusier, façade, wall, Architectural Kansei, Site Environment*

1. INTRODUCTION

1.1 Purpose

As readers will know, the economic rationalism of the period after the Second World War led to the emergence of a placeless architectural form. The causes of this can also be sought in modernist architecture, but the post-modern architectural form, which was a theoretical reaction against modernism, can equally be said to have no relationship with the specific environment. This analysis will amount to a critical examination of architect's Kansei to the environment in architecture.

The present paper is to discuss the notion of 'wall' as metaphysical problem of architectural Kansei (sensitivity) through the analysis of the physical façade design by the modern architect Le Corbusier (1887-1965), in the view point of Kansei-philosophy as the question about the implicit relationship between body (architect) and environment (building site environment) [1]. Because Le Corbusier, who is well known by the proposition of 'free façade (la façade libre)', creates innovative façades as interface to the site environment. However, Le Corbusier himself does not explain all sort of façade design, which will include the Kansei of 'wall' beyond theorization or language.

1.2 Method

To discuss architectural Kansei of 'wall', this paper analyze the physical façade design of the buildings and its design process by the architect Le Corbusier.

Taking as a primary source *Œuvres complètes* (1910-1965, 8 vols., Les éditions d'architecture, Artemis, Zurich,

abbreviated below to the *Complete Works*) [2], Le Corbusier's own explanations on the façade are arranged (chap. 2), and a typology of all the works featured is established according to the main formal feature of the façade based on the Complete Works and the inter-relation of the types is analyzed (chap. 3). Additionally, *Le Corbusier Archives* (1982-1984, 32 vols., Garland Publishing, Inc. and Fondation Le Corbusier, New York, London, Paris, abbreviated below to the *Archives*) [3] are used to analyze modifications in the form of the façade during the design process of these works (chap. 4-5). Finally, the architectural Kansei of 'wall' which causes the modification in the form of the façade are discussed (chap. 6-7).

1.3 Relationship to previous research

Regarding the form of Le Corbusier's façades, there already exists research on the structural methods for window opening [4] and research on the development of what he called 'le brise-soleil (the sun breaker)' devices [5, 6].

These previous research contributions do analyze the distinctive forms of the façade specific to Le Corbusier, but they do not provide a comprehensive elucidation of the varied development of the design methods of the façade in Le Corbusier's work and his design process.

Regarding the Kansei research on architect, Le Corbusier, there exists already some researches on the self formation by journey in younger days or his idea of art [7-9]. However, they do not treat the architectural design

Regarding the Kansei research on architectural space, there are less studies than on product design [10]. The main theme on building is the user evaluation [11], or the design's Kansei information system [12].

In any cases, these previous researches base on the quantitative analysis. On the other hand, this paper is a qualitative study on the subject of architect. This architectural Kansei will be closely related with the specific site. Because architecture inevitably contains the building site which is not the anonymous experimental space.

2. LE CORBUSIER'S EXPLANATION ON THE FAÇADE

In 1926, Le Corbusier spoke of the façade as one of 'les 5 points d'une architecture nouvelle (the 5 points of a new architecture)' [2]. He said that "Pillars should be set back behind the façade in the interior of the house. Floors should protrude in cantilever style. The façade should be no more than a light membrane of insulating walls and windows. The façade should be free; There is also no need to divide windows up. They can stretch from one end of the façade to the other".

This 'free façade (la façade libre)' originated from the 'Dom-ino' structural system which Le Corbusier devised in 1914 (Figure 1), in which the façade is freed from the structure, the piece of architecture becomes an independent object, the frontality of the façade is negated and "the wall does not existe" [13].

Le Corbusier's 'les tracés régulateurs (the regulating lines)' are the aesthetic parameters of the façade structure [14], and one of 'the 5 points of a new architecture', 'la fenêtre en longueur (the strip window)' or 'le plan libre (the free plan)', was a solution to release the notion of 'wall'.

However, in the design of all Le Corbusier's architectural works, it was essentially no more than one possible interpretation, and it is clear that varied façade designs were developed not only from a structural and aesthetic perspective but also with regard to their scenic impact and relationship with the environment [15].

