

ARCHITECTURE AND THE AUTOMOBILE FROM THE 1920S TO THE 1950S

Relationship and Evolution of their Technique and Form
From Mechanicist design to Organicist design

Degree in Architecture Studies

Final Degree Project

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ABSTRACT

The advances in industrialisation in the first half of the 20th century brought about a revolutionary and rapid development of production, which influenced countless fields, one of them being architecture, a discipline that has evolved using industry as a source of knowledge.

The transport industries, such as aircraft, ship and automobile, had a significant influence on architecture during the first half of the 20th century. Until the 1930s, their designs tended to be based on the juxtaposition and assembly of independent elements, while from the 1930s onwards, their designs became more organic and with better interlocking elements. Good examples of this are the two photographs on the cover of this work: Le Corbusier's Double House in Weissenhofsiedlung together with the Mercedes-Benz 8/38 hp Roadster and Alison and Peter Smithson's Upper Lawn Pavilion together with the Citroën DS 19.

In this sense, this work focuses on the technical and formal relationship between architecture and the automobile, of which we will see and analyse numerous examples from the period between the two photographs on the cover, in other words, between the 1920s and the 1950s.

Keywords: History, architecture, automobile, industry, transfer, technology, technique, assembly, form, design, mechanicist, organicist.

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OBJECTIVES

The aims of this work are to investigate and understand the relationship and evolution of technique and form between architecture and the automobile, mainly in the years between the two photographs on the cover, in other words, between the 1920s and the 1950s.

METHODOLOGY

In order to achieve the objectives of this work, the methodology followed was to analyse different references, such as books, articles, doctoral theses, videos and images. Due to the vast field of study that these sources contain, the analysis of all these references has been oriented towards the objectives described in the previous paragraph.

INTRODUCTION

The emergence and development of the automobile industry until the 1930s and the development of its mass production, mainly with the assembly lines of Ford or General Motors in the United States and Fiat in Europe, were an important reference and source of knowledge and research for modern architects, which motivated many of them to industrialise the construction sector as well, including Le Corbusier, Mies van der Rohe and Gerrit Rietveld. Some of the reasons for this motivation to industrialise the construction sector were, among other things, greater efficiency in quality control and production time, greater safety and independence from weather conditions during the construction process, and greater profitability. This early industry was characterised by a formal composition based on the assembly of parts and a mechanicist aesthetic.

From the 1930s onwards, that first industry with a mechanicist aesthetic evolved towards an industry characterised by having a formal composition based on the assembling of parts, making more organic formal compositions. Examples of this type of composition are the invention of styling, streamlining, the unibody chassis, or works by important authors such as Richard Buckminster Fuller, Jean Prouvé and Alison and Peter Smithson. This work ends with the conclusions drawn from this research. It has also been interesting to include as an annex the contributions on these subjects of other important authors such as Reyner Banham, Herbert Read and Lewis Mumford.

“En este último siglo, el debate sobre las relaciones entre arte y técnica (o entre arte e industria) ha incidido en la evolución de la arquitectura moderna, y que a su vez esta evolución ha condicionado tal debate”¹.

[The last century, the debate on the relationship between art and technique (or between art and industry) has had an impact on the evolution of modern architecture, and in turn this evolution has conditioned such debate].

“Podemos definir un estilo como un repertorio de formas que se manifiestan en una época y en un contexto concreto”².

[We can define a style as a repertoire of forms that manifest themselves in a particular epoch and context].

¹ MALDONADO, Tomás. *Disegno industriale: Un riesame. Definizione, storia, bibliografia*. Milano: Feltrinelli Editore; 1976. (Used the Spanish translated edition by Francesc Serra i Cantarell, *El diseño industrial reconsiderado. Definición, historia, bibliografía* [Industrial design reconsidered. Definition, history, bibliography], Barcelona: Editorial Gustavo Gili; 1977).

² CAMPI I VALLS, Isabel. *El diseño de producto en el siglo XX. Un experimento narrativo occidental* [Product design in the 20th century. A occidental narrative experiment] [Doctoral Thesis]. Barcelona: Universitat de Barcelona. Facultat de Belles Arts Sant Jordi. Departament de Disseny i Imatge; 2015.

“En realidad, los diseñadores aspiran a dominar los sistemas constructivos y los materiales para ponerlos al servicio de las ideas”³.

[In fact, designers aspire to dominate construction systems and materials so that they can be at the service of ideas].

“En los últimos años hemos visto, tanto en la arquitectura como en los objetos producidos industrialmente, cómo el binomio “forma-función” se iba escindiendo cada vez más y hemos visto cómo -por encima de cualquier otra exigencia técnica o económica- existe una exigencia estética, ligada no solamente a las peticiones “éticas” de la humanidad, sino también a la necesidad de obtener el éxito del producto en el mercado”⁴.

[In recent years we have seen, both in architecture and in industrially produced objects, how the “form-function” binomial was becoming increasingly splintering. We have also seen how -over and above any other technical or economic requirement- there is an aesthetic requirement, linked not only to the “ethical” demands of humanity, but also to the need to obtain the success of the product on the market].

³ CAMPI I VALLS, Isabel. *El diseño de producto en el siglo XX. Un experimento narrativo occidental* [Product design in the 20th century. A occidental narrative experiment] [Doctoral Thesis]. Barcelona: Universitat de Barcelona. Facultat de Belles Arts Sant Jordi. Departament de Disseny i Imatge; 2015.

⁴ DORFLES, Gillo. *La arquitectura moderna*. Barcelona: Editorial Ariel; 1980. p.12. Quoted in: GAY, Aquiles, SAMAR, Lidia. *El diseño industrial en la historia* [Industrial design in history]. 2nd edition 2004. Córdoba, Argentina: Ediciones tec; 1994.

WEISSENHOFSIEDLUNG DOUBLE HOUSE vs UPPER LAWN PAVILION

The works that planted the seed of this work have been those represented in the following two photographs, the same as those on the cover. In one of them, we can see Le Corbusier's 1927 double house in Weissenhofsiedlung, Stuttgart, together with a 1928 Mercedes-Benz 8/38 hp Roadster. The other shows the Upper Lawn Pavilion in 1962 by Alison and Peter Smithson, together with a Citroën DS 19 from the same period.



Image 01. Double house in Weissenhofsiedlung by Le Corbusier and Mercedes-Benz 8/38 hp Roadster, 1928.

Image 02. Upper Lawn Pavilion by Alison and Peter Smithson and Citroën DS 19, 1962.

Initially, we can see that in the first photograph, the design of both the building and the automobile is a design of more fragmentary and independent volumes and geometries. As we will see in this work, this type of design is typical of that time, when industrial designs were characterised by a formal composition based on the assembly and juxtaposition of parts, forming a machinist aesthetic.

By contrast, in the second photograph, we see a much more organic design. As we will also see in this work, this type of design is typical of the fifties, a design that began to emerge in the thirties, in which the designs of industries are characterised by having a formal composition based on a better assemblage of parts. For example, in the case of the car, the mudguard is integrated into the car body itself, or in the case of the building, the window facing the street is located halfway between the pre-existing wall and the new wall, a fact that also demonstrates the intention of integration, the setting of its design.

Thus, the formal composition represented in the second photograph is characterised by working the materials in a different way, which we can describe in two words:

*“Una es la de **engastar**, término utilizado en joyería y en orfebrería para nombrar el trabajo de embutir piedras preciosas en un metal noble, como el oro o la plata. Otra es la de **incrustar**, en un trabajo de taracea o marquetería, trozos de materiales valiosos en una plancha de madera”⁵.*

[One is that of **setting**, a term used in jewellery and goldsmithing to designate the work of embedding precious stones in a noble metal, such as gold or silver. Another is the **inlaying** of pieces of valuable materials into a wood panel in inlay or marquetry work].

⁵ CORTÉS, Juan Antonio. “Las manos del arquitecto. Una reflexión en torno a la obra de James Stirling” [The architect's hands. A reflection on the work of James Stirling]. Circo. Universidad Politécnica de Madrid. Escuela Técnica Superior de Arquitectura de Madrid. Proyectos Arquitectónicos. 2000; (Nº 72).

DOUBLE HOUSE IN WEISSENHOFSIEDLUNG

As López Padilla⁶ explains, the experiment of the Weissenhofsiedlung exhibition in Stuttgart in 1927 was of great importance in developing the principles of rationalization, typification, economy, flexibility and quality whose authors sought to build a new architecture, making clear the relationship between technique and form.



Image 03. Exhibition of the Weissenhofsiedlung, with the houses of Le Corbusier and Pierre Jeanneret indicated, 1927.

As Galimberti and Rosado⁷ say, Le Corbusier was one of the participating architects who played a key role in the exhibition, which played an important role in the formation of the so-called Modern Movement. The main driving force behind the exhibition was the Deutscher Werkbund, an institution formed in 1907 in Munich, with the union of architects, craftsmen, artists and industrialists. According to its own programme, the aim of the association is the ennoblement of industrial work in close contact and in common collaboration with those involved in art, industry and handicrafts, by means of education, propaganda and ideas on matters within its competence.

⁶ LÓPEZ PADILLA, Eduard Stick. “La arquitectura moderna como experimento: la Weissenhofsiedlung y la relación entre la técnica y la forma” [Modern architecture as an experiment: the Weissenhofsiedlung estate and the relationship between construction and form]. Dearq. Universidad del Valle. 2012; (Nº 10).

⁷ BRUCKMANN, Peter. 1932. “Die Gründung des Deutscher Werkbundes”. 6 Oktober 1907. Die Form, Heft Nº10. (Used the Spanish translated edition by José Manuel García Roig, “La Deutscher werkbund”. Bibliografía esencial, Cuaderno de Notas 3, 75-80). Quoted in: GALIMBERTI, Cecilia Inés, ROSADO, José Luis. “Le Corbusier en Weissenhofsiedlung. Reflexiones en torno a la ciudad, la arquitectura y el habitar” [Le Corbusier in Weissenhofsiedlung. Reflections on the city, architecture and habitation]. A&P Continuidad. Universidad Nacional de Rosario. Facultad de Arquitectura, Planeamiento y Diseño. 2018; (Nº 8).

The Deutscher Werkbund had a great influence, for example, through its involvement in the creation of the DIN Standards, its commitment to improving the quality of German industrial design or its support for educational initiatives aimed at the integration of art and technology, such as the new Bauhaus school of arts and crafts. Furthermore, there was a great need for public housing in Germany after the First World War, which was also one of the main reasons for this exhibition of new housing. According to Frampton, Le Corbusier's relationship with the Deutscher Werkbund made him aware of the achievements of modern industry and engineering, such as ships, aeroplanes and automobiles, and their aesthetics and rationality. This awareness, as we shall see later, was disseminated in *L'Esprit Nouveau* in 1920 and in *Vers une architecture* in 1923. It is also important to note that the international dissemination of the Weissenhofsiedlung and its ideas from the Modern Movement, especially the houses of Le Corbusier and his cousin Pierre Jeanneret, were boosted by the book *The International Style, Architecture since 1922* published in 1932 by Philip Johnson and Henry-Russell Hitchcock. However, given its historical context, both this exhibition and its ideas from the Modern Movement, crystallised in the CIAMs, were also heavily criticised, and not only by National Socialists. They were heavily criticised for their urban dehumanisation, their alienation of the individual, their segregation of the functions of the city and their lack of unity and identity with their local environment⁸.

Le Corbusier and Pierre Jeanneret were the architects of the Double House in Weissenhofsiedlung, an exhibition directed by Mies van der Rohe, a few years after the launch of his book *Vers une architecture* in 1923⁸. This building of two semi-detached houses has the characteristic, as mentioned, of having a formal composition of juxtaposition of parts, spaces and volumes, a compositional characteristic that was also typical of the spaces of the industrial buildings of that time. We can see that the car in front of the building, a Mercedes-Benz 8/38 hp Roadster, also has these same characteristics of formal composition. As for the building, when analysing its design in the plans, we can see that the stairwells are juxtaposed around the perimeter of the building, thus leaving the floor of the rest of the building free, in a manner similar to that of the Ford factory. The floor of the building that remains free becomes a large transformable space, thanks also to its partitions and mobile cupboards, through which it is possible to change the organisation of the space from a day zone to a night zone⁹.

⁸ GALIMBERTI, Cecilia Inés, ROSADO, José Luis. "Le Corbusier en Weissenhofsiedlung. Reflexiones en torno a la ciudad, la arquitectura y el habitar" [Le Corbusier in Weissenhofsiedlung. Reflections on the city, architecture and habitation]. A&P Continuidad. Universidad Nacional de Rosario. Facultad de Arquitectura, Planeamiento y Diseño. 2018; (Nº 8).

⁹ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

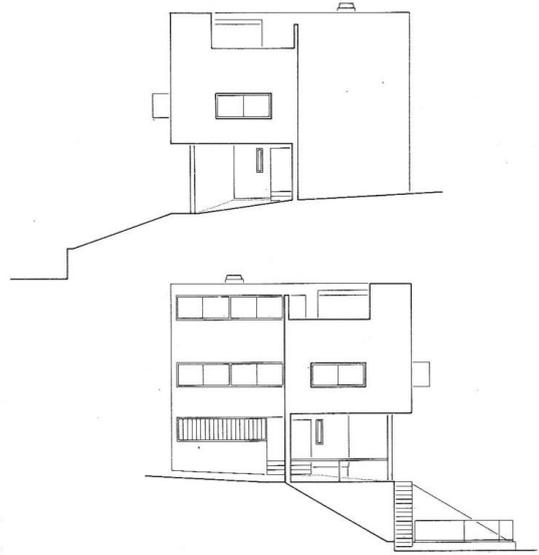
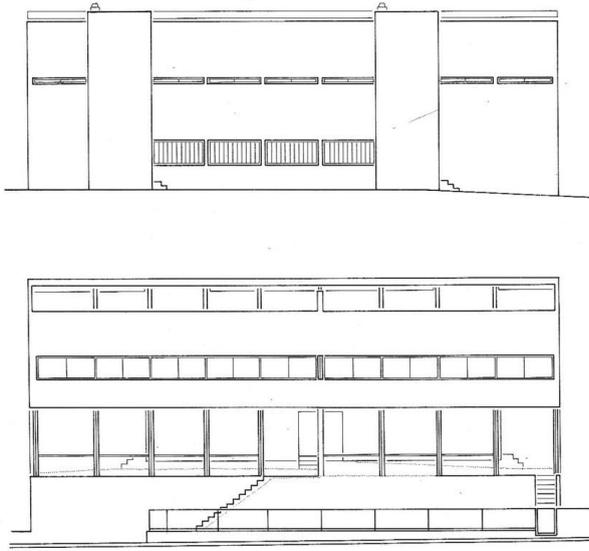


Image 04. West and east elevations of the double house.

Image 05. North and south elevations of the double house.

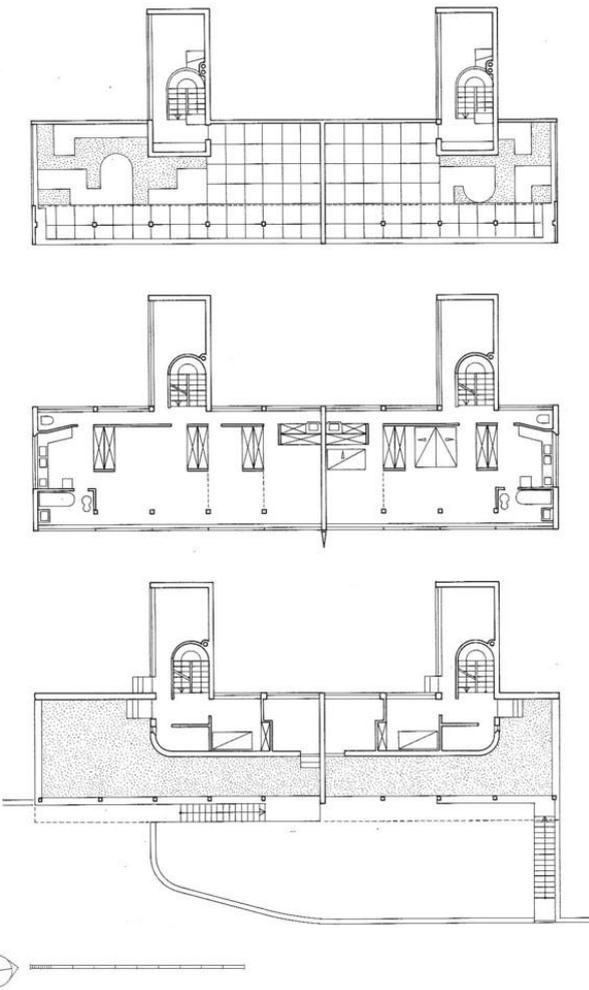


Image 06. Floor plans 0, 1 and 2 of the double house.

