

## A VISION OF THE HUMAN BODY AS A SEATING CONCEPT

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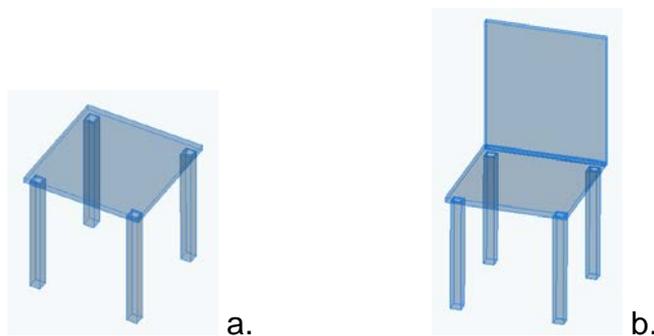
### **Abstract:**

*The paper presents the results of studies and research aimed at identifying general and particular features of the chair design process. Three highlights of 20<sup>th</sup> century chair design were chosen as study cases, due not only to their innovative contribution in areas like construction, materials and technology, but also to their iconic role in setting new forms and new concepts that remain still up to date. The analyses and investigations reach beyond the obvious structural, construction and ergonomic characteristics and discover the subtle links that design creativity seems to develop with the arts, with the world of archetypes, signs and symbols, with the postures of the human body, that become roots of the impulse to design a Chair. Rarely, outside the world of design, specialists agree to confirm the strong contribution of sensorial perception of forms and meanings in the design process. The discovery of possible archetypes, allusions and/or metaphors regarding postures of the human body, form becoming a logo of sitting, are factors that allow the configuration of new investigation instruments that generate a fresh impulse to understand and value creative thinking.*

**Key words:** chair design; concept; symbol; sensorial perception.

### **INTRODUCTION. CONCEPTUAL STRUCTURE OF A CHAIR**

To define and understand a chair from a structural viewpoint requests the identification and individual naming of its elements and/or subsequent components. Hence the chair is supposed to have the following elements, grouped in three components: the supporting component (supporting legs); the seating component (the seat plane or frame); the backrest component (the chairback plane or frame).



**Fig. 1.**

**Standard morphology of a seating object. a - stool; b - chair.**

These groups of elements are sufficient to answer the main functional requirements, namely to support, to prop up the human body in its sitting posture. They are able to define in a simple way a structural archetype, a so-called „icon” (Fig. 1). These icons are visually recognizable and we call them by a generic name – seats; their derivatives are: stool, chair (with a backrest), chair with a backrest and armrests, and so on. The design process of a chair may ask for this analytical approach level, supported usually by dedicated creation methods, for example: morphological analysis, functional analysis, comfort analysis, aesthetical analysis. If we look at this product system we notice that a chair does not express only its related

components in a formal whole, answering one function, favouring it in particular. The offer is complex and includes chair images and versions that are able to communicate also something else, they show a „personal” wish to manifest themselves and attempt to disclose their „productness” through another kind of language. The acceptance of this new reality leads to the assertion that the creation method of a chair is multilayered, reconsidering and restructuring itself permanently, according to the context and the spirit of time.

## OBJECTIVES AND METHOD

The first investigations aimed at highlighting constant structural values when approaching the design of a chair. This favoured the understanding of the moment when a new structural approach of a chair emerged, and in this context, the possible causes and social-historic combinations of circumstances that favoured or strongly helped define the new structural concept that was approached - the cantilever concept and its consequences for chair design, were presented.

The theoretical research was developed along two main paths: 1. defining the elements and the objective characteristics that determined the conceptual diversification of a chair: a. analysis of the significant historic period and identification of the appropriate characteristics and features regarding chair design; b. the coming out of new materials to be experimented for furniture; c. new searches and solutions for technical and technological developments; d. evolution/transformation of the sitting positions; 2. defining elements and characteristics with a relevant inspirational potential, able to trigger ideas for a new structural concept. In this regard it became necessary to understand the chair as a bearer of senses and means of visual communication, to identify new visions and ideas beyond the strict manufacturing process, to discuss about the personality of the designer and the definition of the designed object as a „phenomenon on show”.