In 1946, Le Corbusier published an essay 'the problem of the sunlight' in which he gave his own account of the development of façade design [2]. In this essay, in which he expounds architectural solutions to the problem of solar irradiation, an explanation is given of the evolutionary process of the façade from 'la fenêtre en longueur (the

Figure 1: Le Corbusier's conception on Dom-ino Syetem and Its Sectional Diagram

strip window)' through 'le pan de verre (the glass wall)' and 'le brise-soleil (the sun breaker)' to 'la loggia (the loggia)'. In other words, the problem of the façade was no longer limited to one of frontality in the creation of architectural form, but had expanded into one of the relationship involved in the interface between the interior and the exterior of the architectural space.

3. THE ADAPTATION OF THE FAÇADE TYPES TO THE ARCHITECTURAL WORKS

The architectural works featured in the *Complete Works* largely correspond to these types set up by Le Corbusier, but around the time of the publication of the above essay, 'la claustra (the claustra)' with many small openings of thick wall was mentioned [16] while the some statements affirming the idea of the 'le mur (the wall)' were written in the early book [14]. Accordingly, using the *Complete Works* as the main source, the origins of each type and the inter-relation between the types are analyzed here (Table 2).

3.1 Strip window

The strip window is one of 'the 5 points of a new architecture' which emerged from Le Corbusier's Dom-ino system and had already been demonstrated in the plans for the Citrohan House (Maison Citrohan, 1920). It was first given concrete realization in a series of residential architectural works mainly executed in the 1920s and including notably the Little House on Lake Geneva (Petite maison au bord du lac Léman, 1925) or the Villa Savoye (1931).

Under the Dom-ino system, the façade is freed from the structure and an opening made to stretch the full length, which efficiently realizes adequate securing of daylight in the indoor space. In other words, 'le plancher éclairé (the sunlit floor)' is realized and 'limited views' [17] from the indoor space are achieved.

3.2 Glass wall

However, the strip window was still essentially a 'window' opened up within a façade and according to Le Corbusier, even the strip window represented a diseconomy in terms of execution of detail. He therefore pursued further the potential of the Dom-ino system to free the façade from the structure which provides the limitless

Figure 2: Typical Strip Window (Villa Savoye, 1931) and Its Sectional Diagram

Figure 3: Typical Grass Wall (Cité de Refuge, 1933) and Its Sectional Diagram

views [13] and proposed a glass wall consisting of a surface all of glass in the style of the so-called curtain wall. The prototype had already been demonstrated in the high-rise buildings of *A Contemporary City* (*Une ville contemporaine*, 1922), and was given partial concrete realization in some of the residential works of the 1920s. Thus, “I thought of the façade as a structure to bring light in. It should not be supported by the ground surface. Rather it is suspended from the protruding floors. Thus the façade no longer holds up the floor or the roof. It is merely a glass membrane or something that enfold the house” [2].

Moreover, this plate glass wall is adapted to large public buildings. Its realization was attempted in Moscow’s Head Office of Consumer Cooperative Union (*Centrosoyus*, 1928) or the House of Refugees (*Cité de Refuge*, 1933). According to Le Corbusier, the hermetically sealed plate glass wall is purely for the intake of daylight, while ventilation is secured mechanically. At the same time, however, Le Corbusier said that a piece of architecture should have precise ventilation (*‘respiration exacte’*) and proposed the double-skinned plate glass wall, or neutralizing wall (*‘le mur neutralisant’*). In the space between the double skins, air would be conducted and, operating in parallel with mechanical ventilation, provide indoor air conditioning [2].

In this way, while the façade is seen on one hand as a membrane which functions to regulate the indoor environment, there is also a clearly expressed consideration of the geometrical structure represented by the mullions of the plate glass wall, which later developed into forms such as the undulating plate glass wall (*‘le pan de verre ondulatoire’*).