UPPER LAWN PAVILION

As Rodríguez García¹⁰ explains, the Upper Lawn Pavilion is the weekend house built by Alison and Peter Smithson in the countryside in the south of England, in Wiltshire, between 1959 and 1962. Largely self-built on an experimental basis, it is the renovation of an 18th century English cottage. The new construction is based on a timber, glass and aluminium pavilion, which rests on top of the pre-existing stone masonry wall that encloses the area of the plot.



Image 07. English vernacular farmhouse ensemble, with Upper Lawn Pavilion indicated, 1962.

Thus, this house can be defined as a modern interpretation of tradition, heir to the social, cultural and industrial moment of post-war Europe, and in an architectural context of critical revision of the Modern Movement, with a new attitude towards tradition. This experimental interpretation, the fruit of Team 10's characteristic attitude, is the answer to how to approach the relations between tradition and modernity, vernacular cultures and modern architecture or craft construction and industrial construction, trying to approach a more socially sensitive and traditional architecture. Alison and Peter Smithson were founding members of Team 10, which emerged in 1953 as part of the ninth CIAM, as a continuation and development of the ideas of the Modern Movement. Together with Van Eyck and Bakema, they took over from Le Corbusier in 1959 in the eleventh CIAM, which had been part of CIAM since its foundation in 1928¹⁰.

¹⁰ RODRÍGUEZ GARCÍA, Ana. *Huellas de lo vernáculo en Team 10. Alison y Peter Smithson, Aldo van Eyck, José Antonio Coderch* [Traces of the vernacular in Team 10. Alison and Peter Smithson, Aldo van Eyck, José Antonio Coderch] [Doctoral Thesis].

Also interesting is Montaner's explanation, who says that in the England of the early 1950s, the members of the Independent Group, which also included Alison and Peter Smithson, were admirers of the American culture of that time, such as the automobile, cinema and advertising¹¹. We begin to realise that these latter trends, typical of that period, were characterised by more organic designs, a design also reflected in both the Upper Lawn Pavilion and the Citroën DS 19. Interestingly, DS stood for the French word *déesse*, meaning goddess, while ID, a more basic version of the DS, stood for the French word *idée*, meaning idea. The members of the Independent Group, which also included Reyner Banham, thus took over from the First Machine Age. Alison and Peter Smithson came to own different variants of the Citroën DS, and Alison went on to write and publish a book on the car in 1983, *AS in DS: An Eye on the Road*, in which she included a travel diary on board the car, which she describes as like a living room on wheels. It is also a curious fact that she designed the book in the shape of the Citroën DS floor plan¹².

As for the building, in this axonometry of the constructive process of the project, represented by Bruno Krucker¹³, when analysing its design, we can also observe how its new timber structure and framework fits into the pre-existing stone chimney, making it the centre of the new space. We can also see how the new building is embedded in other pre-existing spaces, such as the stone wall around the perimeter of the plot and in the old paving, which changes from interior to exterior, due to the displacement of the new building with respect to the previous one¹⁴.

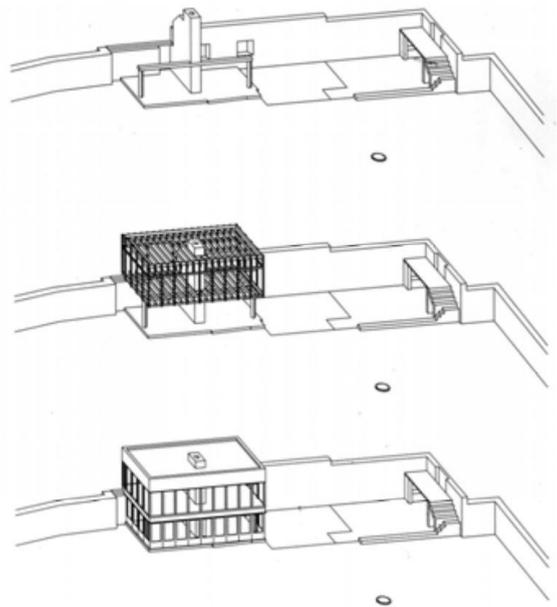


Image 08. Axonometry of the construction process of the Upper Lawn Pavilion, 1962.

¹¹ MONTANER, Josep Maria. *Después del Movimiento Moderno*. [After the Modern Movement]. Barcelona: Editorial Gustavo Gili; 1993.

¹² GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

¹³ KRUCKER, Bruno. *Complex Ordinariness. The Upper Lawn Pavilion by Alison and Peter Smithson*. Zürich: Gta Verlag, ETH; 2002. Represented in: RODRÍGUEZ GARCÍA, Ana. *Huellas de lo vernáculo en Team 10. Alison y Peter Smithson, Aldo van Eyck, José Antonio Coderch* [Traces of the vernacular in Team 10. Alison and Peter Smithson, Aldo van Eyck, José Antonio Coderch] [Doctoral Thesis].

¹⁴ RODRÍGUEZ GARCÍA, Ana. *Huellas de lo vernáculo en Team 10. Alison y Peter Smithson, Aldo van Eyck, José Antonio Coderch* [Traces of the vernacular in Team 10. Alison and Peter Smithson, Aldo van Eyck, José Antonio Coderch] [Doctoral Thesis].

In this other interesting sketch, the construction process is analysed from its original state. We can see how the north wall was transformed, with the elimination and modification of some of its parts, until its finished state¹⁵. In this way, the union and setting of a new architecture in a vernacular architecture, characteristic of that second organicist industry, is graphically represented.

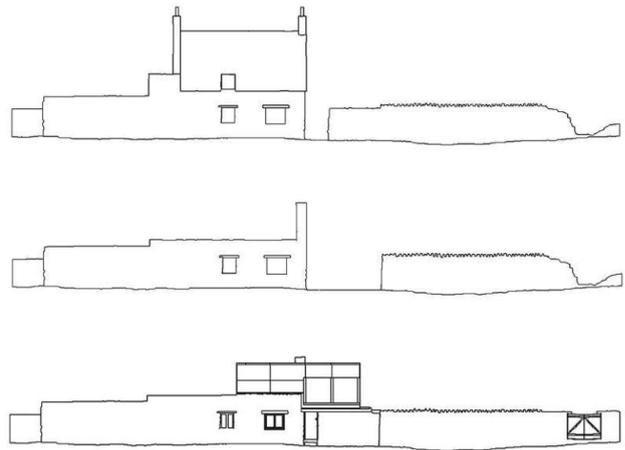


Image 09. Esquema del proceso constructivo del Upper Lawn Pavilion.

In the following plans we can also observe and analyse the characteristics described in the previous paragraphs:

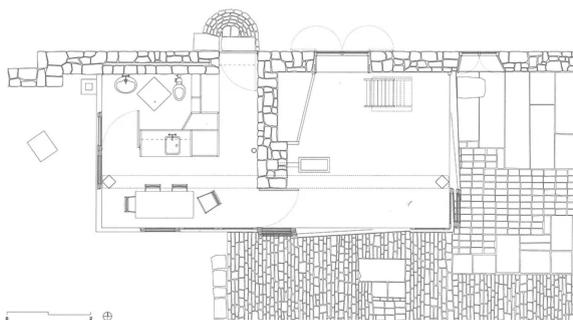


Image 10. Main floor plan of the Upper Lawn Pavilion.

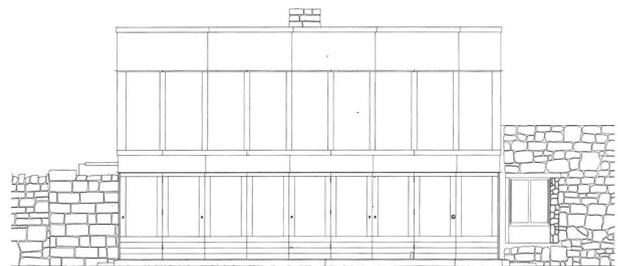


Image 11. South elevation of the Upper Lawn Pavilion.



Image 12. Plan of the Upper Lawn Pavilion mezzanine.

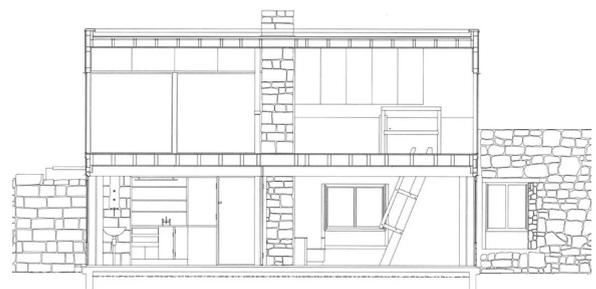


Image 13. Longitudinal section of the Upper Lawn Pavilion.

¹⁵ RODRÍGUEZ GARCÍA, Ana. *Huellas de lo vernáculo en Team 10. Alison y Peter Smithson, Aldo van Eyck, José Antonio Coderch* [Traces of the vernacular in Team 10. Alison and Peter Smithson, Aldo van Eyck, José Antonio Coderch] [Doctoral Thesis].

“La emergencia de objetos técnicos como los vehículos modernos a principios del siglo XX (el automóvil, el trasatlántico, el dirigible o el aeroplano) está relacionada directamente con la Arquitectura de la Primera Era de la Máquina”¹⁶.

[The emergence of technical objects such as modern vehicles at the beginning of the 20th century (the automobile, the ocean liner, the airship or the aeroplane) is directly related to the Architecture of the First Machine Age].

“Los vehículos modernos han sido los medios con los que transmitir los conceptos que ansiaban transformar las propiedades tradicionales de la Arquitectura, relativas a su factura, su habitabilidad, su duración, su funcionalidad o su estética. Destaca particularmente el caso del automóvil en las décadas de los años 30 y 50”¹⁶.

[The modern vehicles have been the means with which to transmit the concepts that sought to transform the traditional properties of Architecture, in terms of its design, its habitability, its durability, its functionality or its aesthetics. Particularly noteworthy is the case of the automobile in the 1930s and 1950s].

¹⁶ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Trans architecture: imagination, invention and individuation of the technical architectural object: technology transfer from the transport industry to the architectural project (1900-1973)] [Doctoral Thesis].

“En italiano, el automóvil es la “macchina” por excelencia. Esto puede dar una idea de la importancia que la invención y el desarrollo de esta clase de vehículos ha tenido en la evolución de toda la cultura industrial, especialmente en el siglo xx. Y dentro de esta cultura de la modernidad, la arquitectura también se ha visto influida por los nuevos conceptos introducidos por esa máquina individual, autónoma y dinámica” ¹⁷.

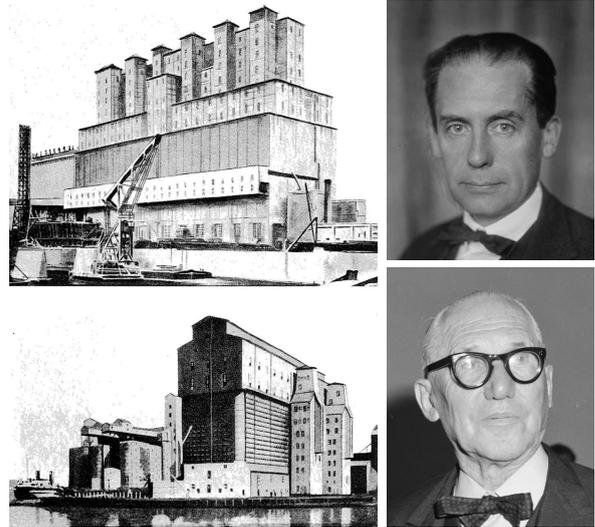
[In Italian, the automobile is the “*macchina*” par excellence. This may give an idea of the importance that the invention and development of this kind of vehicles has had in the evolution of the entire industrial culture, especially in the 20th century. And within this culture of modernity, architecture has also been influenced by the new concepts introduced by this individual, autonomous and dynamic machine].

¹⁷ SAINZ, Jorge. “La máquina por excelencia. Arquitectura y automóvil, una historia moderna” [The machine par excellence. Architecture and the automobile, a modern history]. *Arquitectura Viva*. Universidad Politécnica de Madrid. Escuela Técnica Superior de Arquitectura de Madrid. Composición Arquitectónica. 2006; (Nº 106).

FROM MECHANICIST DESIGN TO ORGANICIST DESIGN

THE BEGINNINGS AND DIFFUSION OF THE AUTOMOBILE INDUSTRY INTO ARCHITECTURE

The automobile, as a technical object, has influenced architecture since the beginning of the 20th century. The Futurist manifestos, Walter Gropius' images of American silos and factories, or Le Corbusier's images of automobiles and other technical objects, such as ocean liners and aeroplanes, are responsible for this. These images were disseminated by avant-garde artists during the first decades of the 20th century, giving rise to the beginning of a modern tradition and a new Aesthetics of the Machine¹⁸.



Images 14-15-16. Left: Two of the images of American silos used by Le Corbusier in *Vers une architecture* in 1923, used before in *L'Esprit nouveau* in 1921, and previously used by Walter Gropius in *Jahrbuch des Deutschen Werkbundes* in 1913¹⁸. - Top right: Walter Gropius - Bottom right: Le Corbusier.

One of the first avant-garde art movements to advocate automobile technology was Futurism. An example of this is the *The Manifesto of Futurism* that Filippo Tommaso Marinetti wrote in 1908. A year later, in 1909, the poet photographed himself in his Isotta Fraschini automobile, the most expensive, exclusive and fastest car of that time¹⁸.



Image 17. Filippo Tommaso Marinetti with an Isotta Fraschini, 1909.

¹⁸ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].



Image 18. Umberto Boccioni.

Another Futurist artist was Umberto Boccioni¹⁹, who in the *Manifesto della Architettura Futurista* of 1914, in relation to architecture and the automobile said that all this shows us that architecture is becoming a rigid, light, mobile art, like an automobile, the environment of a building must provide maximum performance.



Image 19. Karl Benz.

Although the first handcrafted automobiles with internal combustion petrol engines, invented by Karl Benz in 1886, had already been built in Europe by the end of the 19th century, they were still luxury items that were not accessible to the majority of the population¹⁹.

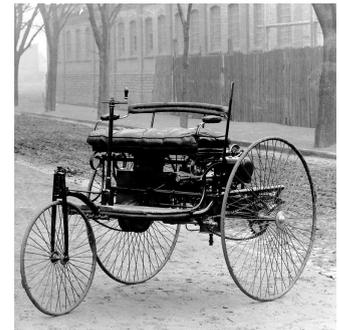


Image 20. Benz Patent-Motorwagen.

The great revolution in the mass production of automobiles began in the United States. The first recorded sale of an automobile in the United States was in 1893, manufactured and sold by Ransom Eli Olds, who later founded the Olds Motors Works in Detroit in 1899. By 1902, he had produced 2.500 Oldsmobile cars, making the car affordable¹⁹.

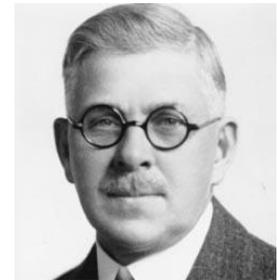


Image 21. Ransom Eli Olds.

Thus, we see that there was a big difference between Europe and the United States in the early days of automobile production. Unlike in Europe, in the United States the automobile industry focused on mass production in order to make cars affordable. From here, we will see that during the first decades of the 20th century, a rapid and powerful development in the automobile industry took place, which also spread to Europe. The greatest exponent of the start of mass production of automobiles in the United States was Henry Ford, in Detroit. Largely responsible for his great success was the implementation in 1913 of the moving assembly line, which produced the first mass-produced car, the famous Ford Model T utility car¹⁹.

¹⁹ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

FORD



Image 22. Henry Ford.

Henry Ford (1863-1947) was the founder of the Ford Motor Company in Detroit in 1903. He revolutionised the automobile industry with his mass production system. This new system of industrial production was called *Fordism* or the *American system*. Henry Ford, along with Frederick Winslow Taylor, are two key figures in industrial capitalism²⁰.



Image 23. Ford's Highland Park factory.

Among Gropius's photographs was one of the exterior of the factory designed by Detroit architect Albert Kahn for Henry Ford, built in Highland Park in 1908. It was not until 1 December 1913 that the first *Moving Assembly Line* was installed. This consisted of the production of a complete automobile, inspired by the continuous, horizontal production methods of the Chicago slaughterhouses²¹.



