CREATIVE REFLECTION

in industrial design

Five Demand Driven Design cases

Jeroen Klaasjan Verbrugge

CREATIVE REFLECTION IN INDUSTRIAL DESIGN
FIVE DEMAND DRIVEN DESIGN CASES

4 oktober 2012 om 14.45h aan de Universiteit Twente
Drienerlolaan 5, Gebouw de Waaier, Zaal 4 (Berkhoff zaal), 7522 NB Enschede.

CREATIVE REFLECTION IN INDUSTRIAL DESIGN

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FIVE DEMAND DRIVEN DESIGN CASES

DISSERTATION

for the conferral of the degree of Doctor
at the University of Twente, on the authority of
the Rector Magnificus, Prof. Dr. H. Brinksma,
in accordance with a decision by the Doctorate Board
to be defended in public on
Thursday, October 4, 2012
at 14.45 h.

by

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born on August 11, 1960

in Vlaardingen

This dissertation, the scientific justification of five technical designs, according to Section 1, Article 1 of the Doctoral Regulations of the University of Twente, has been approved of by the supervisor:

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Patent Otolift: NL1022760 (C2)
Patent 1-2-Paint WO 03/091123 (A1)
ISBN 978-90-365-3416-1

Table of Contents

Summary

Over the years as founder and one of the designers of FLEX/theINNOVATIONLAB (FLEX for short) I experienced major changes in the industrial design profession and its market situation. The first chapter tries to give some insights into these changes and developments and how they influenced the daily design activities and the author in his ideas about his profession. First some questions are answered. Such as: “What is the relationship of design to innovation?” Furthermore a distinction is made between Author Designers and Demand Driven Designers. Both groups of designers show significant differences in their work, their approach and their perceived success. Without any specific methodology, Author Designers, like Droog Design, seem to focus more on semantic complexity and they show to have more success and recognition, whereas Demand Driven Designers, at the same time focus more on technical complexity and seem to remain relatively unseen and undervalued. Both groups of designers are analyzed. Referring to a BNO survey the work of Author Designers is characterized as:

- The personal style of the author/designer dominates the design process;
- Design aims at making objects ‘special’ and ‘exclusive’;
- The approach to design is highly individual and intuitive;
- Unrestrained creativity and spontaneous ideas are the main driving force.

And the work of Demand Driven Designers as:

- Style of the client, manufacturer and/or end-user dominates the design process (“You can’t see the designer in the design”);
- Design aims at creating client specific products with an increased attractiveness for large groups of end-users compared with its competitors;
- The design process is steered by a more or less standardized methodology to restrain the influence of too much uncontrolled creativity and ‘crazy ideas’;
- Concepts, derived from the world of marketing and communication are dominating criteria for success.

In general Author Designers are educated at Art schools and Demand Driven Designers are generally educated at universities of technologies. In an attempt to improve at least the quality of the design process and the outcome of the work of Demand Driven Designers, two questions are raised:

- Why are Dutch Author Designers generally more successful, well known and more internationally respected than their Dutch Demand Driven Design colleagues?

- Can Demand Driven Designers learn from their Author Design colleagues; for instance by relying more on their intuition than their education has inclined them to do?

In the next chapters an attempt is made to answer these questions in analyzing five design cases. In chapter 2 to 6 five Demand Driven Design cases are described. Each of these five projects shows different elements that finally paved the way to the development of a new design approach. They show the opportunities and at the same time bring an increasing insight in how this approach could look like. The first project is the design and development of a bottle tray for CocaCola. In this project the need for '*reframing'* was experienced, where the project was obstructed by a seemingly unsolvable contradiction in the required functionalities. In the project of 1-2-Paint for Akzo, chapter 3, the importance is shown of the *creative spark* and how it should have ample room in a new design approach. The case of the Ahrend 360 stacking chair describes the importance of respecting the first idea in the whole following design and development process. In chapter 5 the projects for Otolift show the limitations of Creative Reflection, where sometimes the complexity of a project might demand for a more sequential 'classical' approach, but in which a well -organized creative activation still *should* play a vital role. Finally in chapter 6 the work for Verstegen seems to be the best representation of a new design approach. This project is an example of a fully 2D and 3D integrated Creative Reflection process.

In chapter 7 an analysis is made of the design methodology, developed at the Delft University of Technology that seems to be very dominant to other industrial design and Demand Driven Design curricula. Also movements like Memphis and Droog are analyzed. Additional a more detailed analysis is provided of Author and Demand Driven Designers; what are their specific qualities and what differentiates them from one another. The classic design approach of Demand Driven Designers seems to drive them more into strict and sometimes even rigid design approaches, leaving less opportunity for their 'free-roaming' creativity; especially in the fuzzy front end of the design process. Analysis may enhance their insight in dealing with these type of problems, but by doing so, it necessarily also seems to shroud the 'wholeness' of their design-problem. In other words, at the fuzzy front end of the process, some sort of *synthesis* always should accompany any analytical step taken from the very beginning to compensate for the blurring of a complete mental picture of a number of different *overall* concepts, simultaneously performing at the highest technical and the highest semantic level.

Recent developments suggest that the former separate domains of Demand and Author Design are also somehow approaching each other. Therefore it seems to become less relevant what separates the two domains, and more important to answer the question what could bring them closer together, as their problems are essentially identical: transforming ideas into products. An analysis provides the insight that an improved design approach should alleviate or even better liquidate many of the shortcomings of the 'classical' design approaches. The new design approach should have the following characteristics:

- *synthesis from the start*
- *holistic approach to avoid fragmentation*
- *integration to avoid fragmentation*
- *thinking through acting*
- *randomness*
- *using and stimulation of one's intuition*
- *from parts to a whole*
- *functionality and meaning*

This new design approach is called: "CREATIVE REFLECTION"; a creative process that leaves enough room for the creative spirit to operate freely without the risk of some sort of chaos. Most essentially the new method is an *integrating* design process instead of a *dissecting* process. Where traditional methodologies tend to disintegrate the design problem through thorough analysis into ever smaller and less complex questions and problems, the new method is explicitly making use of relying on easier and faster accessible information and knowledge[1], the designers' intuition to interpret this information as a whole of interdependent independent facts and factors that constitute together into the essence of the design problem. The starting point of the new approach is a 'frame' in which the design problem is 'pinned down'. The parameters of this frame are: *technology*, *business*, *user* and *semantics*. The new approach seems to be best fitted to the *first* design phases, but it is worthwhile examining whether it is also applicable for other phases like engineering and implementation.

Providing insights in these five cases and by offering a first insight in a new design approach, this dissertation tries to give an initial impetus to the development of what is recently popular called 'Design Thinking' or 'Creative Thinking' and to contribute to the development and more recognition of the Creative Industry.

[1] During the whole design process, using internet, designers are able to collect their (technical) project information almost real-time and instantly.

Preface

During high-school I spend more than six years at the evening course of the Vrije Akademie in Vlaardingen, *the free academy*, making sculptures in clay, plaster, concrete and bronze. During the last years of this period it was my choice either to become a sculptor or a veterinarian. Just before my exams a third option appeared: Industrial Design at the Delft University of Technology; *sculpting products*, combining technology with creativity. Halfway the study it became already my dream to run and own one of the leading industrial design agencies in the Netherlands[2]. After extra business courses at the Erasmus University in Rotterdam, parallel to my study in Delft, and three years working for Vicon Landbouwwerktuigen (agricultural machinery) in Nieuw Vennep from 1986 until 1989, my business partner and I followed that dream and officially started FLEX/theINNOVATIONLAB [3]. To start a design agency and after more than 23 years to be able to look back and to find out that many of these plans and ideals came to reality is of course very satisfying. I would like to thank all my colleagues for their contribution over all these years and especially my business partner Ronald Lewerissa for his friendship and business companionship that yielded to so many products that are appreciated by our clients, end-users and design critics.

This dissertation describes some of the products that are part of this 'dream'.
I would like to thank the promotion commission and especially my supervisor, Prof. J.W. Drukker for offering me this opportunity and for his inspiring, sometimes critical, but always 'witty' support. Most importantly, I would like to show my greatest appreciation and gratitude to my wife – and family - who not only gave me all the support from the early days of FLEX, but who also provided her unconditional trust, belief, mental support and comfort that enabled me to write this dissertation.

[2] 'Flex team for design & development' was founded in 1983, already during the study, as a result of project that was executed for Artifort in Maastricht and that continued after it ended as a project for the university and had to be continued commercially.
[3] After the name 'Flex team for design & development, Flex was named 'Flex development BV' and from 2008: FLEX/theINNOVATIONLAB.

1 Introduction

1.1 The context of five industrial design cases

This text is the scientific justification of five technical designs in the field of industrial design submitted by the author to the Doctorate Board of the University of Twente as the subject for a doctoral defense.[4] These cases are part of the portfolio of FLEX/theINNOVATIONLAB, (FLEX for short), in which the author played the role of chief designer. The projects were realized between 1996 and 2010, during which period the author experienced growing concern about the way in which the designs were conceived and the approach used to achieve the final result. The approach was often significantly different from that which has been and is still being taught in almost all academic curricula in industrial design used by technical universities or colleges. In this same period the design profession witnessed the rise of another type of designer with an approach very different from that of the 'classical' industrial designer and very often someone who had been educated at an art school. Moreover, these new 'kids on the block' often proved to be highly successful in practice, even to the point that the commonly accepted meaning of the word 'design', long associated first and for all with 'industrial design', became something else. The introducing chapter aims to provide an understanding of the way in which the author experienced this period, how this influenced his perception of the design profession and finally how it urged him to search for an adapted design approach. This search steered away from the 'classical approach' taught since the inception of industrial design engineering as an independent technical discipline and aimed instead towards finding an approach which would not only better suit the design projects undertaken by FLEX, but one which could offer other designers support as well and even provide them with new opportunities for more creativity and design quality.

[4] Article 1 of the Doctoral Regulations of the University of Twente offers the possibility of submitting a 'technical design' instead of a 'dissertation' for defense for the possible conferral of a doctorate, provided that it consists of "..one or more original and innovative technical designs, developed in a way that is scientifically sound, through the processing and/or blending of raw materials or the development of software (and that) (a)all of this (…) (is) documented and accompanied by a scientific justification.."(Doctorate Board of the University of Twente 2011: p.3). Article 11 specifies that the dissertation may consist of "..a number of separate scientific/academic treatises which have already been published in their entirety or in part …"" (Doctorate Board of the University of Twente 2011: p. 7). Now, considering the exact parallelism that is maintained throughout the whole corpus of the Doctoral Regulations between the concepts of 'dissertation' and 'technical design', one would expect that the Doctoral Regulations also would open up the possibility of submitting technical designs which have already been realized in their entirety. On this point, however, the Doctorate Regulations are ambiguous in the sense that, on the one hand, they do not state explicitly that this is indeed possible, while on the other hand, it can be inferred from the above mentioned parallelism between 'dissertation' and 'technical design' that the Regulations imply that it should, at least, not be impossible. The submitting of five – earlier realized – technical designs and their scientific justification explores this possibility, to the best of my knowledge, for the first time, in the field of industrial design at the University of Twente. Of course, before actually entering this specific road to a doctoral defense, the Doctorate Board was asked whether the interpretation of the Doctoral Regulations in the above mentioned sense was correct. The author is indebted to the Doctorate Board of the University of Twente for its generous interpretation of its own corpus of Regulations, which made this alternative road to a doctoral defense feasible.

