Nuno Miguel Amorim de Campos Ladeiro
Graduate/masters in Architecture/Industrial design
Email: arq.nunoladeiro@gmail.com

THE POETICS OF MODERN DESIGN: From the grain elevators to the production of Design in the first half of the twentieth century

Abstract.

The shape of the Grain Elevators characterized the formation of the consciousness of the visionary, functionalist, and machinist class of the first half of the twentieth century. Through the study of the evolution model of the Grain Elevators, of the examples built in Buffalo, USA, and the analysis of modern design objects, we intend to establish a relationship between the shape of grain elevators and the shape of modern design objects in order to understand whether the internationalization of this model of functional factory was a model that influenced the design of some modern industrial design pieces.

By using more speculative methodologies, our objective is to identify and understand some modern design objects that reflect a formal relationship with the Grain Elevators.

Keywords: Poetics of Design, Grain Elevators, Modern Design, Pure Shapes, Shape-Function.

Introduction

The Grain Elevators as a new model of construction in reinforced concrete assumed itself as the standard of design and construction. The authors who conceived these structures understood the importance of flexibility, adaptability, as well as the functionality of their economy and rationality. These notions were fundamental to the modernist manifestos of European artistic *avant-gardes* in introducing formalization concepts of architectural design models.

In the United States, industrialization was a national objective that allowed the cross-organization of society and the fulfilment of the American dream on which the entire structure of the working class was based. The factory built in reinforced concrete, as a model of modern construction style, and the grain elevators in particular, represented that society, not only through the organizational and operative form of construction, but also on the explicit architectural motifs of their components and/or sections.

To Reyner Banham (1986) the grain elevators were present in the publications and lectures of different architects who led the Modern Movement, they were praised and presented as functional modern projects. Le Corbusier (1887-1965) in "Vers une Architecture" was the only one who described the industrial prototypes of his architecture in detail. He identified them as going beyond their function of grain storage, more because of their shapes rather than for what they evoked, more for their sensitive geometry rather than their industrial aspect. Industrial prototypes became real models for modern architecture.

The images of factories and grain elevators were a usable iconography, a formal language, through which one could make promises, show adherence to the modern movement and pave the way toward some kind of technological utopia.

To Tomás Maldonado (2006), the history of design is mainly the history of architecture and achievements within the industrial design. The intervention space of industrial design was associated with the field of aesthetic and technical achievements. Modern architects and designers related the shapes with the need for production and the simple and representative shapes were associated with certain functionalities.

This paper discusses the relationship between Grain Elevators, from a viewpoint of the shape, technology and standardization, and the design of the shapes of modern design objects.

Our objective is to identify and understand some modern design objects that reflect a relationship with the shape of Grain Elevators. Thus, we propose to select as case studies the relationship between Buffalo Grain Elevators and modern architecture

and some modern industrialized objects, namely the Cylinda Line by Arne Jacobsen, allowing us to make a comparative study in which we can tell whether there is a relationship between the Grain Elevators and the shapes of modern design. For this reason, we give the following titles to two chapters of this paper: The relationship between Buffalo Grain Elevators and modern architecture and The Cylinda Line by Arne Jacobsen.

FIG.1.. The Cylinda Line by Arne Jacobsen

The relationship between Buffalo Grain Elevators and modern architecture

World War I and World War II justified the need, in some countries, particularly in European countries, to ensure supplies to poor populations. During the two wars, North America was the "breadbasket of the world" and industrial ports were built

along the rivers and coastal areas that served as warehouses, particularly of grain. Buildings were thus constructed to meet these social needs. The storage of cereals started to be made in large towers, grain elevators. Each grain elevator can contain from hundreds up to a few thousands of tons of cereals.
Cities like Buffalo and Enid appeared in the USA; they made history in grain storage by turning into major warehouses for the distribution of wheat.

FIG. 2 Standard Elevator, Buffalo. A.E. Baxter (1928) Source: Historic American Buildings Survey. Photo by Jet Lowe in 1985

The evolution of the shape of the Grain Elevators occurred primarily from experiments carried out in the early twentieth century. The engineers revealed that the static grain stored in the grain elevators acted as a semi-liquid, putting more vertical pressure at the bottom than on the walls. These pressures were related to the relation between the diameter and the length, but after reaching the triple of the diameter, the vertical pressure increased very little. Thus, it seemed safer to build taller grain elevators. Physicists realized that the vertical pressure was influenced by the angle of friction of the grain, which resulted in excessive pressure during the extraction if the outlet was

located at the bottom of the grain elevator. All this knowledge proved essential to build them in concrete in the waterfront of Buffalo, "The Grain Elevators captivated the creative minds of businessmen and engineers from the construction of the first wooden grain elevators in Buffalo (...). The entire history of the transformations of the Grain Elevators from wood to reinforced concrete, including ceramic and steel grain elevators, is represented by Buffalo grain elevators." (Steiner, H.; 2004)

