

# Function, representativeness and spatial implications of form modelling in Le Corbusier's architecture

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## Introduction

Charlotte Perriand recalled that the designs developed in the studio at 35 Rue de Sevres during the years in which she worked there, between 1927 and 1937<sup>1</sup>, usually followed a two-phase ideation process: the first, analytical and rational, in which the possible organisations of the programme of uses were studied using abstract diagrams of squares or circles equivalent to simple geometric volumes connected to each other; and a second, in which those pieces that she wanted to give greater prominence in the composition were moulded with curved shapes, becoming artistic objects clearly differentiated from the regularity of the rest of the design. These unique pieces, in their formal autonomy, would be responsible for introducing into the experience of using the building, both exterior and interior, the perceptual and emotional questions that Le Corbusier was so fond of talking about. If it was a simple project, such as small homes, the functional and artistic criteria could overlap, but if the work involved a certain complexity, such as in buildings for communal use or public programmes, the design process would cover both phases. This was the case, for example, in the design process for the Cité de Refuge in Paris, or in the Competition for the Palace of the Soviets [Fig. 01].

## Spatial modelling

The first artistic forms in Le Corbusier's architecture appear in the houses he constructed in La Chaux-de-Fonds and in Le Locle after his trip to the East in 1911. In the "Villa Blanche" of 1911, a semi-cylinder is attached to a large box. As if it were an apse, this modelled form is situated on one of the main axes of the house, indicating the route that must be taken to get from the access point, on "Chemin de Pouillerel", to the entrance to the house located at the last corner of the rear part of the main volume. Its plasticity, in addition to leading to this necessary turn in the approach route to the house, produces a drastic reduction in the perceptual scale produced when leaving the small secondary staircase that remains hidden between the walls of the support platform

[Fig. 02]. This staircase, situated between the two scales, prepares the encounter with the curved volume, recreating the same effect produced by the propylaea of the Acropolis of Athens, which introduce a blind passage on the path of ascension to the Parthenon<sup>2</sup>. In this first example, the artistic form is moulded from the inside out in an attempt to expand the interior space.

Using this same box and cylinder scheme, but now duplicated symmetrically, he designed the "Villa Turque" (Schowb) in 1916. Beyond the usual Ottoman or Byzantine references to his journey to the East that have frequently been discussed, its composition seems to echo the churches of Andrea Palladio in Venice, especially "San Giorgio Maggiore", which Le Corbusier knew well<sup>3</sup>. Inside the villa, an alternating succession of straight and curved contours, in single and double height, constructs a perceptual sequence of contracted and expanded spaces, at the midpoint of which are located the two semi-cylinders whose shape projects outward toward the boundaries of the garden<sup>4</sup>.

Already in the slightly earlier "Villa Favre-Jacot" in Le Locle, Le Corbusier had used a compositional duality of curve and counter-curve on the entrance façade, in a formal gesture that seems to refer to the Roman Baroque, both to Bernini's Sant Andrea del Quirinale and to that of the Piazza del Vaticano in Rome, which embraces the space before the building. In Le Locle, this artistic form expresses its use, defined by the turn of the car, while bringing the entrance door closer to the person arriving, as occurs in Bernini's works, but its artistic intention goes further, leaving the trace of the displacement of the air swept by the movement of the vehicle as it approaches the house. This expression, more meaningful than practical, would become a recurring motif in many of Le Corbusier's later works, such as the Villa Savoye or the Cité de Refuge<sup>5</sup>.

## Modelling and Function

Already settled in Paris, with the beginnings of his cubist painting and the first white villas of the 1920s, Le Corbusier turns these artistic forms into traits of his idea of 'type-objects' associated with the functional expression of certain uses of special significance, such as circulation elements or hygienic spaces, sometimes as small volumes with a closed guideline and other times, as curved partitions. Nevertheless, their role is very clear since through them we can situate the location of small functions that do, however, have a special significance in this type of architecture. This is the case, for example, for toilets and bathrooms, the modelling of which refers both to the configuration of sanitary appliances, free of hard edges, and to the soft contours of the naked body<sup>6</sup>. The repertoire of these singular volumes ranges from semi-cylinders with simple curvature, as in the Maison Cook, to complex interlacing, such as the arabesque volume of the Maison Canale<sup>7</sup> [Fig. 03].