3.3 Brise-soleil

While progressing with development of the double skin formed by the plate glass wall and the mechanical ventilation system, Le Corbusier revised his ideas and made the following statement. “Depending on the movements and the strength of the sun on one day, the plate glass wall will need one specific device: the brise-soleil (the sun breaker)” [2]. Setting the plate glass wall back and creating a balcony zone with eaves was a more form-based solution

Figure 4: Typical Brise-soleil (Ministère de l'Éducation Nationale, 1945) and Its Sectional Diagram

to the problem of solar irradiation on the plate glass wall or other large openings, creating shade in the summer period of strong sunshine and bringing sunlight into the indoor space during the winter period of weak sunshine. In the Villa at Carthage (*Villa à Carthage*, 1928), the plate glass wall and the partition walls are merely set back into the interior of the building, but in plans for the Barcelona Residence (*Barcelone, Lotissement*, 1933), eaves are also added and in the Urban Plan for Algiers (*Urbanisation à Alger*, 1933), a group of high-rise buildings is fitted with perpendicular eaves, a plan which is realized in the Ministry of National Education and Public Health at Rio de Janeiro (*Le ministère de l'éducation national et de la santé publique à Rio de Janeiro*, 1945).

According to the typology, the plate glass wall carries the functions of soundproofing and windbreak, but in areas with strong sunshine, use of the brise-soleil to mitigate the sun’s rays and ventilation became instead the main themes [2]. However, the brise-soleil did not merely have an environmental control function, but also aimed at the aesthetic effect of ‘channeling light’ [2], a feature which it shares with ‘the claustra’ type discussed below.

3.4 Loggia

In the Housing Estate at Marseille (*Unité d’habitation à Marseille*, 1949), as well as the claustra being developed for the entrance hall, hollow concrete blocks were proposed for the side wall of the balcony and this plan was executed.

This balcony was called the loggia and originated from the monastery at Ema which Le Corbusier visited for the first time in 1909. This loggia, which protrudes well out from the plate glass wall, is in one sense a brise-soleil reinterpreted as a space, but in another sense it can be seen

Figure 5: Typical Loggia (Unité d’Habitation à Marseille, 1945) and Its Sectional Diagram

as a hanging garden ('le jardin suspendu') originating from the Dom-ino system and created by setting the plate glass wall back and placing the space outside the wall [6].

The loggia can thus be thought of as an environment-related design method made possible by the Dom-ino system and which Le Corbusier developed independently as a type.

3.5 Clastra

The typological category of plate glass wall did not develop only as brise-soleil. According to Le Corbusier, in the case of residential structures, it was not necessary to have plate glass walls throughout, and instead of glass, glass blocks or similar materials might be used for the privacy. The first and clearest example of the use of the façade with glass blocks was in the Paris Suburban Weekend House (Une maison de week-end en banlieue de Paris, 1935), in connection with which Le Corbusier identified the selection of components to emphasize the raw materials as one of the problems of modern architecture [2].

Le Corbusier stated additionally that "Moving forward with the interpretation of the plate glass wall, development was progressing in arrangements such as standard precast component materials and double-sliding windows set into walls made of glass blocks" [2]. In other words, experiments were being made not only with the structure of the mullions of the plate glass wall but also with the formation of wall surfaces with a greater feeling of solidity by partly filling it out with glass blocks and similar materials.

This development was put into practice in the entrance halls of the Marseille Unité d'habitation with their wall surface structure of layers of glass blocks. In the Chapel of Ronchamp (La chapelle de Ronchamp, 1950-1954), this gives the western wall a greater feeling of solidity. The claustra is the result of development carried out using 'le Modulor' dimensional system to create an aesthetic effect of daylight illumination for architectural richness ('une richesse architecturale') [16].

3.6 Inter-relation of the façade types

The results of the application of the various façade types analyzed in the above to actual examples of architectural work are listed below (Table 2).

Figure 6: Typical Clastra (Chapelle de Ronchamp, 1950) and Its Sectional Diagram

- 'The strip window' was used from the beginning of the 1920s and appears frequently in architectural works (particularly residential works) until around 1935.

- 'The glass wall' is seen throughout all periods, but from the 1940s its form becomes diversified particularly in public architectural work.

- 'The brise-soleil' is used from the 1930s and appears frequently in architectural work from 1940 to 1964.

- 'The loggia' is contemporaneous with the 'brise-soleil'. (However, if the hanging garden is included, it is used in almost all periods.)

- 'The claustra' is used from 1950.

To summarize the above, in Le Corbusier's architectural work until the Second World War, from 'the strip window (1)' to 'the glass wall (2)', the traditional concept of the structural wall and façade was negated and a new concept of the 'wall' as a two-dimensional surface was explored. 'The glass wall (2)' as a negation of the wall continues to be explored after the Second World War. These explorations are all observed in architectural works in western environment.