Image 24. Albert Kahn

To further optimise production, Ford hired Frederick Taylor, founder of the scientific organisation of work, and succeeded in reducing the production time of a Model T from 12 hours to 2.5 hours. Between 1908 and 1927, 15 million units were sold²¹.



Image 25. Frederick Taylor.

²⁰ GAY, Aquiles, SAMAR, Lidia. *El diseño industrial en la historia*. [Industrial design in history]. 2nd edition 2004. Córdoba, Argentina: Ediciones tec; 1994.

²¹ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

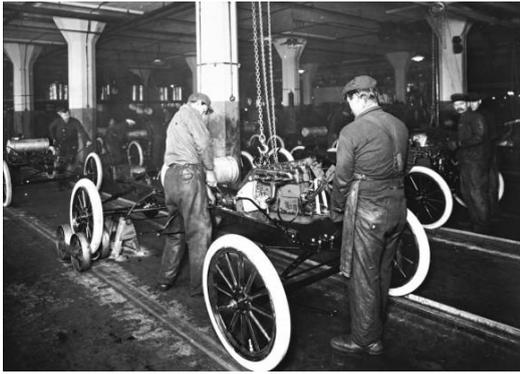


Image 26. Ford Model T construction.



Image 27. Ford Model T series production.

As Gay and Samar²² explain, in Fordism, productivity is not the result of the sum of individual efforts but of the correct planning and utilisation of production capacity. Workers only perform fragmentary and monotonous tasks, which, according to Henry Ford, can be learned in less than two hours. They repeat the same gestures, even without understanding their meaning. On the one hand, it can be said that this conception of chain work does not stimulate freedom of movement, dexterity, individual initiative or technological culture. On the other hand, however, we can also say that it is partly compensated by a smaller workforce.

The technical and formal design of the affordable and reliable Ford T, like its manufacturing process, is fragmentary and mechanicist aesthetic, consisting of an assembly of parts. This type of design was also still characteristic of the 1928 Mercedes-Benz 8/38 hp Roadster, shown in the photograph next to Le Corbusier's double house in Weissenhofsiedlung.



Image 28. Ford Model T, 1910.

In 1918, Henry Ford built another factory in River Rouge, this time a single-storey one, as the vertical factory in Highland Park had become obsolete. The factory's expansion up to 1932 was made possible by its use of steel structures instead of reinforced concrete²³.

²² GAY, Aquiles, SAMAR, Lidia. *El diseño industrial en la historia* [Industrial design in history]. 2nd edition 2004. Córdoba, Argentina: Ediciones tec; 1994.

²³ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

Le Corbusier²⁴ visited Ford's River Rouge factory in 1935, which he said was like a real machine. After the visit, the architect sent a letter to car designer Gordon Buehrig, saying that observing the mass production technique that will soon be applied to the manufacture of houses confirmed for him in a lesson of blinding clarity, the idea that he had been defending for ten years. He said that heavy industry must be involved in housing, construction assembly line, mass production of housing with completely new industrial processes and that housing must be made in workshops similar to those for automobiles.

The moving assembly line thus became an industrial technique that was exported to other industrialised countries. First France with Citroën in 1919, followed by Italy with Fiat in 1924, and Germany with Porsche at the end of the 1930s²⁵.

²⁴ LE CORBUSIER. *Cuando las catedrales eran blancas* (1937). Madrid: Ed. Apóstrofe; 1999. p. 102-104. Quoted in: GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

²⁵ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

FIAT



Image 29. Giovanni Agnelli.

The case of FIAT (Fabbrica Italiana Automobili Torino), founded by Giovanni Agnelli (1866-1945) in 1899 is also important. Located in the Lingotto district of Turin, it was designed by the engineer Giacomo Mattè-Trucco between 1915 and 1923 on the basis of Ford's 1908 Highland Park factory, but reversing the gravitational order of production, thus completing the production of its cars on the test track located on its roof²⁶.

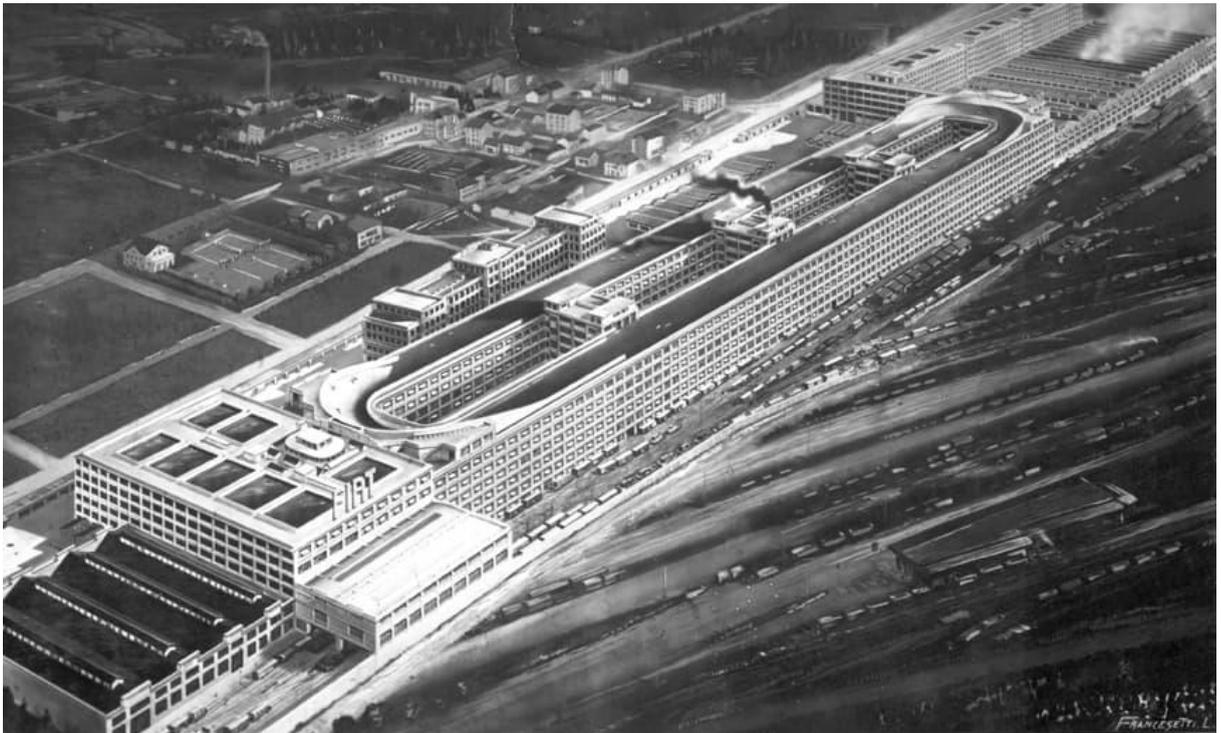


Image 30. Fiat's Lingotto factory.

From the very beginning, Fiat had produced its cars by hand, until the construction of the Lingotto plant. As mentioned above, it was based on the American Fordist-Taylorist system. Giovanni Agnelli visited the Ford factory in 1914, as he was interested in its moving assembly line system, and he also contacted its engineer, Albert Kahn. Fiat's first mass-produced model was the Fiat 509, which sold 90.000 units from 1924 to 1929²⁶.



Image 31. Giacomo Mattè-Trucco.

²⁶ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

In 1923, the same year that the FIAT factory was completed, the magazine *G*, which included editors such as Hans Richter, El Lissitzky, Werner Gräf, Mies van der Rohe and Frederick John Kiesler, published a set of photographs of the building. Le Corbusier also published this composition of three photographs of the new building in the chapter “Architecture or Revolution” in his book *Vers une architecture*. These images were disseminated across Europe over the following years, and became an important reference for many architects of that time²⁷.

The architecture of the car factory ultimately emerged as a result of accommodating a process which was as efficient as possible and yet had no defined form²⁷.

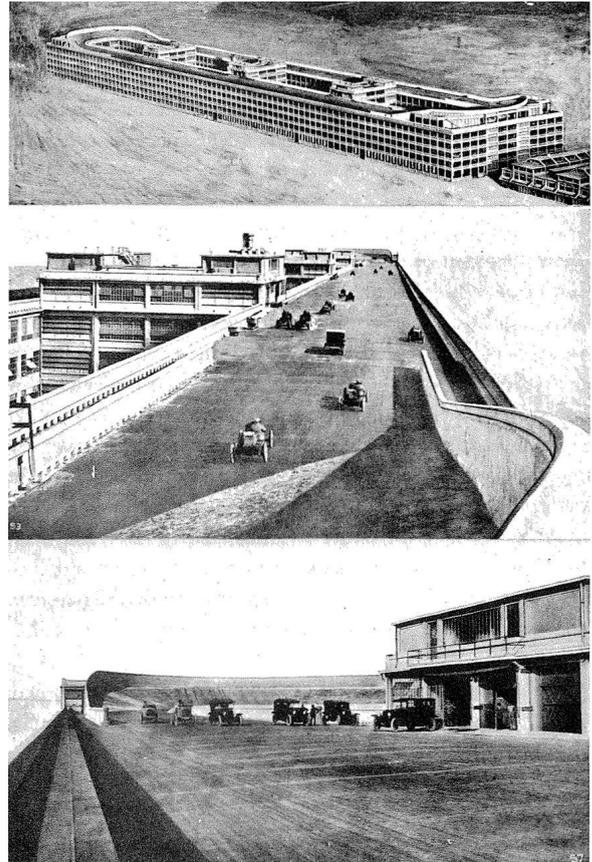
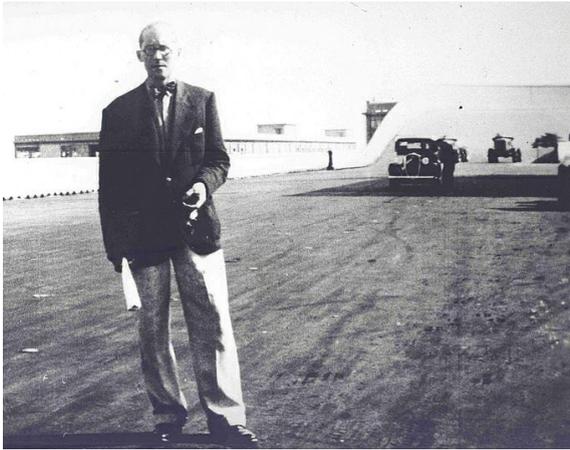


Image 32. Images of the Lingotto factory in *Vers une architecture*.

Le Corbusier also visited the FIAT factory in 1934, and took his famous photographs of himself driving a Fiat Balilla on the test track on its roof. He published a column about his visit in *Quadrante* magazine number 13, 1934, entitled “Le Corbusier a Torino”, in which he wrote that the Fiat factory has taken the lead in the urban planning of the machinist era. The motorway on the roof, for example, offers proof of modern technical possibilities. It is no longer a dream, but a reality. He said that he believed in this and that he saw the solution. That visit to the FIAT confirmed this for him²⁷.

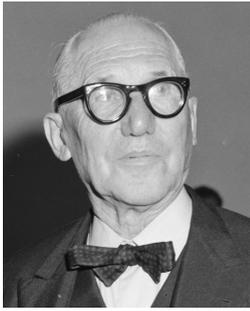
²⁷ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].



Images 33-34. Le Corbusier on the test track on the roof of the Lingotto factory - Ibid. driving a Fiat Balilla.

Both the Ford and Fiat factories were a great influence on many architects of that time, and there were important authors, as we shall see below, such as Reyner Banham, who wrote extensively about them. For example, Banham also thought, roughly like the Futurists led by Marinetti, that Fiat's new Lingotto factory was the closest building in history to the Futurist conception²⁸.

²⁸ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

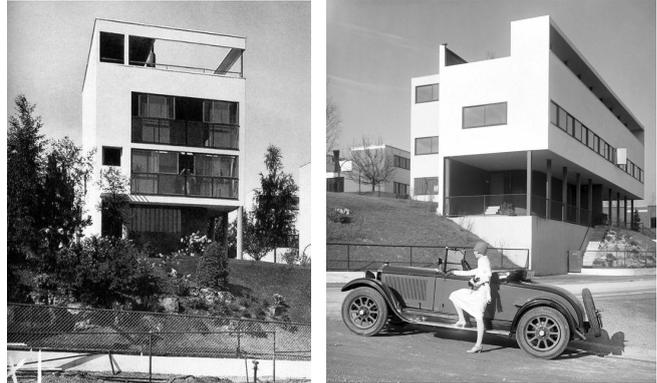


LE CORBUSIER

Le Corbusier (1887-1965) is well known for being one of the rationalist architects clearly interested in the modern vehicles of the first half of the 20th century, or, in other words, of the First Machine Age. Of particular note is his interest in automobiles from the 1920s to the 1950s, comparing their aesthetics and functionality with architecture.

Image 35. Le Corbusier.

As has already been shown, Le Corbusier's works with his cousin Pierre Jeanneret at the 1927 Weissenhofsiedlung exhibition in Stuttgart once again represented Le Corbusier's ideas on architecture and its relationship with automobiles and machines, describing his houses as “machine à habiter”.



Images 36-37. Citrohan House and Double House in Weissenhofsiedlung.

Vers une architecture of Le Corbusier²⁹, 1923, is one of the most representative writings of his work. It includes a section devoted to the automobile, in which he describes the relationship between the automobile and architecture, and another section devoted to mass-produced houses.

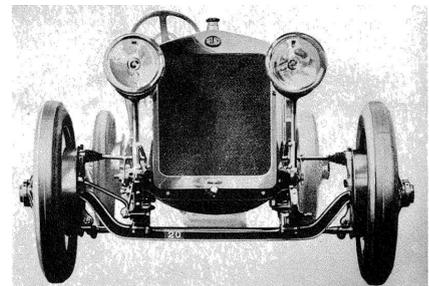


Image 38. Representation of a 1921 Delage, *Vers une architecture*.

“We must aim at the fixing of standards in order to face the problem of perfection.

The Parthenon is a product of selection applied to a standard.

Architecture operates in accordance with standards.

Standards are a matter of logic, analysis and minute study; they are based on a problem which has been well “stated.”

*A standard is definitely established by experiment”*²⁹.

²⁹ LE CORBUSIER - SAUGNIER. *Vers une Architecture*. Paris: Editions G. Crès et Cie.; 1923. (Used the English translated edition from the thirteenth French edition by Frederick Etchells, *Towards a new Architecture*, New York: Dover Publications, Inc.; 1986 Reprint, Originally published: London: John Rodker; 1931).

It is therefore appropriate to include some of his quotations in this book, as they are directly related to the subject of the present work. In it, Le Corbusier³⁰ defended the application of the mass production of the automobile industry to the construction of housing, a fact which, like automobiles, would lead to its rapid evolution:

*“If the problem of the dwelling or the flat were studied in the same way that a chassis is, a speedy transformation and improvement would be seen in our houses. If houses were constructed by industrial mass-production, like chassis, unexpected but sane and defensible forms would soon appear, and a new aesthetic would be formulated with astonishing precision”*³⁰.

The confrontation between works of architecture and automobiles through images was initiated by Le Corbusier in the 1920s. Important examples of this can be found in issue 10 of the magazine *L'Esprit Nouveau* and, as mentioned above, *Vers une architecture*, where we find the famous comparison between two images of automobiles and two images of Greek temples³⁰.

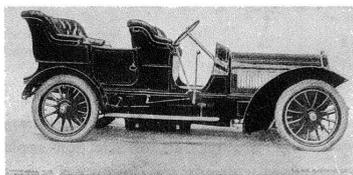
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TOWARDS A NEW ARCHITECTURE



PAESTUM, 600-550 B.C.

When once a standard is established, competition comes at once and violently into play. It is a fight; in order to win you must do better than your rival *in every minute point*, in



HUMBER, 1907

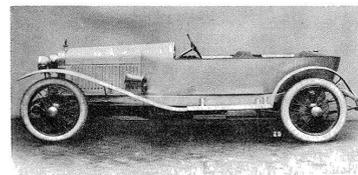
AUTOMOBILES

135



THE PARTHENON, 447-434 B.C.

the run of the whole thing and in all the details. Thus we get the study of minute points pushed to its limits. Progress. A standard is necessary for order in human effort.



DELAGE, "GRAND-SPORT," 1921

Image 39. Left: Paestum and the 1907 Humbert - Right: Parthenon and the 1921 Delage, *Vers une architecture*, 1923.

³⁰ LE CORBUSIER - SAUGNIER. *Vers une Architecture*. Paris: Editions G. Crès et Cie.; 1923. (Used the English translated edition from the thirteenth French edition by Frederick Etchells, *Towards a new Architecture*, New York: Dover Publications, Inc.; 1986 Reprint, Originally published: London: John Rodker; 1931).