In this same sense, in some of the white villas, we find the stairs enclosed within small

cylinders that, in their autonomy, remain adjoined to the outside of the main box of the house. Their role is to express the function of transit by reproducing in its unique geometry the movement that occurs when moving vertically, either on a double-flight staircase, as in the Villa Meyer, or on a spiral staircase. This freestanding cylindrical form expresses the spiral movement of a point along a vertical guideline and at the same time acts as a hinge that, in certain compositions, can resolve the meeting of two rotated boxes, as we see in the Maison Lipchitz-Miestchaninoff [Fig. 04].

So far, we have talked about artistic figures associated with the function of certain uses typical of simple programme designs and which usually appear directly among the initial work sketches, but if the programme is complex, they do not appear, as we have already mentioned, until a second phase of the ideation process.

In the design for the Swiss Pavilion in Paris, the rigorous orthogonal geometry that appears in the initial sketches is transformed, at some intermediate point, into an artistic configuration in which the part for communal use is differentiated from the individual part<sup>8,9</sup>. In this transformation, the space where the staircase is located, initially contained in a large prismatic box for circulation and complementary uses located behind the main body of the rooms, ends up being configured with a curved wall, built in stone, which vertically extends the enclosure of the communal dining room on the ground floor [Fig. 05].

This change from the orthogonal enclosure to another with a free layout not only highlights the difference in uses but also the implications of the different rhythms of activity between a dynamic common area and a quiet bedroom area

## Modelling and Perception

On the other hand, during the same period in the 1920s, it was not unusual for Le Corbusier to use the modelling of some walls to directly stimulate the gaze of an attentive observer. The position of the curved wall enclosing the toilet on the main compositional axis of the ground floor of Maison Cook, in addition to expressing its function, as we have already mentioned, naturally directs the path towards the entrance door to the house. The curved partition that welcomes us into the hall of Villa Stein, which does not even contain any sanitary facilities, also forces us to change direction, leading the way towards the staircase located on the right, which begins the perceptual sequence between parallel planes that organise the home<sup>10</sup>. However, if in Maison Cook this artistic form was already present in the initial ideas, in Villa Stein it was not drawn in until the design had reached an advanced stage and only after other orthogonal distribution schemes had been tested.

Some sketches in the archive of the Le Corbusier Foundation contain an interesting intermediate proposal for the top floor of

Villa Stein in Garches. In them we see that the contiguity of the access doors to two bedrooms is resolved with the undulation of the partition wall that separates them [Fig. 06a]. This

movement introduces a new way of curving the plane, a way that will be replicated in other planes until it creates a kind of freeform modelling, not always well justified by the function.

This same freedom of layout is found in the enclosure of the rooms on the sixth and seventh floors of the Cité de Refuge, in which Le Corbusier draws an interlaced pattern, as an arbitrary ornament, which tops off a tense glass elevation as if it were the carved frame of a painting [Fig. 06b]. Beyond this expressive function, the free movement of these walls seems to show the consequence of the effect of the persistent air thrust action, heralding a new function of the artistic form that will be used in future projects.

The expressive possibilities and spatial implications increase with the development of this type of complex programme design. The first proposal for the Cité de Refuge, drawn up when the Salvation Army had not yet purchased the part of the land bordering Rue Chevaleret, relied on the capacity of a single structure located next to the entrance on Rue Cantagrel to house both the reception area for the homeless, with its complementary uses, and a small function room. However, shortly afterwards, this small venue was pushed to the breaking point of the party wall of the site in order to, once here, mould its form and become a new volume with a double curvature, with a cylindrical lower half and a parabolic upper half [Fig. 07].

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This configuration initially responds to functional criteria, since this double artistic form adapts very well to both the use of a specific lobby for the care of the homeless (cylinder), and as an assembly hall (parabolic prism), but beyond this argument, what is achieved with this modelling expression is to create an additional perceptual effect by crossing the same curved plane twice, once in one direction and once in another, following an oscillating back and forth movement typical of cubist painting.