In pursuit of further development of the physical elements, however, façades made of glass blocks did come to be developed in western countries from around the 1930s. If we accept that to make the façade transparent not only structurally but also visually is a negation of the 'wall', then we can see the solidity and non-transparency of the 'wall' of glass blocks as an affirmation of the 'wall' as a surface. This develops into 'the claustra (5)' façade structure the main theme of which is natural illumination. 'The claustra (5)' was developed in France, but was later applied to architectural works in India also.

Meanwhile, 'the glass wall (2)' develops into 'the brise-soleil (3)'. Through a series of architectural plans for projects in Northern India starting in the 1930s and architectural and urbanization plans for Indian projects after the Second World War, Le Corbusier concluded that the problem of solar irradiation could not be resolved with the façade consisting of a plate glass wall as developed in western countries and developed 'the brise-soleil (3)'. Further, to address the issue of light in 'the claustra (5)' as the affirmation of the 'wall', he developed 'the loggia (4)', which negated the 'wall' as a two-dimensional surface. Rather than the creation of a transparent façade as an interface between interior and exterior, this represented the creation of a boundary zone between interior and exterior or the creation of a façade as a three-dimensional space, and was applied not only in North Africa and India but also in western countries.

Represented in tabular form, the functions and inter-relation of the above façade types appear as above (Table 1) (Figure 7). The climate condition, especially the

Table 1: Function of Each Façade Type

	(1) fenêtre en longueur	(2) pan de verre	(3) brise-soleil	(4) loggia	(5) claustra
site relation*	○	○	⊙ ○	○ ⊙	○ ⊙
environmental function	inner lighting	inner lighting, inner temperature control, insulation of sound	ventilation, shading	shading	aesthetic effect of lighting
year	1910-1950	1922-1963	1933-1964	1914-1964	1945-1960

Legend: ○ Europe and the United States ⊙ India, South America and North Africa

Figure 7: Inter-relation of Façade Types

sunlight, influences the selection of the façade types by Le Corbusier.

4. TENDENCY OVER TIME IN FREQUENCY OF FAÇADE MODIFICATION DURING DESIGN PROCESS

First, an analysis was made of projects in which a façade modification during the design process of the individual architectural work could be gleaned from the *Archives* (Table 2). The tendency over time of modifications in the façade during the architectural design process is as described below.

- Modifications proposed in the façade in architectural works of the early period (up to the Second World War) are few in number (no modification in 54 of 64 works up to 1945 (84%)).
- After the Second World War, proposed modifications in the façade of individual architectural works increase (from 1945 to 1964 modifications in 19 of 39 works (49%)).

5. NATURE OF FAÇADE MODIFICATION DURING DESIGN PROCESS

If the nature of modifications made to the façade during the architectural design process is analyzed using the *Archives*, it can be classified into three kinds: increasing the transparency of the façade, decreasing the transparency of the façade, and spatialization of the façade. In other words, the development of the façade type across the whole architectural work (Figure 7) is also reflected in the design process of individual projects (Table 2). Typical examples of the kinds of façade modification made during the architectural design process are presented below.

5.1 Increase in transparency of façade

The design process of the increase in transparency of

façade can be observed over time.

In the design process of the Millowner's Association Building at Ahmedabad in India (Palais des Filateurs, 1951), the façade with the loggia has been modified for the brise-soleil and clarified the function as the sun shade.

In the design process of the Moscow Centrosoyus (Head Office of Consumer Cooperative Union; Centrosoyus à Moscou, 1928), the early-stage plans (Figure 8) show a façade with a strip-window structure, while later plans (Figure 9) show a revision to a plate glass wall, in which the façade has become physically more transparent.

Furthermore, in the case of the project of the church of Saint Pierre (Église Saint Pierre, 1960), the claustra in the basement has been replaced with the glass wall.

5.2 Decrease in transparency of façade

The design process of the decrease in transparency of façade is remarkable in the late works.

In the Villa Doctor Curutchet (Villa du Docteur Curutchet, 1949), the façade with the strip window has been replaced with the brise-soleil for the Argentine sunlight.