In this comparison in *Vers une architecture* Le Corbusier³¹ wrote this quotation, where he made the rapid evolution of the automobile clear:

*“Let us display, then, the Parthenon and the motor-car so that it may be clear that it is a question of two products of selection in different fields, one of which has reached its climax and the other is evolving. That ennobles the automobile. And what then? Well, then it remains to use the motor-car as a challenge to our houses and our great buildings. It is here that we come to a dead stop. “Rien ne va plus.” Here we have no Parthenons”*³¹.

During the 1920s, the architect used to photograph his luxury automobiles next to his villas in order to represent the modernity of both works. Another well-known example, apart from the double house in the Weissenhofsiedlung, is the image of the Villa Stein, also from 1927, photographed together with a car.

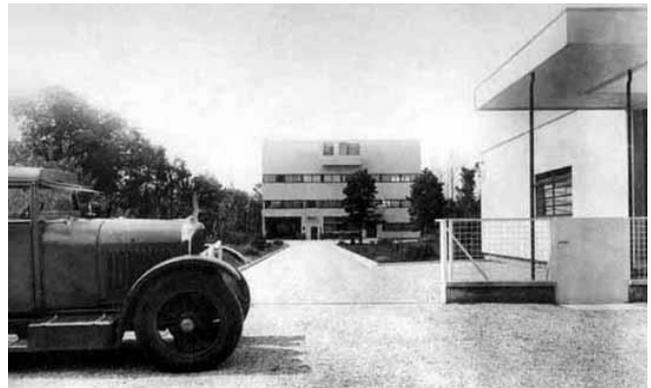


Image 40. Villa Stein and car.

Le Corbusier³¹ also related the automobile to the evolution towards beauty, perfection and harmony, and therefore these were qualities that architecture should also have. In *Vers une architecture*, he wrote the following:

*“All motor-cars have the same essential arrangements. But, by reason of the unceasing competition between the innumerable firms who make them, every maker has found himself obliged to get to the top of this competition and, over and above the standard of practical realization, to prosecute the search for a perfection and a harmony beyond the mere practical side, a manifestation not only of perfection and harmony, but of beauty”*³¹.

For Le Corbusier³¹, the industrialisation of the housing sector had to be based on the complete production of housing, just like the production of mass-produced automobiles. In 1920, Le Corbusier wrote the following texts in *L'Esprit Nouveau* that he also included in *Vers une architecture* in 1923:

³¹ LE CORBUSIER - SAUGNIER. *Vers une Architecture*. Paris: Editions G. Crès et Cie.; 1923. (Used the English translated edition from the thirteenth French edition by Frederick Etchells, *Towards a new Architecture*, New York: Dover Publications, Inc.; 1986 Reprint, Originally published: London: John Rodker; 1931).

“A great epoch has begun.

There exists a new spirit.

Industry, overwhelming us like a flood which rolls on towards its destined end, has furnished us with new tools adapted to this new epoch, animated by the new spirit.

Economic law unavoidably governs our acts and our thoughts.

The problem of the house is a problem of the epoch. The equilibrium of society to-day depends upon it. Architecture has for its first duty, in this period of renewal, that of bringing about a revision of values, a revision of the constituent elements of the house.

Mass-production is based on analysis and experiment.

Industry on the grand scale must occupy itself with building and establish the elements of the house on a mass-production basis.

We must create the mass-production spirit.

The spirit of constructing mass-production houses.

The spirit of living in mass-production houses.

The spirit of conceiving mass-production houses.

If we eliminate from our hearts and minds all dead concepts in regard to the houses and look at the question from a critical and objective point of view, we shall arrive at the “House-Machine,” the mass-production house, healthy (and morally so too) and beautiful in the same way that the working tools and instruments which accompany our existence are beautiful.

Beautiful also with all the animation that the artist's sensibility can add to severe and pure functioning elements”³².

Le Corbusier advocated that architects should use the mass production so successfully practised by Henry Ford. He said that houses should be built in one piece, using the mechanical tools of a factory, just as Ford did when he assembled his cars on moving conveyor belts³³.

³² LE CORBUSIER - SAUGNIER. *Vers une Architecture*. Paris: Editions G. Crès et Cie.; 1923. (Used the English translated edition from the thirteenth French edition by Frederick Etchells, *Towards a new Architecture*, New York: Dover Publications, Inc.; 1986 Reprint, Originally published: London: John Rodker; 1931).

³³ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

As we know, in his famous *Plan Voisin*, presented at the *Pavillon de L'Esprit Nouveau* at the *Exposition Internationale des Arts Décoratifs et Industriels Modernes* in Paris in 1925, an unrealised urban planning project for Paris, Le Corbusier clearly designed it with automobile traffic in mind. In it, we can also see how the buildings are juxtaposed in an orderly fashion on the ground, as if they were an assembly of parts, a design also typical of the industry of that time and which also reminds us of Mies's early cruciform pillars.



Image 41. Le Corbusier's Voisin Plan, 1925.

While the new housing project of the Weissenhofsiedlung in Stuttgart, organised by the Deutscher Werkbund in 1927, Alfred Roth, who was in charge of the construction of the two works by Le Corbusier and Pierre Jeanneret, included in his book the following statements, which said that construction is the efficient and consistent linking of building elements; industries and technical companies are set up to manufacture these elements, which, thanks to mass production, become precise, cheap and good, and they can be produced in advance in any number; industries take care that the elements are continuously supplemented and improved; the architect thus has a construction box at his disposal; his architectural talent can manifest itself freely; only the talent is characterised by the programme of his architecture; and he ended up writing that the time of the architects has come³⁴.

In short, Le Corbusier saw the automobile as a clear example of evolution and modernity that could be applied to architecture. In the beginning, his designs resembled the characteristic design of this early 20th century industry, characterised by a formal composition of juxtaposition of volumes and from an objective point of view. But we also understand that he thought³⁵ that these designs, under the application of rules imposed by the law of selection, could evolve towards perfection.

³⁴ ROTH, Alfred. *“Consideraciones sobre la construcción”*. En: *Dos casas de Le Corbusier y Pierre Jeanneret*. Murcia: Colegio Oficial de Aparejadores y Arquitectos Técnicos; 1997. Quoted in: LÓPEZ PADILLA, Eduard Stick. “La arquitectura moderna como experimento: la Weissenhofsiedlung y la relación entre la técnica y la forma” [Modern architecture as an experiment: the Weissenhofsiedlung estate and the relationship between construction and form]. Dearq. Universidad del Valle. 2012; (Nº 10).

³⁵ LE CORBUSIER - SAUGNIER. *Vers une Architecture*. Paris: Editions G. Crès et Cie.; 1923. (Used the English translated edition from the thirteenth French edition by Frederick Etchells, *Towards a new Architecture*, New York: Dover Publications, Inc.; 1986 Reprint, Originally published: London: John Rodker; 1931).

However, it is well known that Le Corbusier's designs of the mid-twentieth century, in the midst of the crisis of rationalism, are characterised by a tendency towards organicism, which, as we shall see later, is also a trend in automobile designs from the 1930s onwards. In this way, we can say that the designs of both architecture and automobiles evolved from a mechanistic aesthetic towards an organicist aesthetic, that is, from a design of fragmentation towards a design of integration.

A clear example of this is his Notre Dame du Haut Chapel in Ronchamp³⁶, France, 1950-1955. Its design of organic and integrative forms, curved and without straight, orthogonal or fragmentary lines, reflects the crisis of rationalism at that time.

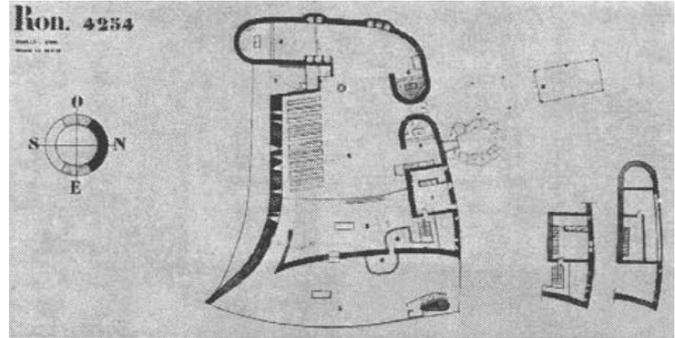


Image 42. Plan of the Ronchamp Chapel complex.

As Paolo Sustersic³⁶ explains, the Ronchamp Chapel represented a radical change in the activity of one of the fathers of the modern movement, as did other projects of his which were also designed away from rationalism, such as the *Errazuris House*, the *Villa for Madame Mandrot* or the *Swiss Pavilion* in the *Cité Internationale Universitaire* in Paris.

Instead of wanting to add pictorial or sculptural elements to the architecture of Ronchamp, Le Corbusier wanted to apply the famous concept of *Synthese des arts majeurs*, with which he intended his work to be a single unit which integrated architecture, painting and sculpture. This new way of doing things was widely accepted and shared in the CIAMs from the late 1940s onwards, it is also important to underline the influence of the Swiss architectural historian Sigfried Giedion, who championed the importance of art and the synthesis between thinking and feeling³⁶.

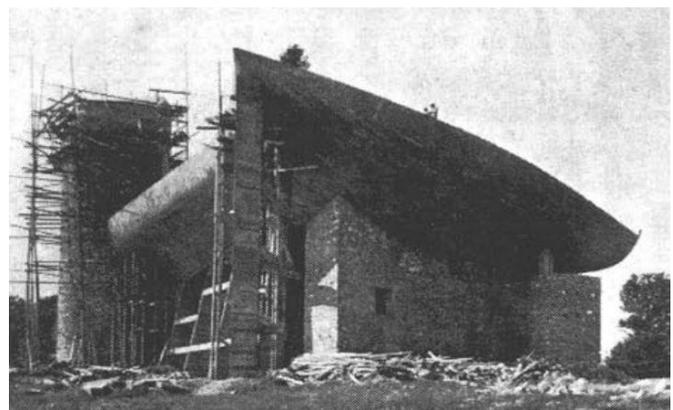


Image 43. Ronchamp Chapel under construction, 1950-1955.

³⁶ SUSTERSIC, Paolo. "Le Corbusier y la capilla de Ronchamp" [Le Corbusier and the Ronchamp Chapel]. DC Papers. Revista de crítica arquitectònica. Universitat Politècnica de Catalunya. Escola Tècnica Superior d'Arquitectura de Barcelona. Departament de Composició Arquitectònica. 1998; (Nº 1).

In this work, Le Corbusier thus abandoned old concepts and functional requirements in favour of a more organic design that took emotions into account. Le Corbusier said that it would be childish to try to formulate a system that would override such a standard of the heart; to want to formulate a system that would not be balanced upon the eternal constants of the human soul³⁷.

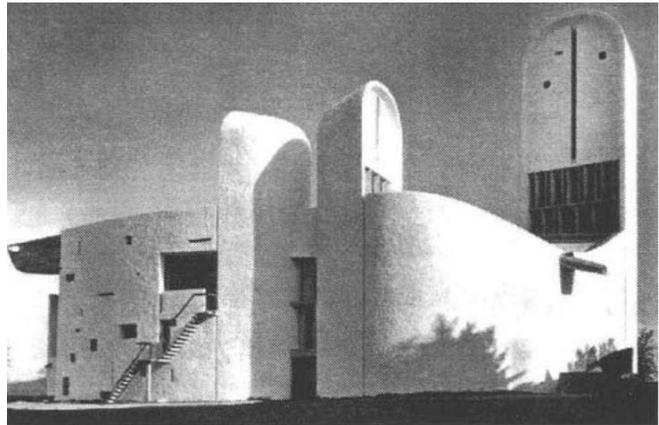


Image 44. Ronchamp Chapel, north and west facades.

The idea of what a sacred building could represent for Le Corbusier was well understood by Father Couturier, who in a 1953 text, later published in the book dedicated to Ronchamp, said that it seemed to them that they could say that it is in such buildings that we reach this higher type of architecture where we go beyond pure functionalism, where the dignity of the functions is manifested directly, and already operates, by the beauty of the forms. In religious buildings, such things acquire their full significance; for a truly sacred building is not a profane building sacralised by a consecrating rite or its subsequent use. A sacred building already is, and substantially so, by the very quality of its forms³⁸.

To achieve these emotions, as well as using organic forms to get closer to nature, Le Corbusier used materials in their most natural state, such as concrete with traces left by the wooden boards of the formwork³⁹, thus approaching the brutalist concept of the Smithsons.

³⁷ LE CORBUSIER. “Où en est l'architecture?”. En *L'Architecture Vivante*. Paris: otoño-invierno, 1927. pp. 10-11 (Translation into Spanish “¿Dónde está la arquitectura?”. En ROTH, A. *Dos casas de Le Corbusier y Pierre Jeanneret*. Murcia: Colegio Oficial de Aparejadores y Arquitectos Técnicos; 1997). Quoted in: SUSTERSIC, Paolo. “Le Corbusier y la capilla de Ronchamp” [Le Corbusier and the Ronchamp Chapel]. DC Papers. Revista de crítica arquitectónica. Universitat Politècnica de Catalunya. Escola Tècnica Superior d'Arquitectura de Barcelona. Departament de Composició Arquitectònica. 1998; (Nº 1).

³⁸ PETIT, Jean, LE CORBUSIER. *Chapelle de N. D. du haut à Ronchamp*. Paris: Le Cahier des Forces Vives; 1957. pp. 92-93. Quoted in: SUSTERSIC, Paolo. “Le Corbusier y la capilla de Ronchamp” [Le Corbusier and the Ronchamp Chapel]. DC Papers. Revista de crítica arquitectónica. Universitat Politècnica de Catalunya. Escola Tècnica Superior d'Arquitectura de Barcelona. Departament de Composició Arquitectònica. 1998; (Nº 1).

³⁹ SUSTERSIC, Paolo. “Le Corbusier y la capilla de Ronchamp” [Le Corbusier and the Ronchamp Chapel]. DC Papers. Revista de crítica arquitectónica. Universitat Politècnica de Catalunya. Escola Tècnica Superior d'Arquitectura de Barcelona. Departament de Composició Arquitectònica. 1998; (Nº 1).

It is important to bear in mind that this new way of doing things was also motivated by its post-war context, in which the aim was to counterpose a spiritual value to the old rationalist value. Le Corbusier did not base this spiritual or sacred value on a specific religion, but on the origins of the human spirit, which he found in the relationship between the cosmos and archaic and ancestral elements. This, together with the interplay of space, light, material and colour, creates a language to evoke feelings of the sacred⁴⁰.

In Ronchamp's design Le Corbusier also plays with a set of contradictions. For example, what seems solid is hollow, what seems very heavy is not so heavy and floats in the air, or what seems to support only envelopes. In this way, Le Corbusier creates a sensation of the existence of an unknown force that escapes the laws of physics⁴⁰.

*“Un désir: oui! par le langage de l'architecture atteindre aux sentiments ici évoqués”*⁴¹.

[A desire: yes! through the language of architecture reach the feelings evoked here].

Mies van der Rohe was one of the many architects who appreciated the Ronchamp Chapel at that time, and who said that only those who do not know what a masterpiece is can think that it is not a masterpiece, but then he said that he forbade himself any freedom of imagination, any subjective act: he said that he wanted to be objective⁴². By this, Mies wanted to underline the difference between two radically different points of view of architecture. The objectivity to which Mies referred was that of his chapel at IIT in Chicago (1949-1952)⁴⁰.

However, as we shall see below, Mies also evolved towards more organicist designs.

⁴⁰ SUSTERSIC, Paolo. “Le Corbusier y la capilla de Ronchamp” [Le Corbusier and the Ronchamp Chapel]. DC Papers. Revista de crítica arquitectònica. Universitat Politècnica de Catalunya. Escola Tècnica Superior d'Arquitectura de Barcelona. Departament de Composició Arquitectònica. 1998; (Nº 1).

⁴¹ LE CORBUSIER. *Le livre de Ronchamp*. Paris: Les Cahiers des forces Vives; 1961. p. 17. Quoted in: SUSTERSIC, Paolo. “Le Corbusier y la capilla de Ronchamp” [Le Corbusier and the Ronchamp Chapel]. DC Papers. Revista de crítica arquitectònica. Universitat Politècnica de Catalunya. Escola Tècnica Superior d'Arquitectura de Barcelona. Departament de Composició Arquitectònica. 1998; (Nº 1).