These two works, Villa Stein and Cité de Refuge, introduce, along with the aforementioned condition of an element that activates the perceptual path, a new implication of the plasticity of the forms that will achieve significant importance in many later projects: the mark of their exposure to natural elements such as wind and sun. This new condition will be used to express the functional hierarchy in particularly representative architectures that, although already announced in the 1930s, would be developed with renewed interest in the works he built in India in the 1950s.

## Modelling and Representativeness

One of the first conditions for the design of the Palace of the Spinners' Association of Ahmedabad<sup>11</sup>, was to be able to unite, in a single image, the dual scale that corresponds to both a private organisation, controlled by family clans, and a public outreach institution, in this case, the largest textile cooperative in the city. To respond to this duality, Le Corbusier recovered the old slogan from 1928 that lends itself to one of his best-known books: "A House, A Palace"<sup>12</sup>, configuring the spinners' headquarters as a large "cubic house" that is made monumental from the harmony of its proportions and its location, in this case, situated precisely along the axis of the narrow and elongated plot of land between the city and the river.

Balkrishna Doshi, his associate in India, drew up the plans for an initial idea, locating all the uses of the programme within a single prism distributed based on a prior study of sizes, groupings and connections with the usual graphic flowcharts. The resulting image, before introducing the artistic forms, is emphatic: a large stone box, carved on the fronts and adapted both to the site and to the direction of the local winds. In this way, the resolution of both functional issues and adaptation to the site is optimised [Fig. 08].

From this first functional proposal, Le Corbusier advanced with artistic issues, seeking to adequately express the implications that the natural conditions of the context impose. Thus it shows that the arrival of the monsoon winds is what causes the contained volumes to retreat and the representative space to become autonomous from the envelope, while the latter, subjected to the persistent action of sunlight, shapes its surface to appear as a veil of concrete that permeates the faces and closes the sides. In the end, the compact, hollowed-out box that Doshi had drawn becomes an enveloping skin that shelters and protects the moulded pieces.

But of all the projects in India, the one that most clearly shows the importance of artistic forms in Le Corbusier's design process is the Chandigarh Palace of Assembly, which, developed together with the Palace of Justice between 1951 and 1955, again takes as its starting point an enormous concrete box, of considerable thickness, with a series of pieces inside, in a game of double scale.

The first sketches already propose this double-scale composition: a larger scale that delimits a shaded and ventilated area and, inside, a smaller scale that houses the functions. The first, configured with a box of 110 x 110 x 22 metres and different façades, within the thickness of which the bureaucratic and functional uses are housed, and the second, with two other boxes, one of 40 x 40 metres and another of 20 x 20 metres, for the representative spaces. The front and rear façades of the main box are initially designed with a system of arches of different sizes related to Indian tradition. The one facing east contains the main entrance and is more monumental as it has triple-height arches, while the west one, behind which is

the only office bay, has three superimposed levels of arches that project the interior organisation to the outside. The other two façades, North and South, are resolved with concrete lattices.

From this first scheme, we have to think that, at some point in the design process, the arched faces curve inwards, increasing their depth to gain protection space, thus creating a specific space for light and shadow on the two main façades, in a mechanism of light control and shadow generation through the curvature of a thick wall that Le Corbusier also used in the contemporary Ronchamp Chapel<sup>13</sup>.

Finally, just as in the Spinners' Headquarters, when the wind acts on the two side façades, the volumes inside the box model its shape, losing its rigid limits and adopting more flexible contours, very different from the rigid enclosing geometry [Fig. 09].

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From here on, the sketches show a design process focused on the formability of these interior volumes, exploring both their floor plan and their relationship with the roof, as well as the route of entry through a completely open geometry, while, in some intermediate sketches, what appear to be numerous points of light are drawn on the ceiling that pass over the two interior rooms while they remain engrossed in their own volumes. The sensation, if it had been built like this, would be that of being under an immense starry sky and not under a neutral black roof like the one that was actually constructed. In this way, the two most representative rooms of the Palace of Assembly are freely configured, as if they were two large stones, rotating on themselves until they are reoriented in a new north-south direction. At the same time, they rise up trying to capture the light from the roof and, with their inclination, expand it to the base in a gesture similar to that of the contemporary "Sainte Pierre Church" in Firminy.