The experimental analysis was carried on through direct collection of data, measurements and visual investigations regarding dimensions, angles, sitting positions, followed by sketching and drawing. Nevertheless the final goal to achieve regarded the aspects of sensorial perception as a vital contribution to design spirituality.

## ANALYSIS OF CHAIR DESIGN

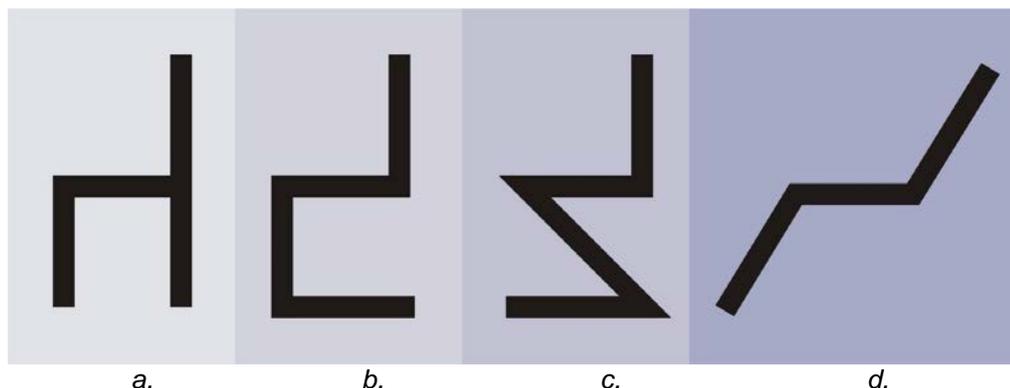
### Sitting Attitude and Posture

A chair has to satisfy the main functional requirement – to assure a reasonable seated position. The aspect of sitting expresses a certain posture. A serious problem is to make sure that the chair harmonizes the sitting posture with need to sit, functionally and qualitatively. At an axiomatic level, a certain posture favours the optimum fulfilling of a need, or a certain need asks for and defines a favourable posture. The images in Fig. 2 are thus edifying.



**Fig. 2.**  
**Relevant sitting postures.**

The constructive and ergonomic characteristics, the quality of the materials and many others may become constant values, influencing one result or another. If we focus on the main segments of the human body in every sitting posture shown in Fig. 2 it is obvious that the the general aspect can be stylized and interpreted as an iconic sign that becomes a synthesis of the relationship between the position of the seated body and the form of the chair. The four situations from Fig. 2 are illustrated by the iconic signs shown in Fig. 3 and described in Table 1.



**Fig. 3.**

**Structural icons of a chair.**

**a. icon of the classic chair concept; b. icon of a cantilever chair; c. icon of the Zig-Zag chair; d. icon for a chaise-longue.**

The four icon models are to be interpreted as essentialized images of constructive-functional visions that define a chair typology. Based on these icon models we are able to identify a relationship of biunivocal determination between the constructive concept of a chair structure and the using of new materials and technologies in the manufacturing process. In some of the icon models we recognize certain influences or sources of inspiration from the area of the arts and/or crafts that are going to be also explored.

*Table 1*

**Interdependence between necessity and definition of the seating furniture concept**

Necessity	Posture	Ergonomics	Construction	Materials	Intensity of manifestation	Duration of manifestation
Work and activities that require movement	a-b-c	- sitting height correctly defined; - backrest; - freedom of moving arms and legs.	- high level of adjustment, adapting and transforming constructive elements to parts of the human body	- optimal qualities for the sitting comfort and for elements that are in contact with the human body	- high and medium intensity with a major influence upon the whole concept	- medium influence upon the concept
Rest and repose moments	b-c-d	- back-and head rest; - leg and arm rests	- does not require special adjustment of the constructive parts	- optimal qualities for the sitting comfort and for the elements that are in contact with the human body	- moderate intensity with medium influence upon the concept	- medium influence upon the concept
Rest and relaxation	c-d	- the interior angle between the seat and the back over 100°; - the entire chair inclined towards the back; - support for all parts of the human body	- high level of adaptation of constructive parts to the human body; - the chair typology migrates towards the easy chair	- high qualities for the sitting comfort and for the parts that are in contact with the human body	- high intensity with major influence upon the entire concept. Correlated with ergonomics and construction of product	- major influence upon the concept

**Structural Deconstructions of a Chair**

A function of an object, be it primary or secondary, may take various appearances or expressions. This is likely to happen because the design of an object, the idea, the image or its formal apparition may have different triggering causes and various sources of inspiration. How can we explain the two icon examples presented in Fig. 4?