1.2 Design versus industrial design

FLEX/theINNOVATIONLAB (FLEX for short) has created, designed and engineered many products. The founders of FLEX, Ronald Lewerissa and Jeroen Verbrugge, both educated at Delft University of Technology, followed the methodology developed by Roozenburg & Eekels in doing so. According to Roozenburg & Eekels, industrial design or product design is the creation of products to be manufactured in mass production or in large series[5]. They promoted the vision that the development of industrial design was a result of the industrial revolution when crafts type production technology, making mainly unique products for specific well known people, gave way to the production of identical products in series production for large target groups, unknown as persons to the designer and the manufacurers. The skill needed to develop these new products, taking into account requirements coming from the end-users, taste, trends, the market, the manufacturer, the production technology and logistics, is industrial design.

From its founding in 1989 until 2012 FLEX realized many products that adhered strictly to this approach. FLEX created 'classic' industrial consumer products such as electrical power tools and cookware, as well as professional products, like agricultural machinery and office furniture. In the same period however, FLEX experienced a profound change in the nature of the industrial design profession which *stemmed from changes in practice rather than in theory*. In recent years, i.e. from the nineteen eighties and nineties onwards, the definition of industrial design was strongly influenced by the increasing popularity of the actual word 'design'. Design became more and more associated with 'style', sensitive to trend changes and the whims of fashion. *Industrial* design sometimes even suffered from this popularity, in the sense that it tended to blur the essential point that industrial design was based on professional marketing analysis, maximizing ergonomic performance and technical assessments.

The increasing popularity of these other 'style' representatives of design raised a number of questions: "Are design and industrial design indeed so different from each other?" "Could both worlds not learn from each other, rather than revolting against and disqualifying each other?" "Could a new design approach stemming from this other world perhaps improve the quality of daily practice at FLEX?" These are the questions that have echoed through the premises of FLEX during the last two decennia.

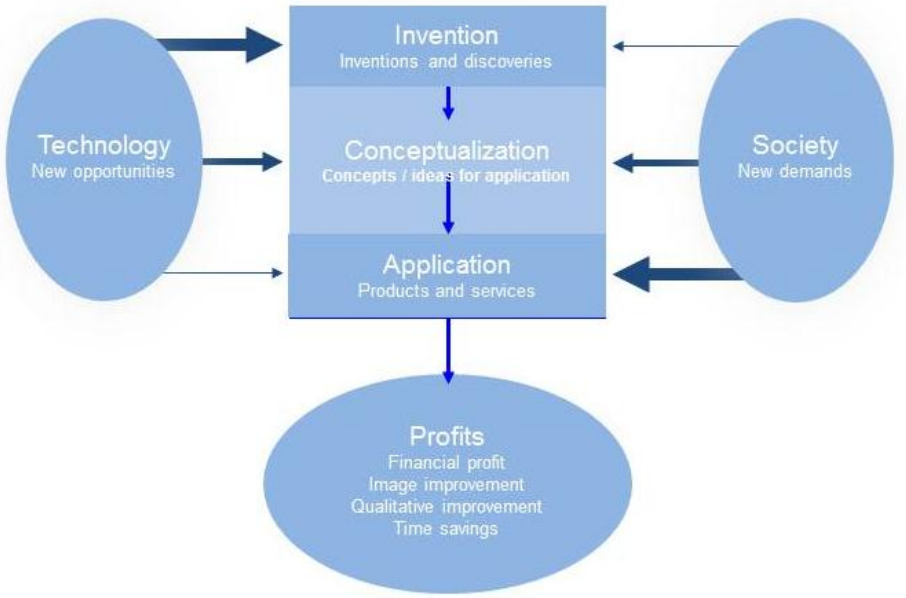
[5] (Roozenburg and Eekels 1986).

1.3 Design and innovation

In trying to find answers to these questions, it is important to define what design and more specifically what industrial design really is. A recent survey initiated by the BNO[6]: “Design en Innovatie” (Design and Innovation)[7] tried to clarify the essence of industrial design, as the government, according to the survey, seemed to focus – again - too much on the ‘artistic’ aspects of the discipline. As such the survey is a reaction to the Governmental report “Ons Creatief Vermogen” (Our Creative Potential) in which the Ministry of Economic Affairs together with the Ministry of Education, Culture and Science tried to formulate a policy on the growth and stimulation of the creative industry in the Netherlands.[8] The BNO survey seeks to clarify the field of design by providing definitions, differences and overlap between ‘innovation’ and ‘design’ and for this purpose suggested discerning two types of design professions: Author Designers and Demand Driven Designers.[9]

An important point was to define the relation between innovation, driven both by technology push and market pull (society), and profit. The central issue is that, from a company’s point of view, innovation should lead to profit, and by this, to continuity and growth [1.1]. The survey splits the concept of innovation into:

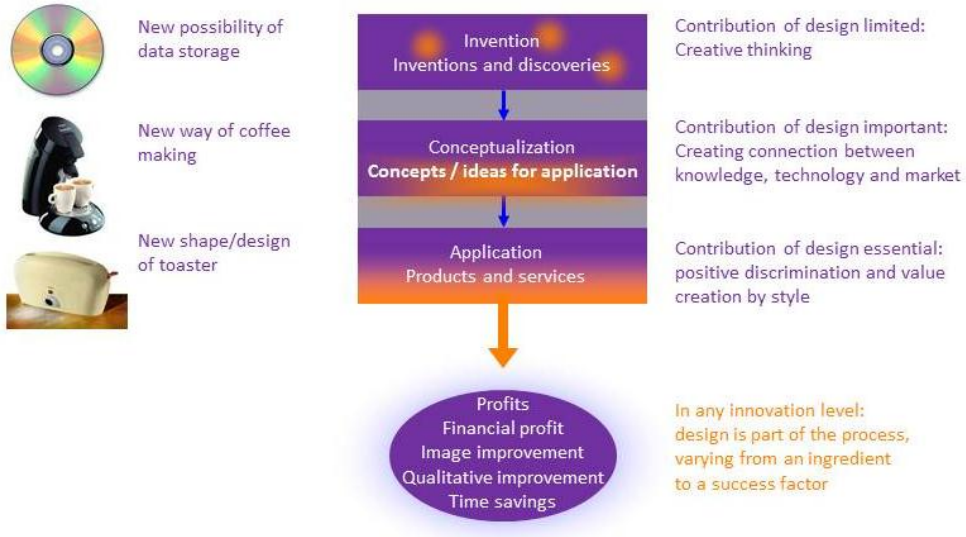
- invention;
- conceptualization;
- application.



[1.1] Innovation breaks down into Invention, Conceptualization and Application

[6] BNO is the Dutch Professional Association of Designers (Beroepsorganisatie van Nederlandse Ontwerpers BNO)
[7] As board member of the BNO the author co-initiated and managed this survey in 2006)
[8] (Min. van Ec.Zaken & Min.van Onderwijs,Cultuur en Wetenschap 2006).
[9] In the literature the same distinction is generally reffered to as ‘signature designers’ versus ‘industrial designers’ or plainly ‘designers’. In this context I prefer to hold on to the nomenclature introduced in the mentioned BNO-survey.

Using this, design can be seen as the total of professional activities aimed towards transforming ‘inventions’ (basically: ideas) into applications (basically: products and services). More specifically, this definition establishes a clear link between design and innovation. The importance of design varies however in each area of innovation, [1.2]:



[1.2] the importance of design varies in different phases of innovation

In the sequence ‘Invention-Conceptualization-Application’, the importance of design grows from ‘an ingredient among many others’ towards ‘the key success factor’. In other words, design is the seed of innovation, and as such is an essential factor in raising profits from successful innovation. The definition given by Roozenburg and Eekels and the positioning of the mentioned BNO survey will be used as guidelines when speaking of industrial design.

1.4 The Classical Methodology

Over the years the two founders of FLEX have developed a continuous and growing interest in the value and the role of a design methodology in their work. Even as students at Delft University of Technology (DUT) they asked themselves whether the classical methodology, in the Delft curriculum embodied in the model of Roozenburg & Eekels really offered the support it claimed, namely, that adherence to their track would always be beneficial to the final result. The years have proved the doubt justified as FLEX has experienced that the original classical approach did indeed provided support for their daily design practice, but only for a specific set of design problems, namely those characterized by a high degree of technical complexity, combined with a limited degree in radical innovativeness (re-design).[10]

[10] This point is worked out in Chapter 7.

As said, the suspicion arose by the two future founders of FLEX that the approach taught at DUT was insufficient for, and in some respects even harmful to accomplish radical innovative and really cutting edge designs. And this was no less than they, ambitious students, aspired to.

One of the aspects that, according to them, was missing in the DUT methodology, was the recognition that products were valued by end users, not only for their functionality, but also for the 'positive feelings' they induced. In other words, emotional aspects in the appreciation of a design were lacking in the Roozenburg & Eekels model. Consequently, this realization gave rise to a continuously growing curiosity from the very beginning of FLEX to finding an adapted design methodology that would enhance inspiration and creativity more that the DUT-model allowed for. Not incidentally "DESIGN-EMOTION' was the fundamental motto featured at FLEX's studio opening in 1989.[11]

1.5 Context

The suspicion that the methodology of Roozenburg & Eekels ignored some important aspects of the design process arose in the period between the 1980's and 1990's when some designers who were *not* educated in the DUT-tradition were producing highly interesting designs that were apparently more appealing and meaningful to the public than the work of industrial designers who were trained in the 'classical' Roozenburg & Eekels inspired tradition.

[11] Apparently the need to broaden the discipline of industrial design engineering with the study of non-technical aspects was felt in Delft too, as can be inferred from the founding and subsequent highly successful development of a research group, working on 'Design and Emotion', by DUT-professor Paul Hekkert. See for instance: (Desmet & Hekkert 2002; McDonagh, Hekkert,Van Erp, , & Gyi (Eds.) 2003; Hekkert & Van Dijk 2011;

1.5.1 Memphis Movement

Typical examples of 'famous designers' lacking 'classical' training in that period are: De Lucchi (architect), Castiglioni (designer), Sottsass (architect) and Paulin (sculptor). Sottsass and De Lucchi were members of the world famous Memphis group. Their work was highly inspirational, highly appreciated and neither of them were trained industrial designers. We asked ourselves: "Why are they nonetheless so successful in design?"

[1.3] Successful designs: (L) Olivetti, Sottsass; (M) Organge Slice chair, Artifort, Pierre Paulin, Michele de Lucchi, Memphis .

1.5.2 Droog Design

Closer to home, there are several historical periods in which Dutch Design was, both nationally and internationally, well known, respected and popular. Prior to World War II, a group known as 'De Stijl', related to the design paradigm of 'De Nieuwe Zakelijkheid' and including people like Gerrit Rietveld and Willem Gispen, was highly influential on an international scale[12]. Recently another group of Dutch designers became world famous: 'Droog Design', some members of which have almost achieved a form of 'stardom' status[13]. Droog was co-founded in Amsterdam by designer Gijs Bakker and design critic Renny Ramakers in 1993. It started early 1992 when Ramakers showed a number of pieces of furniture by young Dutch designers which were assembled from cheap industrial materials or found objects such as old dresser drawers and driftwood, at exhibitions in the Netherlands and Belgium. At the time, so little was sold that she barely covered her costs. Even so, the pieces raised so much publicity that Ramakers was convinced that she had discovered a genuinely new and very promising approach to design.

