

The Single-Piece Chair

Approaches to a Design Concept from Rietveld
to the Present Day



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Contents

Preface	3
Introduction	4
1. Rietveld's single-piece chairs	11
1.1. Experimentation and industry	11
1.2. Single-piece chair designs 1927-1963	14
1.3. Art in theory	28
Concluding remarks	47
2. The single-piece chair after Rietveld	49
2.1. The single-piece chair goes multiform	49
2.2. Rietveld's legacy	56
2.3. Epilogue: the paradox of Marcel Wanders	71
Conclusion	74
Bibliography	78
Illustrations	83

Preface

For an art history student from Utrecht, like me, it is very unusual to pursue the subject of applied arts, and it is even more unusual to do research into furniture. Nevertheless, I chose this topic because furniture has always fascinated me: it is a part of our background in daily life, but a chair, for instance, can just as well be regarded as an *objet d'art*, as a sculpture in space which enters into a relationship with its surroundings. An earlier paper I wrote on Rudolf Wolf (1919-1989), who designed furniture during the 1950s and 1960s – including a wonderful armchair I own myself – sparked my interest in functionalist furniture design. Unfortunately, a thorough understanding and theoretical substantiation of furniture design is still missing, which motivated my wish to explore one specific design concept.

I thoroughly enjoyed doing research into my subject, and my enthusiasm increased over time as I got a better grasp of the material. At the same time, the writing process frustrated me from time to time, especially when things were not going as fast as I had anticipated. Therefore, I am very grateful to Dr Jan van Adrichem, my supervisor, for helping me to define and redefine the scope of my research, for his impressive knowledge on the subject and above all, for his patience to read and comment on all my writings, even if they were sent to him in the early hours of the morning. I would also like to thank Dr Patrick van Rossem for taking time out of his holiday to act as the second assessor of my thesis. Furthermore, I owe thanks to the staff of the Nederlands Architectuurinstituut in Rotterdam, and especially Jaap Oosterhoff of the Rietveld Schröderarchief in Utrecht, for all their help and advice. Lastly, I am grateful to my friends and family for their support, encouragement, patience and useful suggestions.

All I have left to say is: I wish I would have had just a little more time to work on this thesis. However, if that had been the case, I would probably have kept writing and writing until it eventually turned into an entire book – which is something I quietly wish to do someday: I know the subject of furniture design will not let go of my interest any time soon, and I hope the same goes for you, as a reader, after reading my thesis.

Roos Hollander

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Introduction

It is by virtue of its medium that each art is unique and strictly itself. To restore the identity of an art the opacity of its medium must be emphasized. [...] Emphasize the medium and its difficulties, and at once the purely plastic, the proper values of visual art come to the fore. Overpower the medium to the point where all sense of its resistance disappears, and the adventitious uses of art become more important - Clement Greenberg, 1940.¹

With these words, American art critic Clement Greenberg (1909-1994) argued, that it is characteristic of the modern arts that each has had to define itself in terms of the limitations of its proper medium. The artist's struggle with his or her medium is, however, not just limited to the discipline of visual art: one could just as well argue, although it is perhaps less obvious, that this struggle has been crucial in the development of chair design during the 20th century. The designer of a chair has to overpower the material (wood, metal, plastic, etc.) in order to force it to take on the imagined form, like a painter has to struggle with paint and canvas to come, as Greenberg argued, to the purely abstract and plastic form.² In this sense, it is important to note that a chair is not just a useful object, and furniture design is not only a tool for manufacturers to increase their sales. A well-designed chair also acts as a sculpture in space, and can be rightly regarded as such. It is not a coincidence that architects often occupy themselves with furniture design, as highly influential American furniture designer Charles Eames (1907-1978) once explained: "Furniture, and especially chairs, interests me because it is a piece of architecture on the human scale... That's why architects design furniture – so you can design a piece of architecture you can hold in your hands."³ A chair is created more easily than a building, but still requires a very similar approach: their rhythms, tensions, planes, structures, three-dimensionalism and dynamics are alike.⁴

In the design process of a chair, a large set of considerations plays a role, like intended function, appropriate construction and material, production method, marketing, costs, appeal to the public, and, not to be forgotten, aesthetics. Different chairs are the result of different combinations of these considerations, according to the priorities of the

¹ Greenberg 2003, p. 566.

² Greenberg 2003, pp. 561-568.

³ Hartman and Demetrios 2007, p. 106.

⁴ Baroni 1978, p. 29.

designer and the preoccupations of society.⁵ Despite the constraints of these considerations, designing a chair undeniably involves a creative process: furniture designers come up with different combinations of these considerations constantly, often with the intention to create an improvement on existing designs. There are manifold design concepts that a designer may take as a point of departure. The different approaches designers have taken to these different design concepts, has led, until the present day, to an enormous variety of chairs with many different shapes, sizes and colours, made from many different materials.

In the context of furniture design, Greenberg's notion of the struggle to overpower the material, to eventually force it into the shape one initially imagined, becomes especially clear in a specific design concept: the single-piece chair. Creating a chair out of just one continuous piece of material presents the designers with an additional challenge, because it pushes the material's potential strength, flexibility and durability to the extreme. One of the first designers who occupied himself with this design concept, was Gerrit Thomas Rietveld (1888-1964). Rietveld, citizen of the Dutch town of Utrecht, initially became famous for his revolutionary designs as a member of artistic movement De Stijl. His most renowned designs – and art historical icons – the *Red and Blue Chair* (1919-1923) and the *Rietveld Schröder House* (1924), are based on the De Stijl philosophy of employing geometric abstraction as an attempt to create a universal visual language, that would rise above the cultural, political and economic divisions intensified by the First World War.⁶

Even though Rietveld chose architecture as his main activity later in life, he was initially trained as a furniture maker in his father's workshop in Utrecht.⁷ Rietveld was one of the first Dutch furniture designers that attempted to solve the problem of designing functional furniture that was machine-made, mass-produced, and affordable. Rietveld's furniture designs took many different shapes, and moreover, they were based on a variety of concepts. While some designs were executed as a unique piece, Rietveld also designed furniture that was intended to be machine-made in series, such as the tubular steel *Bow Chair* (1927) and the deal wood *Crate Chair* (1934) (ills. 1.9, 0.1). While the first design is the result of Rietveld's aim to create a chair with a combined seat and back, the second, to be

⁵ Fiell and Fiell 2005 (a), p. 8.

⁶ Arnason 2010, p. 285. The exact production date of Rietveld's first unpainted Red Blue Chair remained unclear until Marijke Küper argued convincingly in 2011 that it was made in the summer of 1919. The red and blue variant of the chair was probably made around 1923. See: Küper 2011, pp. 36-59.

⁷ Zijl 2010, pp. 19-20.

assembled by the buyers themselves, offered an affordable furnishing solution. In 1927, Rietveld experimented with a different concept. Instead of constructing a piece of furniture out of different elements, as he had previously done, he examined the possibility of creating a chair by using just one single sheet of material. This single sheet would simply go into the machine, and through a minimal amount of interventions (cuts, folds), a chair was created. Between 1927 and 1963, Rietveld designed a number of single-piece chairs, of which several were executed.

Until the 1970s, Rietveld's furniture designs were predominantly regarded as autonomous objects that form a clean break with history, consequently dismissing their context of both international and national developments in the design and production of furniture. In the 1980s and 1990s, more pieces from Rietveld's large oeuvre were discovered and examined, and moreover, attempts were made to find precedents of Rietveld's designs.⁸ Surprisingly, however, little research has been devoted to Rietveld's thought formation that led up to his single-piece chairs. In publications on Rietveld and his furniture designs, art historians like Peter Vöge and Daniele Baroni have simply stated that Rietveld's single-piece chairs were the result of his quest to design machine-made furniture, without thoroughly explaining his underlying motives.⁹

Furthermore, it is possible to view Rietveld's single-piece chairs in a perspective which embraces both chairs than can be regarded as predecessors of these designs, as well as single-piece chairs that were made by later designers. Already in the 19th century, a number of furniture designers was occupied by the idea of creating furniture that consists of as few pieces as possible. Some of these pieces of furniture consisted of only a few parts as a convenient result of the material and the production technique that was used to construct them: cast iron. Wrought iron and bronze chairs were already made in ancient Rome, but it was not until the 19th century, when the employment of cast iron flourished, that large series of iron chairs and benches were produced. These pieces were often executed in a revival style, like the neoclassical garden furniture designs by German architect Karl Friedrich Schinkel (1781-1841) (ill. 0.2).¹⁰ The tendency to mechanise production and reduce the amount of material used was also present in the wooden furniture industry. Around 1850,

⁸ Vöge 1993, pp. 12-13.

⁹ See: Vöge 1993, p. 17, and Baroni 1982, p. 127.

¹⁰ Máčel, Woertman and Wijk 2008, pp. 17-18.

the Austrian furniture maker Michael Thonet (1796-1871) devised a systemised production process, using a minimal amount of standardised, steam-bended solid beech wood elements to create large series of chairs (ill. 0.2). This process made it easy to create different types of chairs – the simplest type consisted of only six wooden parts – but it also kept the price down. Thonet's chairs became immensely popular in public spaces like cafés and restaurants in Europe and America, and when Thonet's patent expired in 1869, other manufacturers started to produce copies of his bentwood furniture avidly.¹¹

After the World War I, during the 1920s, an international movement to which Rietveld was closely associated arose: functionalism. Functionalists were the first to extensively elaborate on the concept of a single-piece chair, and for a better understanding of Rietveld's single-piece designs, it is important to consider this artistic climate in which Rietveld functioned. In order for people to live a healthy and efficient life, functionalist architects wanted to separate different activities within a building, but also required space to be open and flexible, so that different spaces could flow into each other and into the outside world. Modern construction methods and materials, such as concrete, steel and glass were employed to attain this objective. Objects within the different spaces, like furniture, were not regarded as closed forms, but as a part of the space and the building. Functionalist design principles, which had a large influence on Rietveld, required well-designed consumer goods to be mass-produced at low price levels, to have maximum utility and good quality, and to consist of simple and clear forms.

While most furniture designers and manufacturers applied themselves to a conventional production of (oak) wood furniture in a revival style after the First World War, still preferred by a broad audience, a group of functionalist furniture designers started to experiment enthusiastically with laminated wood, plywood and tubular steel. This resulted in avant-garde pieces like Mart Stam's (1899-1986) tubular steel cantilever chair *S33* (1926), Marcel Breuer's (1902-1981) tubular steel *Wassily Chair* (1927-1928), and Alvar Aalto's (1898-1976) plywood *Paimio Chair* (1931-1932) (ills. 0.4, 0.5, 0.6). In the 1920's, an international mass-production of functionalist furniture, like the pieces of Stam and Aalto, was realised. It is important to note that, even though these chairs have not been fabricated out of just one piece of material, they display the potential to do so in the future. In the

¹¹ Máčel, Woertman and Wijk 2008, p. 119.

Netherlands, functionalist furniture was produced by several furniture manufactures, such as UMS in Utrecht (from 1932 onwards) and Gispen in Rotterdam (from 1927 onwards).

After the Second World War, techniques to process and employ plywood, laminated wood and plastics were improved greatly, which increased designers' possibilities to create a chair out of one piece of material. Pre-war experiments with plywood and laminated wood were continued, which resulted in a number of chairs made from a single sheet of these materials, and the production of single-piece chairs made from moulded plastic boomed in the 1960s. These chairs stood at the beginning of a large and diverse range of single-piece chairs, designed up to the present day. It is important to keep in mind that the fact that all of these chairs were made from a continuous piece of material, does not mean they have similar appearances, or were made according to the same design principles.

It is striking how little research has been done into the theoretical bearings of furniture design. Overviews of modern chair design often remain descriptive, and hardly any effort is made to uncover the underlying intentions and design principles of furniture designs, let alone to compare them. The same is true for specific design concepts like that of a single-piece chair. Therefore, the aim of this thesis is to investigate how the concept of a single-piece chair was approached over time, by exploring the single-piece chairs designed by Rietveld – as a pioneer – and those created by later furniture designers, and to which extent these designs were successful. Success can be defined in a number of ways: a chair can become a bestseller and thus be a commercial success, but its design can also embody a certain formal, material, constructive or technological innovation. In this thesis, the emphasis will be on the final four of these definitions of success, even though the first will not be disregarded altogether.

The interpretation of the term 'single-piece' will be rather liberate at times. Technically speaking, materials like plywood and laminated wood are made from several layers of wood, known as veneers, that are glued together.¹² So, they are composite materials, but since the designer takes a single continuous piece of this material as a starting point, it will be regarded as such. Also, exceptions are made for pieces such as Rietveld's *Aluminium Chair* (1942), which has two separate back legs, because they are experiments on

¹² Plywood and laminated wood are both made from layers of wood (veneers) glued together, but the basic difference between the two is, that in plywood the grain of the alternate layers is crossed at a right angle, while in laminated wood, these are parallel.

the way that lead to chairs truly constructed out of one single piece of material (ill. 1.30). Furthermore, in this research, the focus will be directed exclusively at chairs that are made for the purpose of sitting, not at chairs that solely function as furniture sculptures. Indeed designers like the French industrial designer Pierre Paulin (1927-2009) have produced pieces of furniture with a distinctively sculptural character, but their primary function is still to serve as a seat. On the other hand, the furniture sculptures by Richard Artschwager (b. 1923) or Scott Burton (1939-1989) are based on the shapes and rhythms of furniture, but function as objects of art, not to be actually used for sitting.¹³

For this research, a diverse range of sources will be used. Firstly, primary sources, such as writings, design drawings and executed designs will be employed, and furthermore, secondary sources, such as articles, reviews, analyses and other writings by contemporaries and present day art historians will be consulted. The Rietveld Schröderarchief (RSA) and the Nederlands Architectuurinstituut (NAi) will provide most sources on Rietveld, while the different publications on 20th and 21st century furniture and furniture designers will be key for research into single-piece chair designs by others.

This thesis consists of two chapters: the first chapter concerns Rietveld's single-piece chairs, while the second deals with single-piece chairs by other 20th and 21st century designers. In the first chapter, attention will be given to the positioning of Rietveld's single-piece chairs in his oeuvre, after which a material analysis of Rietveld's single-piece chairs will give rise to an analysis of his underlying design principles. The first section of this chapter shortly discusses Rietveld's continuous experimentation with industrial production; the second section is devoted to an analysis of Rietveld's designs of single-piece chairs, taking a closer look at their formal qualities, development, and production history; in the third section, Rietveld's thought formation that preceded the design of his single-piece chairs will be explored, by analysing writings by the man himself, his contemporaries, and art historians.

The second chapter of this thesis concerns the single-piece chairs that were made by other designers after Rietveld's first experiments with this concept. The emphasis will be placed on chairs that are mass-produced, since this was one of Rietveld's aims. A more general description of the development of the single-piece chair leads to a discussion on single-piece chairs that were made in the spirit of Rietveld's designs, after which an epilogue

¹³ Golberdinge 1992, pp. 9-12.

will present a bridge between groups of chairs with different underlying intentions. In the first section, the beginnings of a multiform production of single-piece chairs after World War II will be analysed, and the technical and material developments that played a role in the realisation of these single-piece chairs will also be included; in the second section, a selection of single-piece chairs that can be placed in the functionalist tradition of Rietveld's design, will be discussed, and an attempt will be made to uncover the intentions that the makers of these chairs might have had, comparing them to Rietveld's design principles; the third section is an epilogue, in which a single-chair which embodies a very unusual paradox will be discussed. Finally, the findings of the two chapters of this thesis will lead to a conclusion, after which illustrations of the chairs mentioned in the text follow.

1. Rietveld's single-piece chairs

1.1. Experimentation and industry

One of the most important characteristics of Rietveld, both as a furniture designer and an architect, is his incessant experimentation with materials, constructions and techniques. He often tried to perfect his designs and elaborated on his ideas, which frequently resulted in different variants of one concept. From the 1920s onward, there is one major tendency that underlies these experiments: an awareness of the industrialisation of the production process and its possibilities, leading to mass-production. Even some of Rietveld's earlier work already shows signs of this tendency. For instance, his iconic *Red Blue Chair* or slat armchair, first made in 1919, is constructed out of different parts mechanically sawn from standard sized planks, and connected with the simplest joint possible. This meant that there was a possibility to eventually manufacture the chair by machine.¹⁴

After the completion of the *Rietveld Schröder House* in 1924, which Rietveld designed in collaboration with Truus Schröder – who later became his architectural partner and mistress – he set out for a new direction. He transferred the ownership of his furniture workshop, which he had set up in 1917, to his assistant Gerard van de Groenekan, and decided to become a full-time architect.¹⁵ In 1928, Rietveld was one of the three Dutch architects that were present in Switzerland when the Congrès Internationaux d'Architecture Moderne or CIAM (1928-1959), an international platform for functionalist architects, was founded.¹⁶ Around this time, Rietveld also began to publish in the Dutch journal *De 8 en Opbouw*, which can be regarded as the mouthpiece of functionalist architects in the Netherlands, most prominently of the members of the Nieuwe Bouwen movement, with whom Rietveld was loosely associated. The spatial and social ideals of the functionalists, as well as their use of modern materials, exerted strong influence on Rietveld, and from this time onwards, his striving for industrial mass-production became apparent in many of his designs, for both furniture and architecture.

¹⁴ Dettingmeijer, Thoor and Zijl 2010, pp. 198-201.

¹⁵ Zijl 2010, p. 73.

¹⁶ Bless 1982, pp. 91-92.

In 1927, Rietveld received a commission that would become the third in his extensive oeuvre: the physician Van der Vuurst asked Rietveld to convert his house extend his garage. The most striking part of this project was the chauffeur's apartment, that was to be placed on top of the garage. For its construction, Rietveld used a steel frame, covered with prefabricated concrete slabs that were painted with water-resistant enamel paint, and measured one by three metres. The building inspector overseeing the unusual project did not trust the flat-roofed construction, and ordered the space behind the concrete slabs to be filled with brickwork. Despite the fact that Rietveld's experimental *Chauffeur's Apartment* was far from watertight – much to the owner's frustration – the building was appreciated widely by the avant-garde for its clean lines, colours and employment of modern materials, that reflected a machine aesthetic.¹⁷

At the travelling exhibition *Neues Bauen*, shown in Utrecht in 1929, Rietveld presented his design for a transportable house core for the first time. His idea was to prefabricate the core of a house, including a front door, a stairwell and a bathroom, as well as technical supplies such as water, gas and electricity. The desired number of rooms could be added to the core at the building site, completing the house. Rietveld kept working on this design and in 1958, at the World Expo in Brussels, Rietveld presented a similar idea: the wet cell, a plastic unit that incorporated a kitchen, a shower, a WC and a washbasin.¹⁸ Even though Rietveld implemented the house core and the wet cell in several of his home designs, neither of them was realised: he could not find a factory willing to produce them.¹⁹ When Rietveld received an increasing amount of commissions for private homes and public buildings after the Second World War, technical developments enabled him to incorporate concrete elements, steel construction and glass façades in his designs, like he did in the Academy for Fine Arts and Design in Amsterdam, renamed the Rietveld Academy in 1968.

For some of his chair designs, Rietveld achieved serial production, most notably in collaboration with department store Metz & Co in Amsterdam. Metz & Co imported foreign designs, such as tubular steel furniture by Marcel Breuer, Erich Dieckmann (1896-1944), Alvar Aalto and Le Corbusier (1887-1965), but also employed Dutch furniture designers such

¹⁷ Dettingmeijer, Thoor and Zijl 2010, pp. 106. The significance this project held for Rietveld is illustrated by the title he gave it on a presentation sheet: 'Proeve voor industrialiseering der bouw' ('Case study for the industrialisation of building'). See: Zijl 2010, p. 105.

¹⁸ Zijl 2010, pp. 105-110.

¹⁹ Dettingmeijer, Thoor and Zijl 2010, p. 106.

as J.J.P. (Bob) Oud (1890-1963), Mart Stam and Willem Penaat (1875-1957).²⁰ The store usually showed a few prototypes in presentations and exhibitions, and if a sufficient number of buyers had shown interest in a piece, it would be taken into serial production. Among the pieces by Rietveld that proved to be a reasonable commercial success, were the *Bow Chair*, designed in 1927 and sold from 1931 onwards, and the *Zigzag Chair*, designed in 1932 and sold from the same year onwards. Of both chairs different variants were put on the market by Metz & Co, probably designed at their own request.²¹ In 1957, Rietveld and his son Wim designed the *Mondial Chair*, which was constructed out of a steel frame and an aluminium moulded seat, and was taken into production by furniture manufacturer Gispen.²² Even though this chair is regarded as Rietveld's most successful industrial product, in reality, it was far from commercially successful: only 250 copies were made.²³ It seems that, despite his intentions, many of Rietveld's designs that were supposed to be produced industrially, were either difficult or impossible to execute, or proved to be commercially unviable. Neither did Rietveld take the necessary steps to adjust his designs to the demands of the furniture industry, not even after the Second World War, when a larger variety of techniques and materials became available. This meant that most of them were bound to remain prototypes.

In 1927, around the time Rietveld became increasingly interested in industrial mass-production, Rietveld began to experiment with a chair made out of one single piece or sheet of material, and the concept of a single-piece chair kept him occupied until his death in 1964. Over time, Rietveld took different approaches to the concept of a single-piece chair, trying out different shapes, materials and techniques. In the next section, the different sketches, prototypes and models that were a result of Rietveld's aim to design a single-piece chair, will be discussed. Their formal qualities and design process will be discussed, as well as their production history.

²⁰ Willem Penaat not only designed furniture for Metz & Co, he also worked for the store as the head of furniture from 1924 until 1949. See: Timmer 1995, p. 193-194.

²¹ Zijl 2010, p. 130.

²² Against the will of Gerrit and Wim Rietveld, in late 1958, Gispen decided to produce the *Mondial Chair* with a moulded seat out of polyester instead of steel. See: Zijl and Küper 1992, p. 285.

²³ The *Mondial Chair* was actually rarer than the *Red Blue Chair* until Italian furniture manufacturer Cassina started reproducing it in 2006. See: Zijl 2010, p. 112.

1.2. Single-piece chair designs 1927-1963

Rietveld was occupied by the concept of a single-piece chair for a large part of his career, as the designs described below demonstrate. Rietveld's first experiments with this concept, in 1927, resulted in two different designs: the fibreboard *Birza Chair* and a chair made from a single sheet of three-ply. The *Zigzag Chair* followed these two designs in 1932, which, as the following discussion proves, Rietveld probably intended to construct out of one piece. A design of a folded chair, based on a series of rectangles, was drawn by Rietveld somewhere between 1930 and 1940. Around the same time, he started to develop a chair design that would eventually be executed as the *Aluminium Chair* in 1942. In 1961, Rietveld designed a garden bench made from a single piece of concrete, and in 1962, he made his last sketches for a single-piece chair. Without exception, the chairs mentioned above are all made by folding a plane into a three-dimensional object, so they could “come out of the machine in one blow” by using a stamping machine only, as Rietveld expressed it in an interview in 1962.²⁴

Rietveld's working method becomes apparent when looking at these different designs. He would first make several sketches, often from different perspectives, and a (cardboard) scale model would make clear whether his idea was feasible. If so, he would make technical drawings, and consequently a prototype, sometimes even more than one, in order to try out different materials, construction methods or dimensions. If Rietveld regarded a model suitable, it would be produced in series, often by either Groenekan or Metz & Co. Today, most drawings and sketches are kept in the RSA and the NAI, while most chairs (including prototypes) are part of the collections of the Stedelijk Museum in Amsterdam and the Centraal Museum in Utrecht.

Birza Chair (1927 and c. 1958)

From this design, two technical drawings (one is simplified, the other is more precise), a fibreboard prototype, a polyester prototype and several pictures reside in the RSA. The fibreboard version of the *Birza Chair* was exhibited in 1928 at the exhibition *Architectuur, Schilderkunst en Beeldhouwkunst (ASB) (Architecture, Painting and Sculpture)* in the

²⁴ Oorthuys 1981, p. 38.

Stedelijk Museum for the first time.²⁵ A year later, in 1929, it was published in the yearbook of the Nederlandsche Vereeniging voor Ambachts- en Nijverheidskunst (VANK), the Netherlands Association for Crafts and Industrial Art. In this yearbook, a picture of the *Birza Chair* and the first, simplified technical drawing were published, as well as a short description, which reads: “Fibreboard chair moulded from one sheet, without additional strengthening. The incised fibreboard is soaked, bent, moulded into a shape and dried”.²⁶

From this information, one can deduce the production process of the *Birza Chair*: a rectangular piece of fibreboard is incised to form two basic sections. The upper section consists of a backrest, and on each of its sides a back and front leg are attached, together with the bottom part of the armrest. The lower section consists of the seat, with the top parts of the armrest attached on each side. Consequently, the lower section is bent upward, while the side parts of the upper section, consisting of the chair's legs, is bent forward. Both armrest elements are folded over and attached on top of each other. They are riveted to fix the different sections. The first technical drawing was probably a preliminary one, because if one follows this design and folds it into a chair, the bottom part of the armrest protrudes from under the upper part; they do not fit (ill. 1.1). In this drawing, the sheet of material is also trimmed already to fit the exact outline of the chair. The second technical drawing, which is more precise and contains measurements, is based on a complete, rectangular sheet of material (ill. 1.2). However, not all parts of the sheet are used, and Rietveld indicated that the residual parts of the fibreboard sheet could be used to strengthen the different weaker sections of the chair – although he did not actually put this into practice for the prototype.

The *Birza Chair* derives its name from its owners: the Birza family. It was bought in 1927 by pharmacist J.W. (Jacob) Birza for his family, for whom Rietveld designed and furnished the entire living room.²⁷ Pictures of the interior of the Birza family's living room show the chair standing in the living room, with, like the technical drawing dictates, square corners (ill. 1.3). However, when the chair was auctioned off by Christie's Amsterdam in 1986, the shape of the chair had changed considerably. All corners of the chair were

²⁵ Küper and Zijl 1992, p. 115.

²⁶ “Fiber-stoel uit één plaat geperst zonder extra verstijvingen. De ingesneden fiberplaat wordt week gemaakt, gebogen, in een vorm geperst en gedroogd”, see: Gouwe 1929, p. 188. (All Dutch to English translations in this thesis are made by its author, unless indicated differently.)

²⁷ The interior remained intact until the house was sold in the 1960s, while furniture was auctioned in 1986 by Christie's Amsterdam.

rounded off, and the sides of the legs were sawn (asymmetrically), giving them a much narrower profile, especially on the left side (ill. 1.4). After pioneering research into the Rietveld Schröder archive in the 1980s, Marijke Küper suggested that the chair was remodelled after a second version of the chair – now lost – that had been executed with rounded corners.²⁸ This adjustment gives the chair a far more organic appearance, which seems out of character for Rietveld. Rietveld was not too happy about the chair's initial looks: he wrote to Bob Oud that he found the *Birza Chair* “not very beautiful, but something was achieved nonetheless”, and it seems likely he therefore adapted the chair slightly.²⁹ The rounded corners and reduced legs give the chair a more elegant and slender appearance.