The new construction model in reinforced concrete assumed itself as the standard of design and construction. The authors who conceived these structures understood the importance of flexibility, adaptability, as well as the functionality of their economy and rationality. These notions were central to the modernist manifestos of European artistic *avant-gardes*, in introducing formalization concepts of architectural design models. In the United States, industrialization was a national objective that allowed the cross-organization of society and the fulfilment of the American dream on which the entire structure of the working class was based. The factory built in reinforced concrete, as a model of modern construction style, and the grain elevators in particular, represented that same society, not only through the organizational and operative form of construction, but also in the explicit architectural motifs of their components and/or sections: "The grain elevators, the mechanics of the operation of bodies of grain and their natural gravity drainage shaped the concrete surfaces that translated into elementary volumes before the balance of forces and reactions involved. This modulation of the surface and the volume to an industrial operation and its specific activities showed the architects of the modern movement the whole truth of the construction as a means of representation of such activities." (Ravara, P.; 2008).

Several authors mention the obvious relationship between architecture and Grain Elevators and that "was the example of America that gave impetus to German architecture when the latter tried to clarify the structural problem of architecture. This impetus did not originate in the skyscraper (...) but in the simple structures of industrial buildings such as grain elevators for grain storage and large grain elevators. (...) These examples of modern engineering, designed only with the practical purpose in mind and free from any decorative aspect by an architect, caused a deep impression due to their simple structure reduced to the basic shapes of geometry such as cubes and cylinders. They were conceived as patterns exemplifying once more the essence of the pure shape of the use, gaining this impressive effect from their bare structure." (Behrendt; 1937)

Cylinda Line, Arne Jacobsen

FIG. 3. Linha Cylinda. Arne Jacobsen.Source: Stelton. Photo by Tue Schiorring

In Scandinavian countries, the new generation of architects and businessmen born around 1920 "received a professional training in the new and remodelled schools of applied arts, which trained the industrial businessmen in the decorative arts. (...) After World War II, these businessmen created their companies dedicated to the production of industrial design objects of and to the mass production of everyday objects. These were companies specialized in glass, textiles, porcelain, metal and furniture. After World War II, there was a great demand for products for the home.

(...) It was crucial for this new generation to associate aesthetics with common household and low cost objects. They created a chain of aesthetic expression based on equality, harmony and balance." (Paulsson, G.; 1919)

In 1960, the Danish applied arts acquired a remarkable reputation in the international scene. The furniture and the arts and crafts became internationally known and many Danish architects were very popular around the world. This international recognition was extended to American consumers. The Stelton brand was paying attention to the international market, and it significantly improved the quality of its products to compete in the U.S. market. In 1964, it began the collaboration with architect Arne Jacobsen (1902-1971). Stainless steel and its industrial characteristics fit perfectly in the industrial vision of the architect. Good design would thus follow democratic principles and would be accessible to all people; follow the harmony between shape and function, consubstantiate the basic and pure shapes.

After taking control of the brand, Peter Holmblad (1934-2004) invited Jacobsen to design a tea and coffee set. Jacobsen found that the porcelain sets were mainly produced with cylindrical shapes. He realized that the reason why these shapes had not been explored in stainless steel was due to the difficulty in producing 107 degree angles between the base and the sides of stainless steel plates. Thus, Holmblad was attracted to the challenge of producing a set from cylindrical shapes.

Initially, Holmblad tried to produce these shapes from stainless steel tubes. This idea was entirely shared by Jacobsen who understood the practical aspect of production from stainless steel tubes due to the apparent simplicity and low cost. However, this idea proved totally inadequate. The stainless steel tubes were not produced to be used inside the houses and did not have the required characteristics to be properly polished in order to obtain the same quality of the other products in the Stelton collection. Even after properly polished, undesirable stains remained on the pieces, particularly after welding the base to the tubes. The polishing had to be far superior to the one in other products, so the initial idea of creating affordable, cost-controlled objects became unachievable.

Jacobsen claimed to believe in industrial methods. The accuracy of the production could only be ensured by the machines. As for the manual production, it was extremely difficult and expensive. To Jacobsen, machines would always be able to produce better results.