[12] On 'De Stijl', see: (Blotkamp 1982, 1996;Jaffé 1956). For a more recent overview: (White 2003).On 'De Nieuwe Zakelijkheid: (Fanelli 1978; Abrahamse & Noyon 2007)
[13] (Bakker & Ramakers (Eds.) 1998; Ramakers 2002; Drukker & Van Velzen 2009)

The collection was called ‘Droog Design’ after the Dutch word ‘droog’, which translates into English as ‘dry’ as in ‘dry wit’. Indeed, it was a wry, subtle sense of humor that characterized all pieces exhibited. Only one year later, she was proved to be right: ‘Droog’ was indeed the talk of the town during the 1993 Milan Furniture Fair. The French newspaper *Libération* suggested that the *“‘unknowns’ responsible for Droog should be given a medal for spiritual savoir vivre”.* Many of the pieces unveiled in that first ‘Droog’ exhibition are now regarded as design icons of the early 1990s.

Looking back it is easy to see why Droog made such a splash. By the early ‘90s contemporary designers rebelled against the cacophony of candy colored plastics and kitsch motifs, the result of the dominance of the mid-1980s Memphis movement, by adopting a restrained, sometimes overly retentive minimalist aesthetic.[14] As Ramakers phrased it, “design became much more sober”. Indeed, ‘Droog’ was very different from Memphis. It combined a severe minimalism with a typical choice of materials, deployed with ‘droog’ humor which struck an emotional bond with the user. It has certainly put Dutch Design once again on the international art and design agenda, and has also played an important role in the attention paid recently by the Dutch government to the so called ‘creative industries’...[15]. The increased attention of the Dutch government for Dutch design had much to do with the international praise for ‘Droog’, but it was also strongly reinforced by Richard Florida’s influential *The Rise of the Creative Class*.[16] Florida was one of the first to identify the social and economic influence of the creative class to society, and his research influenced the policy makers of the Dutch Government greatly at that time. From the perspective of *design methods* the successful ‘Droog’ movement did not use the ‘classical’ design methodologies. At its source were mainly students of the Design Academy in Eindhoven, who used a completely different and less structured design approach.

In this respect it is important to note that there is a fundamental difference between these individually operating Droog designers, who I will label subsequently as Author Designers and to those such as the earlier mentioned Willem Gispen as well as Friso Kramer from the period of the “Nieuwe Zakelijkheid” answering the assignments of industry and clients. The latter I will define as Demand Driven Designers. A survey by the Dutch professional organization of designers BNO, aimed to clarify things.[17]

[14] Memphis was founded and led by Ettore Sotsass. Its history was written by his mistress Barbara Radice (Radice 1985), which explains its almost hagiographical character.
[15] As board member of the Dutch Professional Association of Designers (Beroepsorganisatie van Nederlandse Ontwerpers BNO) from 2002 to 2008 I could experience this change from nearby.
[16] (Florida 2002).
[17] (Verbrugge, Van der Zwaal *et.al.* s.a.)

1.5.3 Demand Driven and Author Design

The BNO survey identified Author Design and Demand Driven Design. The work of Author Designers like Droog was characterized as:

- The personal style of the author/designer dominates the design process
- Design aims at making objects 'special' and 'exclusive'
- The approach to design is highly individual and intuitive
- Unrestrained creativity and spontaneous ideas are the main driving force
- Concepts derived from the world of fashion and avant-garde art ('trendy'; 'showy' or 'flashy') are dominating criteria for success [1.4]

[1.4] Examples of Author design: (L) Rody Graumans Chandelier (1993); (R) Tejo Remy, Chest of Drawers (1991)

Demand Driven Design forms the opposite part of the design spectrum, and is characterized as:

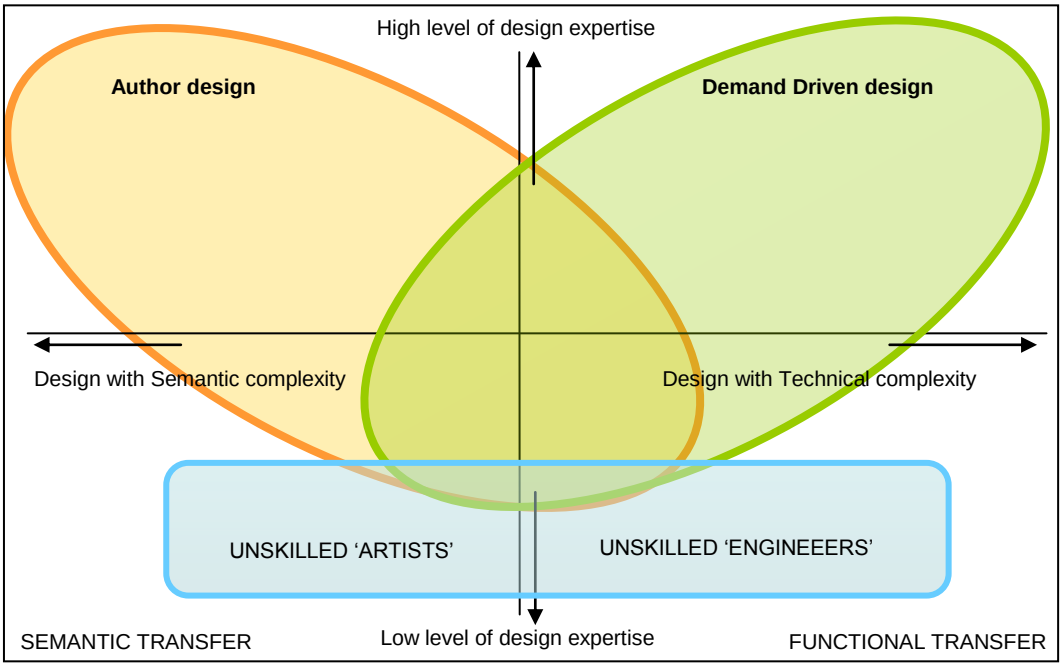
- Style of the client, manufacturer and/or end-user dominates the design process ("You can't see the designer in the design");
- Design aims at creating client specific products with an increased attractiveness for large groups of end-users compared with its competitors;

- The design process is steered by a more or less standardized methodology to restrain the influence of too much uncontrolled creativity and ‘crazy ideas’
- Concepts, derived from the world of marketing and communication are dominating criteria for success [1.5]

[1.5] Examples of Demand Driven Design: MRI scanner, Philips Medical 2006, Beertender, NPK Design 2007

Looking simply at the results, one of the most striking differences between Author and Demand Driven Design is the complexity of the products and projects. Author Designers seem to work exclusively on – technically speaking - relatively simple products like furniture and simple household products, while Demand Driven Designers seem to focus on technically more complex industrial products.

This explains why Author Designers can rely more on their intuition where Demand Driven Designers have to fall back on standardized processes and methodologies. Differences in daily practice between Author and Demand Driven Design can be scheduled as in [1.6].



[1.6] Author versus Demand Driven design, semantic versus technical complexity and experience

The graph shows two axes: from simple to complex projects and from a low level to a high level of design expertise. From a technical viewpoint, the Author Designer concentrates on relatively simple products, where Demand Driven – industrial - Designers execute more complex projects. From a semantic viewpoint, however, it is the other way around: Author Designers tend to work on complex products, while the products of Demand Driven Design tend to be characterized by a relatively low level of semantic complexity. For both groups holds that the more experience they have, the more they successfully handle complex projects.

In this respect, it is essential to understand the difference between semantic and technical complexity. The difference can be identified by the fundamental notion that innovation is essentially a matter of transfer from one domain to another, but that the role of design in this differs depending on its Author or Demand Driven nature. In Demand Driven Design existing technical possibilities (domain: technology - see the right hand side of Figure 2.6) are transferred into products, characterized by specific functionalities, that are asked for by users.

The essential point here is: functional transfer. In the domain of Author Design, while existing technical possibilities are transferred into products, it is not the function as such that is at stake, but the *meaning* the product radiates.[18]

Looking at the education background of both groups, Author Designers are more often trained at art schools. This is not the case in the Netherlands only, but also elsewhere. In the Netherlands the industrial designers or Demand Driven Designers are mostly educated at the technical universities of Delft, Eindhoven and Twente and at the – Polytechnic – Institutes of Product Development (IPO's). With reference to the integration and cooperation between both types of designers, two important questions can be raised:

- Why are Dutch Author Designers generally more successful, well known and more internationally respected than their Dutch Demand Driven Design colleagues?

- Can Demand Driven Designers learn from their Author Design colleagues; for instance by relying more on their intuition than their education has inclined them to do?

An initial step towards answering the first question can be made by analyzing the success of Droog Design. Its members made a far more innovative, progressive and personal statement in the Dutch and international Design world than Demand Driven Designers did. The Author Designers of Droog used a purely individual, personal signature; a more 'art-driven-intuitive-approach'. This formed a fruitful basis for originality in a personal quest for something really new and different. The starting point of Demand Driven Designers however, was general market analysis and technological assessment that forced them into a more guided, rigid and therefore less unique outcome. This was not only the case in the Dutch Design world it was no different in any other international industrial design scene. All Demand Driven Designers were far more dependent on methods, structures and project planning, which in turn impeded the mobilization and utilization of their own personal touch, visions, ideas and intuition.

[18] On the difference between functionality and meaning in relation to Author and Demand Driven design, see: (Eggink 2011). In our context, an elaborated analysis of the difference between function and meaning in design will carry us too far away from our main argument, so we refer to Eggink for this. For our purpose it suffices to state that 'meaning' is a catch-all for all consideration that determines the appreciation of a product, apart from those that stem from functionality in the limited sense of usability. In this sense, 'meaning' stands for: product aesthetics, emotional ties with a product, and the product as a status symbol, as a piece of art, as an ethical statement.

It is not only the work of design professionals which has created this impression; it is further supported by looking at their background. The technical universities they were trained at use strikingly similar design methodologies in their curricula, many of which are related to the earlier mentioned Roozenburg & Eekels approach created and taught at Delft University of Technology.

In order to answer the second question: ”Can Demand Driven Designers learn from their Author Design colleagues?”, one should first consider whether there is any evidence that Author Designers are successful in the domain of Demand Driven Designers. The answer to this last question is undoubtedly affirmative as a number of Author Designers have already demonstrated that they can handle and execute technically complex and more Demand Driven Design problems successfully. This has been done successfully by for instance Jasper Morrison for Rowenta, Constantic Grcic for Krups and Philip Starck for l brands like Aprilia [1.7]. Their intuition, experience and cooperation with the rest of the design team have obviously contributed to the success of these projects.

As such, if Author Designers have proved themselves capable of operating in the arena of more classical Demand Driven Design, why then should Demand Driven Designers not do the opposite?

[1.7] Jasper Morrison for Rowenta, Konstantin Grcic for Krups, Philippe Starck for Aprilia

This gives rise to an important question:

“Could this be facilitated by a new design approach or a new design method and would Demand Driven Designers benefit from this new method?”