After the construction of the two fibreboard prototypes, further production of the *Birza Chair* was not realised, neither by hand nor by machine. One of the problems that came forward was the fact that the fibreboard, that was too weak to withstand the tension caused by bending the material, would tear in the corners.³⁰ Apparently, the construction process of the chair was so laborious – and the fibreboard had the tendency to warp after drying – Groenekan simply refused to make any more copies.³¹ This complicated construction process was obviously opposed to the quick and simple production method Rietveld had in mind. However, Rietveld did not completely abandon his ambitions to produce the *Birza Chair*. The Centraal Museum in Utrecht owns a polyester prototype of the *Birza Chair* that originates from the storehouse of furniture manufacturer Artifort, to whom Rietveld tried to sell the design, without success (ill. 1.5).³² It is likely that this prototype was made around 1958, since Artifort took two other chairs by Rietveld into production that

²⁸ This theory was supported by strong evidence: one of Truus Schröder's photo albums contained a pair of pictures, pasted next to each other, depicting two differently shaped *Birza Chairs*, one with square and one with rounded corners. Above the pictures Schröder had written “2 of one piece 1927” (“2 uit een stuk 1927”). This obviously indicates that these pictures depict two different chairs, and not one chair in successive stages. Moreover, Küper referred to a testimony by Groenekan, who clarified the matter on the *Birza Chair*. According to Groenekan, initially, two versions of the chair were made. One of them was sold to the Birza family, while the other landed up in the ditch behind the *Rietveld Schröder House*. Why the second *Birza Chair* would have ended up in a ditch is unclear. Han Schröder remembers that the fibreboard was soaked in the ditch behind the *Rietveld Schröder House* for days to soften, and perhaps this fact is the source of confusion. See: Küper 1988, p. 195-198, and Zijl 2010, p. 97 and p. 216, note 34.

²⁹ “Ik ben met een stoel van Fibre bezig geweest. Zal een foto met uitslag sturen, is niet erg mooi maar toch is er iets bereikt”, see: Küper 1988, p. 195.

³⁰ Bless 1982, p. 87.

³¹ Vöge 1993, p. 18, and Oorthuys 1981, p. 39.

³² The sketches that Rietveld made for Artifort include a drawing for the *Danish Chair*, so perhaps Rietveld tried to sell them that design as well. Artifort probably asked Rietveld to bring several designs, from which they eventually chose two. Rietveld's upholstered models (nos. 142 and 143), however, did not sell very well. Zijl 2010, p. 196, and Küper and Zijl 1992, p. 298.

year, the *Artifort no. 142 (The Swan)* and the *Artifort no. 143*, both constructed out of a wooden frame with upholstery.³³

The polyester *Birza Chair* model has not been altered much compared to the original plywood prototype – before the corners were rounded off and the legs were narrowed, that is – but the change of material is striking. An increasing number of plastics was already developed in the late 1920's, but when natural sources became exhausted during the Second World War, plastics were often used to imitate these natural materials. In the 1950s and 1960s several furniture designers began to use plastic as a fully-fledged material, not as an imitation.³⁴ This material was not only affordable, it also lent itself very well to Rietveld's purpose of constructing a chair out of a single, flexible sheet of material. The polyester *Birza Chair* is therefore an example of Rietveld ongoing experiments with the same ideas over a longer period of time, trying to improve his designs by using new techniques and materials.

Single-piece three-ply chair (1927)

This design also dates from 1927, like the *Birza Chair*, and is another example of Rietveld's early experiments with the single-piece chair concept. From this design, a technical drawing, a folded out cardboard model, and a picture of a second model (this model is now lost) are known, all held in the RSA (ills. 1.6, 1.7, 1.8). They show that this chair was to be made from a sheet of three-ply that was not rectangular but trimmed already, unlike the sheet for the *Birza Chair*. The sheet is cut to create a seat component and part of the back, and this section is curved upward. The two rounded sides of the sheet are bent forward, and attached to the projecting sides of the seat. The upper edges of the sides and the back are folded over, thus creating armrests.

The small dots on the technical drawing indicate that Rietveld had intended to attach the seat to the sides with rivets, which is confirmed by a description of the chair, published in the yearbook of the VANK (Nederlandsche Vereeniging van Ambachts- en Nijverheidskunst (Netherlands Association for Crafts and Industrial Art) in 1929. The chair was described as a “three-ply single-piece chair, without framework. The moulded, basic form is sawn, the seat is curved upward and fixed with small rivets”.³⁵ This construction

³³ Küper and Zijl 1992, p. 298.

³⁴ Máčel, Woertman and Wijk 2008, pp. 91-92.

³⁵ “Triplex-stoel uit één stuk, zonder regelwerk. De geperste grondvorm wordt ingezaagd, de zitting opgebogen en met klinknageltjes bevestigd”, see: Gouwe 1929, p. 188.

method is very similar to the one that was used for the *Birza Chair*, and so is the material used: flexible, composite wood, left unpainted. This design did not lead to a prototype, and it seems like the *Birza Chair* was deemed the better design of the two.

Although Rietveld eventually abandoned this design, his experiments with sheets of composite woods led to a different, rather successful design: the *Bow Chair*, also made in 1927. The *Bow Chair* is constructed out of three parts, two tubular steel frames on the sides, with a single piece of plywood in between.³⁶ By extending the sheet of plywood on both ends, Rietveld created two crossbars connecting the frames, and no extra parts are needed. The *Bow Chair* connects to Rietveld's aim to produce a chair consisting of as few parts as possible. Even though Rietveld was not the first to use tubular steel for a chair frame – a serial production of tubular steel furniture, such as Thonet's production of Marcel Breuer's and Mart Stam's designs, and Willem Hendrik Gispen's production of his own designs, was reality already – it seems like Rietveld was one of the first furniture designers to experiment with a combined seat and backrest, consisting of one sheet of material. While the first few versions of the chair were made by Groenekan, the chair was produced and sold by Metz & Co from late 1931 onward. Another design by Rietveld and his son Wim, the *Mondial Chair* (1957), produced by Gispen, also had a combined seat and back element (ill. 1.10). Like the *Zigzag Chair*, the *Mondial Chair* is a highly minimalist design, that occupies only a minimal amount of space: from one single point, the tube underneath the angle of the seat and back, just four lines protrude. Rietveld did succeed to realise an industrial production of this chair, even though there were only 250 copies made and Gispen eventually decided to use polyester instead of aluminium.³⁷

Zigzag Chair (1932-1944)

The *Zigzag Chair* was not only Rietveld's most important chair design of the 1930s, it eventually proved to be one of the most influential of all his designs. Rietveld was occupied with this design for many years, and a large amount of drawings, prototypes, serially produced and unique chairs remain today. The Z-shaped *Zigzag Chair* that is well known

³⁶ For the first few prototypes of the *Bow Chair*, Rietveld used iron frames and fibreboard. Around 1930, the design was also executed several times with a pine frames, each consisting of three parts, and a birch plywood seat and backrest. See: Küper and Zijl 1992, pp. 117-118, and Dosi-Delfini, Adrichem and Roode 2004, p. 308.

³⁷ Zijl 2010, p. 112. In 2006, the *Mondial Chair* was taken into production by Gispen once more, which prompted a publication with a laudatory description of its design and history, see: Schaik 2006.

today is constructed out of four cupboard planks, produced by Dutch kitchen manufacturer Bruynzeel, connected with dovetail joints and glue, and reinforced with slats and bolts (ill. 1.11).³⁸ Rietveld designed many different variants of the chair, with different sizes, proportions and colours, some with armrests or a decorative pattern of holes in the back rest. The *Zigzag Chair* was initially produced in quantity by Rietveld's assistant Groenekan; Metz & Co produced series of the *Zigzag Chair* from 1932 onward as well. Many of the variants of the chair were probably designed at the request of the latter. Beside this serial production, Rietveld also designed several unique *Zigzag Chairs* for private commissioners. The last *Zigzag Chair*, as is presumed now, was a children's version, made for the Jesse family in 1944.³⁹

However, Rietveld also designed several different variations of this chair that display his intention to construct it out of one piece of material. One of the first prototypes (or probably the first) is made from a single sheet of fibreboard, attached to a welded iron frame with small screws (ill. 1.12). Unfortunately, similar to what happened with the *Birza Chair*, the fibreboard was too weak to bear the stress exercised by the sharp corners of the frame, tearing as a result.⁴⁰ Another prototype which Rietveld developed around the same time, was constructed out of a welded section steel frame, screwed to four separate pieces of plywood (ill. 1.13). Obviously, these two prototypes did not offer the solution Rietveld was looking for, and unfortunately, another version of the *Zigzag Chair*, with a frame made from a single piece of tubular steel and plaited rubber cord seat and back panels, proved to be structurally weak (ill. 1.14).⁴¹ Sketches and drawings from around the same time, show that he imaged the chair as one continuous line. In *De 8 en Opbouw*, in January 1933, a letter Rietveld wrote to the magazine on a design for a small holiday home was printed, accompanied by some sketches (ill. 1.15).⁴² The chairs that Rietveld depicted in these sketches seem to have been constructed out of a single sheet of material, and have rounded instead of angular corners.

Furthermore, in 1934, Rietveld designed several pieces of furniture for Professor Weve in Utrecht, and among these pieces was a *Zigzag Chair* as well, constructed out of four

³⁸ Küper and Zijl 1992, p. 146.

³⁹ In total, three of these children's *Zigzag Chairs* were made. See: Küper 1988, p. 199.

⁴⁰ Küper and Schijndel 1987, p. 7.

⁴¹ This variant of the *Zigzag Chair* was produced in Germany and sold by Metz & Co in 1933, but the flush welded joint of the frame proved to be structurally weak, and production was halted. See: Vöge 1993, p. 82.

⁴² Merkelbach 1933, pp. 6-7, and Küper and Schijndel 1987, p. 4.

wooden boards and upholstered with green Moroccan leather.⁴³ A preliminary sketch, however, shows that Rietveld was initially thinking of constructing the *Zigzag Chair* out of a single sheet of material (ill. 1.16). It seems likely he was thinking of sheet metal, since a sketch dated around the same time show another single-piece *Zigzag Chair* under which Rietveld wrote “Stoel van geperst staalplaat” (“Chair of pressed sheet metal”) (ill. 1.17). The NAI owns a scale model of this metal chair, and Groenekan remembered that there was one prototype as well.⁴⁴ Why this design was not produced is not clear, perhaps it was structurally impossible, or the costs proved to be too high (the sketch for the Weve *Zigzag Chair* has “f 55,-” written underneath it, which would be a steep price for a chair at the time).⁴⁵

In 1938 Rietveld finally succeeded to construct the *Zigzag Chair* out of a single piece of material: bended plywood (ill. 1.18). The chair was sold by Metz & Co.⁴⁶ It was made by gluing several layers of veneer together and pressing them into shape in a mould. The plywood had to be quite thick, in order for the chair to deal with the pressure exercised on it. Unfortunately, like it was the case with the tubular steel *Zigzag Chair*, the structure proved to be too weak, and the variant of the chair made from four separate boards ultimately proved to be the most stable model, as well as the easiest to produce.⁴⁷ It is interesting to note that, five years before Rietveld came up with his *Zigzag Chair design*, the German brothers Heinz (1902-1996) and Bodo Rasch (1903-1995). produced their so-called *Sitzgeiststuhl* (1927).⁴⁸ The *Sitzgeiststuhl* is, like Rietveld’s chair, shaped like a Z, although the chair’s outline is a not as angular and minimalist (ill. 1.19). The *Sitzgeiststuhl* was published in a booklet titled ‘Der Stuhl’ (‘The Chair’), which was in the possession of Truus Schröder, so, it is very likely Rietveld knew this design – although it is impossible to determine when he saw this design for the first time.

Overall, one can conclude that the *Zigzag Chair* was a highly successful result of Rietveld’s experiments with the single-piece chair concept. Even though the sheet metal and plywood variants (actually made out of one piece) did not meet the requirements, the version that was constructed out of four boards proved to be Rietveld’s ultimate synthesis

⁴³ Küper and Zijl 1992, p. 146.

⁴⁴ Unfortunately, this scale model was not available for inquiry.

⁴⁵ Vöge 1993, pp. 90-91.

⁴⁶ Küper and Zijl 1992, p. 146.

⁴⁷ Zijl 2010, p. 130.

⁴⁸ Küper and Schijndel 1987, pp. 9-10.

between form, function and construction. The spatial character of the *Zigzag Chair* was revolutionary. Its shape was not based, like the avant-garde cantilever chair, on the shape of two boxes on top of each other, but simply consists of a single line in space. The chair does not enclose space, but cuts through it with its four planes: backrest, seat, leg and base. This effect must have been greatly appreciated by Rietveld – even though he called the chair a “little structural joke” – because he placed the *Zigzag Chair* around the dining table in most of his interior designs after 1933.⁴⁹ Apart from that, the *Zigzag Chair* was also a moderate commercial success: it was probably Rietveld’s best-selling design, produced by Metz & Co from the 1930s well into the 1950s.⁵⁰

Folded chair (c. 1930-1940)

Of this very simple folded chair design, several sketches on a scrap of paper in the NAI and a cardboard scale model in the RSA exist (ills. 1.20, 1.21). The sketches show that Rietveld intended to fold this chair out of long sheet of material, that can be divided in a series of rectangular elements. Two elements, which will form an armrest, are attached on each side of the sheet. When the chair is folded, a hollow box is created, with a protruding back and armrests which are slightly tapered. From the sketches and the scale model, the material and exact construction method that Rietveld intended to use cannot be deduced.⁵¹

The Aluminium Chair and similar designs (1930s-c. 1942 and 1960s)

From this design, a large number of sketches exist (kept in the RSA and the NAI), as well as different scale models and several prototypes. It seems like Rietveld was already occupied with this design in the 1930s, as some sketches are dated to this decade, while the last prototypes were made in the 1960s.⁵² Rietveld's drawings for this chair show, that it was to be folded from a rectangular sheet of material, tapered on the short ends (ill. 1.22).⁵³ The

⁴⁹ “Het is geen stoel, het is een constructief grapje”, see: Küper and Zijl 1992, p. 145, and Zijl 2010, p. 130.

⁵⁰ Vöge 1993, p. 20.

⁵¹ Peter Vöge suggested Rietveld probably intended to execute this design using fibreboard, but there is no evidence to substantiate this. See: Vöge 1993, p. 118, no. 227.

⁵² For instance, in the RSA, the paper model (RSA, inv. no. 30207) and an ink-drawing of this design (RSA, inv. no. 528 A 002) are dated “1930-1940”. In the NAI, all sketches of the *Aluminium Chair* and similar designs are dated “1930, 1942” (NAI, Archive Rietveld, inv. no. 469). Küper and Zijl grouped them under the name “vouwmeubelen” (“folding furniture”) in their 1992 publication, but in this thesis, they are regarded as preliminary sketches for the *Aluminium Chair*, see: Küper and Zijl 1992, pp. 196-197.

⁵³ One design drawing shows a square sheet from which the chair was to be folded, instead of a tapered one. It is probably for the sake of perspective, that Rietveld made the short end look flared (RSA, inv. no. 528 A 004).

middle, square element of the lower part is folded upward, forming a seat, and consequently creating two combined front legs and side panels, passing into the back rest. An additional band of material, attached to the front of the seat, is folded over. In order to fix the chair, a bar connects the inside of each front leg to its outside, while the cone-shaped back legs are attached to the underside of the seat. Both the bars and the back legs were supposed to be made from pieces of left-over material.

In the early sketches, probably dating from the 1930s, it is not clear which material Rietveld was planning to use. However, underneath the sketches of a chair and a table, constructed according to the same method, Rietveld wrote “mandenstoel” (“wicker chair”) and “mandentafel” (“wicker table”), suggesting that he intended to make them out of reed (ill. 1.23). Another drawing shows similar pieces that seem to have been constructed out of that material (ill. 1.24). Rietveld not only made scale models from cardboard, he also made one from perspex, so, he might have considered this material as well (ills. 1.25, 1.26, 1.27). Underneath a technical drawing, kept in the NAI, Rietveld had written “Aluminium model for: chair folded from fibreboard” (ill. 1.28, 1.29).⁵⁴ So, at some point, Rietveld decided he wanted to make the chair out of fibreboard, but when he eventually made two prototypes in 1942, this material was not available, so therefore, he used an aluminium sheet taken from a plane that was shot down (ill. 1.30).⁵⁵ The aluminium demanded a specific treatment, and the edges of the chair have been folded over, as were the edges of the holes (seven in each side panel, twelve in the back rest), in order to stiffen and strengthen the material.⁵⁶ These holes serve as a decorative pattern as well, previously used by Rietveld in several other designs, among which some of his *Zigzag Chairs*.⁵⁷ Small rivets are used to attach the bars between the front legs, and to attach the back legs to the underside of the seat.

According to Groenekan, two prototypes were made during the war (one of them is now owned by the Stedelijk Museum, another by the Delft University of Technology): one by Groenekan himself, and another one by Rietveld and his son Wim. Several years later, in the 1960s, Rietveld's son Gerrit jr. made three or more versions of the *Aluminium Chair* in his tool factory in Epe.⁵⁸ So, eventually, an industrial production of this chair was never realised,

⁵⁴ “Aluminium model voor: stoel gevouwen uit fiberplaat”, see: Küper and Zijl 1992, p. 209.

⁵⁵ Oorthuys 1981, p. 39.

⁵⁶ Máčel, Woertman and Wijk 2008, p. 74.

⁵⁷ Oorthuys 1981, p. 39.

⁵⁸ Küper and Zijl 1992, p. 209. and Máčel, Woertman and Wijk, p. 74. Research by furniture restorer Jurjen

nor was it ever constructed out of the material Rietveld intended to use, fibreboard. However, the appearance of the original prototypes must have appealed to Rietveld's clients, even though aluminium was a temporary solution, since several more of them were made in the 1960s.

First Model (c. 1946-1950)

Of the bent plywood *First Model* chair, the RSA owns a drawing and a scale model, while the only prototype that was made is part of the Stedelijk Museum collection (ills. 1.31, 1.32). This chair consists of three main elements: two frames and a continuous seat and backrest element, cut out of a sheet of birch plywood (ill. 1.33).⁵⁹ The two frames, one on each side of the chair, are shaped like an S resting on its side. The sheet of plywood that forms the seat and back has been bent into shape, curling around at the top and the bottom. Several semi-circular areas are cut out on the sides of the sheet, which allows it to interlock with the frame. The different elements are secured with small pegs. Onto each frame a rectangular armrest, made from laminated wood, is attached. The name of this chair derives from the words that Rietveld stencilled on the backrest of this chair: "Eerste Model" or "First Model".

Dating this design is difficult. Previously, it was always dated 1927, because this was the date that Rietveld provided when it was shown for the first time at the retrospective exhibition at the Centraal Museum in Utrecht, in 1958. However, in her 2010 publication on Rietveld, Ida van Zijl dated the chair around the year of the exhibition, 1958, after technical research on the chair revealed that it was not made until after the Second World War.⁶⁰ The Stedelijk Museum, though, registered 1950 as the year in which the chair was donated to them by Rietveld, during the preparations for a large De Stijl exhibition (1951).⁶¹ So, it must have been made in 1950 at the latest. Moreover, while the drawings and the scale model of the *First Model* are not dated, the NAI owns a drawing of the design, on which is written

Creman and art historian Rob Driessen, carried out in 2010, showed that the prototype owned by the Stedelijk Museum in Amsterdam was made during the Second World War, while the other three known prototypes were constructed in the 1960s by a different maker. See: Anonymous 2010.

⁵⁹ Whether Rietveld intended this to be a single sheet of material is not certain, but it is likely, since the design is clearly related to his other single-piece chair designs.

⁶⁰ In 2006, the chair was examined by furniture restorer Jurjen Creman. He confirmed Zijl's suspicion that the piece was not made until after the Second World War, probably to function as an exhibition model. See: Zijl 2010, p. 216, note 37.

⁶¹ Rietveld was closely involved in this exhibition: not only were several of his De Stijl pieces shown, he was also a member of the organising committee and designed the exhibition layout. See: Dosi-Delfini, Adrichem and Roode 2004, pp. 48-50.

“Laatste Model” (“Last Model”) and a date, April ’46 (ills. 1.34, 1.35).⁶² This drawing is almost identical to other design drawings for the *Eerste Model*. Moreover, one of the designs Rietveld included in his 1946 leaflet *Meubels om zelf te maken* or *Do-It-Yourself Furniture* is based on the same constructive principle: two frames, interlocking with a continuous sheet of material functioning as the seat and backrest.⁶³ These different facts indicate the First Model chair was made around 1946, but no later than 1950.

Zijl defined the chair as a “presentation model” that “seems more like a summary of Rietveld's thought processes during the 1920s than a prototype”, or as Jaap Oosterhoff, administrator of the RSA, put it: “it was probably already in his head in 1927”.⁶⁴ Indeed it seems like the *First Model* is the execution of an idea that occupied Rietveld already in 1927, which was probably the reason for Rietveld to date the chair as such. It is hard to miss the fact that this chair is based on the same constructive principle as the *Bow Chair* (1927): both chairs are constructed out of two S-shaped frames made from a continuous piece of material, forming the legs of the chair, with a curved sheet of plywood in between. Perhaps Rietveld's initial idea in 1927 was to execute the design in plywood, as he did later on, but discovered that the *Bow Chair* version, made with tubular steel frames, was more to his liking. Its name, *First Model*, might refer to its status of predecessor of the *Bow Chair*, or even to its significance as the first idea for a single-piece chair, which he started to develop in 1927 and resulted in pieces like the *Birza Chair*, also made from a single piece of flexible composite wood.

Around the time Rietveld made his *First Model*, he also made another chair constructed out of bent plywood: the *Danish Chair* (c. 1946-1950, ill. 1.36).⁶⁵ The chair consists of three pieces of bent plywood, and it very actually very similar in construction and shape to the plywood dining chair (1936-1937) Marcel Breuer designed for English furniture manufacturer Isokon (ill. 1.37). Furthermore, the *Lounge Chair Wood* or *LCW* (1945) by American furniture designers Charles (1907-1978) and Ray Eames (1912-1988) (ill. 1.38) could have provided Rietveld with inspiration. As photographs of his apartment above the Vreeburg Cinema show, taken around 1947, Rietveld himself owned a *Dining Chair Metal* or

⁶² Drawing of *Last Model*, dated April 1946, NAI, Archief Rietveld, inv. no. 500.

⁶³ Zijl 2010, p. 101.

⁶⁴ Zijl 2010, p. 98, and comment by Jaap Oosterhoff, 15-06-2011.

⁶⁵ The *Danish Chair* was always dated 1950, until Küper and Zijl brought forward in 1992 that there was already mention of a chair made from three curved pieces of plywood, in an article published in weekly magazine *De Groene Amsterdammer* in 1946. See: Schenk 1946, and Küper and Zijl 1992, p. 234.

DCM (1946), designed by the Eames', which shows he knew and appreciated the furniture of the designers (ill. 1.39).⁶⁶ The *Danish Chair*, however, is constructed out of elements curved in two dimensions, while the components of the *LCW* are moulded in three dimensions. For the *LCW*, a high frequency generator was used to curve the plywood, a machine which Rietveld did not have to his disposal.⁶⁷

Folded single-piece chair (c. 1950-1960)

For this design, Rietveld made two sketches on a sheet showing a side view and a technical drawing of half the chair, as well as a paper scale model, which is cut rather imprecisely (ills. 1.40, 1.41). They are both kept in the RSA. This chair consisted of a single sheet of material, with two rectangles forming the seat and the back panel. To the back panel and the seat, a more or less triangular piece is attached on each side, to form the armrests (when folded forward) and back legs of the chair (folded downward) respectively. Another section is attached to the lower end of the seat, that can be folded over to function as the front legs of the chair. As Rietveld indicated in the sketch with a red line, the armrest and the back leg were supposed to form one diagonal line together when the chair was seen from the side.

Concrete park bench (1961)

Although strictly not a chair, this bench Rietveld designed for the sculpture garden of the Kröller-Müllermuseum in Otterlo is, in fact, made of one continuous piece of concrete. The bench consists of combined back rest and splayed footing, with a seating element protruding in the middle. Two variations were made of this bench: a concave version and a convex version. For this design, Rietveld made two scale models (held in the RSA), as well as a preliminary drawing, part of the Kröller-Müllermuseum's collection, which shows that Rietveld intended to combine a concave and a convex version, resulting in one large, S-shaped bench (ills. 1.42, 1.43). With this shape, the bench would adjust perfectly to the winding paths of the garden, and visitors would get different views every time, depending on their position.⁶⁸ In reality, however, three copies were made from each variation, and these were placed in the park separately (ills. 1.44, 1.45).

⁶⁶ This date was provided by Jaap Oosterhoff, 4 July 2010. Another picture of the Vreeburg apartment also shows the Eames' *LCW*, placed at the dinner table, and is dated c. 1947 as well, published in: Zijl 2010, p. 114.

⁶⁷ Vöge and Westerveld 1986 (b), p. 24.

⁶⁸ Kooten and Bloemheuvel 2007, p. 330.

The benches were commissioned by Bram Hammacher (1897-2002), director of the Kröller-Müllermuseum from 1947 until 1963. Several months before it was opened in June 1961, he asked Rietveld to design a piece of furniture for the sculpture garden. Rietveld came up with an idea for concrete benches – that would be too heavy for visitors to take home – covered with a protective, water-resistant layer of plastic. This plastic layer, however, proved to be too costly and was never applied.⁶⁹ A few years later, in 1965, another design by Rietveld was placed in the museum's sculpture garden: the Rietveld Pavilion. This pavilion was originally built in Park Sonsbeek in Arnhem, to serve as a temporary exposition space for sculpture during an exhibition held in 1955. When the exhibition ended, the pavilion was broken down. It did not take long before several initiatives to rebuild it arose, and eventually the Kröller-Müller's sculpture garden was the place of choice, where it was completed shortly after Rietveld's death.⁷⁰ For the construction of the pavilion, Rietveld used thatch, timber, glass, iron and a variety of concrete masonry units. In several of the walls, the concrete blocks were set on their side, exposing their hollow centres and giving the walls an airy character. In their material conformity, Rietveld's concrete park benches and the pavilion connect with each other very well. These benches prove that Rietveld certainly was able to design very practical furniture, with a perfect synthesis between medium and function.

Last sketches (1962-1963)

The last single-piece chair design sketches Rietveld made, drawn on two different sheets of paper, date from 1962.⁷¹ On the first sheet, he made sketches for several pieces of furniture intended for the home of Dr Veldkamp in Arnhem, which was rebuilt according to Rietveld's designs as well (1964-1965).⁷² It seems like the pieces of furniture that Rietveld designed for Veldkamp were supposed to be folded, and the chair he sketched is identical to his *Aluminium Chair* design (ill. 1.46). The second set of sketches also includes drawings similar to the *Aluminium Chair*, as well as chairs with a combined seat and back rest, and a folded out chair that is built up from rectangular elements like the folded chair (1930-1940)

⁶⁹ Kooten and Bloemheugel 2007, p. 330.

⁷⁰ Küper and Zijl 1992, p. 266.

⁷¹ A third set of drawings, made in 1963 on the back of a sheet of paper with a plan for the Van Gogh museum, is also named as a sketch of several 'vouwstoelen' ('folding chairs') in the inventory of the RSA (inv. no. 587 A 001). However, these chairs are constructed out of several curved elements, similar to Rietveld's *Danish Chair*.

⁷² Küper and Zijl 1992, p. 341.

mentioned earlier (ill. 1.47). Both sheets with drawings are dated 1962, and none of these designs were executed, other than the *Aluminium Chair* design, which is very similar to some of the models in the sketches.

What becomes clear when taking a closer look at all of these designs by Rietveld, is that hardly any of them were eventually put into serial production, let alone industrial, mechanical production. Reoccurring problems with executed designs were related to the structural imperfection – the consequence of Rietveld's struggle with the material – and the different materials and construction methods Rietveld used seem to have been directed more toward the sake of experimentation, and less toward the realisation of industrial production. That industrial mass-production of functionalist furniture was possible, was already demonstrated in Rietveld's own time, by, for instance, furniture manufacturers Thonet and Gispen. Still, even though none of Rietveld's single-piece chairs was put into mass-production, in some cases they led to other chair designs, that achieved moderate commercial success, like the *Zigzag Chair* (constructed out of four boards), or the *Bow Chair*.