**Fig. 4.**

**Structural iconography through morphologic stylization.**

Certainly they cannot be the result of a functional and morphological analysis. The creative-experimental approach of these representations starts from the area of a sensorial perception of stimuli and presents a „possible” seating object that appeals to a plastic-expressive language and proposes a simple compositional play, a structural-formal composition expressed by opacity and transparency (material-immaterial), fluency or spatial suspension, sign/symbol or even logo.

*Cui prodest - who benefits?* The piece of furniture cannot be separated from an existing spatial context and in this case the object is composed and imposes itself in the same sense or in contrast with the expressed architectural environment. The morphologic stylization of a chair answers a need of clarification and ambiantal synthetization through an expression of formal and structural purity. Aren't all of these characteristics and values of a contemporary environment?

**CANTILEVER DESIGN**

**Forms of a Cantilever Concept**

A cantilever chair is a chair whose seat and/or back are not supported by the classical arrangement of four legs, but instead is supported by a single leg or legs that are attached to one end of a chair's seat and usually bent in an L shape, thus also serving as the chair's supporting base. „Originally developed in tubular steel by the Dutch architect and furniture designer Mart Stam in the 1920s, soon after its invention the cantilever chair has found itself the centre of attention, inspiration and reinterpretation among some of the most prominent Bauhaus figures such as Marcel Breuer and Ludwig Mies van der Rohe. Later, in 1960s, Verner Panton has popularised the form by creating the now-iconic, curvilinear Panton chair which, at the time, was the first cantilevered chair made from a single piece of plastic. Since then, the 'chair without legs' has been revisited and refashioned innumerable amount of times by designers from across the globe”, according to www.dailytonic.com.

<b>Chronological concepts - historical milestones</b>				
				
a.	b.	c.	d.	e.
Mart Stam, Gas Pipe Chair, 1926,	Mart Stam, S 33, 1926	L. Mies van der Rohe, MR 10, 1926/1927	Marcel Breuer, Thonet B33, 1927-1928	Alvar Aalto, Chair No31, 1930

**Fig. 5.**

**Early chronology of cantilever chair design.**

While interpreting the general form of the cantilever concept, a simplification of the ensemble of defining elements, a reduction of their number are noticed, in order to achieve a structure preponderantly rectangular, just like a continuous plane that is folding in space and describing a cursive, stable and elastic iconic direction (Fig. 5). The main defining features of a formal cantilever concept are: a. the general shape of the chair suggests a spatially folded plane; b. the general form expresses fluency, resistance and elasticity; c. utilisation of a single material for the entire structure; d. reduction of the number of elements; e.

reduction of the object's weight; f. simple, undismountable construction; g. complete lack of decorative elements.

The dispute upon the tubular metal chair paternity includes the three great architects Mart Stam (1889-1986) Marcel Breuer (1902-1981) and Ludwig Mies van der Rohe (1886-1969). The orientation of a cantilever chair towards a wood structure happens with Chair No. 31 of the Finnish architect Alvar Aalto (1898-1976), in 1930.

Our analysis goes on with the cantilever concept that is tied up, in a ramified manner, to the Neoplastic inspiration.

### Folding Plane – Zig Zag icon

The chairs that were chosen for the analysis are shown in Fig. 6 and develop chronologically in a period when technological innovation and conceptual thinking bring characteristics and values defined by: elementarism/ neoplasticism; rationalism; organic expression; technological performance; economic efficiency, specific requirements of modernity.

At least the first two chairs are conceptually and expressively tied up to the De Stijl movement, even if they are not made of the same material and do not belong to Neoplasticism, but to later style developments.