To overcome this difficulty in the production, Stelton developed an entirely new equipment to produce cylindrical objects from the stainless steel plate. He invented a machine that welded the edges of the stainless steel sheets, after being folded in rolls, and all at once, without any human action. The invention was perfected and

allowed the rolls to passing on the surface removing the excess of welding almost entirely, thus avoiding too much manual polishing.
Once this problem was solved, Jacobsen created another one when he proposed original handles. Contrary to what was usual (stainless steel or wooden handles), he wanted them to be in black plastic, duly detached from the cylindrical shape. To solve this problem, the technicians had to invent a way to attach the handles to the stainless steel surface. They developed a method for welding two small tubes that held them to the stainless steel. To avoid stains in the welding and the subsequent polishing, they found out that before welding, they would have to soak the stainless steel in soapy water. Three years later, the Cylinda-Line finally started to be produced.
The Cylinda-Line is composed of 17 objects altogether and became an industrial and commercial success because the dimensions of the Cylinda-Line shape were based on the standardized measures of stainless steel tubes and also due to the evolution of the manufacturing means that made it possible to manufacture the product according to the expectations of the author.
The end of the Cylinda-Line in 1967 coincided with the greatest exhibition ever organized on the work of Jacobsen. This event turned the Stelton brand, until then little known, into an important brand. The reports highlighted the stainless steel Cylinda-Line for its unique characteristics; functional, practical, beautiful and economical. The pure shape of the objects, composed of simple parts and high quality industrial details, contributed to that description. In the same year, the Cylinda-Line won the ID award, established in 1965 by the Danish Industrial Design Association that rewards high quality industrial design. It also received the Design Award awarded by the American Institute of Interior Designers and was selected for the permanent collection of the Museum of Modern Art, New York and the Victoria and Albert Museum, London. (Motzkus, F. 2010)

Conclusion

The grain elevators represent an industrialization process, from the standardization and uniformity to the material and moral realism, to social progressivism, to the systematic and scientific management of the entire industrialized operation, to the new taste represented by functionalism, and finally the flexibility of these same structures. The grain elevators showed the architects of the modern movement the entire truth of the construction as a means of representation of those same

activities. The basic shapes of geometry such as cubes and cylinders have become real models for modern architecture.
One must investigate what is the real relevance and influence of Grain Elevators in the conceptual process of modern design; if there is a poetics originating from the Grain Elevators, the same way as what happened with modern architecture and if modern design used to build this mean mentally and quality of its function.
According to José Gorjão Jorge (2011), the period proceeding this historic moment, replaced the metaphysical logic by an apparent logic of the material world. Raised reason and experimental science as instruments of knowledge. The objective observation acquired a new character and assumed this "objectivity" taking away all the "subjectivity" to the dominance of aesthetics.
The basic shapes of geometry such as cubes and cylinders have become real models for modern architecture and had a big influence in academics and in the formation of schools like Bauhaus.
One must investigate what is the real relevance and influence of Grain Elevators in the conceptual process of modern design; whether the taste for the cylindrical shape that has become dominant, such as in the Cylinda Line by Arne Jacobsen, also originated in the Grain Elevators, the same way as what happened with modern architecture.

References

• Arnheim, R. (1988 [1977]) *A dinâmica da forma arquitectónica*, Tradução de Wanda Ramos, Lisbon: Editorial Presença.
• Arnheim, R. (1998) *Arte e Percepção Visual, Uma Psicologia da Visão Criadora*, São Paulo: Livraria Pioneira Editora
• Banham, R. (1986) *A Concrete Atlantis: U. S. Industrial Building and European Modern Architecture, 1900-1925*, Cambridge: Ed. An Mit Press Classic
• Banham, R. (1982) *Theory and Design in the First Machine Age*, London: Ed. The Architectural Press
• Behrendt, W.C. (1937) *Modern Building; Its Nature, Problems and Forms*, New York: Ed. Harcourt Brace and Company
• Dorfles, G. (1972) *Introdução ao Desenho Industrial*, Lisbon: Ed.70

• Gorjão Jorge, Jorge. (2011) 'Imaginações da Arquitetura'. *Revistas de Arquitetura: Arquivo(s) da Modernidade*, Casal de Cambra: Ed. Caleidoscópio
• Maldonado, T. (2006) *Design industrial*, Lisbon: Ed. 70.
• Motzkus, F. (2010) *Stelton*, Copenhagen: Ed. Stelton A/S
• Paulsson, G. (1919) *The Aesthetics of Household Objects*
• Ravara, P. (2008) *A consolidação de uma prática: do edifício fabril em betão armado nos EUA aos modelos europeus de modernidade*, Lisbon: Ph.D. Thesis in Architecture at the FA/UTL, unpublished
• Steiner, H. (2004) 'Silo Dreams: The grain elevator and modern architecture'. *Rediscovering the Concrete Atlantis: Buffalo Grain Elevators. Buffalo*, New York: Ed. Lynda H. Schneekloth