In the Villa Shodhan at Ahmedabad of 1952, the early-stage plans (Figure 10) show the façade structure as a

Figure 8: Centrosoyus à Moscou, south elevation, early project

Figure 9: Centrosoyus à Moscou, south elevation, final project

Figure 10: Villa Shodhan, western elevation, early project

Figure 11: Villa Shodhan, western elevation, final project

Figure 12: Couvent Sainte Marie de la Tourette à Eveux, south elevation, early project

Figure 13: Couvent Sainte Marie de la Tourette à Eveux, south elevation, final project

loggia, while in later plans (Figure 11), in spite of the Indian hot climate, the façade structure is revised to a claustra, which rather than increasing its transparency increases the feeling of presence of the wall.

5.3 Spatialization of façade

One of the most characteristic works of the spatialization of façade is the Housing Estate at Marseille (Unité d'habitation à Marseille, 1945). In the design process of this housing, the glass wall has been added the loggia as veranda.

Similarly, at the Convent of St. Mary de la Tourette at Eveux (Couvent Sainte Marie de la Tourette à Eveux, 1957), the early-stage plan (Figure 12) shows the exterior with a plate glass wall. Subsequently, this is revised in the final draft (Figure 13) to a loggia, so that the surface of the façade acquires a spatial depth.

6. CONCLUSION

There follows a summary of Le Corbusier's façade design methods as discussed in the preceding.

- The façade in Le Corbusier's architectural work comprises five types: 'the strip window', 'the glass wall', 'the brise-soleil', 'the loggia' and 'the claustra'. While the release of façade from the building structure constitutes the negation of the 'wall', the 'wall' is on the other hand affirmed in some instances in order to design aesthetic light effects. The exploration of 'the free façade' which begins with 'the strip window' integrates both affirmation and negation of the 'wall' in 'the loggia'.
- Le Corbusier did not apply a certain type of façade

definitively but undertook a wide-ranging consideration and undertook modifications. Particularly, the façade in architectural works after the Second World War was subject to revisions and modifications and the number of types considered is large. The nature of the modification is also wide-ranging, with increase in transparency of the façade, decrease in transparency of the façade, and spatialization of the façade, ranging thus across both affirmation and negation of the 'wall'.

To summarize the above, the façade typology in Le Corbusier's work, more than Le Corbusier himself explained, was subject to diversification during the design process under the influence of the external factors of the site environment or his own aesthetics, so that the concept of 'wall' undergoes an evolution.

7. DISCUSSION

Le Corbusier's architectural work of the early period employed the idea of 'the free façade' to literally create a visually transparent façade and rejected the traditional concept of 'wall'. However, from the 1930s and after the Second World War, an affirmative approach was taken to the material qualities of the façade, while however at the same time eliminating the surface quality to create a phenomenally open 'wall'. The most typical example of this new notion of 'wall' is the device of 'the loggia', which has the intimate relation with 'the claustra' that Le Corbusier did not clearly mentioned.

This new façade type was the result of the study on the regional condition, especially the sun light, but Le Corbusier had the intention to adapt this façade type on other site environment. This is not only the functional reply, but also the intention of the fundamental research on the relationship between architecture and environment. It is certain that such an adaptation is the characteristic of modernism aiming at the universal architectural language, but also this is the fundamental reflection on site environment through the specific site where the architect's body is involved.

Le Corbusier can be said to have created an architectural environment by consistently ranging between the specific features of the site environment and the universality of architectural systems. That is to say, the plurality of Le Corbusier's 'wall' is the reflection of the 'encounter' of Architect's universal thinking with the site environment [18]. This correspondence is the problem of the Architect's Kansei to the site environment, in other words, the problem of the ambiguity of body with the architectural Kansei (universal body as mankind and individual existence at the same time) [16, 19].

