Complex Skins: the Facade of Windows
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Translated by Laura Mulas & Gina Cariño for AV Monografías 149 (2011) Jean Prouvé 1901-1984

In the forties decade of the past century, when I was born, Jean Prouvé was designing a light-weight facade solution that today serves as model for the design of enclosures: the facade of windows. The window, understood as an opening filled by a system of filters that connect us to the exterior, reached its peak design at the end of the 19th century with the balconies of our urban expansion areas. The sophisticated overlapping of blinds, glass sheets and shutters, with hinged shutters and vent lights, rounded off with drapes and net curtains, optimizes the flow of energies to achieve the desired comfort for each circumstance, each season and each moment of the day.

The disastrous simplifications of the formal proposals of the Modern Movement, oblivious to those virtues, reduced this wonderful system of filters to a “pan de verre” that has been the model for architecture up to our days. Today the need for energy efficiency forces us to redefine some of the demands that those filters fulfilled. However, as the ecosociologist Ramón Folch once reprehensibly told me, "until architects understand that the whole enclosure of the building must be a filtering membrane, you will not achieve reasonable buildings".
Nowadays we like to wrap our buildings with lighter and lighter facades. Ventilated facades lighten their inner sheets by means of metallic profiles and semiproduct boards, while the solid and void surfaces are mixed together in the facade framework filling. In this context, if the whole facade must be a more or less light filtering skin, why don't we fill that frame with components that can be, at will, as opaque to energy as the old wall and as able to connect us with the exterior as a conventional window?

Prouvé ignored the “modern” current, triumphant in those years, which imposed the basic “fenêtres en longueur” and the extensive use of glass. He designed and built modular facades formed by a series of windows designed as sophisticated filters. He stretched their design as far as the technology of the time allowed, and well beyond what the accepted comfort level demanded.

Contrary to the naked glass panes of modernity, Jean Prouvé equipped his building openings with sophisticated systems of climate control.
The light facade originated in his training as blacksmith, relying on the qualities of the material and with the support of the tools and machinery with which he had begun to equip his workshops. But his spontaneous vocation for industrialization made him reject the typical curtain wall with vertical and horizontal mullions in favor of modular systems. This means that from the beginning Jean Prouvé prefabricated totally finished complex facade components, of a much more modern conception than the curtain walls produced several years later in American architecture. The offices of the Maison du Peuple in Clichy, dated 1939, are an example of that modern approach.
The Birth of the Window-Panel
The story of that invention began in the year 1944, three years before the move to Maxéville, a suburb north of Nancy, when Jean Prouvé received the commission to build 800 single-family housing units at a rate of one per day.

His design method, always starting from the production and assembly process, led him to design a structure enclosed with complete facade panels. It is in fact one single type of panel formed by two wooden sheets instead of the metal sheet he would have wanted. The windows were made by opening up a hole in the opaque panel and framing that void with a jamb, also of wood, in which fixed panes were placed. In these first components, and due to post-war scarcity, he had to give up the steel of his training years and use the Bakelite wood supplied by Le Bois Bakélisé, a company they had a friendly relationship with. The Permali pavilion has some of those openings, and one in which a metallic frame has been fit over the window opening and parapet. Inside this frame are runners to direct the movement of a glass sheet. Outside is a frame that only covers the parapet, concealing the sash, and it is wrapped with what he called a wooden “carter”.

In very little time the panel evolved and Prouvé incorporated a new sash guide track in the outer frame for a wood or peforated sheet blind. The detail of the 6x6 prefabricated pavilions, drawn in May 1945, shows the elaborate detail of the solution. The space behind the “carter” is drained by perforating the frame in its lower part.

The facade of the Square Mozart building (second page) is one of the finest examples of Prouve’s window-panel, which was preceded by the nouvel curtain wall of the Maison du Peuple in Clichy (right)
Both sash elements, glass sheet and shutter, are concealed in the parapet and move easily thanks to a device that I haven't seen later: the balancer. A series of bars, whose upper edge runs below the balanced panel, rotate and thus activate the mechanism enclosed in the boxes that can be seen in the Sarre pavilion designed at the end of 1945 and built in 1946. The box that encloses the elements that move vertically is shut with a light aluminum sheet with some perforations.