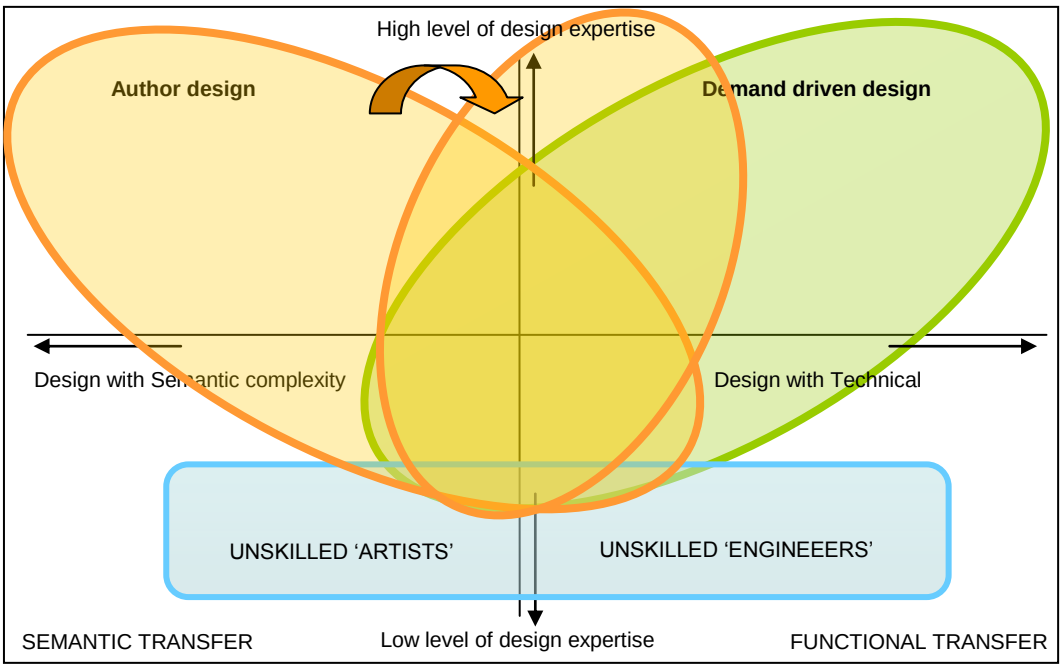
If the answer is affirmative, the next question is:

“In what respect would this new approach differ from the classical methodology?”

There seem to be three good reasons why a new approach for Demand Driven Design should and could be developed. Firstly, even the enormous success of the Dutch design movement Droog Design suggests in itself that Demand Driven Designers can learn much from Author Designers. Instead of a rigid design methodology, Author Designers have relied more on their intuition when starting a design project. Even though the field Droog Design has been active in has been mainly that of simple household and interior products, the power of its success has showed the potential of *free thinking design*.

Secondly, it has become increasingly easy to get almost instant access to many sources of information in the last decades through: web-research, co-operation with a multi-disciplinary project team, open source innovation, use of social media, co-creation and crowd sourcing. In other words, the evolution of project co-operation models and the technological development of the internet have provided designers with ample means to operate quickly in the so called ‘fuzzy front end’ of a design project. Due to recent technological developments, designers are nowadays able to acquire and collect extra knowledge and project information necessary for a design project very easily and rapidly, whereas in the ‘old times’ going through books, literature and papers was the route taken. This had to be done with painful accuracy as the outcome was important for a correct project orientation and was inevitably time consuming. As such it follows that this was why it needed to be done before the synthesis and concept phase of a project. Now that designers have ready access to knowledge and information, this sequence is no longer the *only* one possible. Technological change in information retrieval has enabled designers to develop concepts more or less *parallel* to their analytical and deductive activities. This point is further elaborated on in Chapter 7.

The third reason has been discussed earlier: Author Designers have already proved that it is possible handle relatively complex design projects successfully without bothering too much with accepted methodologies. As such a number of Author Designers have already moved into the design area that used to be the exclusive domain of Demand Driven Designers. This in itself is proof that other, more intuitive approaches can indeed be applied successfully [1.8].



[1.8] Shift of Author Designers into the direction of Demand Driven Designers

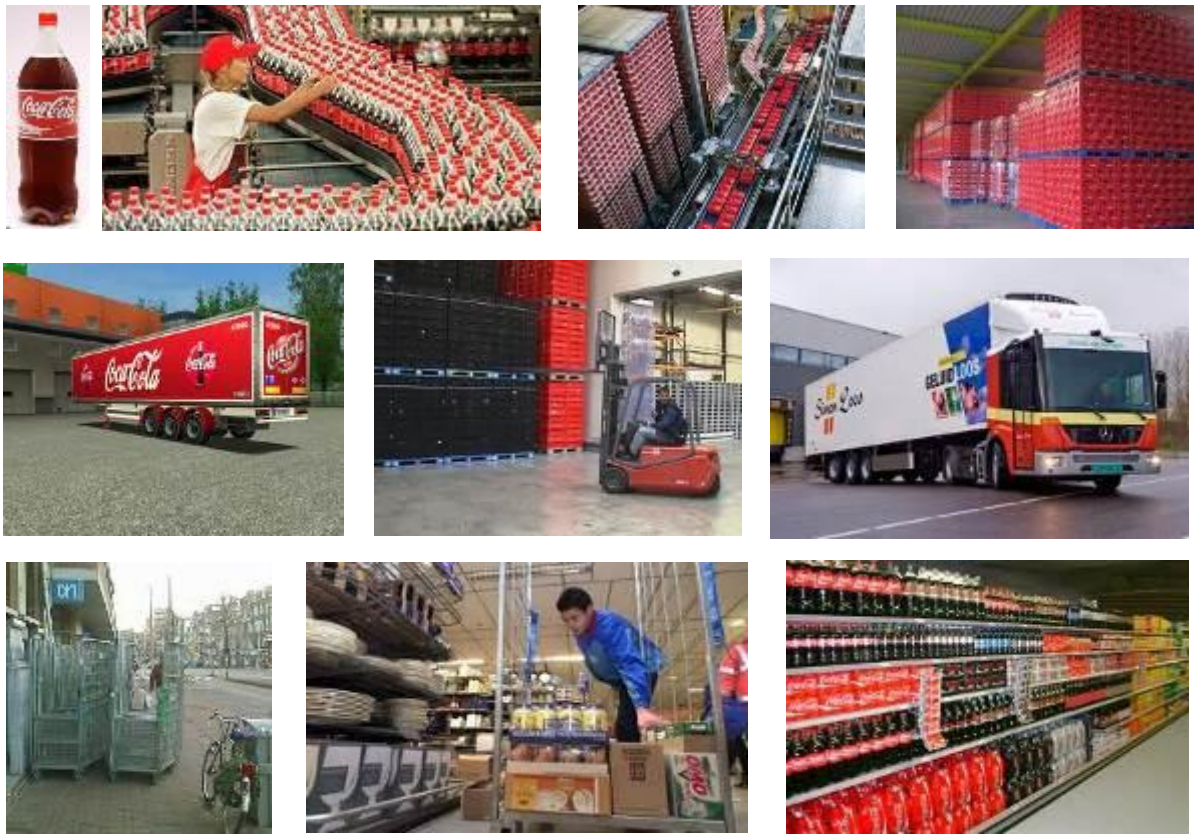
Summarizing the above, recent developments show that the formerly separate domains of Demand and Author Design are starting to merge. What separates the two domains is less relevant than finding out what could bring them closer together. Designers of both domains are 'problem-solvers' and moreover their problems are essentially the same: how to transform ideas into products. The question is just what is it that Demand Driven Designers can learn from Author Designers?

Day to day experience rather than any theory has led to a gradual shift in interest at FLEX to find a design approach that would improve the quality of work. The inspiration for this has been the high standard of semantic transfer achieved by Author Designers. How this gradually developed in daily practice is illustrated by five Demand Driven cases that are described in the following chapters. How this approach differs from the ‘classical’ methodology and the way it is related to theories on creativity, is the subject of chapter 7.

2. Case 1: Coca - Cola tray

2.1 Introduction

In December 1995 FLEX was approached to cooperate in the ESSO project; the development of an Efficient Softdrink Supply Outer. The project was originally initiated by Dutch retailer Albert Heijn (AH). At that time AH suffered serious losses in the sales of soft drinks; especially in so called ‘fast-movers’ like regular Cola. The main reason was the labor intensive character of the operations involved in the total handling of the bottle from production until the shelf delivery, including the return-cycle of empty bottles and crates back to the factory. The total sequence [2.1 and 2.2] could be summarized as follows:

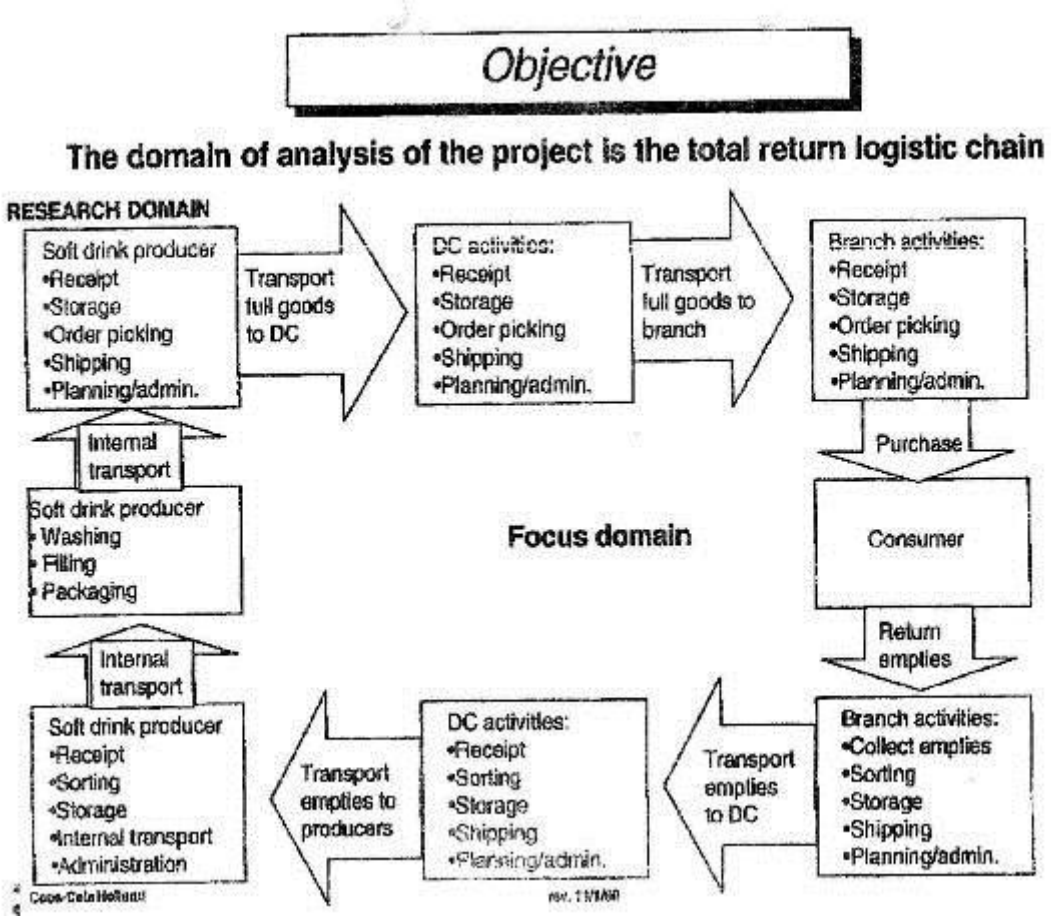


[2.1] Logistic process in daily practice

1. Filling the bottle with Coke on the filling line;
2. Placing bottles into the crates (10 x 1,5 liter bottles in one crate);
3. Placing of filled crates on pallets;
4. Storage of pallets at production plant Coca-Cola;
5. De-stacking of pallets and transportation to Distribution Centre AH;
6. De-stacking of pallets and storage of crates in Roll-containers (so-called order-picking);