⁴² ROGERS, Ernesto Nathan. *L'architettura moderna dopo la generazione dei maestri*. En Casabella. Junio-Julio 1956; (Nº 211). Quoted in: SUSTERSIC, Paolo. “Le Corbusier y la capilla de Ronchamp” [Le Corbusier and the Ronchamp Chapel]. DC Papers. Revista de crítica arquitectònica. Universitat Politècnica de Catalunya. Escola Tècnica Superior d'Arquitectura de Barcelona. Departament de Composició Arquitectònica. 1998; (Nº 1).



MIES VAN DER ROHE

Mies van der Rohe (1886-1969) is also well known as one of the pioneering architects of the modern movement. In the 1920s, Mies⁴³ thought that the industrialisation of the building industry would not be easy, but would bring great advantages. In 1930, however, he became more critical, believing that technological progress detracted from the meaning of architecture.

Image 45. Mies van der Rohe.

But in the same year, it is interesting to analyse the relationship established between his Villa Tugendhat (Brno, 1930) and the automobile. The technological transfer between the two took place in numerous elements⁴³:

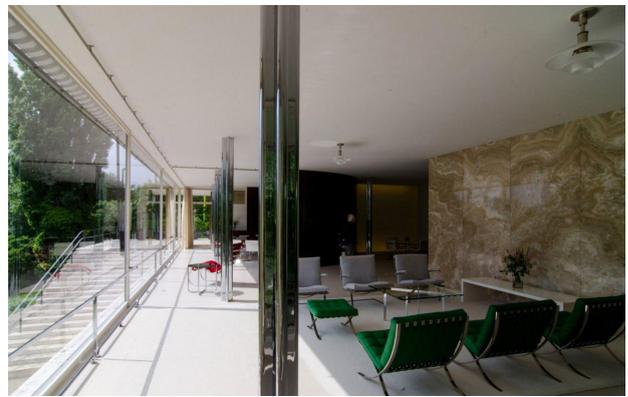


Image 46. Exterior view of the south-facing facade of Villa Tugendhat.

- From the middle floor of the Villa Tugendhat, one can look outside with a 180-degree horizontal view through the large glass windows, just as in a car.
- You can sit on the deck, feeling as if you were sitting in a convertible car.
- Another interesting similarity is that the windows on the south-facing façade are electrically retractable, just as in a car, where the side windows can also be electrically or manually retracted.

⁴³ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

- The use of fine materials such as wood or leather in the interior of the Villa Tugendhat, as in a luxury automobile, is also related to this.
- The Brno chair, designed by Mies and the German designer Lilly Reich (1885-1947), derives from the system used by the leaf spring suspension and also by the suspension by the deformation of the cantilever structure itself.
- In addition to leather upholstery, some Tugendhat seats also have armrests, which is also a common feature in cars.
- The use of sheet steel to cover certain elements is another example used in both cases.



Images 47-48-49-50. Images of the roof and interior of Mies van der Rohe's Villa Tugendhat.

Even so, we see that Villa Tugendhat still generally retains, the machine-like design aesthetic that still prevailed before the 1930s. As we will see below, Mies' later pillars were a key element in the change of this type of design.

Thus, in the mid-twentieth century, we see that Mies's designs, like Le Corbusier's, also tend towards organicism. In his case, for example, we see that this occurs through the evolution of his pillars in terms of their location and integration into the walls. An example of one of his projects in which this change is reflected is the project for the library and administration building of the Illinois Institute of Technology in Chicago in 1944⁴⁴.

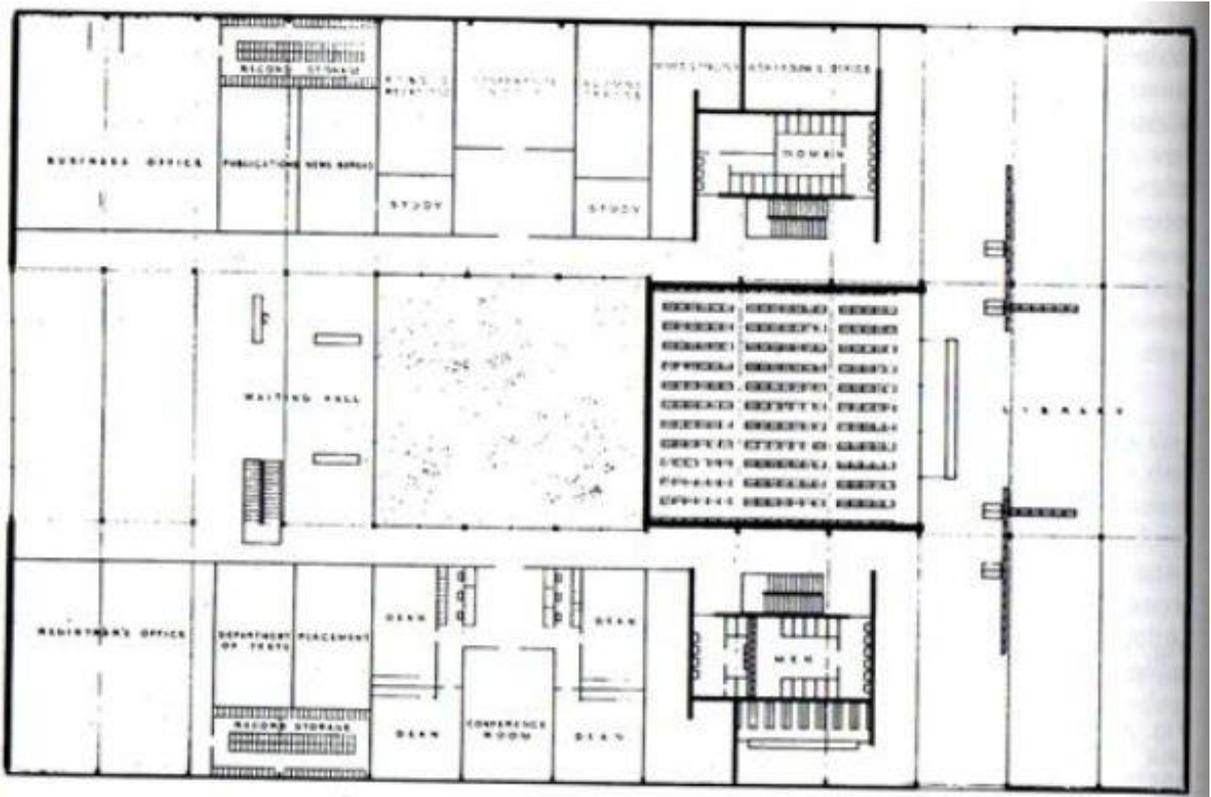


Image 51. Floor plan of Mies van der Rohe's project for the library and administration of the IIT in Chicago, 1944.

On this subject, Colin Rowe wrote that the concept of the new column of Mies was at once more structural and more classical than that of the revolutionary, plastic column of the 1920s; and once the column had been stipulated in these terms, Mies could hardly escape the consequences of its formulation. The structural and spatial expression now promised to become more integral than before⁴⁴.

⁴⁴ ROWE, Colin. "Neo-'Classicism' and Modern Architecture II". En: ROWE, Colin. *The Mathematics of the Ideal Villa and Other Essays*. Cambridge (Massachusetts) and London: The MIT Press; 1976. (Used the Spanish translated version by Francesc Parcerisas, *Manierismo y Arquitectura Moderna y Otros Ensayos*, Barcelona: Editorial Gustavo Gili; 1978, 1999).

In the doctoral thesis of Jiménez Gómez⁴⁵, it is interesting to observe the table with the evolution of the pillars of Mies van der Rohe, who was influenced, at the end of the 1930s, by the work of Albert Kahn, Henry Ford's engineer. We can see that over the years, it has acquired a more integrative design:

LES TRES ÈPOQUES EN L'OBRA DE MIES VAN DER ROHE

Year	Project Name	Structural System	Material
1920			
1921	OFFICE BUILDING FRIEDRICHSTRASSE		
1922	GLASS SKYSCRAPER		
1923			CONCRETE OFFICE BUILDING
1924			
1925			
1926			
1927			WEISSENHOFF, STUTTGART
1928	PAVELLÓ BCN		
1929	CASA TUGENDHAT		
1930			
1931	APARTMENT EXPO BERLIN		
1932	CASES PATI		
1933			
1934			
1935			
1936			
1937			
1938	CASA RESOR		
1939	CAMPUS IIT		
1940	MUSEU PETITA CIUTAT		
1941	CONCERT HALL		
1942	IIT MINERALS AND METALS		
1943			IITRI ENGINEERING
1944	IIT LIBRARY AND ADM.		IIT PERLSTEIN HALL
1945			IIT WISHNICK HALL
1946	CASA FARNSWORTH		IIT ALUMNI MEM HALL
1947	CANTOR DRIVE-IN REST.		PROMONTORY AP
1948	IIT BOILER PLANT		IIT INSTITUTE OF GAS
1949			840-880 LAKESHORE AP
1950	CASA McCORMICK		IIT CARMAN HALL AP
1951	IIT COMMONS TEATRE MANHEIM		BAILEY, CUNNINGHAM AP
1952	IIT CROWN HALL		CASA 50 X 50
1953	CONVENTION HALL		
1954			900-910 LAKESHORE AP
1955			COMMONWEALTH AP
1956			SEAGRAM TOWER
1957	BACARDI CUBA		
1958			
1959	PORT OFFICE FEDERAL CENTER		FEDERAL CENTER TOWERS
1960	SCHAEFER MUSEUM		LAFAYETTE AP
1961			
1962	NATIONAL GALLERY		
1963	TORONTO DOMINION BANK		TORONTO DOMINION TOWERS
1964	UC SOCIAL SERVICE ADM		
1965			
1966			IBM TOWER
1967			MANSION HOUSE TOWER
1968			
1969			

* Els projectes s'han ordenat cronològicament per data d'inici de projecte.
 *** Projectes de transició, encara amb el pilar anterior, però amb el nou sistema estructural
 Material de l'estructura dels tancaments: ac (acer) al (alumini) br (bronze)

Image 52. Table showing the evolution of Mies van der Rohe's pillars.

⁴⁵ JIMÉNEZ GÓMEZ, Eva. *El pilar en Mies van der Rohe: el lèxic de l'acer* [The pillar in Mies van der Rohe: the lexicon of steel] [Doctoral Thesis].



GERRIT RIETVELD

Gerrit Rietveld (1888-1964) was a Dutch architect, designer and carpenter. In his case, it is appropriate to look at the technical and formal evolution that occurs between two types of his chair designs from two different periods, which also reveal the evolution from mechanistic design to organicist design, which, as we have seen, occurs from the 1930s onwards.

Image 53. Gerrit Rietveld.

It is therefore interesting and illustrative to briefly compare the design of several of the chairs he designed at different times. On the one hand, the Red and Blue Chair of 1917 and the Berlin Chair of 1923 have a design typical of the 1920s, a mechanistic design, based on the assembly of parts.



Image 54. Red and Blue Chair, 1917.



Image 55. Berlin Chair, 1923.

On the other hand, the Utrecht Armchair of 1935 and the Aluminium Chair of 1942 anticipate the type of design characteristic from the 1930s onwards. We will see that it arose from the organicist industry produced in aviation and the automobile industry, and which tends to use its derived materials.



Image 56. Utrecht Armchair, 1935.



Image 57. Aluminium Chair, 1942.

ORGANICIST DESIGN: EVOLUTION TOWARDS OTHER TECHNIQUES AND FORMS

STYLING, STREAMLINING AND PLANNED OBSOLESCENCE

In this part of the paper, we will analyse some of the main causes of the formal and technical change that began to take place from the 1930s onwards in architecture and in the automobile and other industrial products.

While it is true that, on the one hand, the rapid evolution of the automobile during the first half of the 20th century was driven by the motivation to perfect its technical functionality, this rapid evolution was on the other hand driven by economic reasons, mainly due to the Crash of 1929 in the United States. Some of the responses to these reasons were the implementation of Styling, Streamlining and Planned Obsolescence.

Gert Selle⁴⁶ defines Styling as an aesthetic-formal manipulation carried out in the design of objects, without any improvement in their technical function or utility; as a “false” codification of the meaning of the forms of products that refers back to the plane of the reality of appearance and creates a new “reality” in the object.

As Campi i Valls⁴⁷ says, the collapse of the US economy in the late 1920s was mainly caused by a financial bubble. Overproduction was another cause, which together with the commercial policy of producing long-lasting models and simplified forms, led to market saturation. A well-known example of this was the Model T Ford. To save the industry and the economy, new business strategies were devised. Research was carried out and it was found that products with more attractive designs sold more. This, along with promoting products through advertising and expanding the range of short-lived models, was the new philosophy of American industry to stimulate economic growth. This new philosophy would later spread to Europe.

⁴⁶ SELLE, Gert. *Ideología y utopía del diseño*. Barcelona: Editorial Gustavo Gili; 1975. p. 234. Quoted in: GAY, Aquiles, SAMAR, Lidia. *El diseño industrial en la historia* [Industrial design in history]. 2nd edition 2004. Córdoba, Argentina: Ediciones tec; 1994.

⁴⁷ CAMPI I VALLS, Isabel. *El diseño de producto en el siglo XX. Un experimento narrativo occidental* [Product design in the 20th century. A occidental narrative experiment] [Doctoral Thesis].

The information provided by the documentary *Comprar, Tirar, Comprar*⁴⁸ was very interesting for analysing and reflecting on this and other directly related issues. It is also interesting to note that the analysis of this documentary extends to the present day.

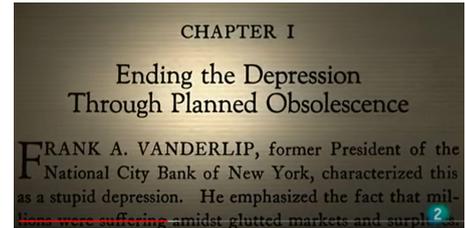


Image 58. Documentary *Comprar, Tirar, Comprar*.



Image 59. Alfred Sloan.

Alfred Sloan (1875-1966), was an American engineer and businessman, who also became well-known as the president of General Motors. Sloan introduced the annual model concept to automobiles in order to accelerate the industry and the economy of General Motors. In order to introduce annual car models, Sloan used styling in his designs, which sold more because of their greater formal appeal⁴⁸.

It was a strategy to compete against Ford⁴⁸. In this way, General Motors, instead of competing using technical improvements, did so using aesthetic improvements. Having seen the commercial success of this strategy, many other car manufacturers also began to use it. The problem was no longer to produce but to sell; thus companies stimulated the desires of consumers, and with the help and rapid development of advertising, distributed through newspapers and radio, consumption was encouraged to the point of creating a consumer society⁴⁹.

Image 60. Cadillac advertising (General Motors) in the 1950s.



Bernard London, a leading real estate investor, first proposed mandatory Planned Obsolescence in 1932 in order to accelerate the economy out of the economic crisis. This concept was based on all products being designed to have a limited shelf life, after which consumers who did not return expired products would have to pay a fine. In the end, his proposal for mandatory planned obsolescence was not implemented⁴⁸.

⁴⁸ DANNORITZER, Cosima. *Comprar, Tirar, Comprar*. España: RTVE - Documentales de la 2. Arte France - Media 3.14 - Article Z - Televisión Española - Televisió de Catalunya; 2010.

⁴⁹ CAMPI I VALLS, Isabel. *El diseño de producto en el siglo XX. Un experimento narrativo occidental* [Product design in the 20th century. A occidental narrative experiment] [Doctoral Thesis].

However, the concept of planned obsolescence re-emerged after World War II in the 1950s, not in a compulsory, but in a persuasive way, through design and marketing. Brooks Stevens was an American industrial designer who successfully promoted planned obsolescence in the United States. He designed everything from household appliances to automobiles, among many other products, always based on planned obsolescence, and designs which tended to convey speed and modernity⁵⁰. Two famous quotes by Brooks Stevens that describe the concept of planned obsolescence are:

“Planned obsolescence: The consumer's desire to own something a little newer, a little better, a little sooner than necessary”⁵⁰.

“The old European approach was to create the best product and make it last forever. (...) The American approach is to create a consumer who is dissatisfied with the product he has enjoyed, who sells it second-hand and buys the newest with the newest image”⁵⁰.

Thus, the American unlimited consumerism of the 1950s was the beginning of today's consumer society⁵⁰.

Ramón Benedito⁵¹ explains more about the history and also the current perception of this topic. In terms of history, 1927, the same year in which the exhibition of modern architecture was held at the Weissenhofsiedlung in Stuttgart, was also the year in which the term "industrial designer" was first used by the American designer Norman Bel Geddes, who also defined the importance of the outward appearance of objects, rather than just their functionality.