**Fig. 6.**

#### **The analysed chairs**

**a. Zig-Zag chair, 1932-1933; b. Panton chair, 1960; c. Wiggle chair, 1972 (after Cionca 2014).**

“De Stijl [1917-1931] encompasses an idea, a movement, a periodical and, ultimately, a visual language”. (Dettingmeijer et al. 2010). Those were times of postwar austerity and later on financial crisis. „Cheap” experiments with „lost and found” materials were meant to satisfy unassuming social needs, not pretentious aesthetic fantasies. According to Ida van Zijl “The Zig-Zag chair ...is more intriguing than that other favourite of the Modernist avant-garde, the Freischwinger [cantilever by Stam, Breuer etc]. The cantilever chair, which was first investigated in the mid-1920s by designers including Mart Stam and subsequently elaborated by many others, is based on a cube with one of its sides missing. The Zig-Zag chair, by contrast, is a single line in space and therefore the ultimate symbol of Rietveld's work for many people. Rietveld characterized the form ‘a little partition in space...It is not a chair but a structural joke’...Rietveld was...forced to restrict himself to timber, but from various sketches and prototypes it seems he was searching for a form that could be punched from the material in single mechanical process and then folded into shape. He sketched a chair of sheet iron and produced prototypes using fibreboard, plywood with strip iron, and tubular steel. [But] the execution in four planks reinforced by slats and bolts ultimately proved to be the most stable and the simplest to produce” (van Zijl 2016).

The image transfer from a classic cantilever chair to the Zig-Zag icon is based on the following arguments: a. An idea of structural-formal restylization coming near the De Stijl concept; b. the „mimetism” as a creation instrument applied to usual sitting postures; c. expressions of new technical and technological performances regarding joints and spatial bonds between the constructive elements; d. reduced transportation and storage room through stacking. In its general form and according to its surface development in space, the Zig-Zag chair, designed by the Dutch cabinetmaker and architect Gerrit Rietveld (1888-1965), looks closer to van Doesburg's vision of Neoplasticism than to Mondrian's.

### **The organic vision of the Panton chair**

According to Hanne Horsfeld in „Innovation-Integration-Provocation. Seating by Verner Panton” (Von Vegesack et al. 2000) „In the 1960s, the impact of young protests and pop culture was felt in the field of design...The young generation wanted to liberate themselves from the convention and the “good taste” of their parents. Pop became the key word in fashion and music, characterizing a new, young and informal life style. ...In design, the Sixties became a decade of plastic, foam and modular furniture systems. Important impulses came from the science fiction craze, which had taken hold in all areas of culture in the age of space travel....Panton’s organic world of forms is inhabited by shapes reminiscent of plants, the human body or internal organs. Associations with the profile of the human body are also triggered by the cantilever principle, which Panton returned to again and again...The Panton chair...embodied the integration of a chair’s individual functional elements – back, seat, base – in a coherent form...Panton expresses doubt about the constant striving for comfort and relaxation, being of the opinion that the most important thing must be to ‘seek harmony between people and their surroundings’...Panton’s seats are addressed to all the body’s senses, feelings and fantasy... Located somewhere between Organic modernism and Pop, Panton can be described as an inventor of “Integral Modernism”. Verner Panton (1926-1998), a Danish architect and designer, sets an example with his Panton chair for the dialogue between a new material with its particular technology. Also he expresses the organic character of form, triggered already in the interwar period. Its concept comprises a shell type ensemble made of fiber-reinforced resin, joyfully coloured, that can be described as having: a structural-constructive simplicity, organic expressivity, ergonomic form, industrial potential, reduced weight.

### **Waves and vibrations: the Wiggle chair**

The Canadian-American architect Frank O. Gehry (1929 -) is known for his use of futuristic shapes and unusual materials for both his architecture and furniture. With his series "Easy Edges" from 1972, he succeeded in lending such everyday materials as cardboard a new aesthetic dimension. Although the Wiggle Chair appears unbelievably simple, it is incredibly robust and stable while feeling at the same time surprisingly soft to the touch. Sixty layers of cardboard are held together by hidden sticks with a fiberboard edging. Gehry named this material Edge Board: it consisted of glued layers of corrugated cardboard running in alternating directions, and in 1972 he introduced a series of cardboard furniture under the name “Easy Edges.” The ‘Easy Edges’ were extraordinarily sturdy, and due to their surface quality, had a noise-reducing effect in a room”, as seen on <http://www.design-museum.de>.