Table 2 : Main Architectural Works and Façade Types

year	project	Site Environment				Façade Type					Façade Type in Design Process					
		realization/ project	country	location	type of site	fenêtre en longueur	pan de verre	claustra	brise- soleil	loggia (jardin suspendu)	fenêtre en longueur	pan de verre	claustra	brise- soleil	loggia (jardin suspendu)	nature of modification
1914	Maison Dom-Ino	p		no place	no place											
1919	Maisons Monol	p		no place	no place	○					○					
1920	Maison Citrohan	p		no place	no place	○					○					
1922	Maison - atelier Ozenfant	r	France	Paris	○	○					○					
1923	Maison de week-end	p	France	Rambouillet	○						●	●				2
1923	Villas La Roche-Jeanneret	r	France	Paris	○	○					○	●				2
1923	Villa "Le Lac"	r	Suisse	Corseaux	○	○					○					
1923	Villas Lipchitz - Miestchaninoff	r	France	Boulogne	○	○					○					
1923	Villa TERNISIE	r	France	Boulogne	○											
1924	Quartiers Modernes Frugés	r	France	Pessac	○					(○)					(○)	
1925	Immeubles-villas	p	France	Boulogne-sur-Seine	○					(○)					(○)	
1925	Villa Meyer	p	France	Neuilly-sur-Seine	○	○				(○)	○	●			(○)	2
1926	Villa Cook	r	France	Boulogne-sur-Seine	○	○					○					
1926	Villa Stein/de Monzie	r	France	Vaucresson	○	○					○					
1927	Villas Weissenhof-Siedlung	r	Allemagne	Stuttgart	○	○					○					
1927	Palais de la Société des Nations	p	Suisse	Geneve	○	○					○	●				2
1928	Villa Baizeau	r	Tunisia	Carthage	●	○				(○)	○				(○)	
1928	Villa Savoye	r	France	Poissy	○	○	○				○	○				
1929	Armée du Salut, Cité de Refuge	r	France	Paris	○		○				●	○				1
1929	Appartement de Beistégui	r	France	Paris	○	○	○				○	○				
1928	Centrosyos	r	Russia	Moscou	○		○				●	○			(●)	1
1929	Maisons Loucheur	p		no place	no place	○					○					
1929	Villa de Mandrot	r	France	Le Pradet	○											
1930	Maison Errazuriz	p	France	no place	○	○	○				○	○				
1930	Immeuble Clarté	r	Suisse	Geneve	○	○	○				○	○				
1930	Palais des Soviets	p	Russia	Moscou	○		○					○				
1931	Immeuble Nungesser et Coli - Appartement L.C.	r	France	Paris	○	○					○	○				
1931	Centre d'art contemporain	p	France	Paris	○											
1935	Immeuble de colonisation à Nemours	p	Africa	Nemours	●					○					○	
1936	Ministère de l'éducation nationale	r	Brazil	Rio de Janeiro	●		○			○		○			○	
1937	Maison de week-end Jaoul	p		no place	no place	no place										
1939	Musée croissance illimitée	p		no place	no place	no place										
1940	Maisons Murondins	p		no place	no place	no place										
1944	Usine verte	p		no place	no place	no place	○					○				
1945	Unité d'Habitation de Marseille	r	France	Marseille	○			○		○			○		○	
1945	Basilique - La Sainte Baume	p	France	La Sainte Baume	○		○			○		○			○	
1949	Villa du Docteur Curutchet	r	Allemagne	Buenos Aires	○				○		●			○		3
1949	Roq et Rob	p	France	Roquebrune-Cap-Martin	○					○	●				○	3
1950	Chapelle Notre Dame du Haut	r	France	Ronchamp	○			○					○			
1950	Maison Fueter	p	Suisse	Lac de Constance	○	○					○				●	1
1950	Maison des Péons 110 m2	p	Inde	Chandigarh	●				○				●	○		1
1950	Palais du gouverneur	p	Inde	Chandigarh	●				○	○	●	●	●	○	○	3
1950	Tour d'ombre	p	Inde	Chandigarh	●				○					○		
1950	Le Musée de la Connaissance	p	Inde	Chandigarh	●				○	○				○	○	
1950	Les bâtiments annexes du palais de Justice	p	Inde	Chandigarh	●				○					○		
1951	Maisons Jaoul	r	France	Neuilly-sur-Seine	○		○					○	●			1
1951	Palais des Filateurs	r	Inde	Ahmedabad	●				○					○	●	1
1951	Villa Sarabhai	r	Inde	Ahmedabad	●					○		●			○	3
1951	Villa Shodan	r	Inde	Ahmedabad	●			○	○	○	●	●	○	○	○	3
1951	Musée	r	Inde	Ahmedabad	●						●	●	●		(●)	2
1952	Haute Cour	r	Inde	Chandigarh	●			○	○				○	○		
1953	Secrétariat	r	Inde	Chandigarh	●		○		○	○			○	○	○	
1953	Couvent Sainte Marie de la Tourette	r	France	Eveux sur l'Arbresle	○					○		○			○	
1953	Maison du Brésil, Cité universitaire	r	France	Paris	○		○		○	○	●	○	●	○	○	3
1955	Assemblée	r	Inde	Chandigarh	●				○	○	●	●	●	○	○	3
1955	Maisons montées à sec	p	France	Lagny	○						●	●				2
1956	Maison de la Culture	r	France	Firminy	○		○					○				
1957	Musée d'Art Occidental	r	Japan	Tokyo	no place		○					○		●		1
1959	École d'Art	r	Inde	Chandigarh	●				○					○		
1960	Unité d'Habitation de Firminy	r	France	Firminy	○			○		○	●	●	○	●	○	3
1960	Église Saint Pierre	p	France	Firminy	○								●			2
1961	Carpenter Visual Arts Center	r	USA	Cambridge	○		○		○			○		○		
1962	Palais des Congrès	p	France	Strasbourg	○		○		○					○		
1963	Centre Le Corbusier, Heidi Weber	r	Suisse	Zurich	○		○		○						○	
1963	Olivetti, centre de calculs électroniques	p	Italy	Rho	○				○	○	●			○	○	3
1964	Musée du XXe siècle	p	France	Nanterre	○											
1964	Hôpital - Venise	p	Italy	Venise	○											