In the 1930s, two important world exhibitions were held in the United States: the Century of Progress exhibition in Chicago in 1933 and 1934, and The World of Tomorrow exhibition in New York in 1939. They showcased the major revolutionary inventions of that time, such as household appliances and automobiles, always based on advertising, the business of mass consumption, the persuasiveness of styling and also aerodynamism as a design style⁵¹.

⁵⁰ DANNORITZER, Cosima. *Comprar, Tirar, Comprar*. España: RTVE - Documentales de la 2. Arte France - Media 3.14 - Article Z - Televisión Española - Televisió de Catalunya; 2010.

⁵¹ BENEDITO, Ramón. “Artefactos, ¿Diseño o Styling?” [Artefacts, Design or Styling?]. *Infolio*. 2019; (Nº 13).

This aerodynamic style, also called Streamlining, was characterised by its teardrop shape and was applied to a multitude of objects that did not necessarily need it because they were not dynamic. But it was applied partly because it symbolised an attractive image of modernity, dynamism and speed and partly because it also improved aspects such as safety and cleanliness⁵².

Years before, in Europe, between 1919 and 1933, there was another design movement called the Bauhaus, which was founded by Walter Gropius, but later closed in 1933 by decision of the German National Socialists. The Bauhaus, contrary to the American styling, was based on the functionalism and purism of objects. It is also important to take into account that in Europe the artistic avant-garde and architecture predominated, while in the United States stage design and advertising predominated⁵³.

It was mainly from the 1950s onwards that this type of design began to spread from the United States to Europe. In terms of cars, the famous Isetta, Mini Morris, Fiat 600, Seat 600, Citroën 2CV or Citroën DS emerged at that time⁵³. These cars were designed with both function and form in mind.

Raymond Loewy (1893-1986) was one of the most important figures in industrial design from the 1930s onwards. He was a pioneer in improving the aesthetics of industrial products, a commercial strategy developed to save industry and the American economy, thus contributing to the consolidation of the culture of consumerism. Loewy was one of the first designers to influence a country's economic policy⁵².

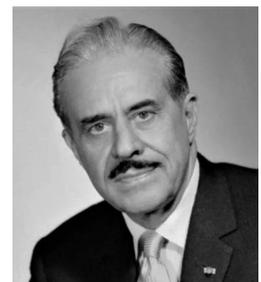


Image 61. Raymond Loewy.

As Loewy once said success materialised when we were able to convince a few men with a creative spirit that good looks were a commercial commodity, sometimes reducing costs, increasing product prestige, increasing company profits, benefiting the customer and creating jobs⁵⁴.

However, Loewy was also heavily criticised by advocates of the neo-functional design philosophy of *Good Design*, who prioritised functionalism in their designs⁵².

⁵² GAY, Aquiles, SAMAR, Lidia. *El diseño industrial en la historia* [Industrial design in history]. 2nd edition 2004. Córdoba, Argentina: Ediciones tec; 1994.

⁵³ BENEDITO, Ramón. “Artefactos, ¿Diseño o Styling?” [Artefacts, Design or Styling?]. *Infolio*. 2019; (Nº 13).

⁵⁴ LOEWY, R.; MAYER, P. *Diseño Industrial*. Raymond Loewy. Barcelona: Editorial Blume; 1980, p. 8. Quoted in: GAY, Aquiles, SAMAR, Lidia. *El diseño industrial en la historia* [Industrial design in history]. 2nd edition 2004. Córdoba, Argentina: Ediciones tec; 1994.

EVOLUTION TO THE UNIBODY CHASSIS

According to the industrial designer Tomás Maldonado⁵⁵, the origin of the car body dates back to the end of the 19th century when covering of industrial machines was enforced in order to avoid work accidents due to possible contact with their mechanisms. Thus, the technical scheme was hidden behind a formal scheme. This new system was also quickly transferred to most industrial products, such as the automobile, with the body supported on a structural chassis. An example of a car that used this system was the Ford Model T.



Image 62. Exploded Ford Model T.



Image 63. Chrysler Airflow unibody chassis.

From the 1930s onwards, with the development of closed-cabin cars, these two parts, the chassis and the body, evolved into a more integrated whole, as the chassis became a space frame, unibody or semi-monocoque. Two 1934 cars that pioneered this system were the Chrysler Airflow and the Citroën Traction Avant⁵⁶.

The Chrysler Airflow was also designed as the first mass-produced aerodynamic car. The aim was to make its unibody steel chassis as light and compact as possible. For this purpose, the *bridge truss* system was used, which was based on the Vierendeel beam principle⁵⁶. In other words, the individual parts were welded together from perforated sheet steel to form the body shell, thus creating a more organicist and integral design.

⁵⁵ MALDONADO, Tomás. *Disegno industriale: Un riesame. Definizione, storia, bibliografia*. Milano: Feltrinelli Editore; 1976. (Used the Spanish translated edition by Francesc Serra i Cantarell, *El diseño industrial reconsiderado. Definición, historia, bibliografía* [Industrial design reconsidered. Definition, history, bibliography], Barcelona: Editorial Gustavo Gili; 1977).

⁵⁶ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].



RICHARD BUCKMINSTER FULLER

Richard Buckminster Fuller (1895-1983) initiated an organicist and integrative trend of architecture as a system, as a mechanical organism. He was a pioneer in using the new techniques, materials and forms that emerged during the 1930s, which he transferred between automobiles and architecture.

Image 64. Buckminster Fuller.

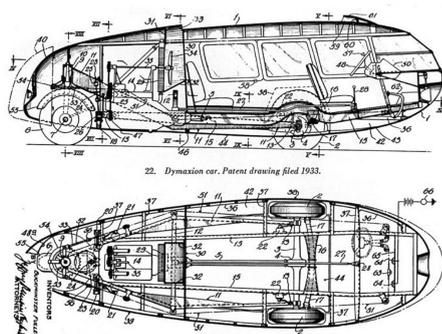
In the 1930s, Fuller understood that there was a relationship between the technical and the organic saying that the man is a self-balancing biped, with 28 joints in its adaptor-base; an electrochemical reduction plant, integral with segregated stores of special energy extracts in storage batteries, for the subsequent activation of thousands of hydraulic and pneumatic pumps connected to motors; 62.000 miles of capillaries, millions of alarm signals, railway and transport systems, crushers and cranes, (of which the arms are magnificent 23-joint affairs with self-weighing and lubricating systems⁵⁷).

Fuller was another architect who stressed the importance of industrialising construction in the same way as the automobile industry had done. For him, building houses by hand was archaic and to demonstrate this he used to compare it to the idea of building a car by hand⁵⁸.

Between 1927 and 1933 he developed a project called Dymaxion (Dynamic, maximum, tension) Transport. In a workshop in Bridgeport, Connecticut, where his 4D Dymaxion Company was based, he produced the three prototypes of his Dymaxion Car from 1933 onwards, a wooden and a metal prototype in the same year, and a third metal prototype the following year, 1934. Fuller considered automobiles to be extensions of people⁵⁸.

⁵⁷ FULLER, Richard Buckminster. *Nine chains to the moon* (1938). Carbondale: Southern Illinois University Press; 1963. Quoted in: GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

⁵⁸ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].



Images 65-66. Dymaxion Car plans - Richard Buckminster Fuller with his Dymaxion Car prototype.

Fuller's intention was to take this car into series production, which would turn it into the most advanced car on the market. He was assisted in its development by, among others, the automobile manufacturers Ford and Continental Motors, which provided some of their engines for the Dymaxion Car prototype⁵⁹.

From 1927 onwards, Fuller was also very critical of the housing construction industry at that time, which was very artisanal, and he compared it with the more efficient industrialised manufacture of the automobile in the United States. He used to give the example of how inefficient it would be, in terms of time, material and economic cost, to manufacture a car in the same artisanal way as housing. Fuller believed that it was necessary to industrialise the housing construction sector. He claimed that the design of housing should take into account the installation of facilities, such as water and electricity, thus forming an integral design. In this sense, Fuller accused Le Corbusier of not taking this into account and of being concerned only with aesthetics⁵⁹. We see in Fuller's way of thinking the change that was taking place towards more integral designs, characteristic, of the 1930s onwards.

Between 1927 and 1930, Fuller designed another prototype characterised by its integral design, the Dymaxion House or *dwelling machine*, an allusion to Le Corbusier's *machine à habiter*. Unlike the latter, the Dymaxion House had an integrated structure that depended on the tension of a central mast, which made its structure function in the same way as that of unibody bodies. Constructed of aluminium, the house featured state-of-the-art technology, such as pneumatic doors and partitions and automated machines and appliances. The intention was for the house to be self-sufficient in every possible way, in energy, cleaning and ventilation, as if it were an organism⁵⁹.

⁵⁹ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

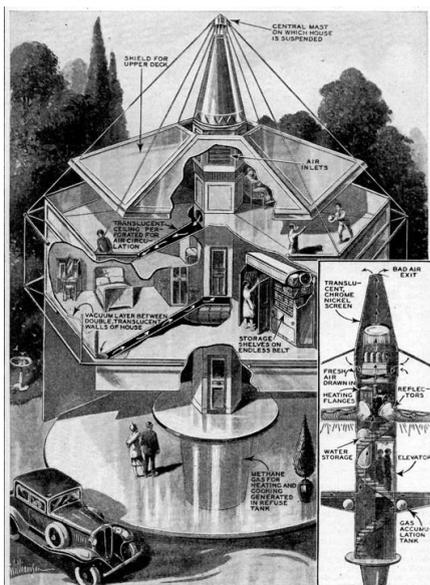


Image 67. Drawing of the Dymaxion House.

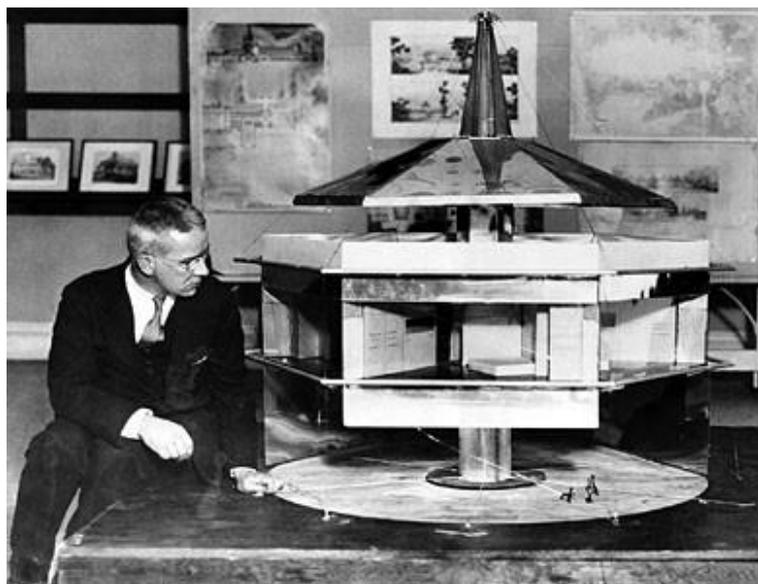


Image 68. Model of the Dymaxion House.

After World War II, Fuller updated his Dymaxion House in 1946 and built his Dymaxion Wichita, in partnership with the *Beech Aircraft Company* in Wichita, Kansas, which after the war would leverage its technology to build affordable, mass-produced housing. This time, he designed and built it in a hemispherical rather than hexagonal shape. Aluminium was an integral part of his technology, with folded aluminium sheet metal for the cladding and ventilated floor slabs and extruded aluminium profiles for the structure. In addition to weighing only three tonnes and being transportable, it was also easy to assemble⁶⁰.



Image 69. Dymaxion Wichita under construction.

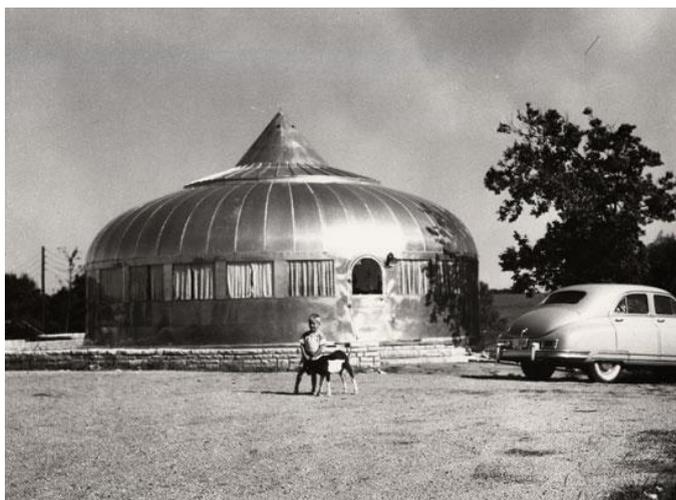
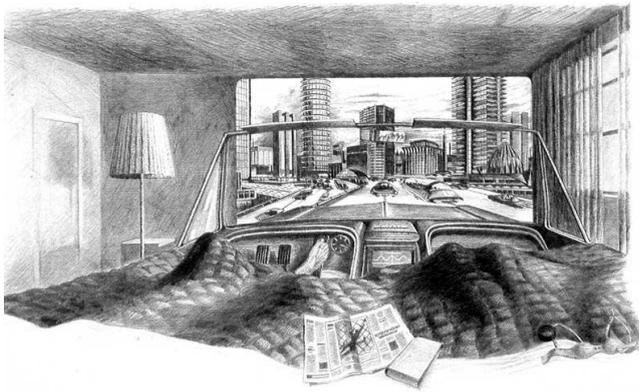


Image 70. Dymaxion Wichita next to a car.

⁶⁰ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

These projects are notable for their principles of integration and for having evolved towards an organicist aesthetic, leaving behind the machinist aesthetic that dominated before the 1930s.

Fuller believed that his houses had a useful life of 22 years, after which they could be recycled. As we have seen, this is directly related to planned obsolescence, which he also applied to his Dymaxion Car. It is also important to highlight his concept of *ephemeralization*, with which Fuller related his projects from an economic and efficient point of view, that is, his well-known “doing more with less”⁶¹.



For Fuller, the automobile was like an extension of man and also like an extension of the front porch of the dwelling. He also championed this relationship between architecture and the automobile, saying that the automobile was a part-time dwelling on wheels⁶¹.

Image 71. Lletto-car representation by Max Peintner, 1969.

⁶¹ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].



JEAN PROUVÉ

Jean Prouvé (1901-1984) was a French engineer, designer, builder and blacksmith. Prouvé, who was interested in technical advances in automobiles, carried out tests in his workshop, by bending steel and aluminium sheets, research and solutions that he translated into his architectural projects. His projects also followed integrative and organicist designs.

Image 72. Jean Prouvé.

In the early 20th century, the automobile industry was looking for systems that would give them greater weight efficiency and strength in their cars than that obtained from rolled steel tubes and sections. And they found a new system: cold-formed sheet steel which could be folded, pressed or stamped. This system was transferred to the construction and other industries and was a major technical breakthrough. As we have seen, Fuller also used this system with folded aluminium sheet derived from aircraft. In 1946, just after the end of World War II, the *American Iron and Steel Institute* launched the first manual on cold-formed steel section structures for the construction industry. Some ten years later, these profiles were already fully integrated into the construction industry⁶².

One of Prouvé's first major works in which he put his knowledge of these systems into practice was the Maison du Peuple in Clichy, France, between 1935 and 1939. Its main features were the incorporation of Vierendeel beams into its structure, curtain walls as if they were car bodies, and sliding partition panels. Even the roof and floor slab were also retractable, sliding on rail mechanisms⁶².



Images 73 and 74. Exterior and interior views showing the Vierendeel beams of the Maison du Peuple.

⁶² GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

Another of his projects was the Maison Metropole of 1949, in which he used the principle of Vierendeel beams and folded sheet metal to achieve greater formal and material efficiency, thus considerably reducing its overall weight by reducing the edge of the beams at their ends without losing structural rigidity, just like the chassis of the most advanced automobiles of the 1930s⁶³.



Images 75 and 76. Exterior and interior views showing the metal structure of the Maison Metropole.

In the Maison Tropicale, also from 1949, Prouvé used another central portico built of folded sheet metal, which, together with the enclosure panels, supported part of the roof and also gave horizontal stability to the structure. It is also worth noting that he included bioclimatic solutions in his design, such as a chimney for ventilation and the extraction of the hot air inside. In addition, the prototypes were designed to be transported by air and subsequently assembled, as was done in Niger and the Republic of Congo⁶³.