Experiments that deal with new materials and new technologies find their best example in the Wiggle chair. It seems that the Wiggle has the desire to express images of physical phenomena concerning the propagation of waves or of sinusoidal oscillations, and least of all the icon of a classic chair. The concept shows the following attributes: structural-formal simplicity; the use of easily recyclable material-corrugated cardboard; innovative construction and technology; industrial capability; reduced weight; expressivity of movement and oscillation on the vertical direction.

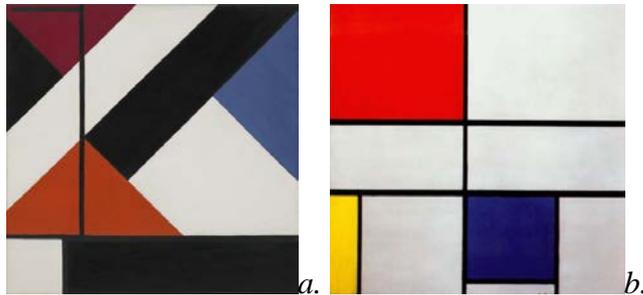
### **Visual references as feasible conceptual ideas**

A creative leap happens when it is understood that everything that exists at a certain moment around us can start triggering stimuli or grow seeds of inspiration and awareness of various objects that await to express themselves or to be investigated. This becomes a viable observation when we agree with a visible conceptual similitude between situations, elements, examples that usually belong to different domains, directions and/or specialties. There is nothing mystical, codified or suspiciously persuasive in this, there is only an individual disponibility to recognize the existence of these impressions and the willingness to consider that sensorial perception has to be used as an instrument for knowledge enhancing, as efficient and valuable as reason itself.

An example: the structure and the overall form of the Zig-Zag chair can be easily identified as being supported by the philosophy and character of Dutch Neoplasticism. The transfer of these contents from the sphere of the art to that of furniture production is easily recognizable as a language of conceptual communication defined by formal purity, stylization and essentialization of the object’s structure until it reaches the symbolic level of understanding. Thus the similitude between art and product design defined as visual influence is continued (Fig. 9, Fig. 10).

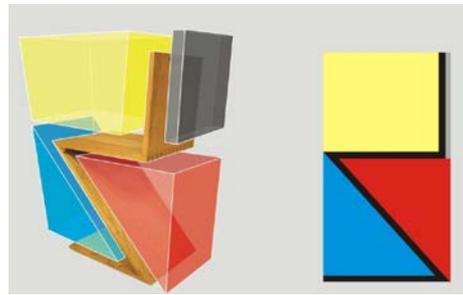
In the case of these two significant images a „random resemblance” of the formal and compositional language can be noticed. This time the artwork is not the reference that has defined the chair concept – but the fact that both examples, even if they use different tools, talk about the same thing: the dynamics of movement. We can’t ignore either of this image associations, with which we maintain the possibility to consider that the „illumination” in the simple creation process may appear through the mimetism pointed out by a random situation that is real. Can there be an affinity between these sitting postures and the Zig-Zag

chair? It was asserted previously that possibly there are concepts and ideas triggering certain elements, but without insisting that it really happened.