7. Transportation of Roll-containers to AH-retail-outlets;
8. Taking Roll-containers to sales floor of AH-Outlet;
9. Taking bottles out of Roll-containers and crates to put them on the shelves one-by-one.
10. Return cycle of empty bottles and crates from retail-outlet via retail logistic center and finally back to the Coca-Cola-factory

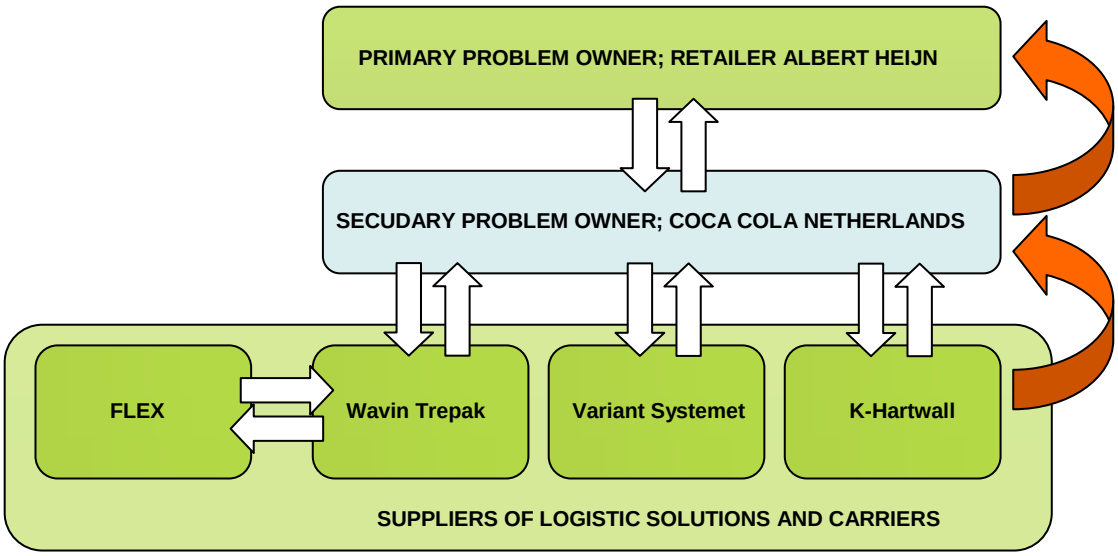
The most important reason for trying to change this into a more efficient logistic solution was the outcome of an internal calculation made by Albert Heijn. It showed that the selling of fast-movers like Coca- Cola required an estimated DFL 40 million in labor costs per year. The essence of the assignment was to be able to skip or at least to substantially reduce the labor costs involved in the whole distribution chain.



[2.2] Logistic chain of CocaCola project

The design of this logistic solution should create a situation in which much of the manual labor as rendered would be obsolete or at least be largely minimized. At the same time the project should yield a situation where the packaging and transportation was kept unchanged in the whole logistic sequence.

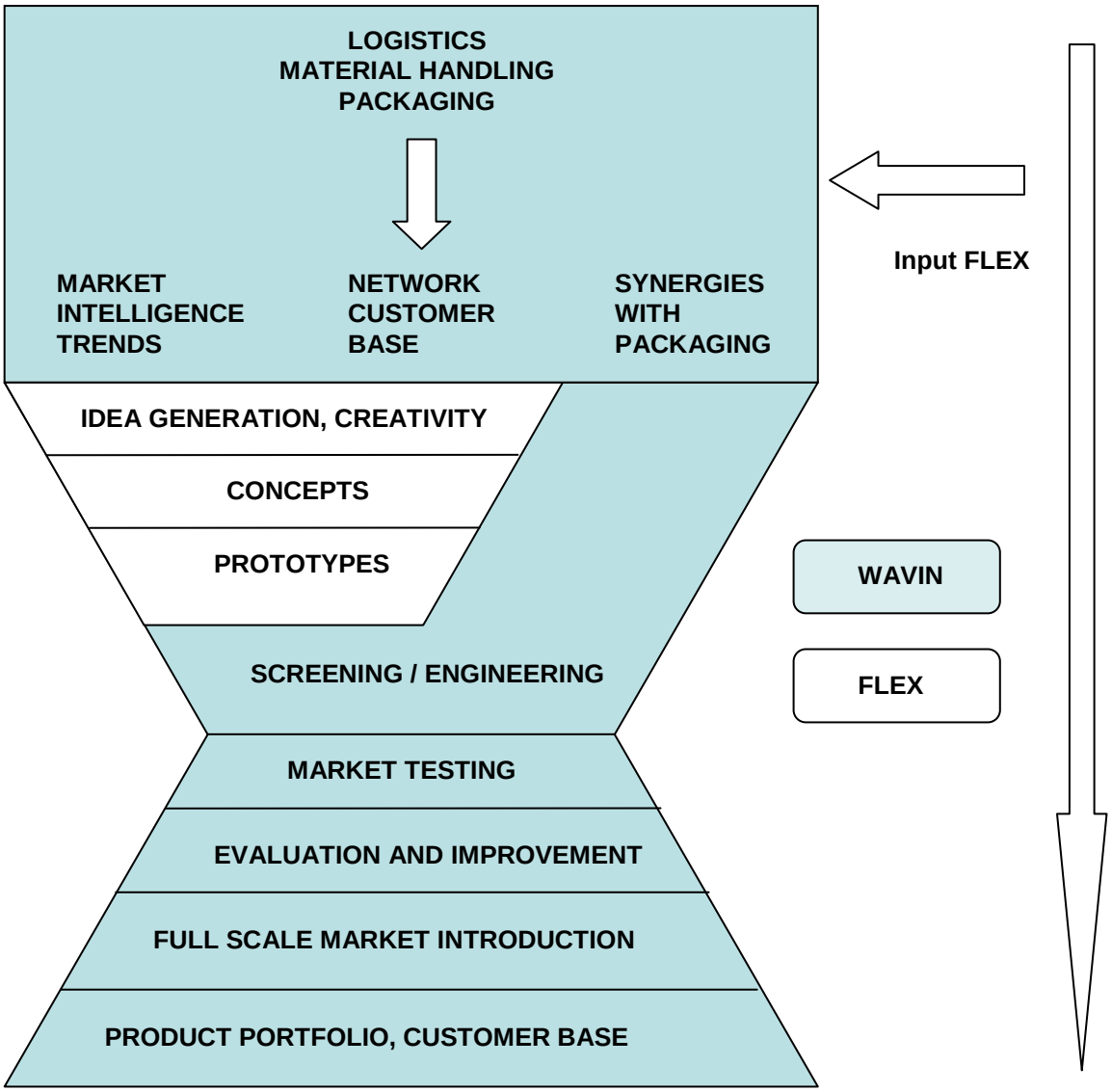
To achieve this, CocaCola approached suppliers of logistic solutions and carriers to come up with a new design. It was an international tender that involved several suppliers, like Variant Systemet, manufacturer of trolleys and Roll containers for the Dutch flower auction and K-Hartwall, one of the manufacturers of the Roll-containers for dairy drinks. Another was Wavin Trepak (these days called Schoeller Arca Systems). As Wavin Trepak could only offer production and engineering capacity and as it did not have an internal design and development department, Wavin approached FLEX to join the team. The dependency of the supplier towards the primary problem owner is shown in [2.3].



[2.3] Independency of involved project parties

The cooperation in this project was quite unique. FLEX was only indirectly involved in the assignment and actually only part of the design team of the supplier and third party Wavin. Within this team the Wavin management defined the specific roles of all the involved managers, designers, engineers and FLEX [2.4]. The main responsibility of FLEX was to provide the team with creativity, intended to integrate:

- Logistic requirements; reducing the intensive handling of the bottle;
- (AH) Retail worthiness;
- Brand values of Coca Cola and AH;
- Technical feasibility.



[2.4] Position of FLEX within the project team of Wavin

The scheme [2.4] shows the specific position of FLEX as the creative motor of the project. FLEX had to connect the commercial and logistic requirements with the technological feasibility. FLEX had to find the proper insights in market trends, logistic and packaging limitations and had to transfer these insights into concrete solutions that would be feasible for Wavin to produce. And maybe equally important: the solutions would need to have the quality to convince AH to choose for Wavin as their future supplier. Altogether FLEX was in a vital strategic position, not only for the end users AH and CocaCola, but also for Wavin.

2.2 Phase 1; Analysis and concept phase

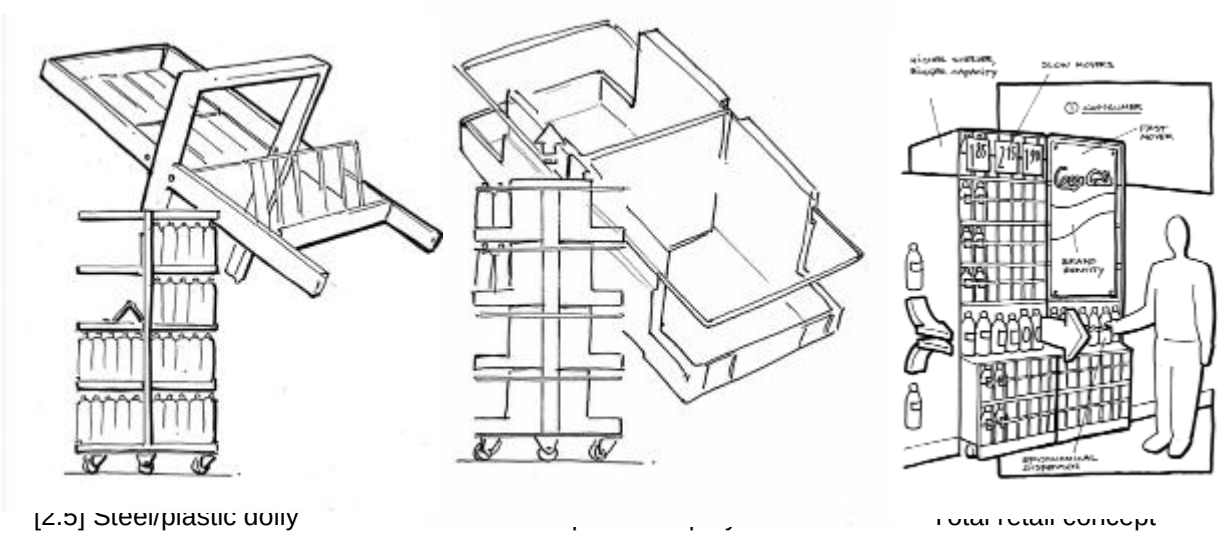
The project started with a conventional TU Delft methodological approach. FLEX first focused on a market analysis and the collection of technical data that would lead to a proper list of requirements. The result of this analysis should lead to a synthesis of ideas that would:

- respect the existing logistic restrictions and requirements,
- answer market intelligence trends like tracking and tracing and
- integrate packaging requirements of 1,5 liter Coca Cola bottle.

A very important point in this first phase was that the teams from all participating and competing companies were looking for a solution and a concept that would fit their experience, knowledge and production facilities in the best way. The competences of the competing companies were:

- Variant Systemet; manufacturer of steel dolly's and containers;
- K-Hartwall; manufacturer of (galvanized) steel containers;
- Wavin Trepak; producer of injection molded plastic crates & dolly's.