Rietveld was probably one of the first to introduce the use of a sheet of thin and flexible material, to create a combined seat and back or even an entire chair, to the vocabulary of modern chair design. Constructing a chair out of one sheet of material creates a unified, reduced form, a continuous shape in space. It was not until the 1930s, that Alvar Aalto, as the first designer to follow Rietveld's experiments, would create a chair with a combined plywood seat and back. Moreover, when designing his single-piece chairs, Rietveld was keen on exploiting the full potential of relatively modern and inexpensive materials, such as plywood, fibreboard and aluminium, and towards the end of his life he even employed polyester and concrete. So, even though Rietveld's single-piece chairs did not achieve commercial success, they held great significance in technical, material and formal respects.

What follows, is an attempt to uncover Rietveld's motives for designing a single-piece chair, while connecting his statements to his writings on industrial production and chair design in general. Some thought will also be given to the opinions of Rietveld's contemporaries and 20th century art historians regarding his ongoing experimentation with the single-piece chair.

1.3. Art in theory

Formal qualities, design processes and production histories only tell one side of a furniture design's story: for a thorough understanding of Rietveld's single-piece chairs, it is important to theoretically substantiate them just as well. In this section, an attempt will be made to uncover Rietveld's motives for designing a single-piece chair, after which a selective reception history by Rietveld's contemporaries and later art historians follows.

For the first section, a number of Rietveld's unpublished manuscripts, published articles and lectures will provide clues to the reasons that led him to design a number of single-piece chairs over a long period of time. For the second, most of the consulted writings by Rietveld's contemporaries are articles published in magazines and newspapers, since it was not until 1958 that the first overview of Rietveld's known work was published, written by Theodore M. Brown. Dutch publications predominate in the third section, which gives an impression of the reception of Rietveld's single-piece chairs by historians after his death. The majority of international publications in which Rietveld's single-piece chairs are discussed are based on Dutch sources, so, it is unnecessary to discuss many of them here. It is striking that just a small number of writings on the *Zigzag Chair* could be found, and it seems like only a small amount of attention was paid to the chair by Rietveld's contemporaries. It was only in 1987 that Marijke Küper and Mart van Schijndel published a comprehensive history and analysis of the *Zigzag Chair*, including the single-piece plywood version, so before this date, the discussion on the reception of Rietveld's designs mostly concerns his other single-piece chairs – that is, the pieces that were actually executed and exhibited.

Rietveld

As an architect and a furniture designer, Rietveld did not extensively substantiate his work theoretically, and the reason behind it can be found at the beginning of one of the first articles he wrote, in avant-garde journal *i10* in 1927: "In order to make something, in my opinion, it is utterly unnecessary to give an explanation or justify why it has to be *that* way; on the contrary, the need for expression in a form is partly eliminated, if one was already able to express it in words".⁷³ As a result, Rietveld gained the reputation of being a

⁷³ "Om iets te maken is het m.i. volstrekt niet nodig, eerst een verklaring te geven of verantwoording te kunnen geven waar het juist zó moet zijn; in tegendeel is de behoefte aan uiting in een vorm gedeeltelijk opgeheven, als

practically trained, though brilliant designer, who was hardly interested in the theoretical aspect of his work, and not much serious research into his writings have been carried out. However, this changed when two recent publications on Rietveld, *Rietvelds Universum* (*Rietveld's Universe*) (Dettingmeijer, Thoor and Zijl) and *Gerrit Rietveld* (Zijl), both published in the Rietveld Year 2010, dedicated much more attention to his written body of thought.⁷⁴ As it turns out, Rietveld did write a substantial number of texts and lectures on architecture, furniture and related subjects, with a total of around 270 (held in the RSA).⁷⁵ Many of these texts are preliminary versions of others, and about a hundred of them were actually published. Rietveld first started to publish more frequently from 1927 onward, but the greater part of his writings was published after 1945.

So, Rietveld sparsely wrote about his designs, and his single-piece chair designs are no exception. He did, however, make some references to the concept of a single-piece chair over a long period of time. Whenever Rietveld handled the subject of single-piece chairs, he always did so within the context of the history of furniture design, taking both technical and formal developments in consideration.⁷⁶ Rietveld often represented the history of furniture design as following: after discussing the furniture of the Middle Ages and the Renaissance, the 17th and 18th century, Rietveld went on to emphasise how mass-production brought many ugly products (mimicking handmade objects) in the world in the 19th century. According to him, members of movements like the Amsterdam School attempted to reintroduce sincerely made furniture in an traditional Dutch style, but there was a lack of focus on the needs of their own time. What followed was “a slow awareness of form, colour and space, a search for the ABC of interior decoration”. According to Rietveld, one aimed for “an almost impossible purity”, a liberation from all superfluity, and the style that embodied all these objectives was De Stijl.⁷⁷ The interiors created according to the ideas of De Stijl were, Rietveld objected, too rigid for comfortable living. Dadaism followed as a counter-movement, and at the present time, Rietveld argued, architects and designers have truly

men het al in woorden heeft kunnen zeggen”, see: Rietveld 1927, p. 89, and Küper and Zijl 1992, p. 23.

⁷⁴ See: ‘Bewustwording. Rietvelds vroege theorievorming’ in: Dettingmeijer, Thoor and Zijl 2010, pp. 36-47, and ‘Conviction and vision’ in: Zijl 2010, pp. 8-17.

⁷⁵ Dettingmeijer, Thoor and Zijl 2010, p. 37.

⁷⁶ See for instance: Rietveld 1932, pp. 93-95.

⁷⁷ “Het was een langzame bewustwording van vorm, kleur en ruimte, een zoeken naar het a.b.c. voor de woninginrichting. Men streefde naar een haast onbestaanbare zuiverheid [...]”, see: Rietveld 1932, p. 94.

found the style of their own time, “everything has to be functional, life comes first”.⁷⁸ At this point in the history of chair design – as Rietveld outlined it – the single-piece chair was a self-evident result of the concurrence of circumstances. By representing it this way, Rietveld turned the rise of the idea of a single-piece chair into a general tendency in the history of chair design, instead of a personal development. Rietveld’s account of the history of furniture design, in which all consequent movements lead up to functionalism is, in fact, an ideological construction, rather like German British scholar Nikolaus Pevsner’s (1902-1983) account of architectural history, which was very much directed to converting his readers to a modernist aesthetic.⁷⁹

Three years after his first single-piece chairs designs, in 1930, Rietveld made an explicit reference to the single-piece chair for the very first time, in a publication on chair design in *De werkende vrouw (The Working Woman)* in 1930, a magazine that aimed for the emancipation of women.⁸⁰ Rietveld illustrated the article, called 'De stoel' ('The Chair'), with a variety of small drawings of chairs, ranging from medieval chairs to Marcel Breuer's Wassily Chair (1925). Rietveld began the article by citing the first strophe of a poem by Christian Morgenstern (1871-1914), titled 'Der Aesthet' (*Galgenlieder*, 1905):

Wenn ich sitze, will ich nicht
sitzen, wie mein Sitz-Fleisch möchte
sondern wie mein Sitz-Geist sich
säße er, den Stuhl sich flöchte.

When I sit, I do not care
just to sit to suit my hindside:
I prefer the way my mind-side
would, to sit in, build a chair.⁸¹

⁷⁸ “[...] nu moet alles functioneel zijn, het leven gaat voor”, see: Rietveld 1932, p. 95.

⁷⁹ Draper 2004, p. 1.

⁸⁰ Rietveld 1930, p. 244. An Harrenstein-Schröder, Truus Schröder-Schäder's sister, worked as an editor for *De werkende vrouw*, so it is likely she asked him to write something for the magazine, see: Küper and Zijl 1992, p. 23.

⁸¹ Rietveld mistakenly used “möchte” instead of “will” in the first line. Original poem and translation published in: Morgenstern and Knight 1963, pp. 184-185.

Rietveld even had stickers made with this strophe printed on it, and occasionally stuck these underneath his chairs in the 1930s.⁸² It seems like Rietveld felt attracted to the idea that one should not sit in order to make the body comfortable, but to fulfil the needs of the mind (Rietveld was often criticised for designing chairs that were highly uncomfortable, to which he always retorted with: “To sit is a verb. If you're tired, you should just lie down”). In the article, Rietveld discussed the lack of a satisfying solution for the construction and appearance of a chair, “a balanced entity, in which the practical requirements of usefulness are met economically in the construction”.⁸³ However, Rietveld continued, “as this ideal was not achieved, the form or finish to make it into a thing out of one piece arose. Every period did this differently (one can approach the matter in different ways). This way, many different types came into existence”.⁸⁴ So, according to Rietveld, the development of the single-piece chair was a result of the aim to construct a chair with unity in construction and form, and, he argued, this is something that happened over more than one period in time.

It was not until after the Second World War, in 1950, that Rietveld made another reference to the concept of a single-piece chair. In an extensive article, called 'Inrichting van woning en gebouw' ('Interior decoration of home and building'), published in *Bouwkunde (Architecture)*, Rietveld discussed interior decoration in previous and modern times, including furniture, flooring, textiles and wallpaper.⁸⁵ In a chapter called 'Het moderne interieur' ('The modern interior'), he discussed the changing artistic climate in the Netherlands around 1900, digressing on Berlage and the Amsterdam School. After mentioning De Stijl, Rietveld described a change in furniture design that occurred with the rise of functionalist movements like the Nieuwe Bouwen in the 1920s: “Furniture transforms once more. It is preferably made out of one piece of bent tubular steel or bent wood. There is a continuous search for greatest possible reduction of material; not for reasons of frugality, but to make the furniture as slender, as mobile as possible. Furthermore, one makes it as transparent as possible. Therefore, glass panels are eagerly used for tabletops and cabinet surfaces. The positioning of furniture is completely determined by the demands

⁸² Küper and Zijl 1992, pp. 23-25.

⁸³ “[...] een evenwichtig geheel, waarin de praktische eisen van bruikbaarheid in de constructie economisch zijn opgelost”, see: Rietveld 1930, p. 244.

⁸⁴ “Daar dit ideaal niet bereikt werd, ontstond de vorm of afwerking om er een ding van van te maken uit één stuk. Iedere periode deed dit verschillend (men kan de zaak van verschillende kanten aanpakken). Zo ontstonden de vele verschillende typen”, see: Rietveld 1930, p. 244.

⁸⁵ Rietveld 1950, pp. 1-16.

of use. In small dwellings in particular, one strives to combine as many pieces of furniture into one. All of this gives the interior a very airy character, makes it almost empty”.⁸⁶ So, as Rietveld explained it, single-piece furniture is an expression of its time, because the reduction of material that it entails, matches the emptiness in the interior people are striving for – leaving them more space – perfectly.

More than a decade later, in 1962, Rietveld seemed to have been occupied with the idea of a single-piece chair once more. Not only did he make his last sketches for single-piece chair designs, he also referred to them in a filmed interview with Piet van Mook. In the interview, Rietveld told Mook that: “I always imagined that a chair shouldn't be any more complicated than a safety pin. Now, that is easy to say, but it is tremendously complicated to make a chair come out of the machine in one blow”.⁸⁷ So, Rietveld admitted that creating a chair – that has to be uncomplicated to begin with – out of one piece seems to be deceptively easy, since it is very hard to actually adapt it to an industrial production process.

A year later, in 1963, Rietveld referred to the single-piece chair in a lecture he gave on the occasion of the opening of the ninth trade fair for homes and furniture textiles.⁸⁸ In this lecture, Rietveld discussed the history of architecture and furniture – that function as our everyday background – and concludes that most developments have been technical, not formal. If one want to achieve any progress at all in either of these two disciplines, it is crucial to break with tradition, but people have only just started to manufacture and accept the “purely industrial product”.⁸⁹ Rietveld went on to say that: “In the future, I see a piece of material, after a successive series of operations in ten minutes, coming out of the machine as a ready-made chair, in a shape that is so neutral, that as a basic element, it will fit in

⁸⁶ “Het meubel verandert opnieuw. Het wordt bij voorkeur gemaakt van uit één stuk gebogen stalen buis of gebogen hout. Steeds wordt gezocht naar het zoveel mogelijk sparen van het materiaal; niet uit overwegingen van zuinigheid maar om het meubel zo iel, zo mobiel mogelijk te maken. Ook maakt men het graag zo doorzichtig mogelijk. Vandaar dat men de glasplaat graag gebruikt voor tafelblad en kastoppervlak. De plaatsing van de meubelen wordt geheel beoordeeld naar de behoefte van het gebruik. Vooral in kleine woningen wordt gestreefd naar het combineren van meubelen tot één. Dit alles maakt dat het interieur een zeer ijl karakter krijgt, bijna leeg wordt”, see: Rietveld 1950, pp. 5-6.

⁸⁷ “T is een zekere sport om een stoel uit één stuk te maken. Ik heb me altijd voorgesteld dat een stoel niet ingewikkelder moet zijn als bijvoorbeeld een veiligheidsspeld. Nou is dat gemakkelijk gezegd, maar het is geweldig ingewikkeld een stoel uit één stuk materiaal met een klap uit de machine te laten komen”, from a filmed interview with Piet van Mook, c. 1962, cited in: Oorthuys 1981, p. 38.

⁸⁸ Rietveld 1964, pp. 117-120, and Rietveld 1963, p. 12.

⁸⁹ “We staan nog maar bij het begin van het produceren en het aanvaarden van het zuivere industriële produkt”, see: Rietveld 1963, p. 12.

almost every interior”.⁹⁰ By putting it this way, it becomes clear that Rietveld saw the single-piece chair as one of these purely industrial products of his own time: it could be made quickly, and moreover, function as a standard (and perhaps ideal) element that is suitable for every interior.

In his writings, Rietveld displayed a deep-rooted conviction that designers should embrace the possibilities mass-production offered, because it would bring the ultimate solution to the problems that they encountered when designing an object (like a piece of furniture): how to unite form and construction in a satisfying way. In his earlier writings, Rietveld was certainly not opposed to handmade products, but, when he touched upon this subject again in the 1960s, he argued that “The mass-produced article is not a reproduction of the unique object; the individual thing is not suitable for repetition”, and even more radical: “No design has any value today (not even experimental), if it is not suitable for mass-production. [...] The machine has, when it comes to form and finish, proven its superiority”.⁹¹

In 1944 Rietveld even displayed openly communist views when stating that “The artist dreams of a society, that is organised in such a manner, that *everyone* contributes, with the aid of the machine, to provide for all general material needs, so that everyone can use this to the same extent. A society, without competition, without profits on an economical basis, organised with the sole purpose to free everyone’s life from worry, routine and trouble”.⁹² Furthermore, when thinking about the things that are produced in masses every day, with the sole purpose of being sold, while not even knowing whether they serve society, Rietveld pleaded that “we shall not without scruple cooperate in stimulating

⁹⁰ “Ik zie in de toekomst een stuk materiaal na een opeenvolgende serie van bewerkingen in 10 minuten kant en klaar als stoel uit de machine komen, in een vorm, die zo neutraal is, dat hij als eenvoudig onderdeel in bijna alle interieuren passen zal”, see: Rietveld 1962, p. 120.

⁹¹ “Het massaproduct is geen reproductie van het unicum; het individuele is niet geschikt voor herhaling”, see: Rietveld 1946, unpaginated. “Geen enkel ontwerp heeft vandaag nog waarde (zelfs geen experimentele), wanneer het niet geschikt is voor massaproductie. [...] De machine heeft ook wat vorm en afwerking betreft haar superioriteit bewezen”, see: Rietveld 1964, p. 34.

⁹² “De kunstenaar droomt zich een maatschappij, die zo is ingericht, dat *ieder* meehelpt om met gebruikmaking van de machine, in alle algemeen materiële behoeften te voorzien, en zó dat ieder hiervan een gelijk gebruik kan maken. Een maatschappij, zonder concurrentie, zonder winsten op economische basis ingericht alleen met het doel ieders persoonlijk leven te bevrijden van zorg, sleur en hinder”, manuscript by Rietveld, 1944, published in: Rens 1979, p. 20. Rietveld never was a member of the Communist Party (or any political movement, for that matter), but he was involved in clubs and societies that were closely associated with the left wing, such as the Genootschap Nederland-Nieuw Rusland (Netherlands-New Russia Fellowship). See: Zijl 2010, p. 11. Moreover, Rietveld’s leftist views were the primary reason for the state’s Department of Education to reject Rietveld as the new director of the IvKNO in 1948, see Slouhouber 1997, p. 19.

the scale of all these things even more by designing them as well as possible".⁹³ So, for Rietveld, achieving mass-production was one thing, but designing them well is another, deserving of attention.

Rietveld's views on the subject of industrial mass-production are completely congruous with the ideas of other leading functionalists of his time. For instance, in 1939, Mart Stam was in the running of becoming the new director of the IvKNO, the applied arts school in Amsterdam, and when he was asked to explain his ideas on applied arts education, he stated that it "should not focus on beautiful hand-made objects anymore, but should give more attention to industry. Machine-made production should be influenced aesthetically and the Institute should educate with this in mind".⁹⁴ It is in this context of views on industrial production, that Rietveld argued that furniture should eventually become an expression of its own time, and the variety of (old-fashioned) styles should be discarded, or as he phrased it in his article 'The Chair' (1939): "Slowly, the chair also frees itself from its complicated past, because with the mechanical production process, new materials and new constructive inventions become more important than stylistic differences". The single-piece chair seems to embody just that, even though Rietveld had to admit that realising the production of a such a chair was easier said than done.⁹⁵ However, beside these practical implications, the reduced amount of space a single-piece chair occupies, both spatially and visually, would leave more space for the inhabitants, consequently making their lives less complicated.

Contemporaries

After a visit to the ASB exhibition in the Stedelijk Museum in 1928, which featured an unpainted prototype of the *Red Blue Chair*, the *Birza Chair* and a *Bow Chair*, graphic artist and art critic Otto van Tussenbroek wrote an article titled 'Drie stoelen van G. Rietveld'

⁹³ Cited in: Zijl 2010, p. 17.

⁹⁴ "De heer Stam verklaart, dat naar zijn mening het kunstnijverheidsonderwijs zich tegenwoordig niet meer moet instellen op het met de hand vervaardigen van mooie voorwerpen, doch dat er meer aandacht besteed moet worden aan de industrie. De fabrieksmatige productie moet aesthetisch worden beïnvloed en voor dit doel moet het Instituut opleiden", both English and Dutch text, see: Slothouber 1997, pp. 14-15. Unfortunately, Stam could not bring his reform of the IvKNO fully into force. With the outbreak of World War II and the following Cold War, the artistic climate in the Netherlands changed, and communist views, such as those expressed by Stam, fell into disrepute.

⁹⁵ "Langzaam bevrijdt ook de stoel zich van zijn ingewikkeld verleden, doordat bij de machinale werkwijze, nieuwe materialen en nieuwe constructieve vindingen belangrijker worden dan vormverschillen", see: Rietveld 1930, p. 244.

(‘Three Chairs by G. Rietveld’), published in *Binnenhuis (Indoors)*. According to Tussenbroek, Rietveld always strove for “the creation of models, which, with the help of the machine, could be produced in large quantities (therefore, in series).” Tussenbroek argued that: “Continuously searching and testing, Rietveld succeeded in constructing a chair out of a single sheet of fibreboard”, which resulted in “remarkably easy to move furniture” and an “extraordinarily strong entity at the same time”. At the present time, Tussenbroek continued, furniture design has become too “decadent”, and Rietveld’s “completely honest work, very much as a reaction, offers chances for renewal on a purer base”. According to Tussenbroek, Rietveld’s point of departure for this “clarification process” is “not to serve beauty, but first of all, practicality”. Tussenbroek concluded: “What will come from all these experiments, no one can tell”, but “Forces like Rietveld are only used by life, to gradually come to a new beauty of form”.⁹⁶ So, Tussenbroek attached great importance to Rietveld’s experiments with a continuous piece of flexible material, as he used for the *Bow Chair* and the *Birza Chair*. For Tussenbroek, Rietveld led the way to a new and improved furniture design, which would be an expression of its own time, and for which function would prevail over appearance – implying that Tussenbroek appreciated Rietveld’s designs for their functional character than for their beauty.

In 1941, Tussenbroek devoted another article to Rietveld’s furniture, titled ‘Over wonen en wat dies meer zij. Z.M. de stoel’ (‘On Living and the Like. H.M. the Chair’) published in *Interieur (Interior)* in 1941. In this article, Tussenbroek tried to find a solution for the following problem: how to construct or design a chair, “which, with a relatively low weight (due to the required mobility) is still strong and stable, which is practically as well aesthetically sound, and is pleasant to look at and to sit on to the same extent”.⁹⁷

Tussenbroek asked Rietveld this very question, and, naturally, Rietveld answered that “most chairs are used by folks, that want to take a rest after work”, but “My interiors are not fit for

⁹⁶ “Steeds zoekend en proeven nemend slaagde Rietveld er in uit één vlakke plaat fibre een stoel te construeeren zoodanig, dat [...] een opmerkelijk gemakkelijk verplaatsbaar [...] en toch ongemeen sterk geheel werd verkregen. [...] laat ons niet vergeten, dat [...] dit volkomen eerlijke werk juist als reactie, kansen biedt tot vernieuwing op zuiverder grondslag. [...] Maar het zoeken, juist als direct gevolg van den tijdgeest, is ongetwijfeld belangrijk. [...] Zijn uitgangspunt [...] bij het onverpoosde zuiverings-proces [...] is niet de schoonheid bewust te dienen, doch allereerst de praktijk. [...] Wat uit al dat experimenteren voort zal komen, kan niemand zeggen. [...] Krachten als Rietveld worden slechts door het leven gebruikt om langzamerhand tot een nieuwe vormschoonheid te geraken”, see: Tussenbroek 1928, p. 71.

⁹⁷ “[...] om een stoel te maken of uit te denken, welke bij een betrekkelijk licht gewicht (door den eisch van verplaatsbaarheid) toch sterk is en stabiel en welke zoowel practisch als aesthetisch verantwoord is en evenzeer aangenaam is om naar te zien als om erop te zitten”, see: Tussenbroek 1941, p. 78.

that purpose – they are rather meant to be stimulating – en the chairs participate with their form and position”.⁹⁸ Moreover, Tussenbroek argued that the single-piece *Birza Chair* and the *Red Blue Chair* – both depicted – possessed the quality of “sitting well”, even though they were somewhat older pieces.⁹⁹ The fact that Tussenbroek took these chairs as an example of furniture that was, besides meeting the other demands, comfortable to sit in, seems to go against the general opinion that Rietveld’s chairs were not the most comfortable pieces of furniture. However, perhaps Tussenbroek agreed with Rietveld’s idea that sitting is supposed to be an activity, instead of complete relaxation of the body and mind. It seems like he regarded the *Red Blue Chair* and the *Birza Chair* as pieces that approach the ideal of a light, strong, stable, practical, good-looking, and comfortable – although not too relaxing – chair.

For the journal *De 8 en Opbouw* (1932-1943), published by the homonymous functionalist architectural association, Rietveld regularly wrote or co-wrote articles, but his own work was the subject of critical analyses just as well. These analyses often concerned his furniture sold by Metz & Co. In an article published in 1935, four of his designs – the *Red Blue Chair*, a chair with a frame made of round poles, the *Zigzag Chair* and the *Bow Chair* – were placed in a different context, although the tone of the article is characteristic. This article, titled 'De stoel gedurende de laatste 40 jaar' ('The Chair During the Last Forty Years') was written by Mart Stam on occasion of the furniture exhibition organised by the VANK in December 1934. In the article, Stam reviewed a total of 42 chairs, placed underneath each other in rows, and loosely divided them into groups: wooden chairs, chairs with steel frames and rattan chairs. The *Zigzag Chair* is positioned among the wooden chairs, just above Alvar Aalto's no. 31 plywood cantilever chair, most likely because they both have seat and back components that appear to be a continuous line. In the *Zigzag Chair's* caption, Stam argued that Rietveld “has a wish to come to an industrial product. He thinks of metal, of fibreboard. He knows, that the old working method does not go any further, and he knows that new materials with a different, easy construction method will have to be found. He attempts, but

⁹⁸ “De meeste stoelen zullen wel gebruikt worden door lieden, die na hun werk willen uitrusten. [...] Mijn intérieurs zijn hiervoor niet geschikt – ze zijn meer aanvurend bedoeld – en de stoelen doen mee door vorm en houding”, see: Tussenbroek 1928, p. 79.

⁹⁹ “[...] die beide de treffende eigenschap bezaten van ‘goed te zitten’”, see: Tussenbroek 1928, p. 79. The RSA owns a piece of paper on which these pictures are pasted, along a simplified technical drawing of the *Birza Chair*, captions and Otto van Tussenbroek’s name (inv. no. 430 A 002). It has been undated until now, but it seems safe to say that the page was made for this article, in 1941.

it is often not right, it is not stable or comfortable; but time and time again – he tries untiringly”.¹⁰⁰

So, Stam appreciated Rietveld’s (necessary) experiments with new materials and construction methods, but also noted that these did not always lead to practical, comfortable pieces of furniture. The fact that Stam wrote these remarks underneath an image of the *Zigzag Chair* indicates that he saw this piece as one of Rietveld’s experimental models, which held certain promises but needed further development. However, the fact that he placed the *Zigzag Chair* at the end of the section with wooden chairs (Aalto’s chair is the last) indicates that he probably regarded it as a design that would lead the way to new and improved wooden chair designs.

Rietveld created his *Aluminium Chair* in 1942, but it was not until 1946 that it was presented to the public, at an exhibition of the Gebonden Kunstfederatie (GKf) (Applied Arts federation) in the Stedelijk Museum in Amsterdam. In that same year, it was featured in avant-garde magazine *Open oog* (*Open Eye*). In the magazine, a long list of aphorisms by Georges Braque (1882-1963) was printed (in French, Dutch and English), accompanied by pictures of several of Braque’s art works, as well as a picture of a coastline, Stam’s *S64* chair (1928) and Rietveld’s *Aluminium Chair*.¹⁰¹ No explanation is provided as to why these items were put together, but it seems they have the fact that they are constituted of flowing, continuous lines in common.¹⁰² The *Aluminium Chair*’s caption, “experiment, bent from one leaf of material: fibre”, emphasises its unconventional and experimental character, which was perhaps the reason, other than its appearance, to publish it in the magazine.¹⁰³

Open oog was a magazine directed towards a renewal of the arts, collaboration between international artists and progress of society as a whole, and was edited by Mart Stam, Willem Sandberg (1897-1984), and, among others, Rietveld himself.¹⁰⁴ Sandberg was the director of the Stedelijk Museum from 1945 until 1963, and during this time, he strove

¹⁰⁰ “Ook hij heeft de wenschen tot een industrieproduct te komen. Hij denkt aan metaal, aan vulkaanfiber. Hij weet, dat het met de oude werkmethode niet verder gaat, hij weet dat nieuwe materialen met andere, eenvoudige montage gevonden moet worden. Hij probeert, dikwijls is het niet goed, is het niet stabiel of zit slecht; maar altijd weer – hij probeert onvermoeid”, see: Stam 1935, p. 5.

¹⁰¹ Anonymous 1946, unpaginated.

¹⁰² This way of grouping images is rather reminiscent of George Bataille’s surrealist magazine *Documents*, published in Paris in 1929-1930.

¹⁰³ “Experiment uit één blad gevouwen, uit te voeren in fibre”. Dutch and English text published in: Anonymous 1946, unpaginated.