**Fig. 7.**

**Geometric abstract art of the twenties: De Stijl**  
*a. Theo Van Doesburg; b. Piet Mondrian.*



**Fig. 8.**

**Structural-volumetrical composition**  
*of the Zig-Zag chair.*



**Fig. 9.**

**Nude Descending A Staircase**  
*by Marcel Duchamp*



**Fig. 10.**

**Zig-Zag, remixed by**  
*Katerina Sokolova.*



*a.*



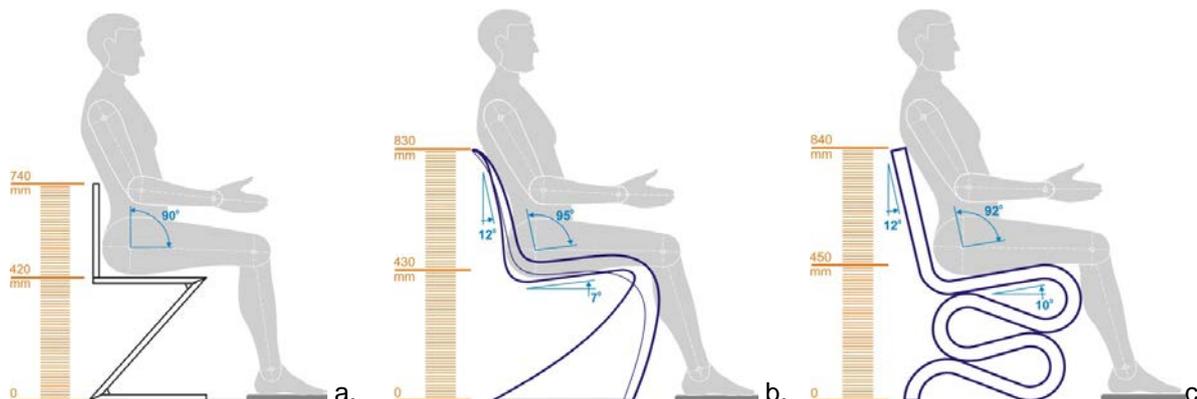
*b.*

**Fig. 11.**

**Visual references for a chair concept**  
*a. Sitting posture – informal socializing position; b. Tubular crosslegged chair by Gerrit Rietveld, 1932-1933.*

### **Sitting positions, dimensions and angles**

The study of the sitting positions started from the necessity of comparing the dimensional and angular characteristics of the three chairs with those recommended by various specialists, preceded by the evaluation of the degree of comfort offered by each of them.



**Fig. 12.**

**Sitting positions. a. Zig-Zag; b. Panton; c. Wiggle.**

The analysis of the sitting positions is shown in Fig. 12, where the position of the average (50% of percentile) human being is represented as sitting on the respectively scaled side view of each chair.

*Table 2*

**Parameters of sitting positions on the three chairs, as compared with ergonomics data ( Neufert 2004, Grandjean and Kroemer 1997, EN 1335-1:2000)**

	<b>Zig-Zag</b>		<b>Panton</b>		<b>Wiggle</b>		<b>Recommended for side chairs</b>
Seat height in front (mm)	420	★	430	★	450	★	400-450
Seat depth (mm)		★		★		★	380-450
Total height of the chair (mm)	740		830		840		-
Seat angle	0°		7°	★	10°	★	5-8°
Seat-backrest angle	90°		107°	★	104°	★	105-115°
Backrest angles	0°		12°	★	12°	★	13-15°
<b>Matches with the recommended parameters</b>	<b>2</b>	★	<b>5</b>	★	<b>5</b>	★	

The results of this analysis are sinoptically presented in Table 2, together with a general evaluation of the chairs' ergonomics: the stars show the dimensional and angle parameters that coincide with those recommended by various authorities.

The concept of the Zig-Zag chair is not formulated to answer comfort requirements. It is a chair meant for short duration sitting. It respects the overall dimensions for this kind of product. The Panton and Wiggle chairs are examples that integrate comfort requirements. The Panton concept highlights the human body in its sitting position. The Wiggle concept shows its elastic attraction in order to enhance the comfort aura of the seated position. This attractivity results from the types of materials used and from the chair's general form.

**Construction, Material, Technology**

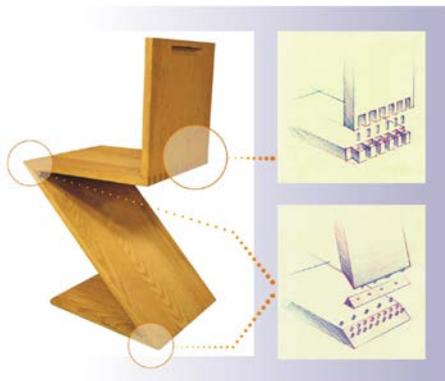
Figures 13 – 15 present details of construction and bits of the technological approach for the three chairs.

**The Zig-Zag** is a chair made of solid wood planks that are joined with classical dovetail and finger joints, enhanced by dowels. The flat components become a formal ensemble that looks like a folded plane.

Although classical, the joints that allow glueing angles ( $40^{\circ}$  -  $45^{\circ}$ ) are remarkably well chosen. Discrete triangular prismatic elements are inserted to increase the strength of the joints.