The main hall is ultimately configured as a hyperbolic solid, the final state of a cylinder modelled by light, the image of which refers to the silhouettes of the cooling towers of some thermal power stations near Ahmedabad, as has been written, but perhaps also to the profile of the dome of Santa Maria del Fiore in Florence, the sketch of which Le Corbusier left behind, drawn on sheet FLC-28992. If this is the reference, which would not be surprising given his well-documented interest in the history of architecture, the dome of the Renaissance building descends to the ground, reaffirming its support through the form of the funnel. In this way, it would be doubling its meaning: on the one hand, enhancing its centralising character and on the other, the condition of a fixed object that orders the space around it by introducing a rotational movement. The first, inside the hyperbolic cylinder, the second, outside. And again, the use of a dual scale, now within the first artistic volume. A larger one, typical in Nature and associated with a vertical and amplified light, and a smaller one, at the

service of man, within an immersive and diffuse lighting context. In the architect's specific strategy, the plasticity problem seems to be definitively resolved with this duality, although the introduction of these artistic forms brings with it new challenges:

How can the hyperboloid be joined to the box? How can the very strong light that enters be controlled? How can its interior be accessed?

Le Corbusier explores several solutions, based on the use of resources from historical architecture on the one hand, and on the use of figures from his particular pictorial vocabulary on the other. For example, the idea of subordinating the surroundings of the hyperboloid to its centre, differentiating its elevation to let in the light, seems to update the section of a medieval cathedral, or that of drawing paths that reach the room as if they were freely drawn fingers that enter until they stop in small amphitheatres while the space remains indifferent, indivisible. Anchored to the ground, this powerful artistic form seems to respond only to the presence of the overhead light that shapes it.

On the other hand, to control the light coming from above, he will have the help of Jean Prouvé. The solution that seems to satisfy them the most and to which they dedicate the greatest number of sketches, although it was not ultimately built, is to place a large cover that slides over the mouth of the funnel and, supported by two guides, opens and closes its passage. These guides, designed as a "V"-shaped metal superstructure, are reminiscent of both the access bridge to the Cité de Refuge and Viollet Le Duc's *Entretiens*. This sliding plane disappears throughout the design process, being replaced by glass pieces that are embedded in the upper part of the hyperbolic space. The side lattices are also covered by new functional bays, leading to the dark interior space that we see today, while the smaller room is reduced to a pyramid with an inclined axis situated on a cube in the manner of the novices' chapel at the convent of La Tourette.

## Conclusion

The use of artistic forms in Le Corbusier's design process shows the coexistence of a dual vision of architectural creation, one rational and the other emotive. They have their origin, on the one hand, in historical references, whether visited or studied, in the early years in La Chaux-de-Fonds, and on the other, in the language of his painting and his interest in the industrial world since his arrival in Paris. If the building has a simple programme, these forms are incorporated from the start into the compositional scheme based on the straight-curved duality typical of his earlier designs; if it is complex, it usually appears in a secondary phase, once the functional conditions have been resolved with volumes of orthogonal geometry.

As we have seen, the role played by these modelled forms is myriad, acting on spatial, perceptual, functional and representative issues, and progressively becoming

incorporated into his manner of working. Initially, they are used as a spatial resource, projecting the interior outwards or directing glances and steps along the perceptual path, as in the first villas in La Chaux-de-Fonds. Later, from the 1920s onwards, with the transition to a compositional system based on pictorial mechanisms and a contrasting aggregation of volumes in the manner of a machine's gear, artistic forms were used to identify certain uses, basically sanitary or for circulation, while at the end of that decade, the movement of the walls announced the possibility of expressing the continued action of nature on the building, in accordance with the change in Le Corbusier's particular interests. Finally, from the 1940s onwards and especially in the works in India from the 1950s, these artistic forms take on a leading role in the representation of the main functions, adding their implications to the previous ones of spatiality, function and perception.