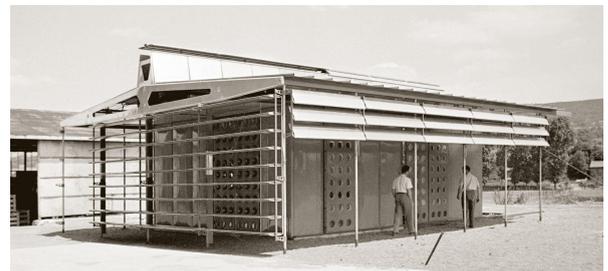


Image 77. Exterior views of the Maison Tropicale.

The Maison Coque of 1951 had a continuous enclosure that acted as both roof and façade, like the bodywork of a car. Prouvé thought that this solution could be implemented in the construction of houses⁶³.

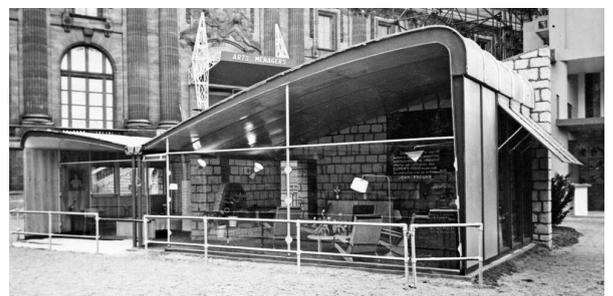
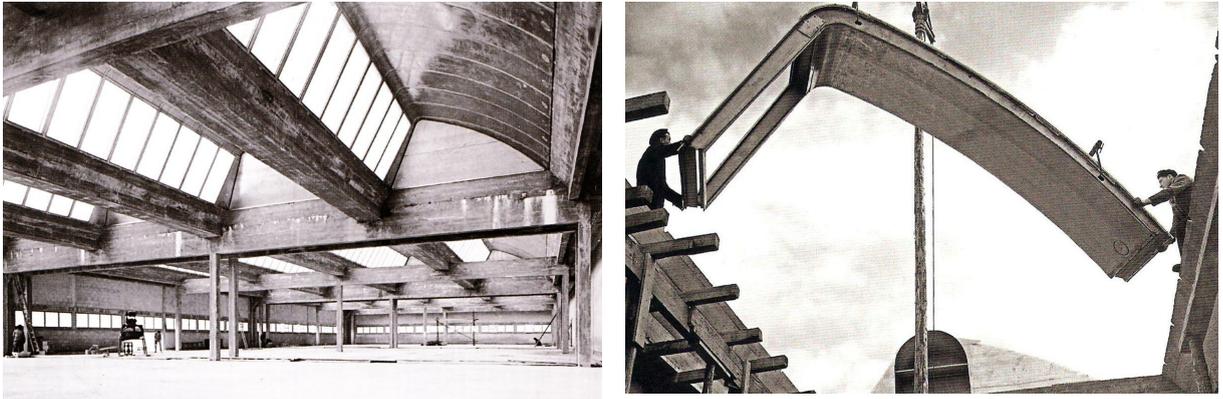


Image 78. Exterior views of the Maison Coque.

⁶³ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

The Mame Printing Press of 1950 was another of his characteristic projects. In it, Prouvé designed and built a type of shell with a “shed” type aluminium structure, which would act as a roof, after mounting it on the framework of the reinforced concrete structure⁶⁴. This project reminds us of the assembly of the first automobiles, such as the Ford T, in which, as we have already seen, the body was mounted on the chassis.



Images 79 and 80. Interior and assembly views of the “shed” type housings of the Mame printing press.

Prouvé wondered why the technological advances of automobiles and aeroplanes were not used in buildings which were still being built as they had been in the Middle Ages, rather than evolving in the same way as automobiles and aeroplanes⁶⁴.

From the late 1940s onwards, Prouvé designed and built numerous interesting multi-layered panels of folded sheet metal that acted as curtain walls, very light panels called *Unitary System*, alluding to the *Unitary Body* car body solution⁶⁴.

Prouvé's panels integrated car-like solutions. A clear example is the panel of the Fédération National du Bâtiment (FNB), made of aluminium and with window openings similar to those of automobiles. The same panels also integrated natural ventilation, thanks to the perforations punched in their upper part⁶⁴.

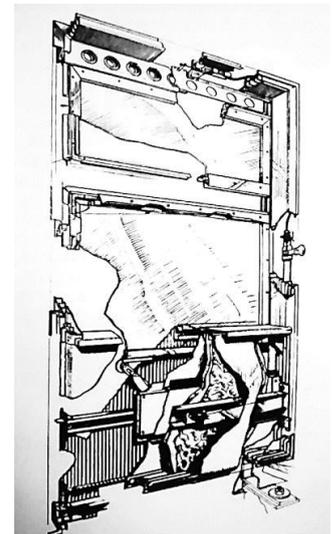


Image 81. Drawing of the panel (FNB).

⁶⁴ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

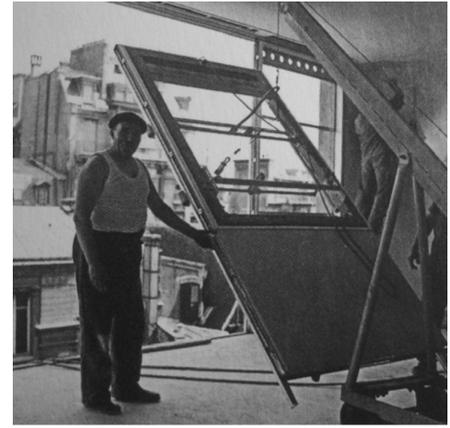


Image 82. Exterior of the FNB building.

Images 83-84. Assembly of the panels in the FNB building from the inside.

In Armesto Pineda's⁶⁵ doctoral thesis, we find an interesting analysis of Jean Prouvé's work, including the panel of the Fédération National du Bâtiment.

This panel was one of the first composed of fully mechanised elements and was designed for the building's programme, which consisted mostly of office space. So it was decided to clad it with lightweight panels that would provide natural light. But in addition, the design of these panels integrated many other functions: thermal and acoustic insulation, airtightness, natural ventilation at the top, and ducts for electrical and telephone installation⁶⁵.

As we can see, it is also an integrative and organicist design, in which a multitude of functions are integrated in a single panel, regardless of scale, as we can see in the following detail⁶⁵:

- 1 Aluminium sheet
- 2 Glass
- 3 Plastic material
- 4 External metal gasket cover
- 5 Anchor bolt
- 6 Inner gasket cover
- 7 Sheet metal for jamb forming

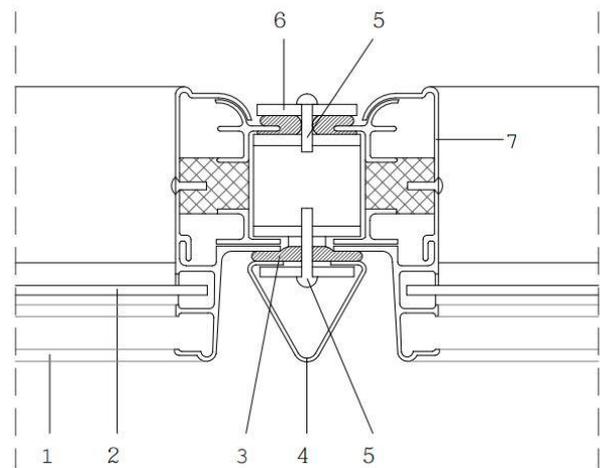


Image 85. Detail of vertical joint between panels (FNB).

⁶⁵ ARMESTO PINEDA, Laura. *Los cerramientos verticales de Jean Prouvé. Variables de intercambio con el exterior* [Jean Prouvé's vertical enclosures. Exchange variables with the exterior] [Doctoral Thesis].



Image 86. Alison and Peter Smithson.

ALISON AND PETER SMITHSON

Alison (1928-1993) and Peter (1923-2003) Smithson were two architects who also reflected integrative and organicist designs, as well as their relationship with automobiles, in their projects.

As we have already discussed in this project, the 1962 Upper Lawn Pavilion was an integrative design project within the existing architecture. The 1955 Citroën DS, on the other hand, also reflected her integrative, organicist design, which Alison⁶⁶ said was like a living room on wheels. Thus, by the mid-twentieth century, it seemed that the boundaries between architecture and the automobile had blurred⁶⁶.



Image 87. Upper Lawn Pavilion of the Smithsons and Citroën DS.



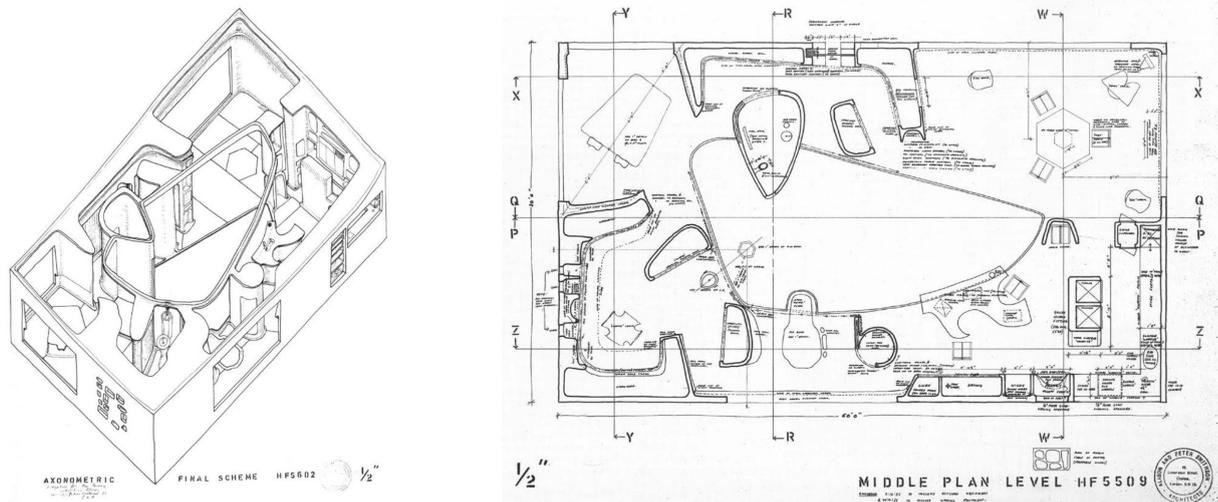
Image 88. Household appliances from The House of the Future.

Another interesting project by Alison and Peter Smithson was the 1956 House of the Future⁶⁶. This project also had an integrative, organicist design, in which household appliances could be integrated into its plastic spaces, and was also oriented towards the concept of throwaway or planned obsolescence, which had emerged more than two decades ago with automobiles, and was already so characteristic in the 1950s.

Alison and Peter Smithson's House of the Future, like the automobile, was a consumer object. It was also designed according to an assembly process. It had elements in common with the automobile, such as the flexible joints of the panels or of the household appliances. The automobile continued to be a reference in architecture, as it represented a way of life with more freedom thanks to the mobility it offered⁶⁶.

⁶⁶ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

In 1958, the Smithsons⁶⁷ wrote that The House of the Future was designed like a car, like a thing, for a precise task, and a house designed like a car has some disadvantages, because the appliances would be so integrated into the structure, that changing the refrigerator would be like putting a bigger glove box in the dashboard of a Volkswagen; it would be easier to buy a new car.



Images 89 and 90. Axonometry and floor plan of The House of the Future by the Smithsons, 1956.

Richard Hamilton⁶⁸, also a member of the Independent Group and author of the famous 1956 collage on consumerism “Just what is it that makes today's homes so different, so appealing?”, referred to the technological and futuristic optimism of the 1950s and, in particular, to the Smithson’s The House of the Future saying that the pop art is popular: designed for a mass audience, passenger: short-term solution, disposable: easily forgotten, low cost, mass-produced, young: aimed at youth, clever, sexy, advertising savvy, charming, and that it is a big business.

⁶⁷ SMITHSON, Alison and Peter. *The Appliance house*, En: Design; Mayo 1958. p. 47. Quoted in: GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

⁶⁸ HAMILTON, Richard. “Carta a Peter y Alison Smithson”. En David Robbins (ed.): *El Independent Group: La postguerra británica y la estética de la abundancia*. Valencia: Instituto Valenciano de Arte Moderno; 1990. 182. Quoted in: PIZZA DE NANNO, Antonio. “La villa Arpel: machine à habiter, “donde todo se comunica (Mon Oncle, Jacques Tati, 1958)” [The Arpel villa: machine à habiter, “where everything is connected” (Mon Oncle, Jacques Tati, 1958)]. Bitácora arquitectura. 2018; (Nº 40).

It is interesting to note that only two years later, in 1958, Jacques Tati's film *Mon Oncle*^{69,70} was released, in which he caustically parodies a technological consumerism and nevertheless clamorously highlights the innate dysfunctions of a modern age that is strongly conflicted towards the common man and his traditional values⁷¹.



Image 91. Parodic photograph from the 1958 film *Mon Oncle*.

The Smithsons then followed up on the ideas of The House of the Future with their Appliance Houses project between 1956 and 1958. The Appliance Houses consisted of cubicles containing the bathroom and kitchen, and smaller cubicles containing the appliances. The rest of the space was free for domestic activity⁷².

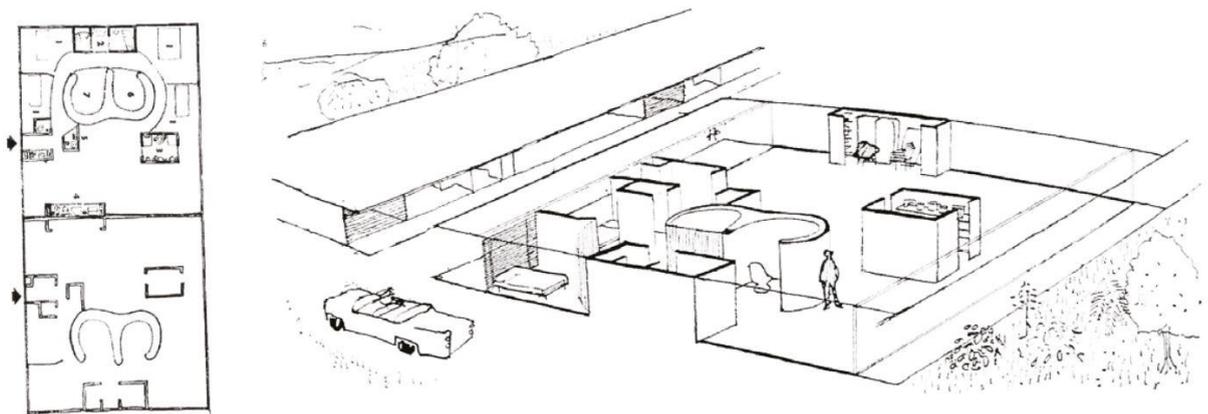


Image 92. Plan and axonometry of the Smithson's Strip Appliance House, 1956-1958.

Years later, Archigram⁷², also obsessed with the aesthetics of the automobile, continued with the ideas initiated with The House of the Future.

⁶⁹ TATI, Jacques. *Mon oncle*. Francia: Gaumont, Specta, Gray, Alter Films; 1958.

⁷⁰ CAMPI I VALLS, Isabel. *El diseño de producto en el siglo XX. Un experimento narrativo occidental*. [Product design in the 20th century. A occidental narrative experiment] [Doctoral Thesis].

⁷¹ PIZZA DE NANNO, Antonio. "La villa Arpel: machine à habiter, "donde todo se comunica (Mon Oncle, Jacques Tati, 1958)" [The Arpel villa: machine à habiter, "where everything is connected" (Mon Oncle, Jacques Tati, 1958)]. *Bitácora arquitectura*. 2018; (Nº 40).

⁷² GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

It is also important to mention F.R.S. Yorke⁷³ (1906-1962), who was another British architect sympathetic to the technological transfer between architecture and the automobile. In his 1934 book *The Modern House*, in which he depicted various modern houses of that time, he used the automobile as an aesthetic reference to the machine, and believed that a house and an automobile are built for equivalent functional purposes.

Yorke also believed, like the French painter Fernand Léger⁷³ (1881-1955) in his 1924 article “The Aesthetics of the Machine”, that the more the functional mechanics of the automobile were perfected, the more beautiful it became.

⁷³ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

CONCLUSIONS

At the beginning of this paper, our attention was caught by two photographs of two emblematic architectural buildings and two emblematic automobiles, both three decades apart. What attracted our attention was the technical and formal difference between the two.