Regarding form development and communication through formal elements, the Zig-Zag is strongly pleading in favour of De Stijl – it is its conceptual determination. Mart Stam declared in 1934: “He [Rietveld] knows that what he needs to do is to find new materials with another and more simple form of assembly.” And Mareike Küper said that „He tried a curved plywood version in 1938, for a living/dining room at Metz & Co showroom in Amsterdam, but this was a prototype” (Küper 1992). But it was too early a step in the molded plywood technology, that chair had to be reinforced with steel.

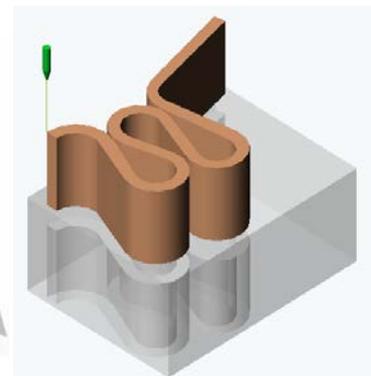
**The Panton chair**, Alexander Von Vegesack wrote, „represents a true synthesis of form, material and manufacturing technique” (Von Vegesack et al. 2000). The same author tells the story of its manufacturing: “Vitra decided to make it [the Panton chair] first of hand-laminated, fiberglass-reinforced polyester (1965)...Towards the end of the 1990s technical advances in processing plastics – in particular the refinement of injection moulding with the ability to achieve varying thicknesses in the shell wall - gave impetus to further development of the Panton chair...A model made of injection moulded polypropylene launched in 1999, finally achieved that the chair became, as Panton’s wish was, “an inexpensive industrial product” (Von Vegesack et al. 2000). Monique Bucquoye fills in: “Panton had a stroke of genius in 1958 when he separated the concept of sitting from the stereotype concept: ‘that thing on four legs’. In contrast with the Zig-Zag chair ... the Panton chair is not a manifesto but a functional object...In the wake of Pop-art, which was a frontal attack on institutionalized abstract art, pop design emerged with trendsetters” (Bucquoye 2002).



**Fig. 13.**  
*Zig-Zag chair. Original joints between the plane elements.*



**Fig. 14.**  
*Panton chair (polypropylene injection).*



**Fig. 15.**  
*Wiggle chair (lasercut cardboard layers).*

The formal elegance of the Panton chair is due to its similitude with the human body, as it was previously described.

**The Wiggle chair** is to be seen as the result of the most famous experiment in the field of furniture of the last 50 years. It succeeded due to its author’s designer skills to elevate the „rank” of cardboard as a respectable material, from the level of a mildly appreciated packaging resource to the level of a beautiful, valuable, recyclable hence ecologic material. It requested an innovative technology, the lateral „ribbon” contour being laser cut up by a CNC in a volume of five dozen corrugated cardboard sheets. During the second part of the process, the „ribbons” are glued and transversally strengthened with 11 wooden sticks.

## CONCLUSIONS AND DISCUSSIONS

The main structural elements of a chair are able to fulfill a double function, to support the human body in a sitting posture and sometimes to express a structural archetype which we called „icon”. The latter eventually becomes a synthesis of the relation between the body position and the shape of the chair.

A chair may propose besides the image of a sign/symbol/logo also a simple compositional play, a structural-formal deconstruction expressed by its material/imaterial logic, its fluency and/or its spatial suspension.

The design process presupposes a high degree of availability from the creator to admit and consider the sensorial perception, which is a strong instrument of knowledge and action, as efficient and precious as reason itself. We should accept a visible conceptual similitude between certain situations, elements, example models that usually belong to different areas, directions and specialties.

The mission of the Zig-Zag chair is to be an experiment and an icon for a vision that is able to materialize itself simultaneously in the arts and in the industry. The Panton and Wiggle chairs are exceptional examples for illustrating the response to comfort needs, but they are much more: the former

evokes a seated human silhouette, the latter describes, by its form and structure the physical phenomenon of elastic movement.

The analysis of the three chairs aimed to define them as highlights of chair design, asserting new visions through their form and functional-expressive structure. The historic reverberation of their concepts continues to bring new forms, new solutions and new technologies in the contemporary world of industrial design.

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