¹⁰⁴ Other editors were architect Jan Piet Kloos (1905-2008), journalist and art historian Hans Jaffé (1915-1984) and graphic designer Wim Brusse (1910-1978). See: Wal 2010, p. 5.

for artistic and social renewal, which resulted in a synthesis of different types of contemporary art in the presentation of the museum, including both fine and applied arts.¹⁰⁵ Sandberg admired Rietveld to a great extent, not only as an architect but as a furniture designer as well. Rietveld's work was featured in different exhibitions in the Stedelijk Museum, and from the 1950s onward, Sandberg acquired several pieces of Rietveld's furniture for the museum's collection, which included the purchase the *Aluminium Chair* in 1951.¹⁰⁶

The exhibition by the Gkf in 1946 inspired another article which discussed the *Aluminium Chair*, 'Na-oorlogsche stoelen' ('Post-War Chairs'), written by M.G. Schenk (chief editor of the liberal woman's magazine *De vrouw en haar huis* (*The Woman and her Home*) published in the weekly magazine *De Groene Amsterdammer* (*The Green Amsterdammer*). In this article, Schenk compared the solutions that Rietveld and fellow-furniture designers came up with for the following problem: how, in this time of shortage of raw materials and housing, can one design furniture that does not require much material, can be produced quickly in series, and “still does not become a bazaar item”.¹⁰⁷ Schenk firstly discussed several furniture designs by Elmar Berkovich (1897-1968) – which she found to be very practical – after which she digressed on Rietveld: “For an entire generation, Rietveld is the man of ideas, which he himself, but above all others can elaborate on, from which useful articles arise. The chairs, which Rietveld designed after this war, are as unfit for use as the first steel furniture that came into existence after the last war. Nevertheless, we now accept steel furniture as something normal. Rietveld seems to be obsessed with the necessity to manufacture a large amount of furniture in a very short period of time. [...] That is why he pondered until at last, he invented a chair that, just like the furniture from the cardboard toy box, can be punched from one single sheet. The aluminium model he made, still possesses all the characteristics of an experiment; only the odd fellow will place this armchair in their living room. That doesn't matter: the idea has taken shape, and now the ideal shape will come [...]”.¹⁰⁸ So, Berkovich had to admit that Rietveld's *Aluminium Chair* was not fit for

¹⁰⁵ Dosi-Delfini, Adrichem and Roode 2004, pp. 44-47.

¹⁰⁶ Dosi-Delfini, Adrichem and Roode 2004, pp. 47-50.

¹⁰⁷ Schenk 1946.

¹⁰⁸ “Een generatie lang is Rietveld de man van de ideeën waarop hij zelf, maar vooral anderen voortbouwen en waaruit dan bruikbare artikelen ontstaan. De stoelen, welke Rietveld na dezen oorlog ontwierp, zijn evenmin direct voor gebruik geschikt als de eerste stalen meubelen na den vorigen oorlog ontstaan. En toch aanvaarden wij nu alleen het stalen meubel als iets normaals. Rietveld schijnt bezeten te zijn door de obsessie van de

industrial production just yet, but she did attach great value to its experimental character: eventually, she argued, like Rietveld's other designs, it would lead the way to new and practical pieces of furniture.

More than ten years later, in 1958, Theodore M. Brown's dissertation on Rietveld (examined by Utrecht University), *The Work of G. Rietveld Architect* was published, and it was to remain the standard work on Rietveld for decades.¹⁰⁹ Brown, an American citizen, published several writings on Rietveld in the Netherlands, and taught art history at the universities of Louisville and Cornell.¹¹⁰ In his dissertation, he mainly focused on Rietveld's De Stijl period, even though he did pay some attention to Rietveld's single-piece chairs. When speaking of Rietveld's use of bent plywood, Brown argued that "by the simple expedient of bending the surface [...] its stiffness increases tremendously, thus enlarging its structural efficiency. The same principle is exploited by the hen in the creation of her structurally marvellous egg. The climax of Rietveld's visionary approach was achieved in a chair made entirely from one piece of material", that is, the *Birza Chair*.¹¹¹ He was equally enthusiastic about the *Aluminium Chair*, stating that it "[...] combines back, seat, arms and legs into an aesthetic and structural entity".¹¹² He was also the first author to mention that Rietveld had initially intended to make the *Zigzag Chair* out of one single piece: "Conceived originally as being made from one piece of material, Rietveld was unable to execute it thus [...]".¹¹³

Furthermore, Brown pointed out that Rietveld's *Bow Chair*, when featured in an exhibition titled *Der Stuhl* in 1928, it was actually the only design which incorporated seat and back into one surface.¹¹⁴ Adolf Schneck (1883-1971), a German architect, not only put the exhibition *Der Stuhl* together, but also wrote the accompanying catalogue. The exhibition included simple, functional and affordable wooden chairs, but (more experimental) chairs

noodzaak in zeer korten tijd zeer veel meubelen te moeten vervaardigen. [...] Vandaar dat hij zo lang peinsde, tot hij een fauteuil bedacht had, die als de meubelen uit de kartonnen speeldoos, uit één plaat gestansd kan worden. Het aluminiummodel dat hij maakte, draagt nog alle kenteekenen van het experiment; slechts een zonderling zal deze fauteuil in zijn zitkamer neerzetten. Dit deert niet: de idee heeft vorm gekregen, nu zal de ideale vorm er komen [...]". See: Schenk 1946.

¹⁰⁹ This publication, which was heavily influenced by Rietveld and Truus Schröder, focused mainly on Rietveld's De Stijl period and the *Rietveld Schröder House*, without a convincing analysis of his later work. This fits into the dominant narrative that existed at the time. See: Dettingmeijer, Thoor and Zijl 2010, pp. 33-34.

¹¹⁰ <<http://guidewhois.com/2011/04/theodore-m-brown-biographybibliographybooks-reviewpublicationscareeremail-address/>> (06-08-2011).

¹¹¹ Brown 1958, p. 84.

¹¹² Brown 1958, p. 121.

¹¹³ Brown 1958, p. 103.

¹¹⁴ Brown 1958, pp. 84-88.

with metal frames, like the *Bow Chair*, as well.¹¹⁵ According to Brown, the *Bow Chair* and the *Birza Chair*, “which exploited the properties of curved surfaces, were several years ahead of their time, because this phenomenon does not enter the vocabulary of twentieth century design until the early thirties [...]”. Brown’s statement is only partly true: it is safe to say that Rietveld was one of the first designers of modern furniture who experimented with a seat and back rest made from one continuous piece of plywood, but the use of large pieces of plywood and laminated wood in furniture is not without precedent. For instance, around 1850, John Henry Belter (1804-1863), a German furniture designer who emigrated to America, created furniture that was made with a mechanised process. It takes some effort to look beyond the curving forms, bulging upholstery and elaborate ornamentation, but when one does, it becomes clear that Belter used large sheets of laminated wood for many of the curved surfaces (ills. 1.48, 1.49).¹¹⁶ Furthermore, since the 1870s, New York-based furniture manufacturer Gardner & Company produced theatre seats as well as railway station benches and using bent plywood shells (ill. 1.50). Plywood began to be used for furniture frequently in both America and Europe around 1900, even though it often served as a supporting element in upholstered chairs.¹¹⁷

When analysing the different ways in which Rietveld's single-piece chairs were received during his lifetime, it becomes obvious that Rietveld's single-piece chairs – that is, the designs that were featured in publications or exhibitions – were esteemed highly for their experimental value. By employing unusual materials, shapes and construction methods, Rietveld was thought to lead the way to a renewed and improved kind of furniture. It is, however, necessary to nuance this image slightly. At the same time, Rietveld was regularly criticised for letting innovative design prevail over solid structure and execution of his furniture. One of Rietveld’s critics, architect Jan de Meijer (1872-1950), remarked in an article titled 'Vakverrotting' ('Deterioration of the Profession'), which was published in *Bouwkundig Weekblad Architectura* (*Architectural Weekly Magazine Architectura*) in 1935: “Any genuine professional will let the execution come first, not the design. It is only in the realisation of the design that its essence will take effect in the most powerful way. A designer, filled with love for his profession, should not tolerate bad execution. [...] Doing one's work by halves is of no

¹¹⁵ Schneck 1928, pp. 5-7.

¹¹⁶ Pile 2005, p. 262.

¹¹⁷ Ngo and Pfeiffer 2003, p. 31.

use for any profession".¹¹⁸ So, Meijer was of the opinion that the – in his eyes - abominable execution of Rietveld's designs reflected his lack of qualities as a furniture designer, and furthermore, his lack of dedication this profession: his designs are of no use at all.

Art historians

The first important publication that came out after Brown's dissertation, was *I mobile di Gerrit Thomas Rietveld* in 1977, translated as *Gerrit Thomas Rietveld Furniture* a year later, written by Daniele Baroni. In this book, Baroni focused entirely on Rietveld's furniture. In a chapter called 'The Single-Sheet Chair', he discussed four of Rietveld's single-piece chairs: the *Birza Chair*, the single-piece three-ply chair, the *First Model* and the *Aluminium Chair*. According to Baroni, "It was the curved combined seat and chair back of his first metal chair which suggested this possibility to him", referring to the *Bow Chair* – even though the *Bow Chair*, the *Birza Chair* and the three-ply chair were all made in 1927, and Rietveld never made any statements about the order in which he designed them.¹¹⁹ When discussing the *Zigzag Chair*, Baroni noted that: "[...] it should be realized that Rietveld wished to make the chair in one piece, anticipating present-day mass production from a single mold, and seeking for ways which were still unknown at that time. Unlike the one-piece chairs designed in 1927 made out of a sheet of curved material, here the only thing which could have helped him was chemistry, after the discovery of giant molecules".¹²⁰ Here Baroni seems to refer to synthetic polymers or plastics, which Rietveld actually did not use for his furniture until he designed the *Birza Chair's* polyester prototype in 1958.¹²¹

Furthermore, Baroni regarded Rietveld's single-piece designs as "equivalent" to his transportable house core, and argued they were "closely associated with the trend toward industrialization". He defined Rietveld's act of folding a sheet of material into a chair an "achievement [that] was both technical and psychological. All the cultural stratifications emerging from his earlier furniture no longer seemed to belong to him: De Stijl seemed forgotten". However, Baroni continued, the single-piece chairs were merely "a variation on

¹¹⁸ "Elk waarachtig vakman zal de uitvoering, niet het ontwerp, het hoogst stellen. Pas in de verwerkelijking komt het innigste van het ontwerp tot zijn krachtigste werking. Een ontwerper, vol van liefde voor het vak, mag een slechte uitvoering niet dulden. Een kunstenaar is ieder, die het door hem begonnen werk ook afmaakt! Met half werken worden de vakken niet gediend", see: Meijer 1935, pp. 463-464.

¹¹⁹ Baroni 1978, p. 127.

¹²⁰ Baroni 1978, p. 135.

¹²¹ The first widely used synthetic polymer, Bakelite, was invented by Belgian chemist Leo Baekeland in 1907, see: Morris 1986, p. 40.

his perpetual theme: to build in terms of simplicity and intelligence, which is also a way of understanding life". According to him, with these chairs, Rietveld "unconsciously" stood at the beginning of a new trend: "the movement from rationalism to the organic tendency".¹²² This last remark by Baroni seems a little far-fetched. As mentioned, Rietveld was interested creating a piece of furniture which was made from a reduced amount of material using an efficient, industrial production process, resulting a spatially and visually reduced form. Organic design – meaning design for which forms and materials found in nature are used, principally curvilinear, and often expressing traces of their own history and development – is clearly not something Rietveld aimed for.¹²³

In 1987, the first extensive analysis of the *Zigzag Chair* was published, titled 'Der Sitzgeist. Over het ontstaan van de Zigzagstoel' ('Der Sitzgeist. On the Development of the Zigzag Chair'). It was written by art historian Marijke Küper and architect and industrial designer Mart van Schijndel for visual art and design magazine *Jong Holland (Young Holland)*. In this article, Küper and Schijndel convincingly argued that the first *Zigzag Chair* was created by Rietveld in 1932, not in 1934 as was previously assumed. Moreover, the prototypes of the *Zigzag Chair* were discussed, and according to the authors, "In the material fibreboard, Rietveld saw the possibility to construct the seat and the back rest as one entity".¹²⁴ They went on to argue that, although the *Birza Chair* and the *Bow Chair* (which have a combined seat and back rest) did not have much in common with the *Zigzag Chair* when it comes to their shape, they were "in line with Rietveld's aim to construct a chair out of a minimal amount of elements; perhaps with the idea of putting them upon the market as industrially manufactured mass-products".¹²⁵

According to the authors, "the formal solution Rietveld found for the chair, fits entirely in the development of his oeuvre, in which time and time again, a very characteristic view on spatial experience manifests itself. Rietveld wanted to make furniture that would not confine space. He attempted to avoid physical as well as a visual delimitation of

¹²² Baroni 1978, p. 127.

¹²³ Drexler 1973, p. 5.

¹²⁴ "In het materiaal fiber zag Rietveld de mogelijkheid om zitting en rugleuning als één geheel te construeren", see: Küper and Schijndel 1987, p. 4.

¹²⁵ "[...] liggen zij alledrie in de lijn van Rietvelds streven om een stoel samen te stellen met zo min mogelijk onderdelen; wellicht met de gedachte ze als industrieel te vervaardigen massaproducten in de handel te brengen", see: Küper and Schijndel 1987, p. 4.

space”.¹²⁶ However, there were other factors, besides this personal view, that led Rietveld to his *ZigZag Chair* design. The authors mentioned the Freischwinger as an important influence: both the Freischwinger and the *Zigzag Chair* are cantilever chairs. Moreover, Küper and Schijndel were the first to point out the similarities between the *Zigzag Chair* and the *Sitzgeiststuhl* (1927), designed by Heinz and Bodo Rasch. Moreover, they pointed out, the chair’s name derived from the same poem written by Morgenstern that Rietveld had cited in his article ‘De stoel’ (‘The Chair’) in 1930. To conclude, the authors stated that, with the *Zigzag Chair*, “Rietveld achieved [...] a perfect synthesis in constructive and visual respect. At the same time, it can be established that even he was inspired by existing examples”.¹²⁷

So, with this article, Küper and Schijndel placed Rietveld’s design in a wider context, by examining the designs that probably influenced him. The authors established that, even though the chair was eventually not constructed out of one piece, it was certainly Rietveld’s intention to do so, and therefore, it should be regarded as a result from the principle that also led to design the *Birza Chair* and the *Bow Chair*.

A year later, in 1988, Küper published the results of her research into the Rietveld Schröder Archief, in book titled after the archive, which appeared alongside an exhibition in which several pieces of the archival material were featured. When speaking of Rietveld’s house core, the *Chauffeur’s Apartment* and his aim for an increased industrialisation of both the building trade and furniture production, Küper argued that the single-piece chairs he designed in 1927 are a result of the same aim, as were many of his later furniture designs.¹²⁸ Furthermore, Küper discussed archival material on the *Birza Chair*, and she stated that “Mechanical manufacture makes different demands on the design than an artisan execution would. A design that meets these demands of a mechanical production is the chair, that was made in 1927 as an experiment [...] of the material fibreboard”.¹²⁹ However, while it is true Rietveld had intentions to make a chair that could be mass-produced by machine, and the

¹²⁶ “[...] de formele oplossing die hij voor de stoel vond, past geheel in de ontwikkeling van zijn oeuvre, waarin zich steeds weer een zeer eigen opvatting over ruimtebeleving manifesteert. Rietveld wilde meubelen ontwerpen die de ruimte niet zouden begrenzen. Hij trachtte zowel een fysieke als een visuele afbakening van de ruimte te vermijden”, see: Küper and Schijndel 1987, pp. 7-8.

¹²⁷ “Rietveld bereikte in zijn ontwerp in constructief en visueel opzicht een volmaakte synthese. Tegelijkertijd kan geconstateerd worden dat ook hij zich liet inspireren door bestaande voorbeelden”, see: Küper and Schijndel 1987, p. 11.

¹²⁸ Küper 1988, p. 44.

¹²⁹ “Machinale vervaardiging stelt uiteraard andere eisen aan het ontwerp dan een ambachtelijke uitvoering. Een ontwerp dat aan de eisen voor machinale vervaardiging voldoet is de stoel, die in 1927 als experiment [...] uit het materiaal fiber is gemaakt”, see: Küper 1988, p. 193.

Birza Chair was a result of these intentions, it was clear that it could not serve Rietveld's purpose. As mentioned, the chair was extremely difficult to construct, and, moreover, the fibreboard tore under the pressure of curving the material.

Küper published another important book on Rietveld several years later, in 1992, co-written by art historian Ida van Zijl, who was (and still is) the Curator of Applied Arts at the Centraal Museum in Utrecht. This book, titled *Gerrit Th. Rietveld 1888-1964. Het volledige werk*, translated as *Gerrit Th. Rietveld 1888-1964. The Complete Works*, was published on the occasion of the exhibition *Gerrit Rietveld 1888-1964*, held at the Centraal Museum in Utrecht in the same year. It was the first time Rietveld's entire oeuvre – or at least, the large part that was known at the time – was published together in a catalogue. In the book's introduction, Küper and Zijl remarked that "As it happens more often, the cliché contains the sheer truth: Rietveld was far ahead of his time. Both his designs for chairs that are constructed out of one sheet of material and his core dwellings [...] were only put into practice much later by others".¹³⁰ Indeed Rietveld was one of the first designers of modern furniture that experimented with relatively new materials and construction methods, but it did not take long until others succeeded in making single-piece chairs. English furniture designer Gerald Summers (1899-1967), for instance, already constructed a chair out of one single curved sheet of plywood in 1933 (ill. 2.7).

When discussing Rietveld's *Aluminium Chair*, the authors cited part of Schenk's 1946 article on this chair, which included her statement that "the idea has taken shape, and now the ideal shape will come". Küper and Zijl consequently concluded that "The Dutch furniture industry was, however, unable to take up Rietveld's ideas en turn them into the ideal shape".¹³¹ This is not completely true: on the one hand, the furniture industry was not properly equipped to produce most of Rietveld's experimental furniture designs, but, on the other hand, one must also bear in mind that Rietveld often did not take the necessary steps to adapt his design to industrial production process. Moreover, it is striking that Küper and Zijl did not mention any other reasons (besides practical ones) for Rietveld to design a single-piece chair: they made no comments on the spatial and visual effects such a chair may have.

¹³⁰ "Zoals wel vaker bevat het cliché de zuivere waarheid: Rietveld was zijn tijd ver vooruit. Zowel zijn ontwerpen voor stoelen die uit één plaat materiaal zijn gemaakt, als de kernwoningen [...], zijn pas veel later door anderen in praktijk gebracht", see: Küper and Zijl 1992, p. 19.

¹³¹ "De Nederlandse meubelindustrie was echter niet bij machte Rietvelds ideeën op te pakken en om te zetten in de ideale vorm", see: Küper and Zijl 1992, pp. 209-210.

The same goes for Peter Vöge, who wrote the first catalogue raisonné of Rietveld's furniture (which disclosed many of Rietveld's design sketches), titled *The Complete Rietveld Furniture*, published in 1993. In the chapter 'The One-Piece Chair, an Industrial Optimum', part of the introductory essay 'Space, Simplicity, Relativity', Vöge provided the reader with an overview of Rietveld's single-piece chairs and other designs that were made with an industrial production in mind. Towards the end of the chapter, he aptly concluded his analysis by stating that "It is fairly obvious that Rietveld created his designs with a somewhat abstract view of the industrial possibilities. In particular, his one-piece chairs seem to be more of an expression of the concept of mass-production than designs that meet the actual requirements for the industrial manufacture of furniture. [...] A successful industrial designer must be able to modify his original concept over and over again, ultimately coming up with a new product that surpasses anything else on the market. Rietveld was too much of an original spirit to fit that mould".¹³² Indeed Rietveld seems to have been more interested in the experiment than in realising an industrial production, but these experiments with different materials and constructions were not only directed towards industrial production: Rietveld's interest in formal and spatial effects should not be forgotten.

In her most recent publication, *Gerrit Rietveld* (2010), Zijl placed the single-piece *Birza Chair* into a wider context: the development within Rietveld's oeuvre of furniture. In the chapter 'Experiments for industrial production', Zijl argued that: "The ongoing development of the Red-Blue Chair, in which the frame and the seat are two separate entities, proceeds via the tube framed chair [the *Bow Chair*], in which the seat serves as a structural connection between the two supports, to the *Birza Chair*, in which form and construction converge".¹³³ So, Zijl did not simply regard the *Birza Chair* as one of an entire series of single-piece chairs, but observed a formal and constructive development that connects his first iconic piece, the *Red Blue Chair*, to his single-piece *Birza Chair*. Zijl was the first author to critically analyse Rietveld's attempts to achieve industrial production of his designs, stating that "There is a striking discrepancy between his faith in the exigency and blessings of ongoing industrialization and the steps Rietveld actually took to advance it. [...] In Rietveld's vision, the designers, for all the good intentions, stands opposite or above

¹³² Vöge 1993, pp. 37-40.

¹³³ Zijl 2010, p. 97.

industry, and his ultimate and only objective is the spatial experience".¹³⁴ Here Zijl rightly concluded that it was not so much the mechanical furniture production that was to blame for Rietveld's unfeasible chair designs, it seems like he just did not take any measures necessary to adapt his designs to the demands of an industrial mass-production process.

Overall, it seems like art historians, who wrote about Rietveld's single-piece chairs after his death, did not pay much attention to the spatial and visual implications of these pieces of furniture. The main focus was directed towards Rietveld's aims for industrial production, and the single-piece chairs were merely regarded as a result of this aspiration. The furniture industry was blamed for its lack of mean or vision to execute Rietveld's designs, until Zijl correctly pointed out that this was also due to Rietveld's unwillingness to adapt his designs. Furthermore, since Küper and Schijndel published their article on the *Zigzag Chair*, more attempts have been made to trace possible precedents of Rietveld's designs than before.

So, after analysing Rietveld's writings on the concept of a single-piece chair, one can conclude that Rietveld regarded natural result of the demands of his own time, since it could be quickly and easily mass-produced by machine, preferably using just one sheet of material. In this time, he argued, one aimed – or should aim – for an interior freed from all superfluous elements, and furniture made from a reduced amount of material, like the single-piece chair, would suit such an environment perfectly. Rietveld's single-piece chairs were mostly appreciated by his contemporaries for their experimental value, and, according to some, these pieces would lead to a renewal of furniture design in general – widely available through efficient and modern industrial mass-production. After Rietveld's death, art historians mostly placed his single-piece chairs into the context of industrial production. The spatial and visual implications of these designs were largely disregarded, as were Rietveld's unwillingness to adapt his designs to the demands of mechanical mass-production, until Zijl pointed this out in 2010. Moreover, it took a rather long time before Rietveld's chairs were no longer regarded as purely autonomous designs, and were related increasingly to the pieces of his own oeuvre, as well as international furniture designs.

¹³⁴ Zijl 2010, p. 112.

Concluding remarks

Rietveld's writing show, that as an architect and a furniture designer, Rietveld had the intention to achieve an industrial mass-production of his designs: for him, quickly, cheaply and well-designed products and homes were simply a natural result of the opportunities the machine offered. The single-piece chair, Rietveld had hoped, would be one of these products that could be quickly and easily mass-produced by machine, using just one sheet of material. However, despite Rietveld's intentions, many of his designs were too difficult or even impossible to execute by machine, or they were simply commercially unviable for any manufacturer. The production history of his single-piece chairs show, that Rietveld was unwilling to take the necessary steps to adjust his designs to the demands of the furniture industry, which meant that most of them were bound to remain prototypes. It becomes clear, that the different materials and construction methods Rietveld used – illustrating his struggle with the medium – were directed toward experimentation, and less toward the realisation of industrial production. So, there is a discrepancy between his belief in industrial mass-production, and the actions Rietveld undertook to achieve this. Rietveld himself emphasised more than once, that his works and the remarks he made about them were simply not entirely consistent, or as he phrased it in 1953: “[...] I could make a couple of loose remarks, that I might later contradict in my own work, because the nature of art is contradictory to logic”.¹³⁵

Rietveld's experiments with the single-piece chair were greatly valued by Rietveld's contemporaries and by later art historians, who ascribed Rietveld a pioneering role in the search for new and improved chair designs, widely available through mass-production. It took a rather long time before Rietveld's chairs were no longer regarded as purely autonomous designs and were put in a wider context of furniture by other designers. However, the spatial and visual implications of Rietveld's single-piece chair designs have been largely overlooked, even though it seems hard to miss the fact that Rietveld aimed for an interior freed from all superfluties, and furniture made from a reduced amount of material, like the single-piece chair, would fit in this environment perfectly. It seems like the spatial effect of a single-piece chair was much more important to Rietveld than achieving

¹³⁵ “[...] ik zou enige losse opmerkingen kunnen maken, die ik later misschien zelf in eigen werk tegenspreek, want de aard van de kunst is in tegenspraak met de logica”, see: Rietveld 1953, p. 63.

industrial production, or as he phrased it in 1950: “There is a continuous search for greatest possible reduction of material; not for reasons of frugality, but to make the furniture as slender, as mobile as possible”.¹³⁶

Rietveld had a Utopian ideal: to produce a chair constructed out of one sheet of material only, that could be produced quickly, easily and cheaply by machine – making it widely available to everyone – and would take up just a minimal amount of space. Even though he came close to realising this ideal, he did not succeed. But that is not the end of the story. Rietveld’s search for a single-piece chair led him to other designs, such as the *Bow Chair* or the *Zigzag Chair* constructed out of four boards, that were produced in series. Moreover, Rietveld was not the only – although one of the first – designer of modern furniture to occupy himself with the concept of a single-piece chair. Furniture designers of his own time and after, executed this idea in a large number of ways, with different points of departure in mind, which resulted in a very multiform production of single-piece chairs. Nevertheless, as will be substantiated in the next chapter, a lineage can be traced, running from Rietveld to the present, along designers who focused on the possibilities of mass-production, using new materials and techniques, while aiming to design a chair as light and reduced as possible.

¹³⁶ Rietveld 1950, p. 5.

2. The single-piece chair after Rietveld

2.1. The single-piece chair goes multiform

In the previous chapter it became clear that, in his single-piece chair designs, Rietveld was striving for a synthesis between function, form, material and construction, while employing mass-production techniques – even though he hardly succeeded in achieving mass-production itself. With this synthesis as an underlying principle for his designs, Rietveld can be placed in a functionalist context of design. From the 1920s onward, a large number of avant-garde designers, like the members of modernist movements such as the Bauhaus, De Stijl and Het Nieuwe Bouwen, created their furniture in the same functionalist tradition as Rietveld did. Other style movements, such as Art Deco, existed simultaneously, but did not aspire the same synthesis as functionalists in their designs. With the furniture of Alvar Aalto, an organic approach was added to the vocabulary of functionalist design during the 1930s, as a reaction to the initial strictly geometric approach developed in the 1920s. Aalto rejected the angular aesthetic of the functionalist avant-garde, and instead of cold and sterile materials like tubular steel, he chose wood (most often bent plywood and laminated wood), which he regarded as a “form-inspiring, profoundly human material”.¹³⁷ Aalto's furniture – as is organic furniture in general – was characterised by flowing lines, ergonomic shapes and a harmonious balance in proportion, material and colour (ill. 2.1). His wooden chairs had a more friendly, soft and warm look than the angular tubular steel furniture, and appealed more easily to a broad audience.