From there, we have made a brief analysis of each of the works represented in each photograph, intuiting that they are not isolated cases, but the fruit of different designs that emerged in different periods. Therefore, we have found it appropriate to carry out a research on different works and authors related to this theme, mainly between these two periods. We realised that both architectural design and automobile design are directly or indirectly related by a series of technical and formal transfers and, in general, always related to industry, which is obviously influenced by other factors such as social, cultural, political and economic ones.

The turning point in the industry that we analysed from the 1930s onwards is important. Many designs went from having a mechanicist formal composition, based on the juxtaposition and assembly of individual pieces, with straight, orthogonal lines, to having a more organicist formal composition, with better interlocking between pieces or with curved lines.

We also realise that in this period automotive design, in general, evolved more rapidly than architecture, although not in all cases. Some of the causes originated in the United States, such as styling, advertising and commerce, which were applied to the automobile and also to other industrial products. This forced the industry, which until then had been mainly focused on the correct technical functioning, to adopt an aesthetic point of view towards its designs, sometimes of a superficial nature.

Thus, taking into account both the technical and the formal aspects of the machines, including the ones called “living machines” by Le Corbusier, the design of both architecture and the automobile evolved considerably from the 1920s to the 1950s, both from the point of view of Semper, who defined form on the basis of technique and materials, and from the point of view of Riegl, who took it to the limit, motivated by *kunstwollen* or artistic will.

We can say that after this research, we realise something very important. Among many other things, we realise that we end up with the feeling and synthetic conclusion that there has to be a balance between reason and emotion in the design of both architecture and automobiles or other objects, which adapts as well as possible to our condition as human beings and to the condition of our environment. Therefore, we agree with the statement of Gay and Samar⁷⁴ that this crisis of rationality is nothing other than the search for a new rationality; man is not only thinking and reasoning, he is also feeling, emotion, imagination, etc.

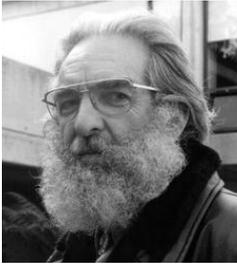
Finally, it is also important to bear in mind that during the period on which this work has been based, the concept of sustainability was little considered, as the current levels of mass production had not yet been reached. However, the passing years have taught us the lesson of the vital importance of the concept of sustainability.

⁷⁴ GAY, Aquiles, SAMAR, Lidia. *El diseño industrial en la historia* [Industrial design in history]. 2nd edition 2004. Córdoba, Argentina: Ediciones tec; 1994.

ANNEX

REVIEWS BY OTHER AUTHORS

It has also been appropriate to include in this paper three prominent authors who have written on topics related to those of this research. These authors are Reyner Banham, Herbert Read and Lewis Mumford.



REYNER BANHAM

Reyner Banham (1922-1988), British writer and architecture critic, is well known for writing extensively on architecture, machine culture or the automobile. An advocate of the throwaway consumer society, he criticised architecture for not doing the same.

Image 93. Reyner Banham.

The images published by Walter Gropius in *Jahrbuch des Deutschen Werkbundes* in 1913 were considered as Adoptive Monuments of the Modern Movement by Reyner Banham. He considered them so because of the great impact they had in Europe, where they inspired both the creation of new forms and the work of artists of the different avant-garde movements, such as Futurists, Constructivists, Expressionists and Cubists⁷⁵.

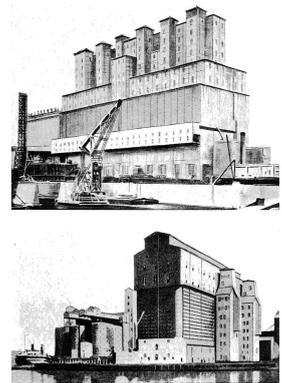


Image 94. Two of the images of American silos used by Walter Gropius in 1913.

He also defined the Ford and Fiat factories as transcendental works of the Modern Movement. Banham devoted an entire chapter of his 1986 book *A Concrete Atlantis* to the futuristic Lingotto factory, now abandoned, having visited it in 1984, saying that the choice of an American model for this imagined future is a sign of the profound changes that have taken place not only in industrial architecture, but in the modern vision of architecture as a whole and that they are one of the sacred spaces of the European Modern Movement⁷⁵.

⁷⁵ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].



Image 95. Ford's Highland Park factory.

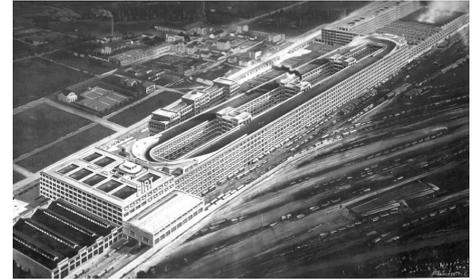


Image 96. Fiat Lingotto factory.

In this sense Reyner Banham made a very interesting comparison between the 1930 Adler Cabriolet by Walter Gropius, the Streamlined Cars also of 1930 by Sir Charles Burney, and the Dymaxion Car of 1933 by Richard Buckminster Fuller. Here he clearly demonstrated the limitations of the Modern Movement in relation to the understanding of the technological mentality of that time⁷⁶.

For Banham, the Dymaxion Car design represents the end of the First Machine Age: *“the end of the First Machine Age in design can be demonstrated in its symbolic machine, the automobile”* ⁷⁶.

Thus ends the characteristic design of the First Machine Age, that is, the early industry of juxtaposition and assembly of parts, giving way to more organic designs, as in this case, the Dymaxion Car of 1933.

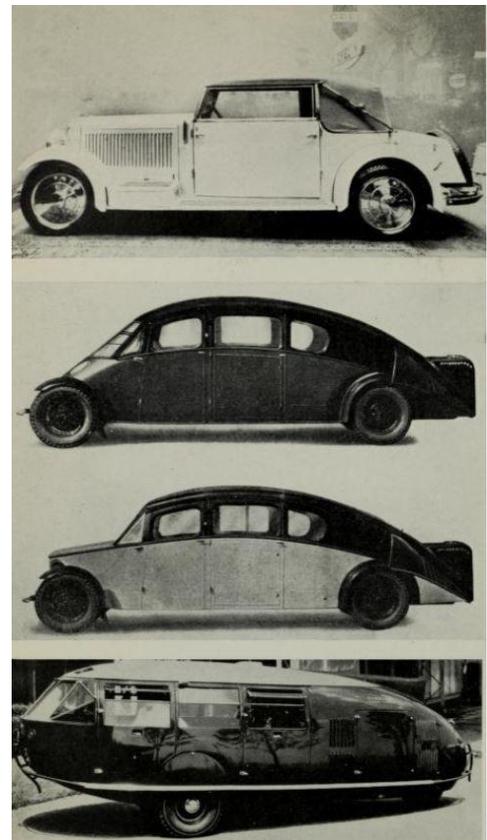


Image 97. Comparison of car design, Banham, 1967.

⁷⁶ BANHAM, Reyner. *Theory and Design in the First Machine Age*. 2nd edition 1967. London: The Architectural Press; 1960.

Again in reference to Fuller, in this case with his Dymaxion House of 1927-1930, Banham wrote that it was a critique of the modern pioneers of the 1920s:

*“Conceived at the time that the International style was crystallising into a set of forms symbolising the Machine Age, this project for a house of light metals and plastic, planned radially around a core of mechanical services, established a radical technological criticism of the International style as mechanically inadequate”*⁷⁷.

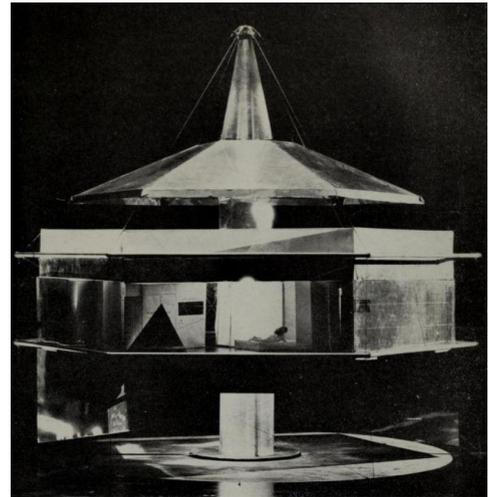


Image 98. Dymaxion House, Fuller, 1927-1930.

As for the brutalists Alison and Peter Smithson, Banham thought that their architecture was an architecture that rejected form and classicism, relying on an *architecture other* (term taken from Michel Tapié's *art autre*), in favour of an architecture that defended the human factor and its consumer society. Unlike the modern pioneers, his architecture complied with the aesthetics of the machine by honestly showing its materials and functions, as the machines were neither smooth, flat nor simple in form⁷⁸. However, Banham began to be critical of the Smithsons from 1959 onwards, and in 1966 he wrote in *The New Brutalism: Ethic or Aesthetic?*⁷⁹ that in their latest resource they are dedicated to the traditions of architecture as the world has known them and that their aim is not *architecture other* but, as always, *vers une architecture*.

Banham was also critical of Le Corbusier because he used images of handcrafted, luxurious automobiles to speak of standardisation, rather than images of automobiles such as the Ford T. Instead, Banham was an advocate of the appeal of the throwaway diversity of models exercised by General Motors, based on the consumer society⁷⁸.

⁷⁷ BANHAM, Reyner. *Theory and Design in the First Machine Age*. 2nd edition 1967. London: The Architectural Press; 1960.

⁷⁸ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

⁷⁹ BANHAM, Reyner. *The New Brutalism: Ethic or Aesthetic?* London: The Architectural Press Ltd; 1966. Quoted in: GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

According to Banham, the differences that still existed between a building and a car were not only in the different materials of which they were made and the fact that the former is static and the latter dynamic, but more importantly the way in which they were consumed. Thus, Banham compared a building to a tree and a car to a fruit⁸⁰.

While the former was a long-term investment, the latter was something with an expiry date, associated with the concept of planned obsolescence, and which also had to be appetizing, associated with the concept of styling, both of which are analysed in this paper.

It is also interesting to note Banham's⁸¹ critique at the end of his book *Theory and Design in the First Machine Age*, in which he reproaches the modern pioneers of the 1920s for their limited understanding of the technological mindset of their time and warns of the need for architecture to adapt to the rapid evolution of technology:

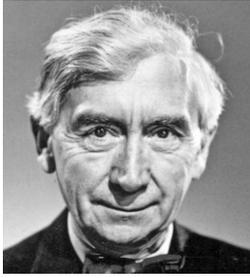
*“It may well be that what we have hitherto understood as architecture, and what we are beginning to understand of technology are incompatible disciplines. The architect who proposes to run with technology knows now that he will be in fast company, and that, in order to keep up, he may have to emulate the Futurists and discard his whole cultural load, including the professional garments by which he is recognised as an architect”*⁸¹.

And he continued by adding:

*“If, on the other hand, he decides not to do this, he may find that a technological culture has decided to go on without him. It is a choice that the masters of the Twenties failed to observe until they had made it by accident, but it is the kind of accident that architecture may not survive a second time - we may believe that the architects of the First Machine Age were wrong, but we in the Second Machine Age have no reason yet to be superior about them”*⁸¹.

⁸⁰ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

⁸¹ BANHAM, Reyner. *Theory and Design in the First Machine Age*. 2nd edition 1967. London: The Architectural Press; 1960.



HERBERT READ

Herbert Read (1893-1968) was a British philosopher, poet and art critic who made an architectural criticism in relation to the automobile which we present below.

Image 99. Herbert Read.

Read made several interesting comparisons between images of Robert Maillart's Salginatobel Bridge (1930) and various automobiles from different periods, which he included in the different versions of his book *Art and Industry* from 1934 to 1961⁸².

These comparisons served to demonstrate the rapid evolution of the automobile, as opposed to the more static evolution of architecture⁸².

For Read, industrial design created works of art to not only please the senses, but also to have a practical purpose. In the sense of pleasing the senses, objects of industrial design, such as automobiles, had an abstract beauty achieved largely through spiritual freedom⁸².



Image 100. Salginatobel Bridge, Rolls-Royce Phantom II Continental coupé 40-50 hp, Bentley Mark VI convertible, Alvis Saloon and Mercedes-Benz W196.

In this sense we should also highlight another author, Martin Pawley. In his work *Theory and Design in the Second Machine Age* he expressed the belief that architectural technology had evolved more slowly than the technology of the automobile. For Pawley, architecture was the forgotten industry of capitalism⁸².

⁸² GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].



LEWIS MUMFORD

Lewis Mumford (1895-1990) was an American sociologist, historian, philosopher of technoscience, philologist and urban planner. We have found it appropriate to include him in this work, because apart from his great importance as an author on these and other subjects, he made criticisms related to different concepts presented in this work.

Image 101. Lewis Mumford.

In his 1934 book *Technics and Civilization*, he wrote about the effects of the automobile on society. According to him, the automobile had the potential to restructure human relations, but in the end it blocked them because of the development of the automobile into a symbolic function. This symbolic function is due to commercial interests, which also block the development of technics⁸³.

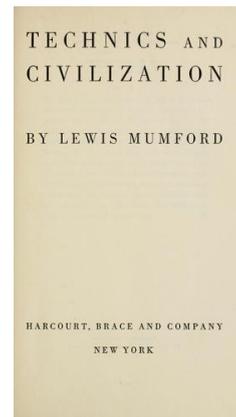


Image 102. *Technics and Civilization* by Lewis Mumford, 1934.

In this book, we find many references to the topics covered in this paper, among which we can highlight some of the most interesting ones. Mumford⁸⁴ reflected the influence that the automobile and the aeroplane had on society saying that the social effects of the automobile and the aeroplane did not begin to be felt on a large scale until around 1910 with Blériot's flight across the English Channel in 1909, and the introduction of the cheap mass-produced car by Henry Ford were the crucial significant points.

In the book, Mumford also refers, in a way, to styling, when he speaks of "superficial fashion", which does not take advantage of the principles of technique saying that hence the continual designing of cars in terms of superficial fashion, rather than taking advantage of aerodynamic principles in construction with a view to comfort, speed and economy⁸⁴.

⁸³ GARCÍA-SETIÉN TEROL, Diego. *Trans arquitectura: imaginación, invención e individuación del objeto técnico arquitectónico: transferencia tecnológica desde la industria del transporte al proyecto arquitectónico (1900-1973)* [Doctoral Thesis].

⁸⁴ MUMFORD, Lewis. *Technics and Civilization*. New York: Editor Harcourt, Brace & Company; 1934. (Used the Spanish translated edition by Constantino Aznar de Acevedo, *Técnica y civilización*, Madrid: Alianza Universidad; 1992).

In the same sense he describes the possible blockage or paralysis that the automobile, like other technical objects, can create in society. In this regard, Mumford explained that to the extent that the phonograph and the radio discard the impulse to sing, to the extent that the camera eliminates the impulse to see, to the extent that the automobile avoids the desire to walk, the machine leads to a functional condition that is one step away from paralysis⁸⁵.

Mumford also criticises mechanicist design based on the juxtaposition of parts, which we have also discussed in this paper, describing it as resources and approaches that express themselves in incomplete forms, forms resembling the absurdly awkward and ill-fitting telephone apparatus of the past, like the old-fashioned aeroplane, full of armatures, threads, supplementary supports, all testimony to the anguish to remedy innumerable uncertain and unknown factors; forms like those of the old automobile in which one part after another was added to the effective mechanism without having been absorbed into the body of the design as a whole⁸⁵.

Another critical reference, this time on superficial styling, argues that a good design is one that removes any detail that does not enhance its function, saying that a good design aims to eliminate from the object, be it an automobile, a porcelain set or a room, every detail, every moulding, every surface variation, every superficial part, except that which can lead to its effective functioning⁸⁵.

Mumford returns to the subject of styling and its diffusion in America through advertising, promoting the interests of symbolic and pecuniary function, saying that what applies to electric light bulbs, applies to automobiles; what applies here, applies to every kind of apparatus or work. The desperate attempts that have been made in America by advertising agencies and “designers” to stylise machine-made objects have been, for the most part, attempts to divert the process of the machine in favour of caste interests and pecuniary distinction⁸⁵.

Finally, Mumford points out that standardisation blocks product improvement, in this case using the Ford T as an example, writing that the dangers in premature standardisation, and in producing objects with assembled parts - such as automobiles - so completely standardised that they cannot be improved without completely scrapping the factory facility. This was the costly mistake that was made with the Model T Ford⁸⁵.

⁸⁵ MUMFORD, Lewis. *Technics and Civilization*. New York: Editor Harcourt, Brace & Company; 1934. (Used the Spanish translated edition by Constantino Aznar de Acevedo, *Técnica y civilización*, Madrid: Alianza Universidad; 1992).

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