legend: ○Europe and the United States ●India South America North Africa ●façade which was canceled in the design process 1 increase in transparency 2 decrease in transparency 3 spatialization

REFERENCES

1. T.Kuwako; Philosophy of Kansei; NHK Publishing, Tokyo (2001).
2. Le Corbusier; Œuvres complètes, 1910-1965; vols.8, Les éditions d'architecture, Artemis, Zurich (1910-1965).
3. Le Corbusier Archives; vols.32, Garland Publishing, Inc. and Fondation Le Corbusier, New York, London, Paris (1982-1984).
4. B.Reichlin; La petite maison à Corseaux, une analyse

- structurale. in Le Corbusier à Geneve 1922-1932 ; Editions Payot Lausanne, Zurich, pp.119-134 (1987).
5. T.Benton; La villa Baizeau et le brise-soleil. in Le Corbusier et la méditerranée ; Éditions paranthèses, Marseille, pp.125-129 (1987).
6. J.Sbriglio et al.; Le Corbusier l'Unité d'Habitation de Marseille ; Éditions Parenthèses, Marseille (1992).
7. P.Saddy et al.; Le Corbusier, le passé à réaction poétique; Caisse national des Monuments historiques et des Sites, Paris (1988).
8. S.von Moss, A.Rüegg; Le Corbusier before Le Corbusier; Yale University Press, New Haven and London (2002).
9. G.H.Baker; Le Corbusier – The Creative Search; Van Nostrand Reinhold, New York (1996).
10. K.Tokou, K.Sakaguchi; Science of Kansei; Asakura-shoten, Tokyo (2006).
11. S.Terumura, S.Nagasawa; Creating Customer Experience in Architecture of “Hikarinokyokai Church”; Proceedings of The 9th Annual Conference of JSKE 2007, F13.pdf (2007).
12. T.Yamanaka; Kansei-Design and Brain-Functions Research; Journal of Japan Society of Kansei Engineering, 8(3), pp.445-448 (2009).
13. Le Corbusier; Précision sur un état présent de l'architecture et de l'urbanisme; G. Crès et Cie, Paris, p.42 (1930).
14. Le Corbusier; Vers une architecture ; G. Crès et Cie, Paris, pp.49-64 (1923).
15. Le Corbusier; La Charte d'Athènes; Plon, Paris (1943).
16. Le Corbusier; Modulor 2; L'Architecture d'Aujourd'hui, Paris (1955).
17. Le Corbusier; Une petite maison, 1923, les carnets de la recherche patiente n°1; Les Édition d'Architecture, Zurich, p.23 (1954).
18. N.Kioka; Logic of Landscape; Sekai-Shiso-Sya, Kyoto (2007).
19. R.Wittkower; Architectural Principles in the Age of Humanism; Alec Tiranti Ltd., London (1970).

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