Aalto's furniture, along with that of Finnish American architect and designer of organic furniture Eero Saarinen (1910-1961), exerted a strong influence on many later designers. Among these designers were Charles and Ray Eames, who are regarded as the most important representatives of organic design. They experimented with new materials and techniques from the 1940s well into the 1960s, and the upholstered, moulded plywood chairs they designed with Eero Saarinen for The Museum of Modern Art's 1940 *Organic Design in Home Furnishings* competition won them first prize (ill. 2.2).¹³⁸ Their wish to mould plywood in three dimensions led them to develop a custom-built press in 1941, which could

¹³⁷ Fiell and Fiell 2005 (b), pp. 531-533.

¹³⁸ Murphy, Colomina and Albrecht 1997, p. 74.

mould pieces of plywood in complex shapes, using high frequency waves to dry the glue between the layers of veneer. In 1948, the Eameses won second prize in the Museum of Modern Art's *International Competition for Low-Cost Furniture Design* with their series of chairs which incorporated a combined seat and back component, or shell, made of glassfibre-reinforced polyester (ill. 2.3). These chairs were the result of the couples' strive for furniture that was cheap, lightweight, versatile and fit for young families.¹³⁹ Furthermore, the plastic shell chairs by the Eameses were the first amongst the first unlined, plastic pieces of furniture to be mass-produced.¹⁴⁰

Until the 1960s, functionalism remained the leading movement in furniture design, with the designs by Aalto, Saarinen, the Eameses and Danish architect and designer Arne Jacobsen (1902-1971) as important exponents. However, after World War II, more and more designers developed different types of syntheses between the various design aspects, as alternatives to the synthesis Rietveld and other functionalists aspired to. These aspects – function, form, material, construction and industrial mass-production – were pulled apart, which led to chairs designed with varying emphasises on the different design principles. In some cases, the reorientation within this synthesis led to single-piece chair designs which display completely opposite intentions: for instance, in one design a certain sculptural form may have been the primary starting point, while in another the latest materials and construction methods are employed to create an extremely high-tech chair. The increase in material and technical possibilities resulted in a strong connection between industrial production and the development of 20th century furniture design. On the one hand, the demands some designers made of their material – like Charles and Ray Eames, who wanted to mould the plywood shells for their chair designs in three dimensions – led to the development of new production techniques such as high frequency plywood moulding. On the other hand, the developments of new materials like moulded plastic, initially used to imitate more expensive materials, made the production of plastic single-piece chairs possible.

The development of synthetic polymers, or plastics, already began in the 19th century, with the respective inventions of vulcanised rubber in 1844, celluloid in 1870 and Bakelite in 1907. When the patent on Bakelite ended in 1927 and a number of other plastics

¹³⁹ Murphy, Colomina and Albrecht 1997, p. 86.

¹⁴⁰ Fiell and Fiell 2005 (b), p. 229.

were developed, the material began to be widely used in the 1920s for a large variety of consumer goods. During the economic depression of the 1930s, plastic consumer goods offered an affordable alternative to other, more expensive materials, and this continued during World War II, when natural sources became exhausted and plastic products were used as cheap imitations.¹⁴¹ In the 1950s, several furniture designers began to use plastic in their designs, not as an imitation, but as a fully-fledged material. They started to look for ways to fully exploit the characteristics of the material, because plastics offered designers a whole new array of functional and aesthetic potentialities: fluid shapes, shiny surfaces and bright colours.¹⁴² However, the introduction of plastics into the furniture industry also brought along specific difficulties that had to be dealt with. It took some time before the (injection-)moulding technology was perfected, and each type of plastic brought along its own specific advantages and disadvantages. Plastics asked for a completely different approach of the designer than wood or metal did, and a new balance between form and material had to be found: the mouldable, fluid material asked for a plastic-organic approach, instead of a spatial-constructive one. With the rise of pop culture in the early 1960, a large number of designers moved away from the dogmas of functionalism. Instead, they adhered to a new aesthetic of flexibility, playfulness and temporality, and plastics proved to be the perfect medium for this new aesthetic. However, after the economic crisis of the mid 1970s, a heightened awareness of the environmental implications of the material arose, and designers tried to find ways to use plastics in a more durable way.¹⁴³

It is striking that, when it comes to plastic furniture designs, Italian designers occupy a prominent position. The development of the plastics industry in Italy, which deviates from the rest of the world, offers an explanation. After the production of celluloid was begun in Italy in 1924, the synthetics industry grew rapidly. However, during the 1930s, the Italian government limited the import of raw materials in its strive for autonomy, and the consequent shortage of raw materials stimulated a search for alternative materials and technologies. After World War II, the developments in the area of the plastics industry, which brought forth new materials like polypropylene, proved to be a great advantage for Italy: from the early 1950s until the outbreak of the energy crisis in the 1970s, Italian design

¹⁴¹ Máčel, Woertman and Wijk 2008, pp. 91-92.

¹⁴² Máčel, Woertman and Wijk 2008, p. 94.

¹⁴³ Máčel, Woertman and Wijk 2008, pp. 94-95.

of plastic products, including furniture, was leading.¹⁴⁴ Moreover, the Italian magazine *Domus*, (established by architect and industrial designer Gio Ponti (1891-1979) in 1928), which focuses on architecture and design, offers Italian furniture designers an excellent platform for their work.¹⁴⁵ The bilingual magazine, with articles printed in both English and Italian, is one of the most influential international magazines of its kind.

Whoever leafs through a book with a selective overview of the modern chair, like Charlotte and Peter Fiell's *1000 Chairs* (2005), finds numerous examples of single-piece chairs made during and after Rietveld's time. These examples display a very diverse range of forms, constructions, colours, materials, and, most importantly, intentions. In some cases, the intention of the designer may be similar to Rietveld's, seeking a more or less similar synthesis, but in other cases, a solid comparison cannot be made at all. When using Rietveld's single-piece chair designs and their underlying principles as a standard for the large and diverse group of single-piece chairs by other designers, three arbitrary categories can be made to structure the group: firstly, chairs that, despite being produced out of a single piece of material, have little else in common with Rietveld's designs, secondly, single-piece chairs that have some affinity with Rietveld's chairs, but clearly originate from a different set of principles, and thirdly, single-piece chairs that were designed along the same lines as Rietveld's pieces.

Most of the single-piece chairs that can be put in the first category can be said to have a common underlying intention, namely: to be unique, not generic. This can be explained by the fact that, after World War II, furniture became a mass-produced, disposable consumer good to an increased extent. Some designers questioned the supposed advantages of mass-production, and they preferred to produce chairs with unique instead of identical characteristics, or chairs with a highly artistic and sculptural character. Such chairs appeal to people's longing for individuality and their wish to possess a unique piece of furniture (which sometimes acquires the value of a work of art), while chairs by designers working in a functionalist tradition, such as Rietveld, are made in large quantities for an anonymous and generic public. For the type of single-piece chair that is created to be a (semi-)unique object, craft and craftsmanship are employed to realise a standardised, serial

¹⁴⁴ Máčel, Woertman and Wijk 2008, pp. 93-94.

¹⁴⁵ Fiell and Fiell 2005 (b), p. 562.

production of chairs: craftsmanship is often rehabilitated, instead of exploring the possibilities of industrial mass-production.

A large number of single-piece chairs that display this tendency for uniqueness, were produced by designers of biomorphic furniture. Biomorphic design should not be confused with organic design: although the two movements brought forth designs that may have formal similarities, biomorphic design copies and alters shapes taken from nature, like plants or the human body, for a purely decorative purpose. Biomorphic ornaments were already used during the baroque, rococo and Jugendstil style periods, but they became particularly popular during the 1950s and 1960s, and, once more, in the 1990s.¹⁴⁶ A well-known German designer of biomorphic furniture, Luigi Colani (b. 1928 as Lutz Colani), expressed his aesthetic as following: “We evolve on a round planet, all that surrounds us is curvilinear, therefore I don’t see why we should detach ourselves from our environment, hiding behind straight lines and sharp corners that correspond to nothing. I’ve come to a pretty certain conclusion. Nature sculpts perfect designs”.¹⁴⁷ The asymmetrical, fluid and sculptural shapes of this type of biomorphic furniture were, ironically, best expressed in synthetic materials such as injection-moulded plastic, like Colani used for his *Zocker* chair (1971-1972) (ill. 2.4). Overall, it is clear that such chairs do not have much in common with Rietveld's designs. Rietveld never had a tendency to incorporate biomorphic and plastic forms, nor did he use a material like injection-moulded plastic to construct an entire chair. Moreover, he aimed to produce large quantities of identical single-piece chairs, suitable for every home, instead of unique pieces.

The single-piece chairs in the second category are affiliated to Rietveld's designs to a certain extent. When keeping in mind the approach Rietveld took towards the five design aspects (function, form, material, construction and industrial mass-production), these designs contain only a superficial similarity: they were made with different intentions, but Rietveld may have actually approved of the final result. An example of such a single-piece chair is Alberto Meda’s (b. 1945) *Light Light Chair*, designed in 1987 (ill. 2.5). Meda, who was originally trained as a mechanical engineer in Milan, uses technology to achieve fluidity and unity of shape and structure in his furniture designs.¹⁴⁸ Meda has stated: “Paradox: the more

¹⁴⁶ Fiell and Fiell 2005 (b), p. 118.

¹⁴⁷ Pernodet and Mehly 2000, pp. 58-59.

¹⁴⁸ Fiell and Fiell 2005 (b), p. 458.

complex the technology, the more it is suitable for the production of objects for simple use, with a unitary image, almost organic”, and this paradox is very much embodied by his *Light Light Chair*.¹⁴⁹ His objective for the chair was “lightness, to reveal structural performance, [...] reducing the sections to a minimum, working by 'subtraction'”, or in short, a chair that is as lightweight and reduced as possible. Meda tried to achieve this objective by using a complex production process to create the chair, which consists of a Nomex composite honeycomb core, coated with carbon-fibre. During this process, the materials merge and are transformed into one continuous shape. The legs as well as the backrest of this chair, which weighs less than a kilo, are reduced to a minimum, while the seat is as thin as possible.¹⁵⁰ For that matter, the formal similarities between the backrests of the *Light Light Chair* and Colani’s *Zocker* are striking: it is interesting to see how designers with such different starting points arrived at a comparably shaped chair.

Although Meda succeeded in creating an incredibly light chair for which he used the latest technologies and materials, it was very costly to produce. Moreover, user tests showed that the chair was too lightweight and too high-tech to be accepted by a wide public.¹⁵¹ The *Light Light Chair* was obviously not destined for mass-production, but then again, this does not seem to have been one of Meda’s concerns. Rietveld, on the contrary, did aim for a mass-production of his single-piece chairs – in theory, at least – and employed inexpensive materials and uncomplicated constructions and production techniques to achieve this. Nevertheless, Rietveld was also aiming for a reduction of material in his single-piece chairs, for both economical and spatial reasons, while experimenting with different materials and constructions. As an experiment in finding applications for carbon fibre composites within the furniture industry, the *Light Light Chair* was a pioneering and highly influential design.¹⁵² Therefore, Rietveld may actually have appreciated Meda’s innovative, reduced and lightweight chair.

The last category, to which the next section is devoted, is the most relevant for this thesis. The chairs that come under this heading show, how Rietveld’s range of ideas on the single-piece chair was developed and continued, up to the present day. The designers of these single-piece chairs used materials and techniques in an innovative way, while aiming

¹⁴⁹ Roberts 2007, p. 61.

¹⁵⁰ Fiell and Fiell 2009, p. 217.

¹⁵¹ Roberts 2007, p. 61.

¹⁵² Fiell and Fiell 2009, p. 217.

to design a chair as light and reduced as possible and exploiting the possibilities of mass-production. The selection in this category, however, also shows that some of the design principles mentioned at the beginning of this section preponderate over others, resulting in a diverse set of designs.

2.2. Rietveld's legacy

When placing single-piece chairs in a functionalist tradition that takes Rietveld as a pivotal point, it raises questions about the extent of the designers' knowledge of Rietveld's oeuvre and the direct influence Rietveld might have exerted on them. It is often hard to determine with certainty that designers knew his furniture designs, but since Rietveld had many ties to the international avant-garde and travelled abroad, it is very likely most designers of modern furniture had seen his work. Rietveld's oeuvre received an increased amount of attention in the 1950s, when different retrospectives on his work and De Stijl were organized and Theodore Brown's published his dissertation on Rietveld, which makes it certain most post-war designers had been exposed to Rietveld's furniture. Nevertheless, Rietveld's body of thought was shared by a larger number of architects and designers (such as Mart Stam, Marcel Breuer and Ludwig Mies van der Rohe) who also spread the design principles he adhered to. It is important to establish that the designs that follow below were made in the same functionalist tradition, and they are an international, not an exclusively Dutch phenomenon. In the following discussion, it will be established how the different single-piece chairs relate to the synthesis between function, form, material, construction and mass-production techniques that Rietveld aimed for.

The *LaWo Chair* (c. 1941), designed by Han Pieck (1924-2010), was the first Dutch single-piece chair to be made out of just one sheet of bent laminated wood (ill. 2.6). This sheet was bent with a high-frequency plywood press, and by making incisions in the material, a strip of wood on each side of the chair could be curved backward to form the armrests, which pass into the back legs of the chair. Pieck was educated at the IvKNO from 1939 till 1941, where he was taught by functionalist architects and furniture designers Mart Stam and Johan Niegeman (1902-1977).¹⁵³ Even though Peter Vöge dated the chair 1944, Pieck designed his chair as a final project at the IvKNO, which means it could probably be dated as early as 1941.¹⁵⁴ The production history of the chair is characterised by difficulties. When Pieck originally designed his chair during World War II, the shortage of raw materials, wood included, made the execution of Pieck's design impossible. After the war, Pieck met a former employee of aircraft manufacturer Fokker, Maarten van Raalte, who had experience

¹⁵³ Vöge 1986 (a), p. 36.

¹⁵⁴ Arnoldussen 2006, p. 24.

with the technology of high-frequency wood lamination.¹⁵⁵ Together they started their company LaWo (an abbreviation of Laminated Wood), and managed to obtain a contract for 10,000 of Piecks chairs with an Amsterdam sales firm. Unfortunately, the bending of laminated wood, with the use of the high-frequency press they built, proved to be too complicated. Pieck and Raalte were unable to produce enough chairs, and their contract was lost. The LaWo company was dissolved in 1948, after only a total of around 1300 chairs were produced.¹⁵⁶

Pieck's name soon fell into oblivion, and in 1950, his *LaWo Chair* was featured as an anonymous entry in an exhibition titled *Schoonheid in Huis en Hof (Beauty in Home and Garden)* in Amersfoort, for which Rietveld acted as exhibition architect. According to the chairman of the exhibition committee, architect David Zuiderhoek (1911-1993), Rietveld regarded the *LaWo Chair* as an "interesting, but not entirely successful design".¹⁵⁷

Unfortunately for Pieck – even though it must have been flattering – the chair was attributed to Rietveld himself in a review of the exhibition in *De vrouw en haar huis*.¹⁵⁸ According to the author of the article, the chair could be regarded as a descendant of Rietveld's *Aluminium Chair*, and, unlike the latter, the critic wrote, it would even be suitable for some interiors. It was not until 1986 that Pieck's chair received renewed attention, when it was published in Peter Vöge's *Stoelen. Nederlandse ontwerpen 1945-1985*, and in 2006, Pieck announced he was planning to restart the production of the *LaWo Chair* in collaboration with shop and gallery Wonderwood in Amsterdam. Unfortunately, Pieck died in 2010 and these plans remained unexecuted.¹⁵⁹

Pieck was actually not the first to design an armchair created with just one sheet of bent wood. English furniture designer Gerald Summers (1899-1967) preceded Pieck when he designed a similar chair in 1934 (ill. 2.7). Summers displayed a pragmatic approach to design, and he aimed to produce simple, practical and economical pieces of furniture – hence the name of his furniture company, Makers of Simple Furniture (established in 1931).¹⁶⁰

¹⁵⁵ Máčel, Woertman and Wijk 2008, p. 230.

¹⁵⁶ Vöge 1986 (a), pp. 39-40.

¹⁵⁷ Vöge 1986 (a), p. 41, and <<http://zoeken.nai.nl/CIS/persoon/4428>> (01-08-2011).

¹⁵⁸ Vöge 1986 (a), p. 41.

¹⁵⁹ Arnoldussen 2006, p. 24.

¹⁶⁰ Summers' approach to furniture design is illustrated by the following statement, which he made in an article in *Design for To-day* in 1935: "The first consideration in design is purpose and, having decided this, the designer can consider how he will fulfill that purpose. Then follows consideration of the medium most suitable for gaining this fulfillment. Finally, consideration of the possibilities and limitations of the medium for the purpose

Summers found plywood suitable for his purpose, because it was a modern and inexpensive material.¹⁶¹ Summers's designs were sold in Britain and America, which meant they received little exposure on the continent, and it is possible Pieck had no knowledge of Summers's design as he claimed.¹⁶² Nevertheless, the idea of making a chair by bending a single piece of plywood or laminated wood seems to have been pursued by more than one designer at the time. The flexible but firm qualities of the inexpensive material, that could be bent quickly and easily, seem to have suggested the possibility to them.

The exploration by both Pieck and Summers of the possibilities of the material, pushing both its flexible and rigid qualities to the extreme, is very similar to Rietveld's material experiments of 1927 with plywood and fibreboard for his single-piece chairs. Since Mart Stam, who taught Pieck at the IvKNO, knew Rietveld very well and shared his convictions, it seems plausible Rietveld's work was part of the school's curriculum, and it is very likely Pieck had at least some knowledge of his furniture.¹⁶³ One can only speculate about Summers's knowledge of Rietveld's designs, but pieces like Summers's 1934 folding coffee table, which was designed in a geometric idiom very similar to Rietveld's asymmetrical side table (1923), suggest that he did know Rietveld's work (ills. 2.8, 2.9).¹⁶⁴ Although Rietveld never made an entire chair out of a single sheet of plywood, Pieck's and Summers's single-piece chairs are in line with his experiments with material, construction and form. Both Pieck and Summers aimed for industrial mass-production of their chairs, but only Summers succeeded. Pieck lacked the appropriate machinery, and the Dutch furniture industry did not offer him a solution either, so unfortunately, this design never had a chance to display its full potential. The cases of these two individual designers illustrate very well how different circumstances play an important role in the commercial success a design achieves. They both had a similar idea – to create a single-piece, plywood lounge chair – but the machinery, commercial network and investors Summers had to his disposal, enabled him to produce and sell fairly large quantities of his chair, while Pieck failed to do the same.

When plastics came to stay in furniture design in the 1950s and 1960s, plywood became merely one of the materials and technologies available to furniture designers, and

of deciding the method of construction to be employed", see: Deese 1992, p. 194.

¹⁶¹ Deese 1992, p. 185.

¹⁶² Deese 1992, p. 192, and Vöge 1986 (a), p. 36.

¹⁶³ From October 1950 until June 1952, Rietveld taught History of Interior Design at the IvKNO, but of course, Pieck had already left the school by that time, see: Slothouber 1997, pp. 94-97.

¹⁶⁴ Deese 1992, p. 189.

very few innovative plywood designs were created during the 1970s and 1980s. In the 1990s, the critical reassessment of mid-century modern design, illustrated by exhibitions like the Eames retrospective organised by the Vitra Design Museum in 1997, sparked a renewed and wide interest in plywood furniture.¹⁶⁵ Plywood, with its characteristic warmth, elegance and directness, regained its popularity among a new generation of furniture designers and had not lost its appeal for a wide audience.

Roderick Vos (b. 1965) belongs to this new generation of designers working with plywood. His *RePLY Chair* (2010), the answer to the traditional wooden farmer chair according to Vos, is made from a single sheet of incised and bent plywood, with varying thickness (ill. 2.10). Vos stated, that he aims to design beautiful, simple, self-evident and affordable pieces of furniture that appeal to a large audience.¹⁶⁶ For Vos, "a one piece chair is the optimum in machine oriented furniture design", and he claims to be fascinated by industrial processes.¹⁶⁷ The *RePLY Chair*, nevertheless, is not just a straightforward piece of furniture: it seems like Vos also put much thinking into the form of the chair. The chair is ergonomically shaped, and moreover, it almost resembles a shrugging, seated human figure. With its playful air it is less formal than Summers' and Pieck's designs. In his aim to achieve a synthesis between uncomplicated but innovative forms and structures in his furniture, while employing new technologies and industrial production, Vos's objectives are similar to Rietveld's, although he seems to be much more of a commercial man than Rietveld ever was.

Canadian American architect Frank Gehry (b. 1929) went one step further, and did not take wood, but cardboard as a starting point for his series of furniture designs titled *Easy Edges* (1972) (ill. 2.11). The use of cardboard in furniture in itself was not new: during the 1960s, sheets of the material were used for folded pieces of furniture, such as Peter Murdoch's *Spotty* chair (1964), as a cheap, lightweight and playful alternative to traditional and conventional wooden furniture (ill. 2.12).¹⁶⁸ Gehry, however, took a different approach to the material. One day, Gehry explained, he saw a pile of corrugated cardboard outside his office (which is the material he used for building architectural models) , and as he did not like the look of folded cardboard with its structural shapes, he "began to play with it, to glue

¹⁶⁵ Ngo 2003, pp. 68-72.

¹⁶⁶ <http://www.eijerkamp.nl/extra/nieuws/bert_plantage_reply_stoel_roderick_vos/> (25-07-2011).

¹⁶⁷ <<http://mocoloco.com/fresh2/2011/01/14/reply-chair-by-roderick-vos.php>> (25-07-2011).

¹⁶⁸ Vegesack and Dunas 1996, p. 52.

it together and to cut it into shapes with a hand saw and a pocket knife”.¹⁶⁹ Gehry glued layers of corrugated cardboard together – with the layers running in alternating directions, like the veneers in plywood – and called the material *Edge Board*. The exposed edges of the cardboard layers with their fuzzy texture that is almost “like corduroy”, offered Gehry a “pleasant” texture.¹⁷⁰ The *Easy Edges* series he consequently designed comprised seventeen sturdy, inexpensive pieces (some were selling for only \$15) and appealed to a wide audience.¹⁷¹ The *Easy Edges* series was sold in different department stores and became an instant success. Gehry, however, felt threatened by the success of the *Easy Edges* furniture, and he decided he would rather profile himself as an architect, not as a furniture designer. Consequently, the sale of the *Easy Edges* series, including the *Wiggle Chair*, was halted.¹⁷²

The least conventional piece of the series is the *Wiggle Chair*, which resembles a snake, coiled up and ready to strike. In their publication *Deconstructing Product Design*, William Lidwell and Gerry Manacsa draw a parallel between Gehry's *Wiggle Chair* and Rietveld's *Zigzag Chair*. According to them, Rietveld is to credit for the “innovation of form”, but Gehry's chair “transcends the original”, because, the authors argue, the organic design tells “a clear story about the nature of its material” while serving as a functional seat at the same time.¹⁷³ This argument is not thoroughly convincing: Rietveld, like Gehry, openly showed the material and construction he used in his *Zigzag Chair*, which was just as avant-garde at the time as Gehry's use of laminated cardboard, and it still functioned as a seat. Moreover, one needs to bear in mind that the approaches they took in designing a single-piece chair were very different: Rietveld used a constructive approach, by building his *Zigzag Chair* up in space from different elements, whereas Gehry took an organic approach, by regarding his *Wiggle Chair* as one, fluid form. A qualitative comparison of the forms of these chairs, therefore, seems faulty. Nevertheless, Gehry's exploration of the possibilities and innovative use of the material, while introducing new forms, and employing industrial mass-production to make inexpensive chairs, is quite in the spirit of Rietveld.

One of the earliest experiments directed at creating a single-piece chair out of plastics, was the lounge chair American designers Robert E. Lewis and James Prestini (1908-

¹⁶⁹ Vegesack and Dunas 1996, p. 52.

¹⁷⁰ Isenberg and Gehry 2009, p. 189.

¹⁷¹ Lidwell and Manacsa 2009, p. 206.

¹⁷² Nevertheless, Vitra has been producing remakes of four of the *Easy Edges* pieces since 1988, see: Vegesack and Dunas 1996, p. 52.

¹⁷³ Lidwell and Manacsa 2009, p. 206.

1993) created in collaboration with the Armour Research Foundation, as an entry for the Museum of Modern Art's *International Competition for Low-Cost Furniture Design* (ill. 2.13). This single-piece lounge chair was made from resin-impregnated wood fibre which was pressed into a mould. According to the MoMA's booklet that discussed the different entries of the competition, the team of designers of the chair "concentrated its effort on the development of a large, comfortable one-piece chair in molded plastic designed to issue from its mold fully finished with integral coloring and perfect surface".¹⁷⁴ Aesthetically, the chair is not quite satisfying: it is rather large, and its legs appear to be just a bit too short. Even though the moulded plastic enabled the chair to have a flowing outline, its basic form is still that of a conventional upholstered armchair. It seems like the competitions committee mostly appreciated Lewis's and Prestini's material, constructive and technological achievements, as the team was awarded the prize for the best research report.¹⁷⁵ Whether the chair was actually inexpensive to produce, as the competition demanded, is unknown. However, since the MoMA's competition was primarily aimed at low-cost furniture, this was probably the main drive for Prestini and Lewis to mould their design with plastic, and the introduction of new shapes to the vocabulary of furniture design, to accompany this new medium, did not concern them. It is clear that the material, constructive and technical principles underlying this chair prevail over form, with an emphasis on innovation. Like it was the case with Rietveld's *Birza Chair*, the intention to design a single-piece chair using an experimental and new material that implies a continuous shape, is key in understanding Lewis's and Prestini's lounge chair.

While Prestini's and Lewis's chair was not developed past the stage of prototype, the *Panton Chair* (1957-1960), designed by Danish architect and industrial designer Verner Panton (1926-1998), proved that it was possible to mass-produce a plastic single-piece chair (ill. 2.14). In Panton's cantilever chair, which was made by injecting plastic into a mould, backrest, seat and legs (or leg) are combined in one sweeping motion. When Panton designed this chair between 1957 and 1960, it was not the first time the idea of a cantilever chair occupied him. He already made sketches for such a chair during his studies at the Royal Academy of Art in Copenhagen, and in 1956 he competed in the *Europäischen Wettbewerb für Möbel-Entwürfe* (*European Competition for Furniture Design*), organized by German

¹⁷⁴ Kaufmann 1950, p. 44.

¹⁷⁵ Kaufmann 1950, p. 44.

foundation Neue Gemeinschaft für Wohnkultur (New Society for Taste in Home Decor) with a design for a chair made from a single sheet of moulded plywood, shaped like a continuous S.¹⁷⁶ It took ten years before this chair was finally executed: it was taken into production in 1965 by Thonet as *Model no. 275* or *S-Chair* (ill. 2.15).¹⁷⁷ After designing his single-piece plywood chair, Panton continued by exploring the possibilities of plastic. He was attracted to the possibilities that the material offered: it nearly guaranteed a fabrication of inexpensive products, and it did not limit the designer to any particular forms.¹⁷⁸

After the production of his first prototype in the late 1950s, however, Panton could not find a suitable manufacturer that was able and willing to produce his chair. Eventually, the owner of furniture manufacturer Vitra, Willy Fehlbaum, who fabricated Herman Miller products under license, ventured upon the production of the *Panton Chair*. Panton's design was adapted to make it stackable, and the eventual model was made from fibreglass-reinforced polyester in 1967. This material rendered the details of the design beautifully, but the sanding process, that was necessary for a smooth surface finish, took up too much time and labour. After experimenting with several other materials, the production of the *Panton Chair* was halted in 1979 until 1990, when Vitra started producing the chair once more, this time using HR foam.¹⁷⁹ This long process of finding the right type of plastic is illustrative of the struggle with material designers have to go through, when attempting to realise their designs by pushing the potentialities of the material to the extreme. Panton was the first designer to realise the mass-production of a single-piece, injection-moulded plastic chair, but this was by no means an effortless achievement: not only did it take almost ten years before Panton could see his design executed, even then, difficulties with the chosen material repeatedly surfaced.