Being part of the Wavin-team we were of course restricted in finding a 'plastic' solution, whereas normally we would create concepts without the obligation to work with especially one type of material or one production method. In the first phase however, with the approval of Wavin, we decided to broaden our conceptual horizon further than just to find a smarter retail-worthy 'plastic-display-crate'. By doing so we were able to act more independently and objectively than the other parties involved. This value was recognized by both Wavin and later by CocaCola which increased our credibility towards the real interests of CocaCola and Albert Heijn. The concepts we developed varied from plastic-based dolly's , via only crates to more or less complete retail concepts [2.5].



[2.5] Steel/plastic dolly . Total retail concept

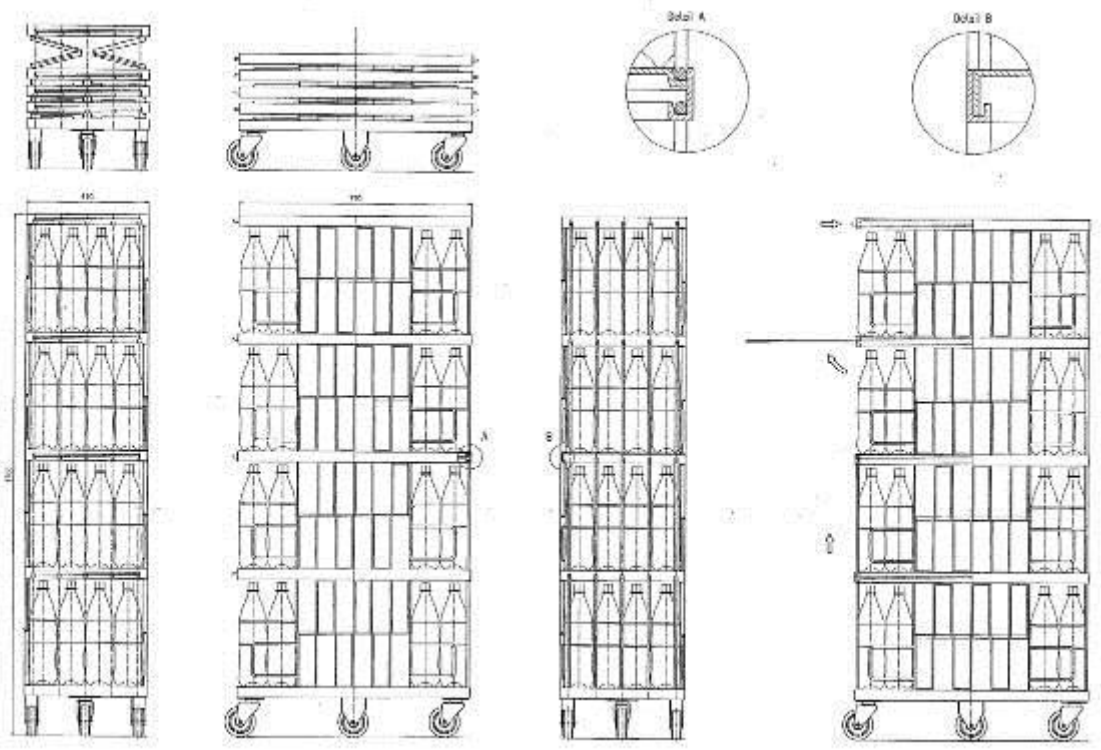
The idea of the steel-plastic dolly was a more or less direct copy of the existing steel dairy roll-containers that were already in use at that time [2.6].

[2.6] Conventional steel dairy roll container

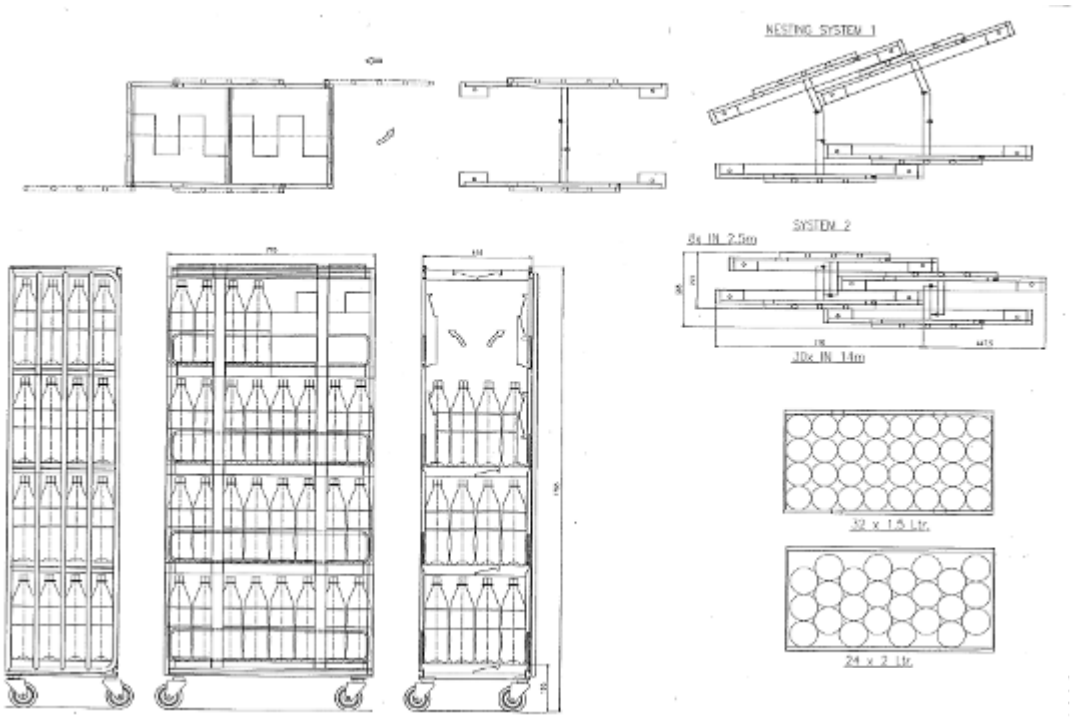
In our ‘plastic’ version the steel trays would be transferred into a plastic variant. This would deliver an ergonomic improvement as the steel versions were suffering from corrosion that was leading to a malfunctioning of the sliding principle, subsequently leading to the problem that the next layer of bottles could not be reached by the consumer. The plastic version would overcome this problem.

The stackable display crate was essentially still a ‘plastic-crate’. It had, however an effective solution for the problem to reach all the bottles in all the stacked crates without the need of un-stacking the crates to reach the next layer of a full crate. This possibility was offered by the integrated removable steel bar.

All the proposals were subsequently drawn in Auto CAD and printed on large size 1:1 scale to present the concepts in a most realistic way. For these type of more technical and mechanical products this is the best way to get a proper impression of the feasibility of the concepts. Hand sketching would never have given the right insights into the value of each concept.

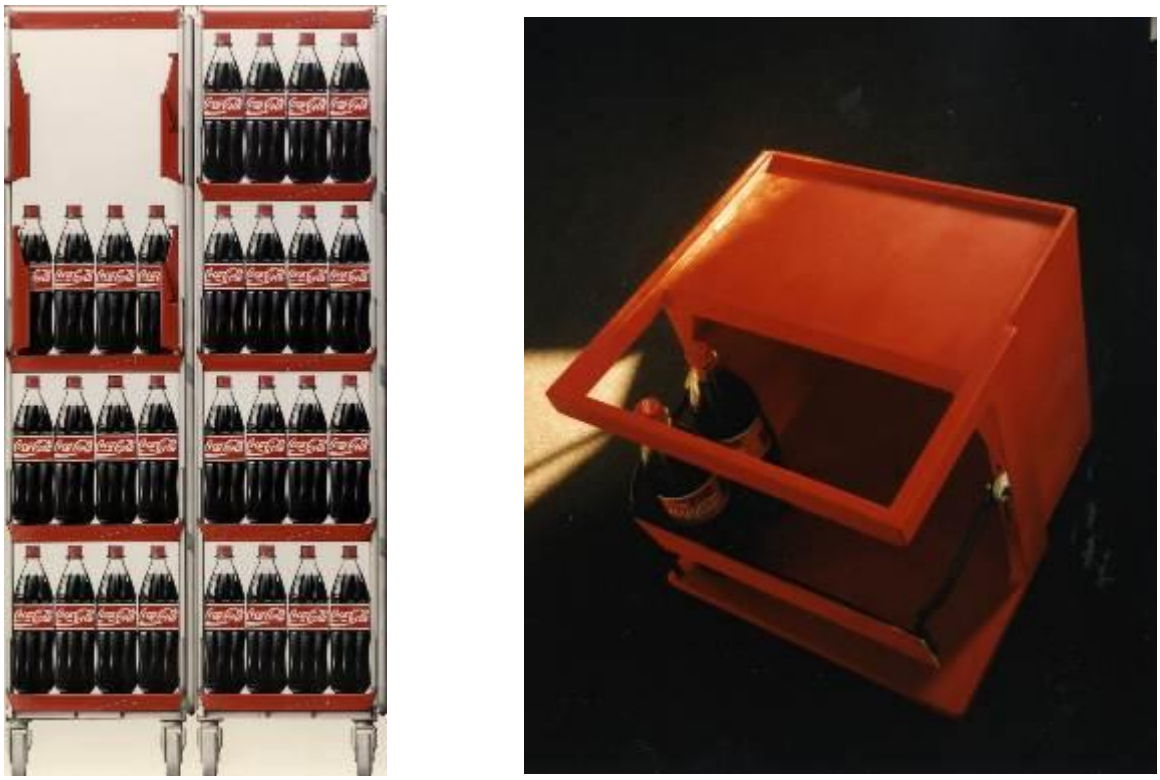


[2.7] Collapsible container with plastic layer boards



[2.8] Nestable container with plastic layer boards

Five concepts in total were first internally presented and discussed with Wavin. The outcome of this was that Wavin decided to continue with two concepts and to present only these two concepts to Coca Cola. The first concept was the collapsible container with plastic layer-boards [2.9]. The second concept was a stackable display crate, from which bottles could be taken out while the crates were still in stacking position. Both concepts were presented with large renderings. The display crate was also presented with a wooden model [2.9].



[2.9] Collapsible container and mock-up of display crate

The crate concept was Wavin's favorite; they wanted to present this solution with some more attention than the other. As part of the design team of Wavin we as FLEX also felt at the same time that, also in the interest of Albert Heijn and CocaCola, this was the best overall concept.

The main reason why we thought that this solution was the best, was that with this display crate all the bottles in each stacked crate could be reached directly without any additional handling. With the collapsible container in case that the top-layer-board would be empty and without any bottles, the consumers had to remove this top-layer-board to reach the next level with bottles. This consumer handling was generally seen as an undesired threshold for the purchase process.

Next to this main reason there were also two important supporting arguments:

- the display crate showed the lowest price per bottle;
- the display crate showed adequate retail quality; it had for instance no problems with rusting of iron parts).

The presentation to Coca Cola was so successful that Coca Cola decided that Wavin had won the tender and that they wanted to continue with Wavin as the leading company for the next steps in the development. Variant Systemet was asked to become a supplier to Wavin as they had specific knowledge and experience with mobile containers. With regards to the fact that the concept of Wavin would be using ‘wheels’ and that Wavin was not experienced in this area, this seemed to be an acceptable decision.