In 1946 the family wanted to vacation again in Carnac, Brittany, where they used to spend the summers with grandfather Victor. Prouvé was very busy and did not have time to make arrangements, so he decided to send a lorry with an “emergency shelter” that hadn't been used. Madeleine, his wife, looked for a site and oversaw the assembly process of the house where the family would spend two months. The pavilion lasted many years as a beverage shop.
The Fertile Years
The most fertile years of his window facade production were from 1948 to 1952. The publications on the workshop's successes drew the attention of a group of architecture students who wanted to escape the academic “beauxartian” teaching of the time and join the industry. The workshops opened their doors to them and for approximately four years they collaborated closely with Prouvé.
The Maxéville Ateliers centered their activity on more creative works, encouraging large industries to use their patents for mass-produced series. The investments made, and the search for a greater technological credibility, are the reasons why Aluminium Français became a stockholder. Studal was the group representing the Ateliers in Paris.

In the intense creative activity of Jean Prouvé during that time, there are three noteworthy lines of investigation: The Maison Standard, the urban facades and the folded sheet facades.
The Maison Standard
The development of several types of light, industrialized single-family houses allowed the use forms much resembling the window-panel. The facade panel was improved and manufactured entirely with metallic elements. In March 1947 Prouvé applied for the first of a series of patents to protect the design of a pavilion that he wanted to mass-produce in the aeronautical factory of Fourchambault. In June 1949 he obtained a go-ahead from the CSTB, which approved his Standard House. The section of the figure shows the complexity of the steel and aluminum profiles with which he achieved sash movement. The industrializing project was mature and tested. The window-panels were completely developed at this point. Some of the dwellings manufactured for the Reconstruction Ministry were stored in the workshops and assembled later in Meudon, but the awaited larger series never arrived. Prouvé even gave his employees the houses that the Ministry did not use.
Urban Facades
During those years he introduced the facade technology of pavilions to tertiary urban buildings. The most interesting example is the Fédération Nationale du Bâtiment headquarters, which was designed in 1949 and built in 1951.

The building has a light facade with a very modern conception. It is actually a panel-facade, what they call “unitary system” in the United States today; a system that replaces the horizontal and vertical mullions of the conventional curtain wall with a series of bespoke units that Prouvé repeats as production modules. Each one of the panels is identical in its basic conception to the window-panel he used to build his single-family houses. The facade component is delicate and slender. It is no longer a perforated opaque panel, but a sophisticated series of elegant metallic components whose repetition offers a light and transparent image.
The axonometric drawing was done for a publication, and shows the component's complexity. The elevation of the opening is a bit more complex. In the upper part there is a perforated sheet with circular openings that, complemented by a similar one concealed behind it, generates a controlled ventilation system. Right below it, a fixed glass sheet performs as transom light. Below is the conventional sash type glass sheet, concealed in the parapet with a weight compensation mechanism that he had often used before. For some reason, this lime he didn't use sash blinds. The elevation and assembly of the panels on site reproduced, with basic tools, the most modern construction systems.

The wall and window sections of the Maison Standard (two previous pages) show the increasing complexity of the prefabricated panels that were used by Prouvé, perfected for the curtain wall of the FNB (right).
Folded Sheet Facades
As has often been said, for Prouvé the production tool was the essential piece of the design process. In that magical year of 1949, Máxeville welcomed the new folding machines that could shape the sheet without seams, creating almost any type of section. His view of design from the production and assembly process led him to explore the uses of that folding machine, for which he designed a facade of horizontal pieces: a revolution in the facade design world that had never been studied before.

The folding machine that could shape sheets without seams gave rise to new panel forms, such as those that were devised for the small Alba house (right) and the residential development in Bron-Parilly (next photo)
The coil breadth was actually insufficient to achieve the width of a vertical panel, so Prouvé designed a series of long horizontal components that were fit together to achieve watertightness. Thanks to these folding shapes, the wind stress could be transmitted to the mullions with greater distance between them. The models built by his brother Pierre are extraordinary. With this system he designed at least three late projects, in the period 1952-1954, all with the collaboration of the efficient “interns”, above all Maurice Silvy: the Alba one-family house, in which every horizontal piece runs across the whole facade, with portholes logically placed at different heights; the housing block in Bron Parilly (1952-1953), although the Ateliers only produced the drawings because the job was eventually commissioned to another workshop; and the dwellings on Saint-Jean-de-Maurienne (1953-1954), the only built example of this facade type. The facade is suggestive: three types of openings with embedded enclosures and ventilation incorporated. But the horizontal system prevents the use of sash blinds. The cantilevered terraces offer sun protection but there are no darkening systems besides the curtains hung by the occupants.