Even though he is often heralded as the godfather of the plastic single-piece chair – and the creator of an icon of pop culture – Panton was not the only one who considered the idea. Around 1953, two Danes, architect Poul Kjaerholm (1929-1980), in whose architecture studio Panton worked between 1950 and 1952, and sculptor and designer Gunnar Aagaard Andersen (1919-1982) both created a prototype of a cantilever chair which looked

¹⁷⁶ Vegesack and Remmele 2000, p. 76.

¹⁷⁷ Vegesack and Remmele 2000, pp. 76-78.

¹⁷⁸ Vegesack and Dunas 1996, p. 164.

¹⁷⁹ Máčel, Woertman and Wijk 2008, pp. 110-111. Between 1983 and the late 1980s, the Panton Chair was made from HR foam by another furniture manufacturer, Horn GmbH & Co. KG in Rudersberg, see: Vegesack and Dunas 1996, p. 164.

incredibly similar to Panton's chair (ills. 2.16, 2.17). As soon as Panton's chair was featured in Danish furniture magazine *Mobilia* in 1967, Kjaerholm and Andersen responded by publishing their prototypes in the magazine, laying claims on the design. Panton denied, of course, he had ever seen their designs before.¹⁸⁰ In his publication *100 Masterpieces from the Vitra Design Museum Collection* (1996), the Vitra Design Museum's curator, Alexander von Vegesack, suggests that during the long period between Panton's initial design and its execution, the chair was exposed to several other designers, who consequently elaborated on the idea.¹⁸¹ This seems unlikely – even though it makes sense that Vitra, as the producer of the *Panton Chair*, would want to convince the audience that the chair is an original and innovative design – since Panton designed his chair in the late 1950s, and Kjaerholm's and Andersen's prototypes date from around 1953. Both Kjaerholm and Andersen had anticipated to execute their cantilever chair designs using glassfibre-reinforced polyester, the same material the *Panton Chair* was initially made of.¹⁸² It seems like all three designers had conceived the same idea: that plastic is a perfect medium for a cantilever single-piece chair, or perhaps, that a cantilever single-piece chair is the perfect form for a chair made of plastic. Who came up first with this concept is hard to determine, but the idea that making a single-piece chair out of plastic forms a good design solution most definitely appealed to more than one designer.

Of course, it is hard not to notice the similarities between the *S-Chair*, the *Panton Chair* and Rietveld's *Zigzag Chair* – the latter were even shown together at the most recent exhibition on Rietveld's work in Utrecht, *Rietveld's Universum (Rietveld's Universe)* (2010-2011).¹⁸³ Like the *Zigzag Chair*, the form of these chairs by Panton is not based on the shape of two boxes on top of each other, like the early functionalist cantilever chairs, but on a Z-shape, which intersects the bottom box. Panton always denied that he knew Rietveld's *Zigzag Chair* when he designed his cantilever chairs, and even though this is possible, it is unlikely. Rietveld's furniture was well-known among avant-garde designers at the time, and some designers from Panton's circle, like Kjaerholm, were even acquainted with Rietveld.

¹⁸⁰ Vegesack and Remmele 2000, p. 92.

¹⁸¹ Vegesack and Dunas 1996, p. 164.

¹⁸² Kjaerholm had intentions to execute his design with glassfibre-reinforced plastics or welded steel wire, while Andersen anticipated on using only the first of those materials. See: Fiell and Fiell 2005 (a), p. 305, and Helmer-Petersen and Wilkins 2007, p. 47.

¹⁸³ Compared to Rietveld's *Zigzag Chair* made from a single-piece of plywood, Panton's *S-Chair* is more technically advanced: the plywood is much thinner and moulded in three instead of two dimensions.

For instance, in 1963, Rietveld gave a lecture at the opening of an exhibition of furniture designs by Kjaerholm (who was present) at Metz & Co in Amsterdam.¹⁸⁴ However, it was not unusual for designers to deny certain influences, because they want their designs to be perceived as original, or as Pantón stated in 1950: “I try to forget existing examples even though they may be good, and concern myself above all with the material. The result then rarely has four legs, not because I do not wish to make such a chair, but because the processing of materials like wire or polyester calls for new shapes. The mere question of one or four legs I find rather unimportant”.¹⁸⁵ By explaining his design principles this way, Pantón claims that the shape of his chair was not inspired by any existing designs – like Rietveld's *Zigzag Chair* – but was a natural result of these principles. It seems to be more likely, though, that Pantón took the cantilever form as a starting point, since he had already experimented with this concept for several years. He seems to have been looking for another way to execute this idea, after which he arrived at plastics.

Leaving the question of Pantón's awareness of Rietveld's *Zigzag Chair* aside, it is obvious that the idea single-piece chair made from plastic was considered by a number of designers during the 1950s and 1960s. The material, moulded plastic, was exceptionally suitable to express the fluid, organic shapes that became increasingly popular in furniture design at the time, and the earlier experiments of the Eameses with plastic shells provided an important exemplary innovation. The *Pantón Chair* also fits very well in Rietveld's tradition of functionalist design: it embodies all the technological, formal, and economic goals to which the earliest functionalist designers already aspired. The chair, with its plastic shape, is comfortable for the sitter, while its cantilever structure adds flexibility. The injection-moulding production technique reduces the complexity of the manufacturing process, and moreover, the low-cost material reveals its construction.¹⁸⁶ Yet, the production history of the *Pantón Chair* includes recurring difficulties with the suitability of the materials used, which even caused the production of the chair to be halted for several years at one point, and so, it does not quite reach Rietveld's ideal of an uncomplicated, quickly and mechanically produced single-piece chair.

¹⁸⁴ Vries and Rietveld 1963, pp. 14-16.

¹⁸⁵ “Ich versuche existierende, auch gute Beispiele, zu vergessen und beschäftige mich vor allem mit dem Material. Das Resultat hat dann selten vier Beine, nicht weil ich keinen solchen Stuhl machen will, sondern weil Materialien wie Draht oder Polyester durch ihre Verarbeitungstechnik neue Formen verlangen. Aber, ob nur ein Bein oder vier, das finde ich nicht so bedeutend“, see: Anonymous 1969, p. 3.

¹⁸⁶ Ngo 2003, p. 68.

As mentioned in the previous section, an increasing number of designers rejected the ideal of mass-produced, identical objects after World War II, and created pieces of furniture with a plastic character or unique elements as a counteract. An example that is essential to mention in the context surrounding both Rietveld's *Zigzag Chair* and Panton's later chair, is the *Amateurs Masters S* chair (2011), designed and produced in small series by German designer Jerszy Seymour (b. 1968) (ill. 2.18). For this chair, Seymour borrowed the design of Panton's chair, but instead of using injection-moulded plastics, he hand-moulded polycaprolactone wax into the right shape. Seymour used the wax as “a construction material as well as a metaphor for the creative energy in all people”, which can be explained by Seymour’s specific design philosophy.¹⁸⁷ He believes in a so-called amateur society, in which people function as amateurs – engaged in activities for pleasure, not for financial benefit – and handcraft instinctive, passionate objects as an alternative to industrially mass-produced objects.¹⁸⁸ So, by taking a stance against the mechanical mass-production of identical objects – which is one of the aims of functionalist design – and the entire rational train of thought that underlies such a production, Seymour presents himself as an anti-functionalist and an anti-rationalist. Nevertheless, Seymour still makes a single-piece chair like Panton and Rietveld did before him.

In this context, it is important to keep in mind that the handcrafting of an exclusive, unique object and the industrial mass-production of identical objects, each stand on one side of a sliding scale. There are many types of production that hold a position between these two extremes, from a small scale production of objects that are handmade but still look identical, to a serial production of object that are partly made by machine (after which they all look identical) and then finished by hand (after which they all look different). Seymour’s production of the *Amateur Masters S* chair can be placed more towards the handicraft end of the scale. Seymour makes small series of *Amateur Masters S* chairs, and every chair has the same basic shape, but since they are handmade in his studio in Berlin, each chair will have unique details.¹⁸⁹

Seymour borrowed this basic shape, Panton's design, because for him, it has proven its worth – by which he probably means the fact that the design is iconic, it appeals to a wide

¹⁸⁷ <<http://www.gispen.nl/nl/producten/30-stoelen/164-ngispen/931-amateur-masters-s/>> (23-07-2011).

¹⁸⁸ Dodewaard 2011.

¹⁸⁹ Dodewaard 2011.

audience, and has been mass-produced since 1968. Handcrafting this design, which was originally machine-produced in large quantities, is an ironic and critical act, that refutes the industrial mass-production of generic objects and proposes an alternative attitude.

Interestingly enough, Seymour was asked to design this chair by Gispen, mostly known for its industrially produced, functionalist office furniture, for its home design label NgispeN.

Richard Hutten (b. 1967), who was a member of Dutch design bureau Droog Design and is famous for his conceptual, humorous designs, acts as the creative director of this label.¹⁹⁰ By creating the label NgispeN, which offers non-conventional, playful pieces of furniture, Gispen seems to undermine its own position as manufacturer of functionalist furniture, but actually stays astutely on trend.

Around the same moment Panton's chair was produced for the first time, architect and industrial designer Vico Magistretti (1920-2006) designed a plastic single-piece chair with a traditional number of legs: the *Selene* chair (1968) (ill. 2.19). The chair has a recognisable and conventional appearance at first glance, but the shape of its legs is quite ingenious. A cross-section of one of the leg reveals that it is shaped like an S, which resolved any technical difficulties regarding the chair's strength.¹⁹¹ The legs of the chair look like they have been folded, and this is precisely what Magistretti did: he initially used paper for a folded model of the chair.¹⁹² For this chair design, Magistretti took injection-moulded, glassfibre-reinforced polyester, a new material at the time, as a starting point. Magistretti later explained: "My approach was to master the concept of molding. [...] I wanted a chair in one piece, but not like the one designed by Joe Colombo, which was well made, had a strong image, but looked like an elephant. No, I want to design things that don't seem strange, that don't overdo the technology bit [...]"¹⁹³ With his stacking side chair, which predated the *Selene* chair by two years, Joe Colombo did not succeed in producing the chair in one piece; the legs had to be attached separately to the rather chunky design, and indeed, Magistretti's succeeded in designing a more elegant chair with his *Selene* (ill. 2.20).

Magistretti defined himself as a functionalist designer, as he stated: "I always thought of myself as a product of the Modernist Movement, of rationalism, even if I wasn't always

¹⁹⁰ Dodewaard 2011.

¹⁹¹ Fiell and Fiell 2005, p. 384.

¹⁹² Magistretti already applied the concept of an S-shaped leg to the *Studio Table* he designed in 1966, which was never taken into production, see: Máčel, Woertman and Wijk 2008, p. 108.

¹⁹³ Pasca 1991, p. 53.

very orthodox”, and “I like technology because it’s what allows mass production. [...] my basic concept was repeatability, not uniqueness”.¹⁹⁴ However, Magistretti did place himself prominently in an Italian tradition of design, praising the Italian entrepreneurial spirit and relentless search for new materials and technologies. So, in his experimentation with new materials and technologies and innovative formal solutions, in order to achieve the mass-production of a well-designed chair, Magistretti's intentions are congruous with Rietveld's. On the other hand, Magistretti's nationalism differs from Rietveld's internationally oriented design practise.

Another Italian furniture designer, Pietro Arosio (b. 1946), designed a single-piece chair that is punched from a continuous sheet of aluminium: the *Mirandolina* (1992) (ill. 2.21). Even though the stackable *Mirandolina* chair may look rather straightforward, its design is quite refined. For its production, a sheet of aluminium is cut to size and shape, and provided with a punch-hole pattern. The sheet is bent before it reaches its final form; no welding seams, nuts or bolts are required for the production of the chair (ill. 2.23).¹⁹⁵ The reduction of the amount of material used and the patterned holes provide the chair with a very light and transparent appearance, an effect heightened by the shiny surface of the chair. This chair is not without precedent: clear similarities exist between the *Mirandolina* and Swiss artist and furniture designer Hans Coray's (1906-1991) *Landi Chair* (1938-1939) and Rietveld's *Aluminium Chair* (1942) (ill. 2.22). Coray's *Landi Chair* is constructed out of two sections that form the combined legs and armrests, which support a continuous, bent sheet of aluminium that forms the seat as well as the backrest. Like the *Mirandolina*, the aluminium of the combined seat and back is punched with holes, achieving a similar effect of lightness and transparency. The mass-produced *Landi Chair* has been on the market to the present day, which indicates its enduring popularity among a wide audience.¹⁹⁶ Rietveld's *Aluminium Chair* is no conventional four-legged chair, but was still designed with the same aim as Arosio's chair: to quickly and easily produce a chair consisting of a single sheet of aluminium, using industrial production techniques – even though Rietveld had intentions to eventually produce the *Aluminium Chair* out of fibreboard. The *Mirandolina* is a much less complex design than Rietveld's, but does elaborate on the same principles.

¹⁹⁴ Pasca 1991, pp. 53-55.

¹⁹⁵ Anonymous 1998, p. 66.

¹⁹⁶ Rüegg and Bonney 2002, p. 158.

English industrial designer Jasper Morrison (b. 1959) achieved a lightness and reduction of material that is reminiscent of the Mirandolina when he designed his *Air Chair* (1999) (ill. 2.24). Morrison is known for his technically advanced and minimalist designs, and the *Air Chair* is no exception. The production technology used for this chair was radically new at the time: gas-injection moulding. This technology was his starting point, and according to Morrison, the design “was born out of a simple length of plastic molded tube given to me by Euenio Perzazza from [furniture manufacturer] Magis, as a sample of a new plastic molding technology called gas injection. The design began from the leg up, describing the tubular structure of a chair for which a thin skin is applied for the seat and back”. With this gas-injecting technology, Morrison was able to create a strong and durable chair, that could be produced within three minutes. The chair became a critical and commercial success instantly.¹⁹⁷ With his process-led design, Morrison wants to make inexpensive, democratic design, available to everyone, and his reduced and technically advanced chair, which is mass-produced and appeals to a wide audience, can be placed in a functionalist tradition of design. Rietveld never designed a single-piece chair that was the result of a close involvement in industrial furniture production, but nevertheless, the *Air Chair* with its unified and reduced character might have appealed to him.

Swiss architect and pioneer of industrial design Willy Guhl (1915-2004) took an unusual material, fibrated concrete, as a point of departure for his *Loop Chair* (1954) (ill. 2.25).¹⁹⁸ After researching ergonomic design with his brother Emil – they even competed in the MoMA's 1948 *International Competition for Low-Cost Furniture Design* with a moulded plastic chaise longue – Guhl began using concrete in his designs for the first time. His collaboration with Eternit AG, a manufacturer who produced this material, resulted in several pieces of fibrated concrete furniture in 1951-1952, which Guhl designed together with the students he taught at the Kunstgewerbeschule (Applied Arts School) in Zurich.¹⁹⁹ Of the pieces Guhl designed, his *Loop* garden chair became a great commercial and critically acclaimed success. The *Loop Chair* consists, as its name indicates, of a single, looped slab of concrete. This slab corresponds to the dimensions of the standard slabs Eternit AG produced

¹⁹⁷ Fiell and Fiell 2009, p. 251.

¹⁹⁸ In the late 1970s, it was discovered that asbestos fibres, which were used by Eternit AG to reinforce its concrete, had a carcinogenic effect, and the production of the chair was halted immediately. Today, the chair is made from a mixture of cement and cellulose fibre. See: Vegesack and Dunas 1996, p. 122, and Cage 2004.

¹⁹⁹ Rüegg 2002, p. 172.

for the construction industry, and it was simply pressed into the right shape when it was still wet – without any loss of material, since it did not have to be trimmed.²⁰⁰

The elegant, reduced *Loop Chair* was a result of Guhl's functionalist design philosophy, which he once described as “achieving the most with the minimum of effort”, and he believed that “Function, material, construction, production method and intuitive imagination result in form”, which is resonant of functionalist architect Louis Sullivan’s (1856-1924) credo “form follows function”.²⁰¹ Guhl employed a modern and unusual material and production technique, to create a highly minimalist chair with an innovative and appealing, almost playful shape. Rietveld, who was also interested in the possibilities of concrete, illustrated by his designs for the Kröller-Müller Museum's park benches (1961), was striving for a similar synthesis of design principles in his single-piece furniture designs as Guhl did, even though he did not share Guhl’s interest in ergonomics. Guhl’s aim to design furniture that is comfortable and healthy for the sitter, is a stark contrast to Rietveld’s well-known opinion on this subject (“To sit is a verb too”).

Belgian interior architect and furniture designer Maarten van Severen (1956-2005) designed a chair around 1993, that is reminiscent of Guhl's *Loop Chair: the Low Chair (LC95A)* (ill. 2.26). Severen's chair is made from a single sheet of aluminium, which does not form a continuous shape, but an open one, with its ends folded over each other like a spiral. The top part of the chair appears to be floating and gives the illusion of supporting the sitter's weight with the strength generated by bending the material, but in reality, the two ends of the chair are connected with rubber spacers. The *Low Chair*, like Severen's furniture designs in general, is characterised by a clarity of line and a reduction of form to simple geometric shapes.²⁰² Severen explained that: “My furniture designs have that uncomplicated form because they have to be as 'compact' as possible, and have to serve an almost invisible construction. I search for the utmost minimal form”.²⁰³ For Severen, a chair functions as a “nomad”, that one briefly encounters when crossing a room, and therefore a chair should only be a subtle presence. So, like Rietveld, Severen aimed to design a chair that is reduced and takes up a minimal amount of space, even though he uses a more rigidly minimalist

²⁰⁰ Rüegg 2002, p. 172.

²⁰¹ Cage 2004, and Rüegg 2004, p. 172.

²⁰² Antonelli 2003, p. 185.

²⁰³ “Mijn meubelen hebben die eenvoudige vorm omdat ze zo ‘compact’ mogelijk moeten zijn en een vrijwel onzichtbare constructie dienen te hebben. Ik zoek naar de hoogst minimale vorm”, English and Dutch text, see: Reinewald 1994, p. 55.

idiom than Rietveld did. Interestingly enough, Severen did not necessarily aspire to realise an industrial mass-production of his designs: “[...] I don't feel like making concessions to the design. Actually, I am too emotionally involved in my existing products to 'give' them to the industry. I feel related to my work not as a designer, but as an artist”.²⁰⁴ Rietveld has implied this same sentiment in his (non-mass-produced) single-piece chair designs, but he never expressed it out loud.

To conclude, one can establish that the discussed selection of single-piece chairs, that were made within Rietveld's functionalist design tradition, come in many different appearances. These chairs were made from a wide range of materials: incised and bent pieces of wood, metal, and concrete, (injection-)moulded plastics, and even laminated cardboard. Their designers often had one specific starting point: for instance, while Gehry and Morrison took certain unusual materials and techniques as a point of departure, Severen's primary aim was to achieve a reduced and minimalist form in his design. So, often one design principle prevails over others, but in general, the designers of the chairs discussed in this section still wanted to achieve the same synthesis Rietveld aimed for: a synthesis between innovative materials and techniques, light and reduced form (in visual as well as material respect), and the possibilities of industrial mass-production, which should eventually lead to a useful and attractive chair design. The everlasting struggle of the designer with his material to eventually come to a satisfying form in his design, plays a crucial role in the development of a chair, as Panton's troubles with finding a suitable type of plastic for his *Panton Chair* prove once more. Lastly, the fact that many different factors contribute to the potential success (technical, formal or commercial) of a single-piece chair, and of every chair in general, is illustrated by Pieck's difficulties with finding the appropriate means to produce his *LaWo Chair*, while Summers already achieved an industrial production of his single-piece plywood armchair more than a decade earlier.

The epilogue that follows below, shows how a designer named Marcel Wanders (b. 1965) managed to create an extremely interesting and unorthodox single-piece chair, by leaving Rietveld's set of functionalist principles aside – he has taken an alternative route – while the chair still embodies certain characteristics Rietveld was striving for.

²⁰⁴ “[...] ik heb geen zin om voor serieproductie concessies aan het ontwerp te moeten doen. Eigenlijk ben ik teveel emotioneel betrokken bij mijn bestaande produkten om ze aan de industrie 'te geven'. Ik voel mij niet als vormgever maar als kunstenaar bij mijn werk betrokken”, see: Reinewald 1994, p. 57.

2.3. Epilogue: the paradox of Marcel Wanders

As mentioned, within the large group of single-piece chairs designed during and after Rietveld's time, a division in three major groups of chairs with different underlying tendencies can be made: chairs that were made in the functionalist tradition of Rietveld, chairs that appeal to people's desire to own something partly handcrafted, unique and personal, and chairs that do not belong to either of these groups. The single-piece chairs that can be placed in this last category, are affiliated to Rietveld's designs to a certain extent, since Rietveld may have actually approved of the final result, even though they were made with different intentions. With his *Knotted Chair* (1996), Dutch designer Marcel Wanders created a piece which belongs to this last group of chairs (ill. 2.27). It holds a position between the tendencies of first two categories, but, interestingly enough, unifies them at the same time. The *Knotted Chair* was the result of a workshop organised in 1996 by the Laboratorium voor Luchtvaart- en Luchtvaarttechnologie (Laboratory of Aerospace Engineering) in which Wanders participated.²⁰⁵ The chair, which has the overall shape of a rather conventional, four-legged lounge chair, is knotted from rope, which is made from aramid (a synthetic fibre) twisted around a carbon core. The rope has consequently been impregnated with epoxy and hung in a frame to harden (a process called Dry Tech), and its eventual shape is created by gravity.²⁰⁶ It must be said that interpreting the Knotted chair as a single-piece chair, does stretch the definition of the term – but, since the epoxy resin that coats the entire chair transforms it into a unity, it can still be regarded as such.

Wanders's *Knotted Chair* can be characterised as an embodiment of a paradoxes. These paradoxes are evident in both the chair's construction and its appearance. The chair's construction is high-tech, yet handmade. Wanders experimented with unorthodox materials and technologies in the innovative Dry Tech process, while collaborating with a technical laboratory. At the same time, however, Wanders created the chair not by using a modern and industrial construction method, but a traditional handiwork technique: macramé. Macramé, a form of textile making which uses knotting rather than weaving or knitting, became popular in the 19th century for home decoration as well as sailors' objects (for instance hammocks or belts), and was revived once more during the late 1960s and early

²⁰⁵ Máčel, Woertman and Wijk 2008, p. 117.

²⁰⁶ Antonelli 1999, p. 45.

1970s.²⁰⁷ Moreover, with its high back, saggy seat and legs positioned at an angle, the *Knotted Chair*'s shape is reminiscent of ancient, archetypical chairs, like an Egyptian chair or an African throne. In the *Knotted Chair*, the macramé as well as its shape invoke associations with the handicraft and traditionally made objects of past generations and ancient cultures. It appeals to one's sentiment, not to one's rationality. The handcrafting of this chair, which leads to the production of small series, is nothing close to an efficient, quick or inexpensive production method, and it seems to deny the rational train of thought as proposed by the functionalists. By making the chair this way, Wanders – like Seymour did with his *Amateurs Masters S* – refutes the functionalist ideal of industrial mass-production: the chair rather is an anti-functional and anti-rationalist statement.

The fact that Wanders's chair appears to be lightweight, transparent and delicate, but at the same time proves to be strong, supportive and durable, forms another paradox. This paradox has a very confusing and surprising effect on the sitter, and confounds his or her expectations: how can a material that is so flexible and has so little substance to begin with, be so sturdy? The work of Wanders, who, like the aforementioned Richard Hutten, was a member of design bureau Droog Design at that time, is characterised by such confusing yet playful paradoxes. For instance, the material Wanders chose for his *Sponge Vase* (1997), a natural sponge impregnated with liquid clay, makes one question its practicality (ill. 2.28). The small vase that is incorporated in the design, though, is very capable of holding a flower. The *Sponge Vase* can be manufactured industrially, but each vase is unique since it is made from organic matter.²⁰⁸ Wanders's use of the natural sponge has a very similar effect to the handicraft of the *Knotted Chair*: the eventual shape of the object is left to nature. Wanders dislikes the facts that nowadays, the life of products is becoming shorter and shorter, and they are being replaced prematurely. According to Wanders, in the throwaway culture of today, every innovation asks for another, wasting energy and materials. Wanders wants to give his products a durable quality, but, he stated: "I also dreamed, finally, about products that not only offered more quality but could also bring together a variety of qualities. Products that would be complete and hence genuinely significant to the user. Objects that touch you and that generate a positive feeling. In short: products worth bonding with for a

²⁰⁷ DuMont 2000, pp. 8-9.

²⁰⁸ Antonelli 1999, p. 44.

lifetime".²⁰⁹ So, Wanders suggests that he wants his designs to transcend the temporary and the fashionable, and wants to create meaningful objects that last instead.

Wanders's *Knotted Chair* represents a balance between technology and handicraft. By making use of modern materials and techniques in an unorthodox way, while still managing to manipulate the material in such a way that a useful chair can be created, Wanders continued one of the central principles of functionalist design. An analogy can be drawn with, for instance, Mart Stam's use of tubular steel and Alvar Aalto's – and Rietveld's – use of large sheets of plywood in their furniture in the 1920s and 1930s. At the same time, Wanders made sure his chair still appeals to people's emotions by using traditional handwork and by giving each chair individual characteristics, and moreover, he played with people's connotations with the material he presents to them. For Rietveld however, the experiments with materials and constructions were primarily aimed at realising the industrial mass-production of a well-designed but generic, inexpensive, and quickly made single-piece chair, that also carried specific spatial implications. Wanders intentionally leaves these functionalist aims behind, and reaches for a different ideal: he aspires to design durable, unique products, that form a bond with their owners. To conclude, one can say that with the *Knotted Chair*, Wanders demonstrates that it is possible to unite two seemingly opposed approaches to the single-piece chair: a technological *and* a handicraft approach. Wanders has only taken certain elements of Rietveld's functionalist legacy, and consequently went his own way, still giving shape to the concept that once kept Rietveld occupied too: the single-piece chair.

²⁰⁹ Antonelli 1999, p. 15.

Conclusion

In the course of this thesis, it has become clear that the single-piece chair design concept poses a problem, for which many solutions are possible. The first steps towards a mass-produced chair made from a single piece of material were already taken in the 19th century, with Schinkel's cast iron furniture and Thonet's bentwood chairs, for which as few separate parts as possible were used. The primary reason for these designers to reduce the amount of material used, however, seems to have been the uncomplicated and quick production technology it enabled, and the economical advantage this entailed. With the rise of international functionalism in the 1920s, the concept of a single-piece chair became a recurring theme. For several functionalist designers, the single-piece chair provided the solution in their search for a chair that had maximum utility and good quality, consisted of clear, open and reduced forms, and could be industrially mass-produced at low price levels, while making use of modern materials and technologies. Chairs made from continuous, bent pieces of laminated wood and plywood, like those by Aalto, already displayed this tendency.