1. Charlotte Perriand's contribution to 20th-century furniture and interior design was highly significant, both during her time working in the studio of Le Corbusier and Pierre Jeanneret and later, during her time in Japan and her collaborations with Jean Prouvé. This has been recognised through the publication of numerous texts and videos dealing with her work and life. Among others, Jacques Barcac, *Charlotte Perriand. Complete Works. 4 volumes*. (Zurich. Scheidegger&Spiess, 2014) and Charlotte Perriand, *Une vie de création*. (Paris: éditions Odile Jacob. Paris, 1998).
2. Geoffrey Baker, *Le Corbusier. An Analysis of Form*. (Barcelona: Editorial Gustavo Gili, 1985)
3. The references to the "Villa Turque" are in the Byzantine and Ottoman architecture that he saw on his Journey to the East, but I think we should not forget Le Corbusier's interest in Palladio's work in Venice, specifically in "San Giorgio Maggiore", during his study sessions at the Paris Library in 1915. Jorge Torres, "Le Corbusier. Le Pòeme de Venise". *LC. Revue de Recherches sur Le Corbusier. n°6 (09/2022)*. Valencia, 2022. See also Paul Venable Turner. *La Formazione di Le Corbusier*. (Milan: Jaca Books editoriale, 2001)
4. In Le Corbusier's archive, there are two pen-and-ink drawings that study this space between curved volumes (FLC-32103 and FLC-32107).
5. Alejandro Gómez. *El Proyecto cubista. De Le Corbusier a Stirling. Estudio del Proceso de creación de la arquitectura*. PhD thesis. Madrid: ETSAM-UPM, 2001. Also, Gilles Ragot; Olivier Chadoin, O. *La Cité de Refuge: Le Corbusier et Pierre Jeanneret - L'usine à guérir*. Paris: Editions du Patrimoine Centre des monuments nationaux, 2016
6. "All the pieces in the bathroom are concave: the bathtub, the sink, the bidet, the toilet bowl. Organised as a system, they provide the opportunity - the temptation - to plunge into its ravine. Immerse your body, your hands, your feet, your sexual organs, in its call. A voice comes from each element to absorb us in its depths. The weakening of the hands, the dissolving ablation of the bidet, the consummation in the sarcophagus of the bathtub, the anchor of the intestines. A colloquium of private death is his speech". Vicente Verdú. "El cuarto de baño. La memoria lavada". In Luís Fernández Galiano. (coord.). *El espacio privado. Cinco siglos en veinte palabras*. Exhibition catalogue. Madrid: Ministry of Culture, 1990, pg.113.
7. Tim Benton. *The Villas of Le Corbusier and Pierre Jeanneret 1920-1930*. Paris: Editions de la Villette, 2007. Edition consulted, Bassel: Birkhäuser Verlag AG, 2007.
8. Ramón Alonso. "El Pabellón Suizo y el Colegio de España en París". *Notebook*, 18. Madrid, 2017

9. It is interesting to note that, at this same time, Erich Mendelsohn was also using the curvatures of glass enclosures and the rhythms of carpentry to express the different speeds of movement in the interior space. See, for example, the Schocken Department Store in Stuttgart or the Petersdorff Department Store in Breslau / Wrocław, both from 1926/27.

10. Several authors have studied the spatial configuration of Villa Stein (Von Moos, Rowe or Curtis), highlighting its parallelism with the compositional mechanisms of Cubist painting, especially with regard to the construction of space through phenomenological transparencies. Sonia Delgado. "Le Corbusier y la construcción vertical del espacio estratificado". In *LC-2015 50 years later. International Congress*. Valencia, 2015
11. Luís Guillermo Hernández. *Le Corbusier en Ahmedabad. Los atributos del sitio como arquitectura presentada*. PhD thesis. Barcelona: ETSAB. UPC, 2015
12. Le Corbusier. *Une maison, un palais*. Paris: Collection L'Esprit Nouveau, 1928. Edition consulted Le Corbusier. *A House, A Palace*. Madrid: Student Residence, 2011.
13. William Curtis relates the interrelation of exterior and interior surfaces with the studies on seashells that Le Corbusier had carried out shortly before. William Curtis. *Le Corbusier. Ideas and Forms*. New York: Rizzoli International Publications, 1886

Composition  
Design  
Modelling and Function  
Artistic Forms  
Perception