The design of the metal sheet enclosure at Bron-Parilly, developed by means of elaborated prototypes, took off from the limited width of the conception of panels set in horizontal bands.
This new design was probably driven not only by the possibilities of the folding machines but also by the desire to vary the type and size of the openings, which had little flexibility with the sash window-panel. Prouvé was approaching the globalizing conception of the membrane facade, the facade in which different openings can be placed in different parts with different filters.
After the Crisis
In 1953, Aluminium Français forced Jean Prouvé to leave the Ateliers. The testing processes and the custom-made projects did not produce the desired profits and the managers decided to focus on serial and more conventional production. The “intern” architects had been dismissed from the factory. Benedikt Huber said: "The spirit of Maxéville has been ruined by businessmen because the simplicity of its proposals scares them".
It is difficult to imagine what that dismissal meant for Jean Prouvé. He was 52 years old, and had not only been expelled from the workshop he had built throughout his entire life, but many of his patents and projects were transferred to the company, dramatically limiting his future. After several attempts to resume production Prouvé became a consultant in Paris, an office job of the kind he had always disliked. In this article I must still mention two works that, though anchored in the finest moments of the workshop, were produced after Prouvé’s move to Paris: the house in Nancy and the Square Mozart apartment house.
The House in Nancy
During these times of economic difficulties, Jean Prouvé undertook the construction of his, family home. Though for work reasons he had to move to Paris, his family needed a house in Nancy. Coherent with his proposals, he devised a house that was industrially produced from top to bottom. At that time he dreamt of enveloping shells, but because of his financial situation he used the panels of the pavilions, built years before for the ministry, that had been left in Maxéville. He bought them reluctantly, as they were quite expensive (Prouvé said that he knew that the panels were valued at one franc apiece). The house is very interesting and the recycled panels fulfil their role very decently. The footage of their transportation by foot to the precipitous site is moving.
The Square Mozart Apartment House
Also an aftermath of his activity in Maxéville, the first drawings are from July 1953. Its facade panels embody the most detailed expression of the panel-window. Functional complexity is optimized with a minimum number of pieces. The “carter”, or sash protection, is transformed into the first sash that, with its perforations, can perform as blind and. thanks to its rotation over the upper axis and the telescopic compass, becomes an adjustable projected sun protection system.

In the Square Mozart building, the sliding and pivoting parapets simultaneously serve as protection (“carter”) for the upper sash, as a grooved window blind, and as an adjustable and movable sun screen.
The window consists of a lower sash which has the full height allowing it to be concealed in the parapet, and fixed upper glass to increase the amount of light that can come in. This upper glass was reduced in some cases to insert sheets with circular openings for ventilation and movement. Behind all this the guillotine balancers and light enclosure panels form the parapet. The facade panels of the Préfecture de la Nièvre were also designed at that time.

The panels used in the Préfecture de la Nièvre follow the model developed at Square Mozart, including its ingenious system of ventilating through circular perforations in their upper parts.
Peter Sulzer relates this window with the so-called contemporary intelligent facades; he says they are manually regulated intelligent facades. I think the professor forgets that the first manual intelligent facades were the 19th-century windows with their sophisticated filter systems. The value of the facade designed by Prouvé lies mainly in its search for the contemporary version of the virtues of the window with varied filters, a search that was only possible thanks to his independent criterion and innate good sense. Later on, thanks to the modern conception of lightweight facades, he placed the windows in such a way that they took up the whole facade surface, creating a vast membrane, a window-facade that brings together and multiplies the value of the traditional window.

Jean Prouvé continued to design creatively until his death in 1984, but once his connection to materials and tools had been broken, he considered his professional life finished. In a note sent to this daughter in 1983 he wrote: "I died in 1952."