Rietveld, who worked within this functionalist artistic climate, was one of the first designers to take on the challenge of designing a single-piece chair, which he regarded as the realisation of his aim to design a chair that would be an answer to the needs of his own time: not only could it be quickly and cheaply mass-produced by machine, thus making it widely available for everyone, it could also function a standardised and lightweight element in people's interiors, leaving them more room to move around freely. Rietveld presented himself as a firm believer in the possibilities of industrial mass-production, or as he once radically stated: "No design has any value today (not even experimental), if it is not suitable for mass-production".²¹⁰ However, his single-piece chair designs never really made it to this stage: he let the experimental value of these designs prevail over adapting them to the demands of mechanical mass-production. Some of Rietveld's single-piece chairs were produced in series, like his single-piece *Zigzag Chair* by Metz & Co, but they did not achieve significant commercial success. However, the experimental and innovative character of his designs were greatly appreciated by his contemporaries. So, even though Rietveld did not fulfill his wish to achieve industrial mass-production of his single-piece chairs, he did succeed in creating designs that embodied significant material, constructive and formal innovations.

²¹⁰ Rietveld 1964, p. 34.

The idea of a single-piece chair appears to have been a sensible result of the balanced synthesis between several design principles – function, form, material, construction and mass-production – Rietveld was striving for, and his approach to the single-piece chair concept had a lasting influence on a group of later furniture designers. Rietveld's functionalist design principles remained a dominant influence on the design of single-piece chairs well into the 1960s. After World War II, two important developments played a role in the rise of new and different approaches to the concept of a chair made from a single, continuous piece of material. Plastics were introduced into the vocabulary of furniture design, which required designers to create their single-piece chairs by moulding the fluid material into an organic, unified form instead of building it up in space, like Rietveld did; furthermore, an increasing number of designers developed syntheses between the various design principles, that worked with different parameters and offered an alternative to the functionalist design principles Rietveld adhered to. This set of functionalist principles was, by some designers, experienced as a dogma from which they wanted to liberate furniture design – which did not mean, however, that the functionalist design approach disappeared.

The separation and redefinition of the different design principles made a very heterogeneous mass-production of single-piece chairs possible, with an extremely diverse range of underlying intentions. When this diverse group of chairs is related to Rietveld's set of design principles, an arbitrary division into three categories of chairs can be made, that derives from the chairs themselves, not from the designers. The first group includes chairs that are the result of intentions that are congruous with Rietveld's functionalist design principles. The second group of chairs is affiliated to Rietveld's designs. The designers of the single-piece chairs that belong to this group, took a starting point that differs from Rietveld's approach, but still created designs that are innovative and lightweight, like Rietveld aspired to. The third group of chairs represents a loosely associated set of designers that rejected the rational design principles of the functionalists, by striving for a serial production of (semi-)unique pieces. They approached the one-piece chair as a handcrafted object, that is to say: these chairs are often partially made by machine, after which they are worked on by hand. Even though the designers that belong to this third group still created single-piece chairs, their underlying intentions are completely different from Rietveld's.

This last group of single-piece chairs shows, that industrial mass-production and the objects it brought into the world provoked a strong reaction in some designers, who

responded with a small-scale production of (partially) handcrafted objects, as a critical alternative. Some furniture manufacturers who employed mass-production responded aptly to this phenomenon. For instance, manufacturer Gispen even created a separate label for these anti-rationalist and anti-functionalist designs such as Jerszy Seymour's *Amateur Masters S*. By doing this, Gispen incorporates a type of production that counteracts its conventional mass-production of functionalist furniture. This seems paradoxical, but by offering its audience products from both extreme ends of the production range, Gispen makes a smart move from a commercial point of view, but also acquires a trendy image. Gispen's case shows, how some furniture manufacturers that employ industrial mass-production can turn a critical act like that of Seymour into an advantage.

While Gispen incorporates the two types of production (industrial mass-production and serial production of partially handmade objects) but still keeps them separate, Marcel Wanders binds them together. His *Knotted Chair* embodies a paradox, and at the same time, acts as binding agent between the groups of single-piece chairs that are positioned on opposite sides of the scale (functionalism vs. anti-functionalism). Wanders's chair meets the functionalist aim to employ modern materials and technologies in an innovative way, which leads to a lightweight and almost transparent chair design. On the other hand, it also contains a handcrafted aspect as well as references to ancient, archetypical chairs, responding to people's desire to own something unique and personal – which is, in fact, a rejection of the functionalist aim to provide people with mass-produced, identical objects. By incorporating elements of the two approaches that are such complete opposites of each other, Wanders's *Knotted Chair* connects at once functionalist principles and anti-functionalist principles, and proposes a new, alternative synthesis of design principles as a starting point for the design of a single-piece chair. Wanders's act that countered the functionalist approach, has now become a new approach to single-piece chair design in itself.

One can establish that the single-piece chairs that have been created in the course of the 20th and 21st century, with their manifold appearances and underlying intentions, demonstrate how the concept of a chair made from a single piece of material has acquired an important position in furniture design, ever since Rietveld first started experimenting with the idea. At present, the approach taken by designers like Wanders, who incorporates both functionalist as well as anti-functionalist design principles, could indicate a new

direction in single-piece chair design, with high-tech, lightweight chairs that are made from one piece of material, but still contain an appealing element of handicraft as a result.

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Illustrations

Introduction



0.1. *Crate Chair*, 1934, deal wood, 77,3 x 57 x 55 cm, CMU, inv. no. 12580.



0.2. Karl Friedrich Schinkel, cast iron armchair, c. 1820, cast iron, painted black, 80,4 x 51,5 x 51 cm, Victoria & Albert Museum, London, inv. no. W.10-1986.



0.3. Gebrüder Thonet, *Vienna Café Chair* (no. 18), 1876, bent beech wood, 84.8 x 43.2 x 51.1 cm, MoMA, inv. no. 444.1956.



0.4. Mart Stam, *S33*, 1926, tubular steel frame, fabric upholstery, 86,5 x 50 x 64 cm, sold by Christie's in 2004.

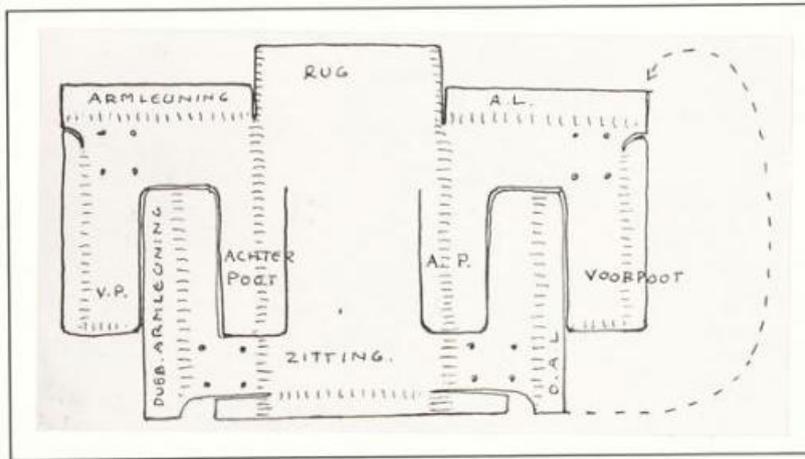


0.5. Marcel Breuer, *Wassily Chair (B3)*, 1927-1928, chrome-plated tubular steel frame and canvas, 71,8 x 78,1 x 71,1 cm, MoMA, inv. no. 229.1934.

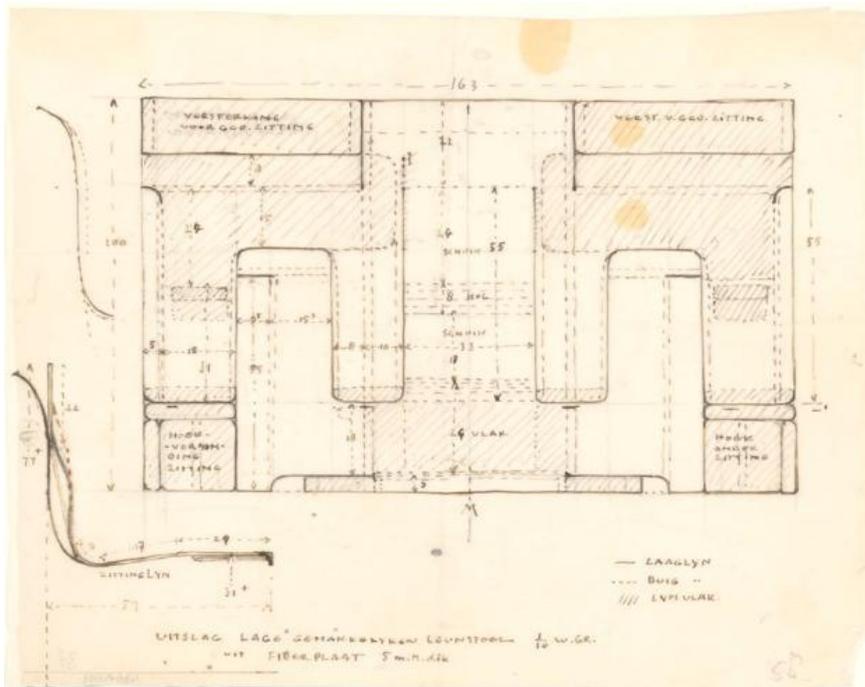


0.6. Alvar Aalto, *Paimio Chair*, 1931-1932, laminated birch wood and solid birch wood frame, bent plywood seat and back panel, 66 x 60,3 x 87,6 cm, MoMA inv. no. 710.1943.1.

Chapter 1



1.1. Technical drawing of the *Birza Chair*, 1927, photo glued on paper, 15,5 x 24,5 cm, RSA, inv. no. 430 A 003.



1.2. Technical drawing of the *Birza Chair* (1:10), 1927, ink and pencil on transparent paper, 17,3 x 21 cm, RSA, inv. no. 430 A 001.



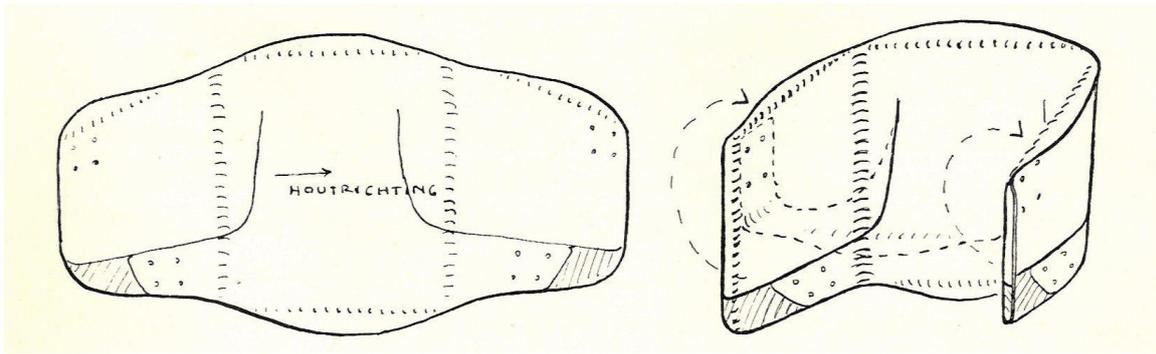
1.3. The Birza family living room, with the *Birza Chair* on the left, and Rietveld can be seen in the mirror on the wall, c. 1928, black and white photograph, RSA, inv. no. 126 F 001.



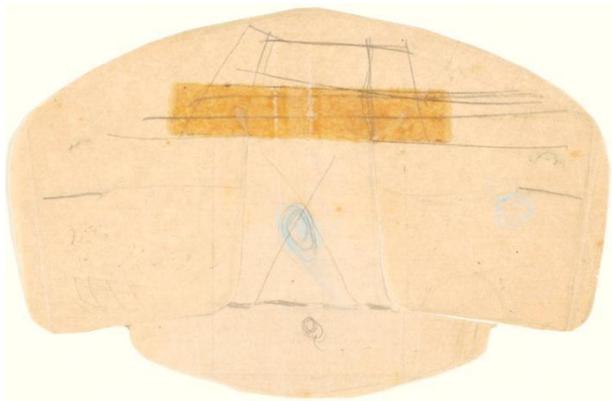
1.4. *Birza Chair*, 1927, fibreboard, cut, soaked, bent and dried, assembled with blind rivets, 71,5 x 75 x 61 cm, SMA, inv. no. KNA 6712.



1.5. *Birza Chair*, polyester prototype, c. 1958, polyester, 74,5 x 79 x 65 cm, CMU, inv. no. 29992.



1.6. Technical drawing of a single-piece three-ply chair, 1927, slide of an ink drawing, RSA, inv. no. 114 F 003.



1.7. Folded out scale model of a single-piece three-ply chair, 1927, pencil on paper, 11 x 17 cm, RSA, inv. no. 431 A 001.



1.8. Photo of a scale model of a single-piece three-ply chair, 1927, black and white photograph, RSA, inv. no. 114 F 001.



1.9. *Bow Chair*, produced by Metz & Co, 1927, tubular steel frame, bent plywood seat and back, 73,1 x 39,8 x 55,5 cm, CMU, inv. no. 26109.



1.10. *Mondial Chair*, produced by Gispen, c. 1957, steel frame, seat of glassfibre and polyester, 75 x 49 x 42 cm, CMU, inv.nr. 12584.



1.11. *Zigzag Chair*, produced by Metz & Co, 1932, elm frame, dovetail joints reinforced with brass nuts and bolts, seat and base glued in mitre joints and reinforced with a cross bar, 74 x 37 x 44 cm, SMA, inv. no. KNA 3414 (1-4).



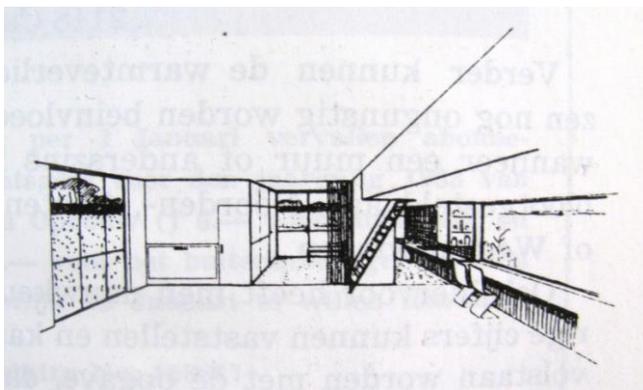
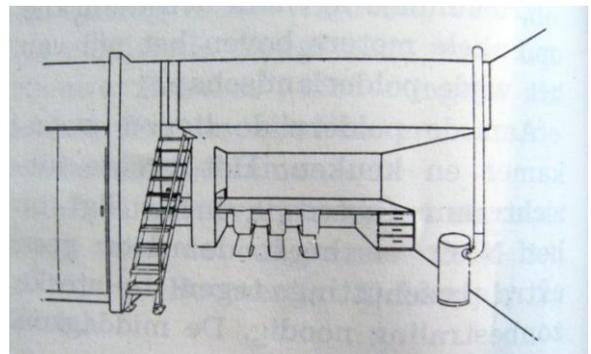
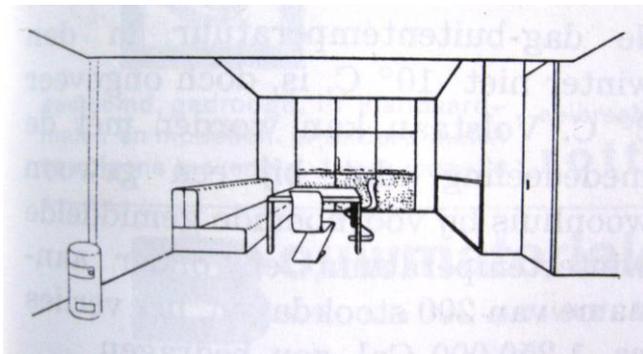
1.12. *Zigzag Chair*, first prototype, 1932, welded flat iron frame covered with bent and stained fibre, 79 x 41 x 46,5 cm, SMA, inv. no. KNA 2962.



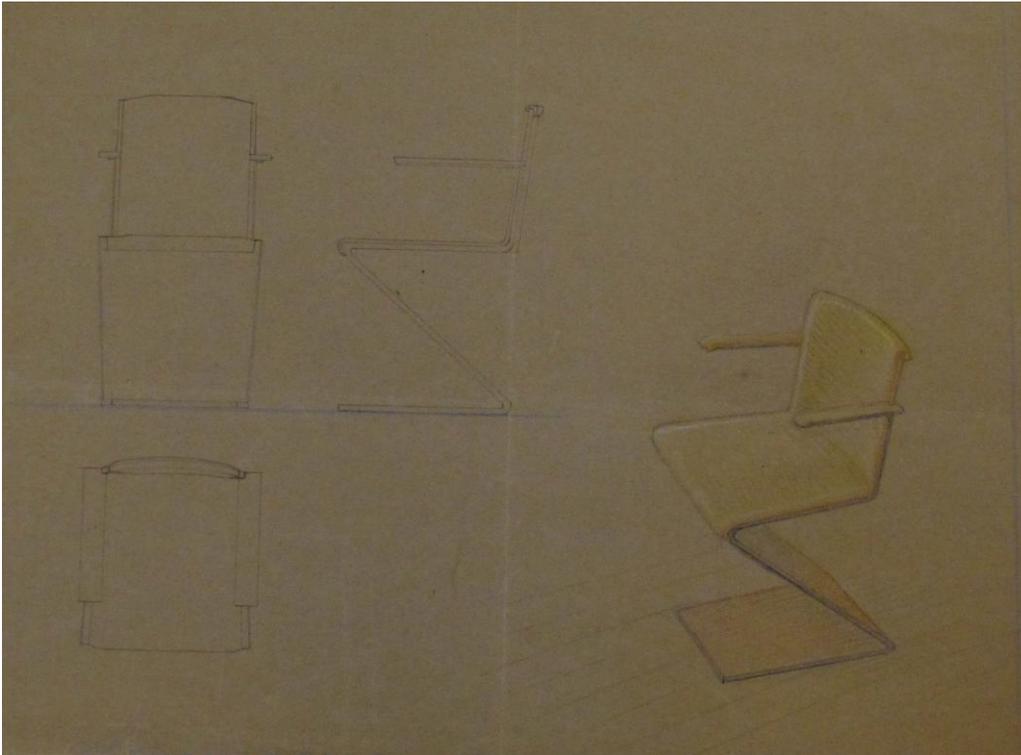
1.13. *Zigzag Chair*, second prototype, 1932, welded section iron, screwed onto four sheets of birch plywood, 79,5 x 41 x 43,5 cm, SMA, inv. no. KNA 2961.



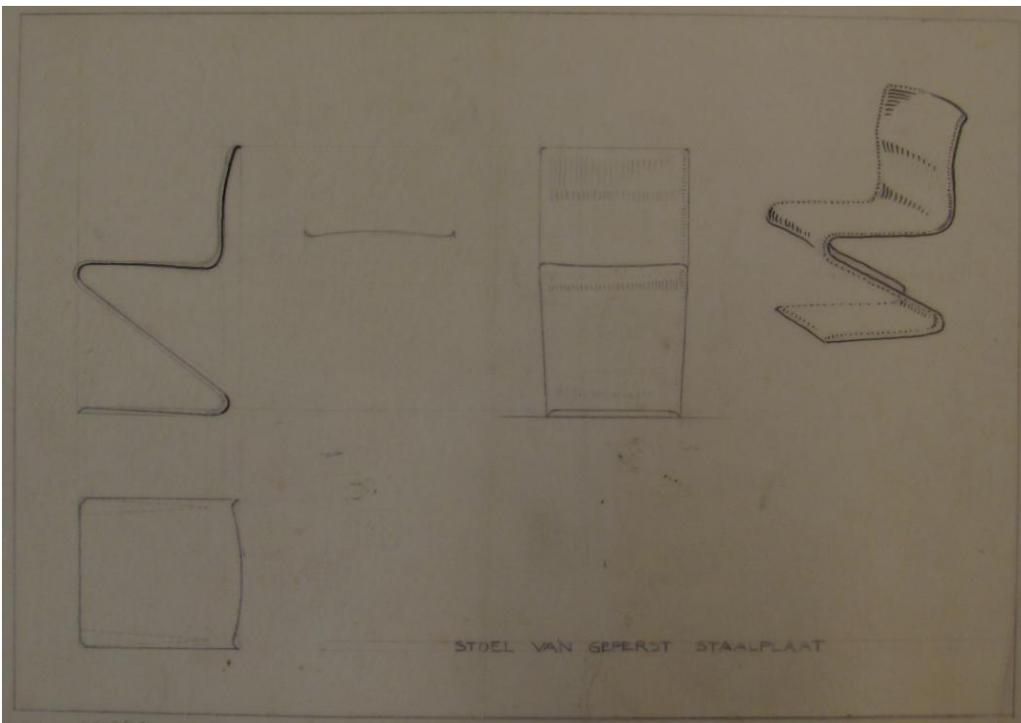
1.14. Tubular steel *Zigzag Chair*, produced by Metz & Co, c. 1932-1933, tubular steel frame, plaited rubber cord seat and back panels, 83,5 x 40 x 48 cm, CMU, inv. no. 28223.



1.15. Sketches with single-piece *Zigzag Chairs*, published in Merkelback 1933.



1.16. Design for *Zigzag Chair* for professor Weve, 1934, pencil on paper, NAI, RA, inv. no. 473.



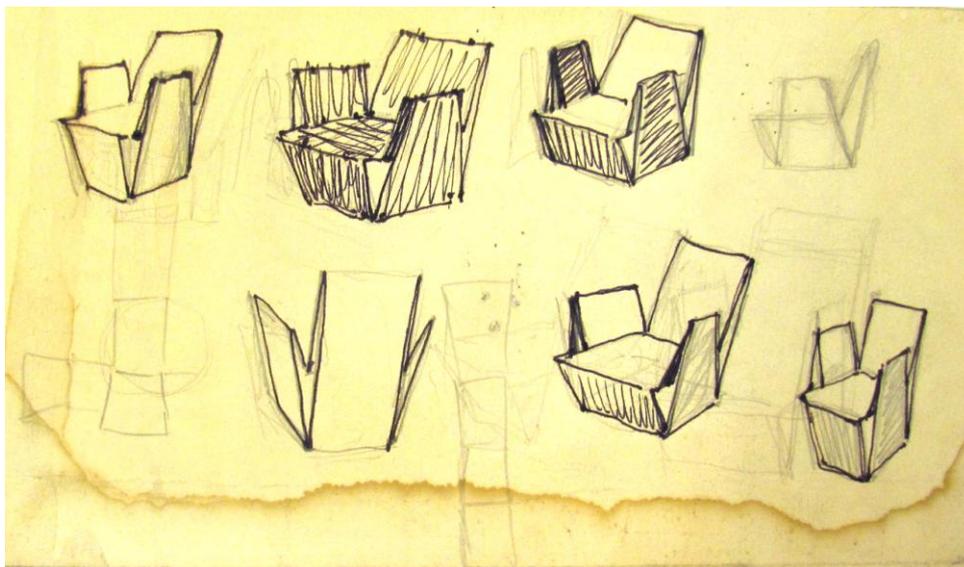
1.17. Design for *Zigzag Chair* of pressed sheet metal, c. 1934, pencil and ink on paper, NAI, RA, inv. no. 473.



1.18. *Zigzag Chair*, produced by Metz & Co, 1938, bent beech plywood, 79,5 x 40 x 36 cm, private collection.



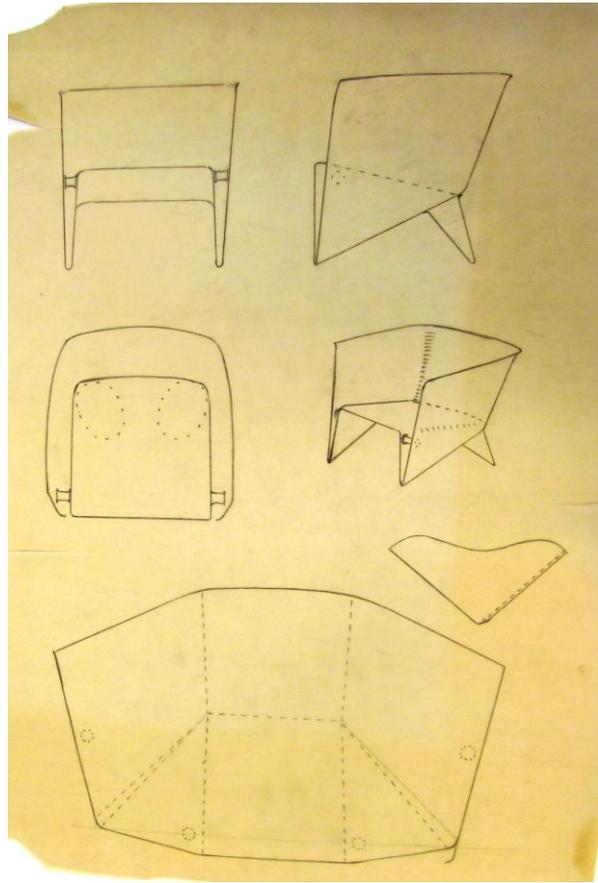
1.19. Heinz and Bodo Rasch, *Sitzgeiststuhl*, 1927 (reproduction by Vitra, 2010), bent and lacquered plywood, 88,8 x 43,6 x 47,2 cm, Collection Vitra Design Museum, Weil am Rhein.



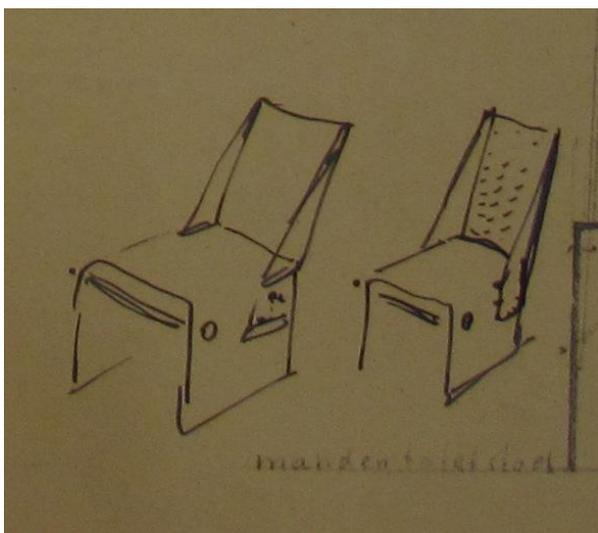
1.20. Design for a folded chair, c. 1930-1940, pencil and ink on paper, 15 x 24,9 cm, NAI, RA, inv. no. 469.



1.21. Scale model for a folded chair, c. 1930-1940, cardboard, CMU, inv. no. 30203.



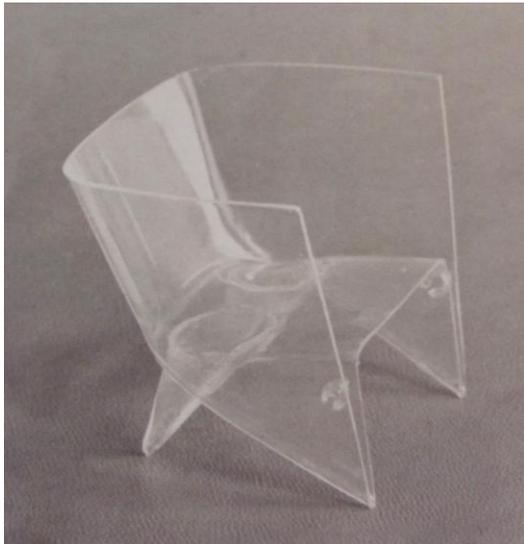
1.22. Technical drawing for *Aluminium Chair*, c. 1930-1940, ink on paper, NAI, RA, inv. no. 469.