During the last meeting a very important remark was made by CocaCola: they had the impression that the concept should be made and executed simpler and that it should use less material as CocaCola was worried that the concepts would become too expensive. This remark triggered the FLEX team and especially myself to rethink completely the concept that had been developed so far.

What was at stake? The display crate was somewhat larger than a conventional plastic crate. It had to use more space above the bottles as the bottles needed to be lifted and tilted out of the crates. This implied that the display crates would need more plastics, and as such require more material costs and larger tooling than existing crates. As the display crate would replace the existing crates, the investment level of the new crates would be significantly higher and ‘between the lines’ CocaCola had let us know that the investment level should be the same or even preferably lower. At first sight this seemed unsolvable within this concept and likely to become a problem in the further execution and engineering.

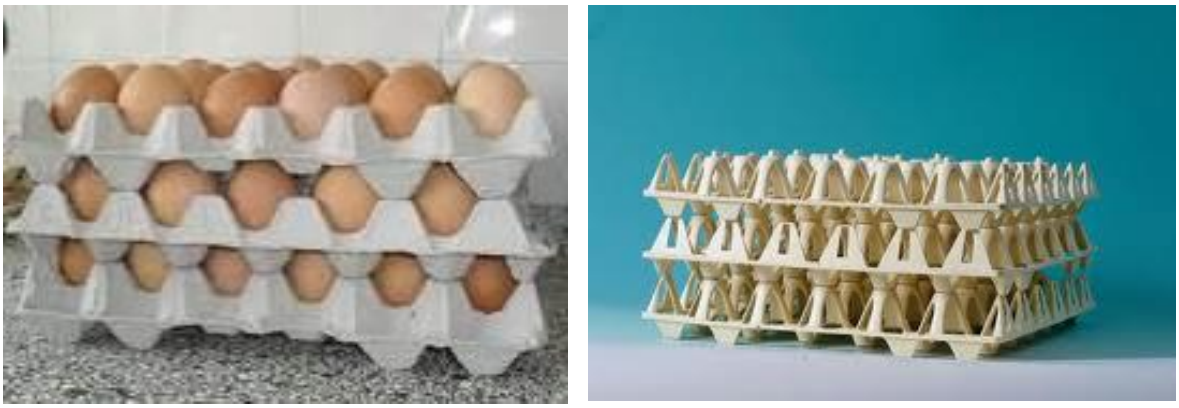
This phenomenon is very often a problem in design projects. The new design should always be less expensive than the old one, even if this is an incorrect point of view, as in this case the concept would of course realize a large reduction in logistic- and handling-costs as a stacked series of bottles could go directly from the factory to the retailer, without labor intervention. It was also calculated that the total costs of ownership (TCO) were much lower. But the cost of one unit was higher, compared with the old and standard HDPE CocaCola crate; as the new crate was using 5 - 10% more plastic.

Within the FLEX team several brainstorm sessions were organized to come up with improved concepts or even with alternative concepts; however with no success whatsoever. Was the project heading for a failure as the requirement of CocaCola could probably not be met?

2.2.1 Creative spark

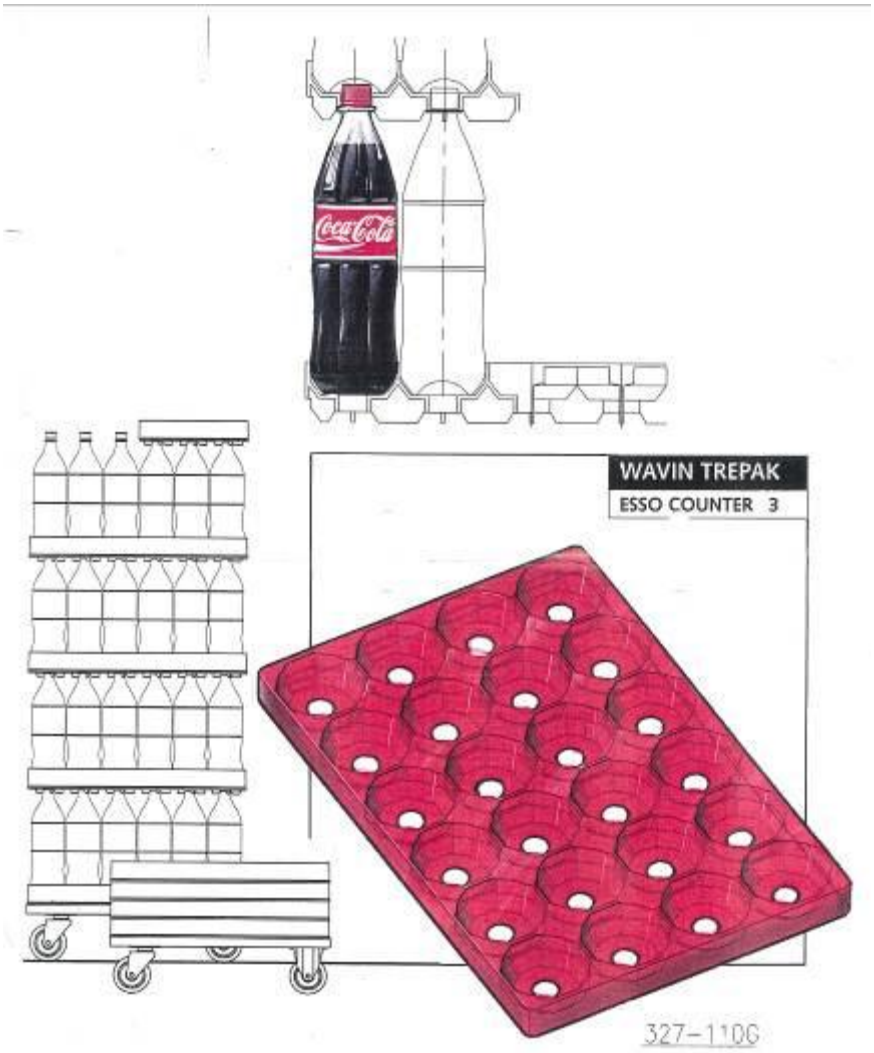
The foregoing situation made the whole team - the combined design teams of Wavin and FLEX - very insecure with respect to a feasible solution at this particular instance. One late evening however the creative spark ignited.

The essence of finding a new solution is to penetrate to the essence of the design problem. The assignment was to design and develop a more efficient crate or dolly/container. As a result of this, the project orientation given by CocaCola was to fully support and carry the bottles as we were used to do with the existing crates. But was this really needed? Did we have to design a ‘similar milk-container’ or otherwise a plastic ’display-crate’ for especially this type of retail environment? The assignment was ‘re-framed’. The question was asked: “Where else did a similar situation and design problem occur and how was it solved?” The association was made with ‘industrial’ egg-trays that we were familiar with within another project, the essential feature being that with the packaging and transportation of large quantities of eggs*, the eggs were carrying each other* [2.11]. Designing is often making new combinations.



[2.11] Industrial ‘packaging’ for eggs“

Also in this project we did so. We made a technological transfer from an industrial egg-tray towards the CocaCola crate. The CocaCola bottle could and should carry itself. The transition to a tray for 1,5 liter Coca Cola bottles was quickly made [2.12].



[2.12] First sketch of CocaCola tray

2.2.2 Creative spark; the hypothesis

Where did this idea come from? Why did it not pop up during the fore mentioned creative group sessions? How was this idea generated? Referring to the theory of Banerjee[19] the new insight was obviously a result of *framing* or even better *re-framing*. The solutions of the display crate and the collapsible roll-container covered the requirements stemming from the user, the technology and the required semantics needed in the retail environment.

[19] (Banerjee 2011: pp. 72 - 73).

However these solutions did not sufficiently cover the business aspects as these solutions showed to be too expensive. The project had to be *reframed*; the solution had to be found in a fundamentally different direction.

The necessity to reframe the project explains partly the creative spark that finally led to the CocaCola tray, but it does not explain the fact that the Wavin-FLEX-project-team was not able to come up with it, and that it was obviously an individual effort. So what can this Coca-Cola-Case tell us more? What can it learn us about either the potential of collectivistic or individualistic design processes?

In a survey and research program by Goncalo and Staw[20] individualism versus collectivism and group creativity was analyzed. The research in organizational behavior suggested that organizations should adopt collectivistic values because they promoted cooperation and productivity, while individualistic values should be avoided because they incited destructive conflict and opportunism. In their paper however, they highlighted one possible benefit of individualistic values that had not previously been considered: because individualistic values encourage uniqueness, such values might be useful *when creativity is at stake*.

Equally important, Goncalo and Staw also considered an important competing hypothesis: given that collectivistic groups are more responsive to norms, they might be more creative than individualistic groups, *when given explicit instructions to be creative;* as it was in fact the case with CocaCola. The results did not support this competing hypothesis and instead showed that individualistic groups, instructed to be creative, were more creative than collectivistic groups with the same instructions. Another view on this phenomenon is provided by Belsky[21]. To make ideas happen he states that a creative team should not become burdened with consensus. In his believe in collaborative projects it is the ultimate challenge to understand how to draw on the best input of all without settling on the lowest common denominator. If not, consensus can often lead to a lackluster outcome.

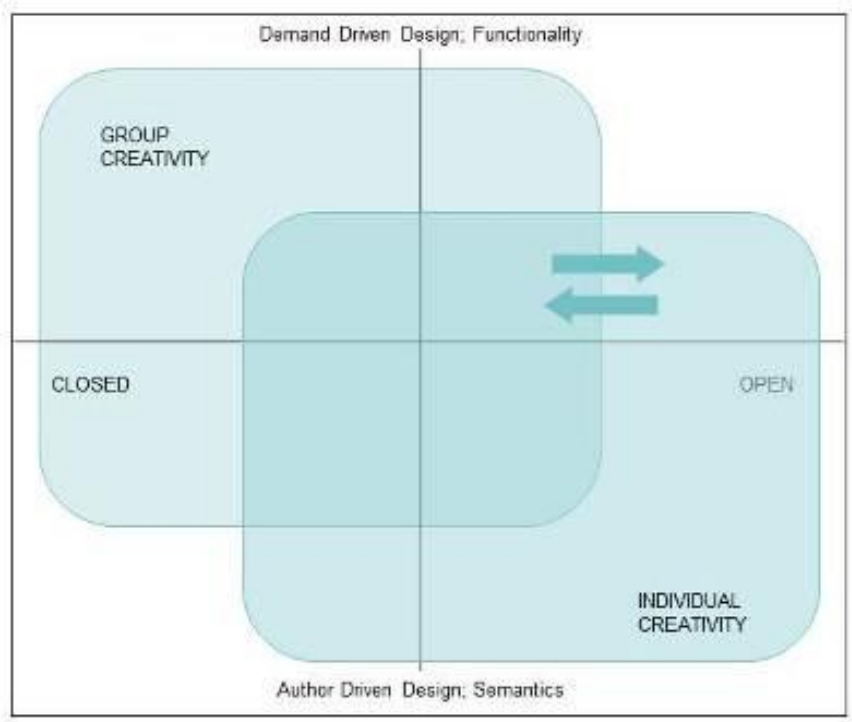
It is illustrative in this respect that the CocaCola case did not render the proper outcome when the project was approached from a collectivistic point of view, but that it did so, when ample room for an individual initiative was created.