1.23. Design for wicker *Aluminium Chair*, c. 1930-1940, pencil and ink on paper, NAI, RA, inv. no. 469.



1.24. Design for wicker *Aluminium Chair*, c. 1930-1940, ink on paper, NAI, RA, inv. no. 469.



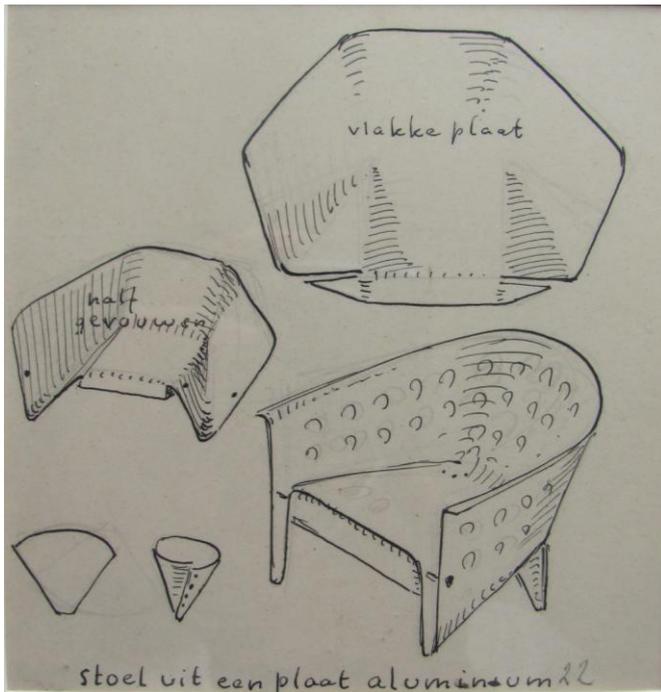
1.25. Scale model for *Aluminium Chair*, c. 1930-1940, perspex, 7,8 x 5,2 x 5,2 cm, NAI, RA, inv. no. MAQV340.



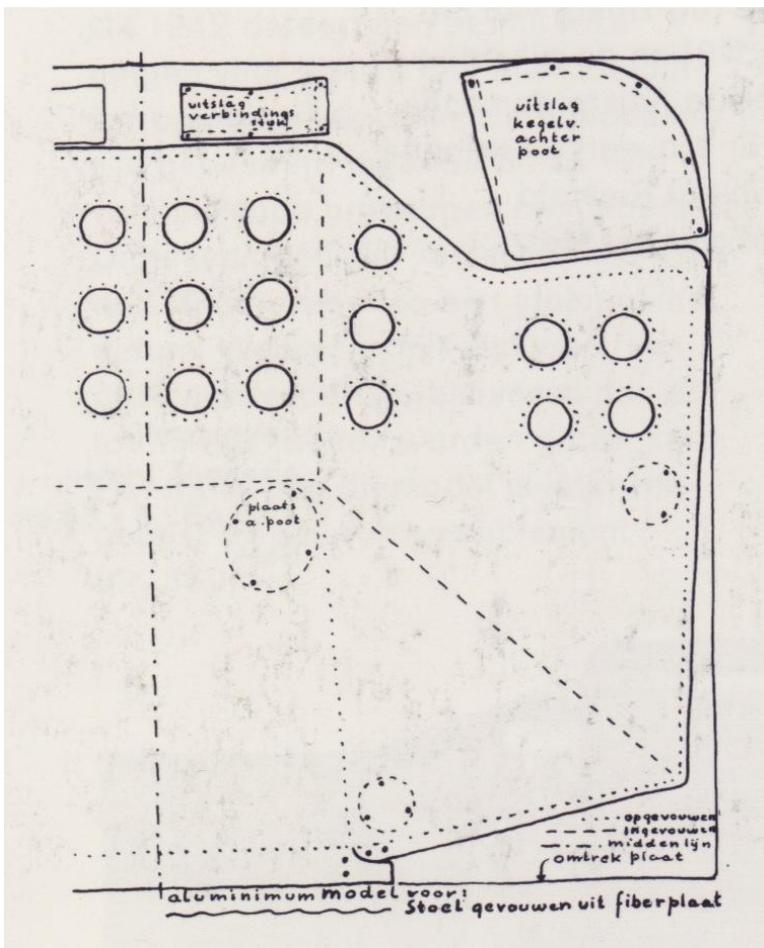
1.26. Scale model for *Aluminium Chair*, c. 1930-1940, paper, CMU, inv. no. 30207.



1.27. Scale model for the *Aluminium Chair*, 1942, ink on cardboard, 9 x 15,6 cm, CMU, inv. no. 30206.



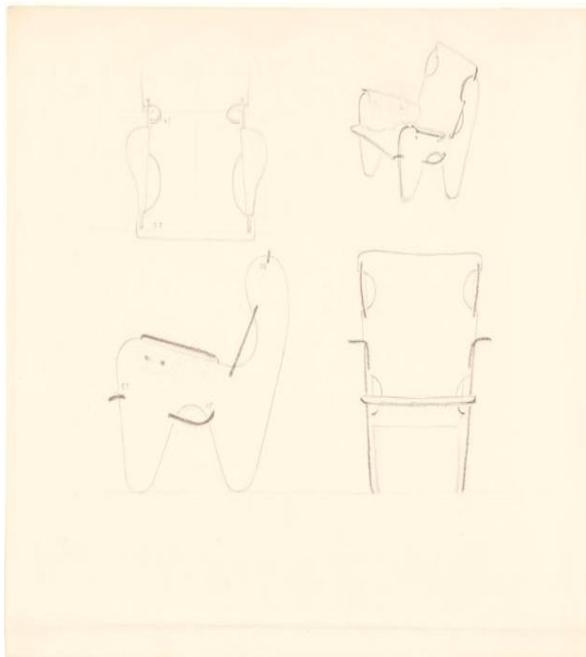
1.28. Technical drawing for *Aluminium Chair*, 1942, pencil and ink on cardboard, 14,2 x 13,7 cm, RSA, inv. no. 528 A 001.



1.29. Technical drawing for *Aluminium Chair*, 1942, ink on transparent paper, 30,5 x 24,5 cm, NAI, RA, inv. no. 469.



1.30. *Aluminium Chair*, 1942, frame from a single sheet of perforated and folded aluminium, rivet joints between seat and armrests, 71 x 73 x 62,5 cm, SMA, inv. no. KNA 1264.



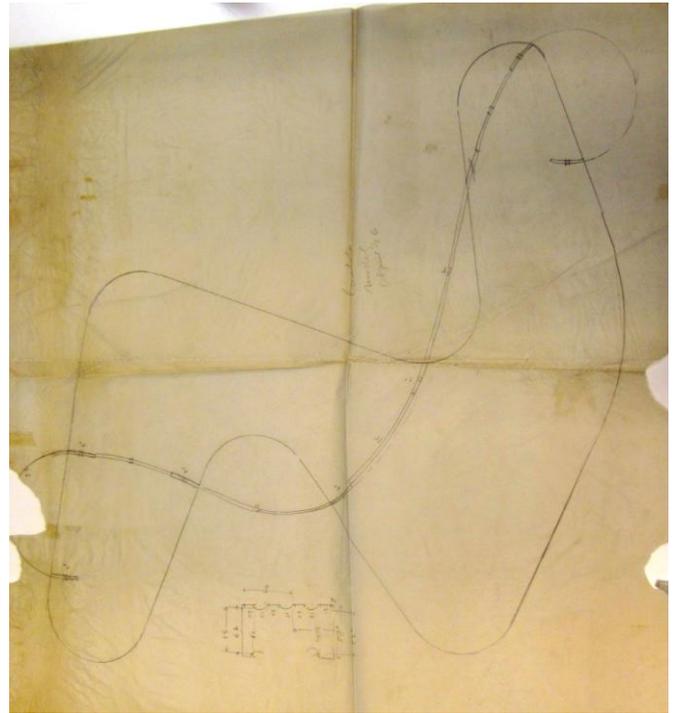
1.31. Drawings for *First Model*, c. 1946-1950, pencil on paper, 24 x 30 cm, RSA, inv. no. 428 A 001.



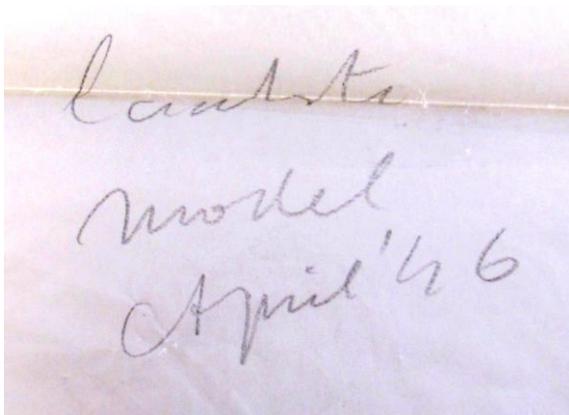
1.32. Scale model of *First Model*, c. 1946-1950, three-ply, RSA, inv. no. 30202.



1.33. *First Model*, 1958, cut out birch plywood seat, back and armrests, pegged and glued joints, stencilled painted text, 83 x 69 x 94 cm, SMA, inv. no. KNA 1265.



1.34. Drawing for *Last Model*, 1946, pencil on transparent paper, NAI, RA, inv. no. 500.



1.35. Detail of drawing for *Last Model*.



1.36. *Danish Chair*, c. 1946-1950, bent plywood with red lacquer, 61,5 x 61,5 x 59 cm, CMU, inv. no. 12582.



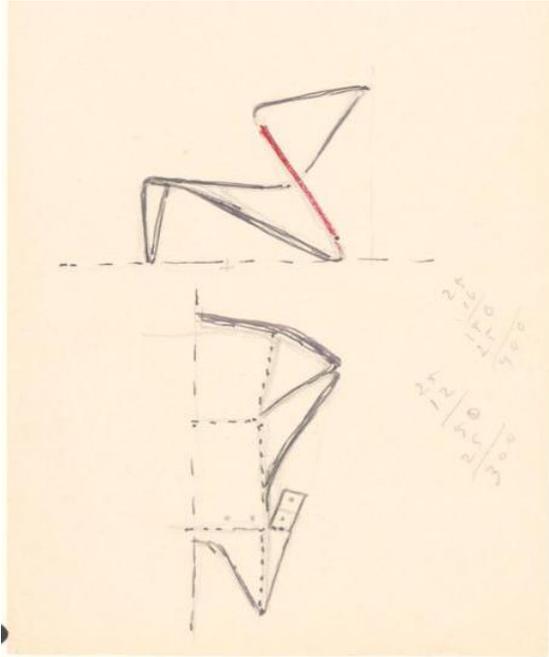
1.37. Marcel Breuer, dining chair, 1936-1937, bent birch plywood, 75 x 41 x 51 cm, Victoria & Albert Museum, London, inv. no. CIRC.79A-1975.



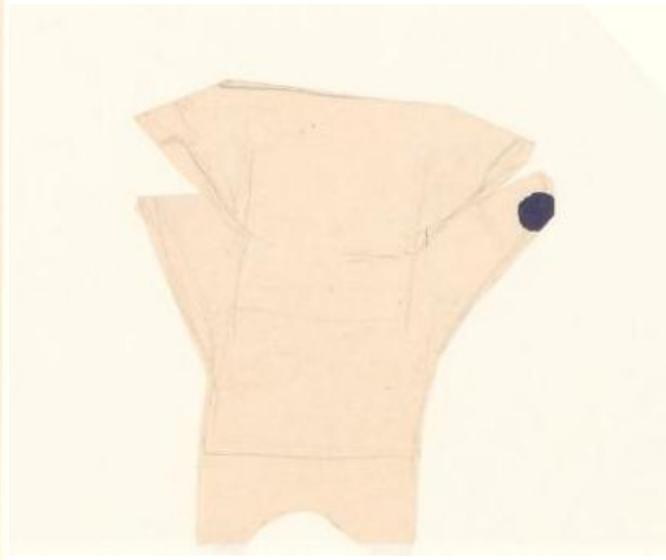
1.38. Charles and Ray Eames, *Lounge Chair Wood (LCW)*, 1946, moulded and bent birch plywood, rubber shockmounts, 65,4 x 56,5 x 63,5 cm, MoMA, inv. no. SC102.1973.



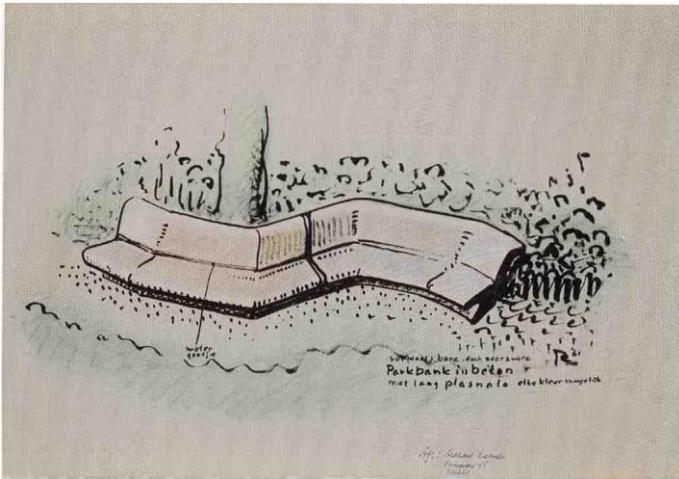
1.39. Interior of the Rietveld family's apartment above the Vreeburg Cinema, with a *Dining Metal Chair (DMC)* (1946) by Charles and Ray Eames on the left, c. 1947, black and white photograph, RSA, inv.nr. 248 F 017.



1.40. Folded single-piece chair, c. 1950-1960, pencil and ink on paper, 20,5 x 13,2 cm, RSA, inv. no. 562 A 001.



1.41. Scale model (folded out) of folded single-piece chair, c. 1950-1960, pencil and ink on paper, 6,7 x 5,9 cm, RSA, inv. no. 562 A 002.



1.42. Drawing for concrete park benches, 1961, ink and pencil on paper, Kröller-Müller Museum, Otterlo, inv. no. KM 123.511.



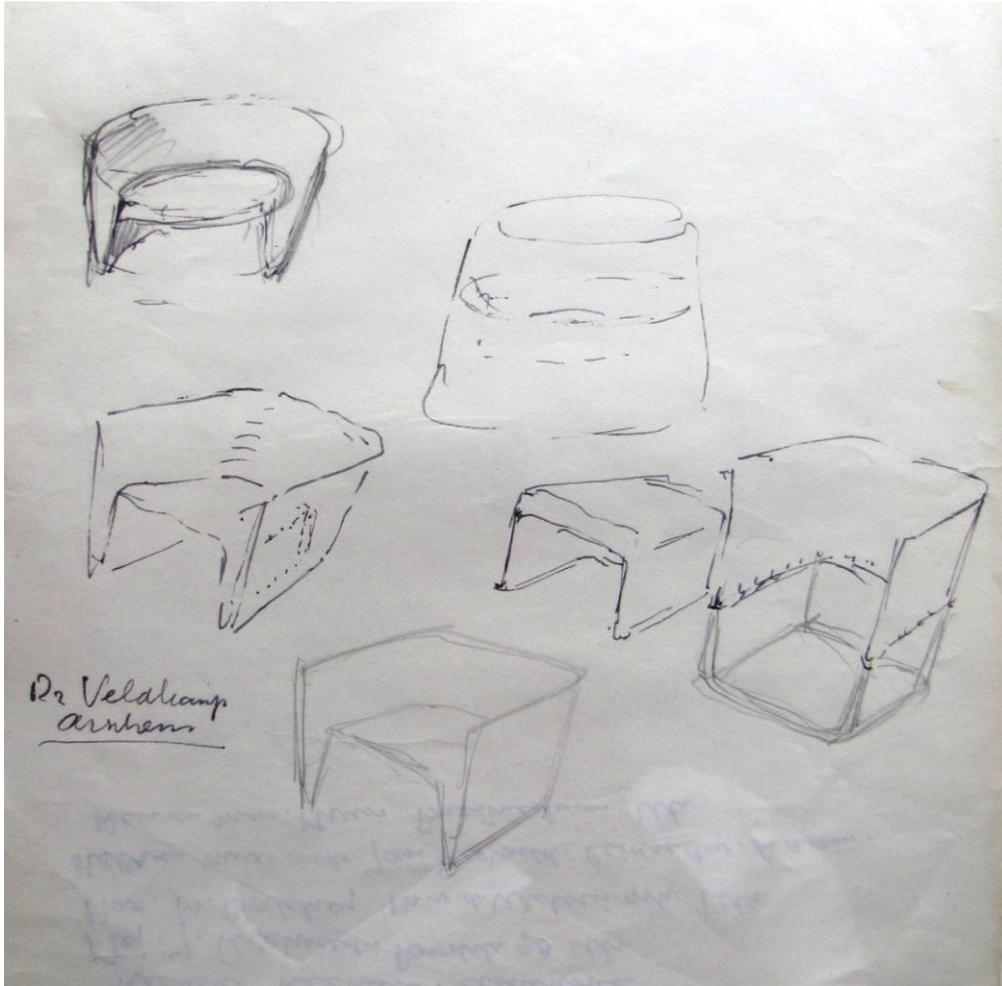
1.43. Models for concrete park benches, 1961, multiply, paper and cardboard, 7,5 x 26 x 10,7 cm and 7,5 x 26 x 10,1 cm, CMU, inv. no. 27013 a-b.



1.44. Concrete park bench, convex version, 1961, concrete, 96 x 80 x 278 cm, Kröller-Müller Museum, Otterlo, inv. no. KM 120.386-1-3



1.45. Concrete park bench, concave version, 1961, concrete, 96 x 80 x 278 cm, Kröller-Müller Museum, Otterlo, inv. no. KM 120.386-4-6.



1.46. Sketches for single-piece furniture for Dr Veldkamp, 1962, ink and pencil on paper, 25 x 21 cm, RSA, inv. no. 585 A 001.



1.47. Sketches for folded chairs, 1962, pencil and ink on paper, 25,8 x 20,7 cm, RSA, inv. no. 586 A 001.



1.48. John Henry Benter, Victorian armchair, laminated rosewood, rosewood carvings and upholstery, c. 1850, 122 x 63,5 cm, private collection.



1.49. Back panel of Victorian armchair, made from a single piece of laminated rosewood.



1.50. Gardner & Co, railway station chair, c. 1870-1920, turned wooden frame, perforated and bent plywood seat, published in Ngo 2003.

Chapter 2



2.1. Alvar Aalto, *Model no. 21*, bent plywood seat and back, laminated birch wood frame, 82,6 x 47,5 x 57 cm, Victoria & Albert Museum, London, inv. no. W.39-1981.



2.2. Charles and Ray Eames with Eero Saarinen, *Low-Back Armchair*, moulded plywood shell, foam rubber padding, upholstery, wooden legs, 83,8 x 73,7 x 52,7 cm, MoMA, inv. no. 840.1942.



2.3. Charles and Ray Eames, *Dining Height Armchair Rod Base (DAR)* (Plastic Shell Group), 1948-1950, fibreglass-reinforced polyester shell, steel rod frame, 76,8 x 63,5 x 60,3 cm, MoMA, inv. no. 267.1958.



2.4. Luigi Colani, *Zocker*, 1971-1972, polyethylene (rotation sintering procedure), 50,5 x 35 x 56 cm, sold by Christie's London in 2007.



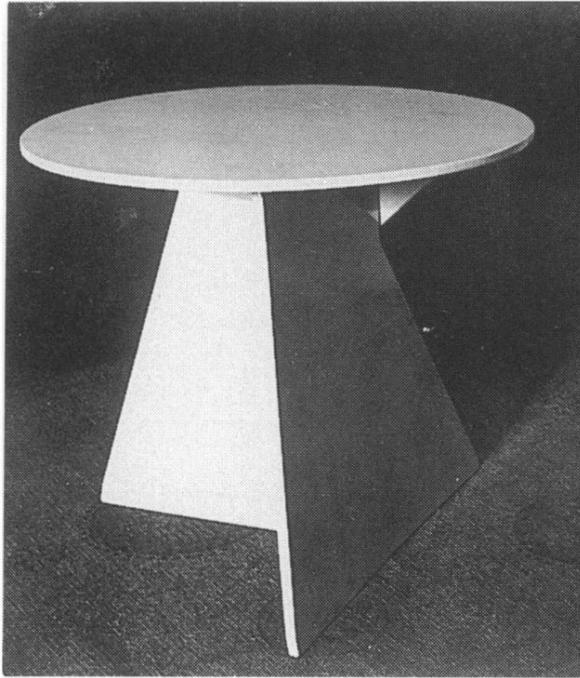
2.5. Alberto Meda, *Light Light Chair*, 1987, carbon fiber and Nomex composite honeycomb, 74,3 x 55,2 x 49,5 cm, MoMA, inv. no. 397.1994.



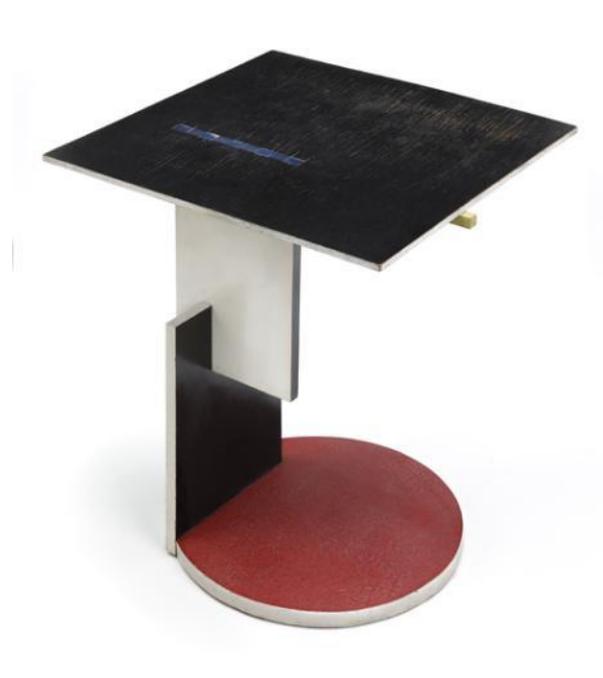
2.6. Han Pieck, *LaWo Chair*, 1946-1948, laminated beech wood and copper corner joints, 78 x 66,5 x 74 cm, Delft Faculty of Architecture Collection, Delft, inv. no. 20032121.



2.7. Gerald Summers, single-piece lounge chair, 1933, birch plywood with pigmented lacquer, 75,2 x 59,7 x 88,9 cm, MoMA, inv. no. 1434.2000.



2.8. Gerald Summers, folding coffee table, 1934, published in Deese 1992.



2.9. Side Table, 1923, beech wood and plywood, 59,5 x 50 x 50 cm, CMU, inv. no. 27848.



2.10. Roderick Vos, *RePly Chair*, 2010, beech plywood, 86 x 57 x 49 cm, see roderickvosshop.nl.



2.11. Frank Gehry, *Wiggle Side Chair (Easy Edges series)*, 1972, laminated corrugated cardboard, fibreboard, 85,1 x 42,2 x 61,3 cm, MoMA, inv. no. 252.2002.



2.12. Peter Murdoch, *Spotty*, 1965, polyurethane-coated laminated paper, die-cut and folded, 52 x 52,5 x 46,5 cm, Victoria & Albert Museum, London, inv. no. CIRC.17-1970.



2.13. Robert E. Lewis and James Prestini, *Lounge Chair*, 1948, moulded resin-impregnated wood fibre, published in Kaufmann 1950.



2.14. Verner Panton, *Panton Chair*, c. 1968, moulded polyurethane rigid foam (Baydur), 82,5 x 49 x 54 cm, SMA, inv. no. KNA 3319.



2.15. Verner Panton, *Thonet no. 275 (S Chair)*, c. 1965, bent plywood, 81,5 x 43,5 x 53 cm, sold by Christie's Amsterdam in 2004.



2.16. Poul Kjaerholm, prototype for a cantilevered lounge chair, 1953, welded steel wire frame and papier-mâché, 66 x 61 x 58 cm, private collection.



2.17. Gunnar Aagaard Andersen, prototype for a stamped aluminium or fibreglass chair, 1952-1953, chicken-wire frame and newspaper, Kragstuhlmuseum, Lauenförde.



2.18. Jerszy Seymour, *Amateur Masters S*, 2011, hand moulded polycaprolactone wax, see gispn.nl.



2.19. Vico Magistretti, *Selene*, 1969, fibreglass-reinforced plastic, 74,9 x 47 x 50,2 cm, MoMA, inv. no. 412.1972.1-3.



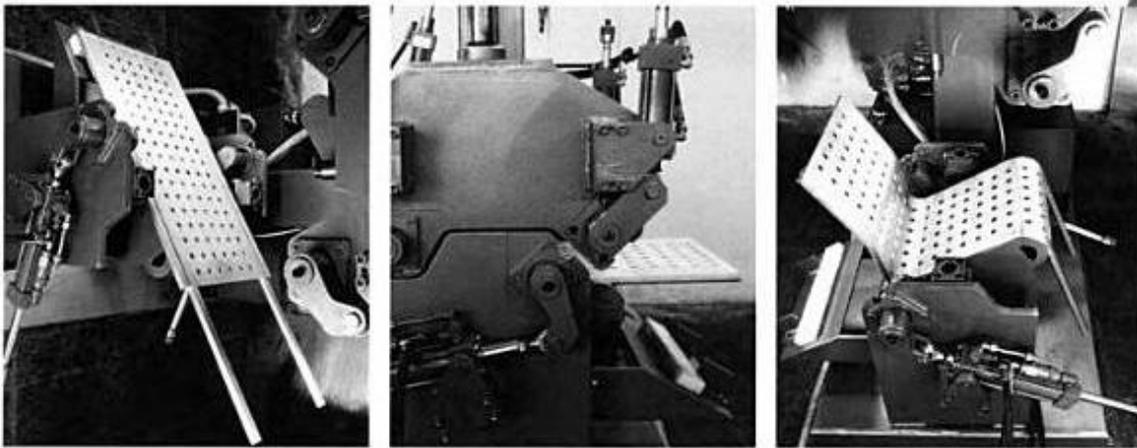
2.20. Joe Colombo, stacking side chair, 1967, polypropylene, 73,7 x 41,9 x 47 cm, MoMA, inv. no. 138.1988.1-3.



2.21. Pietro Arosio, *Mirandolina*, stamped metallic, stove-enamelled aluminium alloy frame, 1992, 84 x 40 x 53 cm, La Triennale di Milano Design Museum, Milan.



2.22. Hans Coray, *Landi Chair*, 1938, bent and pressed aluminium, 77,5 x 54 x 56,2 cm, MoMA, inv. no. 519.1998.



2.23. A cut and punched sheet of aluminium is bent into shape to form the *Mirandolina*.



2.24. Jasper Morrison, *Air Chair*, 1999, glassfibre-reinforced polypropylene, 76,3 x 49,5 x 52,5 cm, Vitra Design Museum, Weil am Rhein.



2.25. Willy Guhl, *Garden Chair (Loop Chair)*, 1954, fibrated concrete (Eternit), 52 x 55 x 89,5 cm, sold by Christie's London in 2005.



2.26. Maarten van Seeveren, *Low Chair (LC95A)*, design 1993-1995, aluminium, rubber spacers, 60,8 x 50 x 105,3 cm, Victoria & Albert Museum, London, W.669-2001.



2.27. Marcel Wanders, *Knotted Chair*, 1996, epoxy-coated aramid fibers with a carbon core, 71,1 x 50,2 x 62,2 cm, MoMA, inv. no. 434.1996.



2.28. Marcel Wanders, *Sponge Vase*, 1997, porcelain, 7 x 10 cm, see marcelwanders.nl.

Abbreviations

RSA = Rietveld Schröderarchief, Utrecht

NAi RA = Nederlands Architectuurinstituut, Rotterdam, Rietveld Archief (RIET)

CMU = Centraal Museum, Utrecht

SMA = Stedelijk Museum, Amsterdam

MoMA = Museum of Modern Art, New York

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