In that sense the CocaCola case corroborates Goncalo and Staw's findings that individualistic groups are generally more creative than collectivistic groups. In the CocaCola case the individual setting of solving the problem without the group pressure could be helpful for an explanation of the 'creative spark'. The 'group-pressure' was oriented towards the more conventional trolley or plastic crate solutions. In brainstorms within the project group this led to a tendency not to look elsewhere.

[20] (Goncalo & Staw 2006: p. 23).
[21] (Belsky 2010: p. 205).

The individual setting led to an out of the box solution. It can also be seen as an advice to Demand Driven Designers to seek these moments explicitly, instead of blindly following the ‘holy grail’ of brainstorming in groups. The designer as an individual creative source has to be respected and within projects the project management should create possibilities to allow for such individual moments and efforts.

However this role could also be depending on the type of design problem. Open and more semantic oriented design problems, like the work of author designers, need more individualistic creativity than well described and much more closed functional design problems of demand driven designers. But leaving out individuality in demand driven projects always and completely would certainly be unwise. This is one of the lessons of almost 20 years of experience with demand driven projects at FLEX. The dependency is shown in [2.13].



[2.13] Group and individual creativity in relation to open and closed design problems

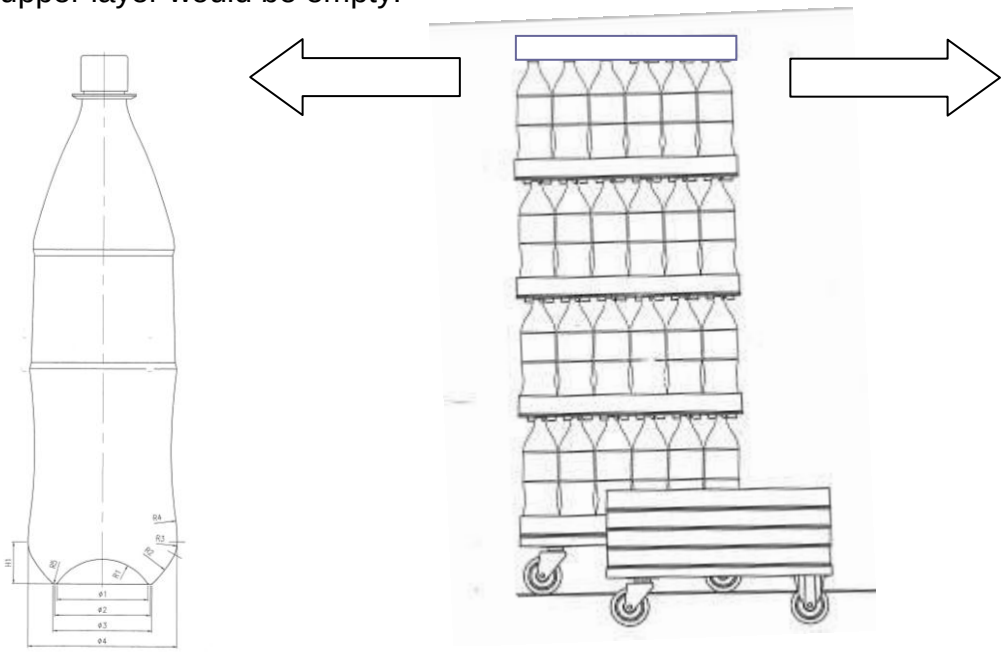
2.3 CocaCola tray phase 2; final design

In the following presentation to Coca Cola, the Wavin-FLEX team presented the next steps in the first two concepts, but the revolutionary tray concept was added as a third. Although the first reaction of Coca Cola was of disbelieve and surprise, the value of this new concept was recognized very soon after. Coca Cola and AH made a choice to grant the final assignment and production to Wavin Trepak and FLEX and they decided too that the team should continue its work on the tray concept.

In the next phase towards the final design, the team was aware of two critical aspects:

- The round ‘ball-shaped’ bottom of the CocaCola bottle would offer a very unstable basis for stacking in great heights; as the CocaCola bottle would easily tilt and this would result in an unstable stack of bottles and trays [2.14].

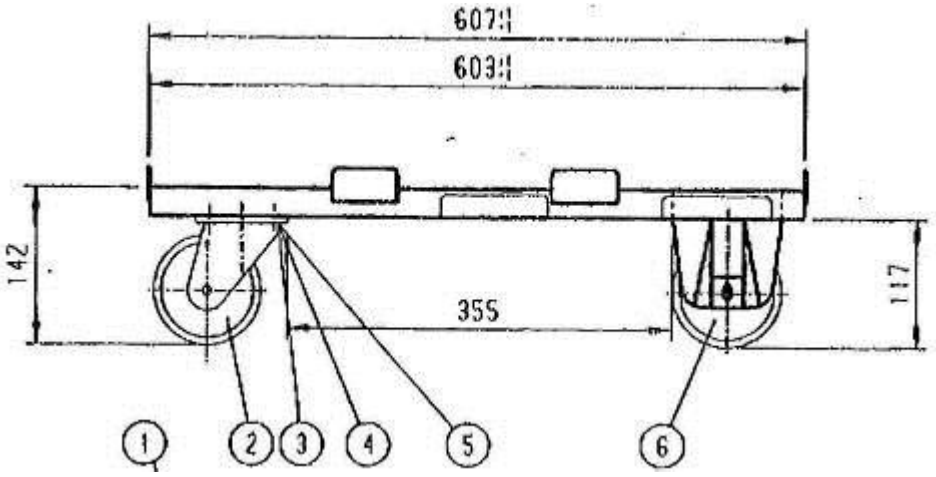
- One tray should carry as many bottles as possible. CocaCola specified the minimum of 16 bottles per tray to minimize the labor involved of taking away the upper tray in times when the consumer is forced to reach the next full level and to lift the top tray themselves in case the upper layer would be empty.



[2.14] Specific geometry of the base of the CocaCola bottle

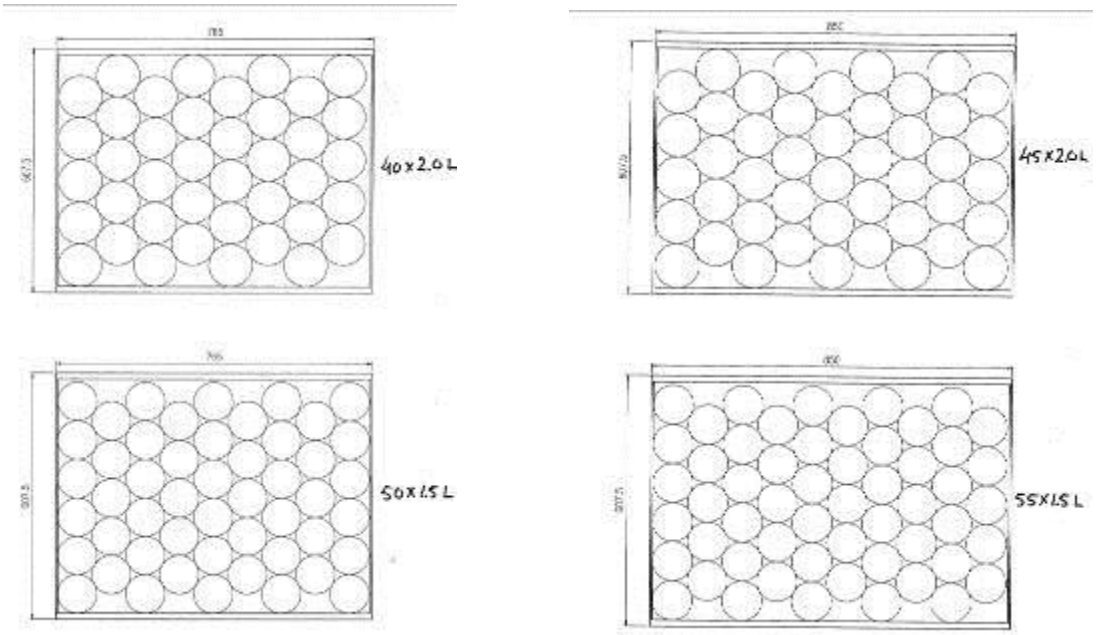
The second issue was attacked first, in the sense that the overall dimension of the tray should be set. Soon it was clear that neither Albert Heijn nor CocaCola was willing to create a new logistic standard of their own, but that they wished to use a standardized format. Albert Heijn was planning to use a collomodular dimension of 600 – 400 mm or a bigger version of 600 – 800 mm.

For transportation of the trays standard CC- dolly's with either a size of 600-400 [2.15] or otherwise 600-800 mm were chosen.



[2.15] Dimensions of standard CC dolly

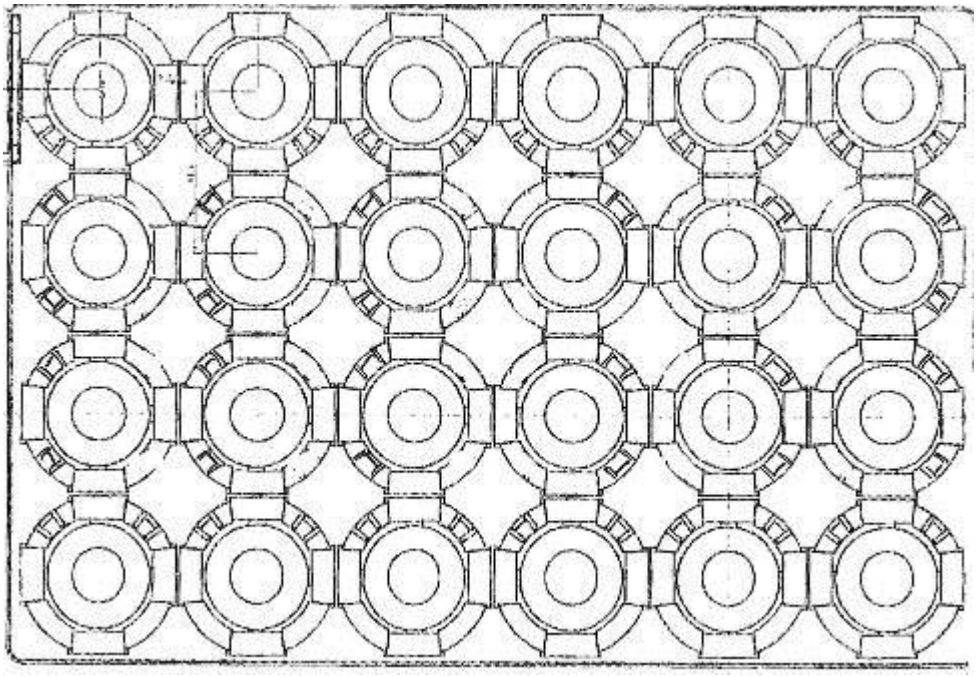
Being responsible for the overall logistic performance, FLEX also included the intention to achieve an improvement of the manual labor dealing with the stacked trays and made an estimation of the weight of the bigger sized dolly's measuring 600-800 mm [2.16]. The weight of these dolly's in four layers including filled bottles turned out to be 300 kg.



[2.16] Positioning of Coca Cola bottles on 600-800 mm dolly's

For this reason it was advised to refrain from the bigger dolly's as these would give at least questionable labor implications and possibly even dangerous situations on the retail floor, where customers might possibly get hurt by these heavy moving objects.

So the final decision was in favor of the 600-400 mm dolly's. The most efficient placing of the bottles on the trays would be a grid of 6 x 4, creating a load 24 bottles of 1,5 liter for each tray, resulting in a weight of approximately 160 kg per unit of 4 trays [2.17].

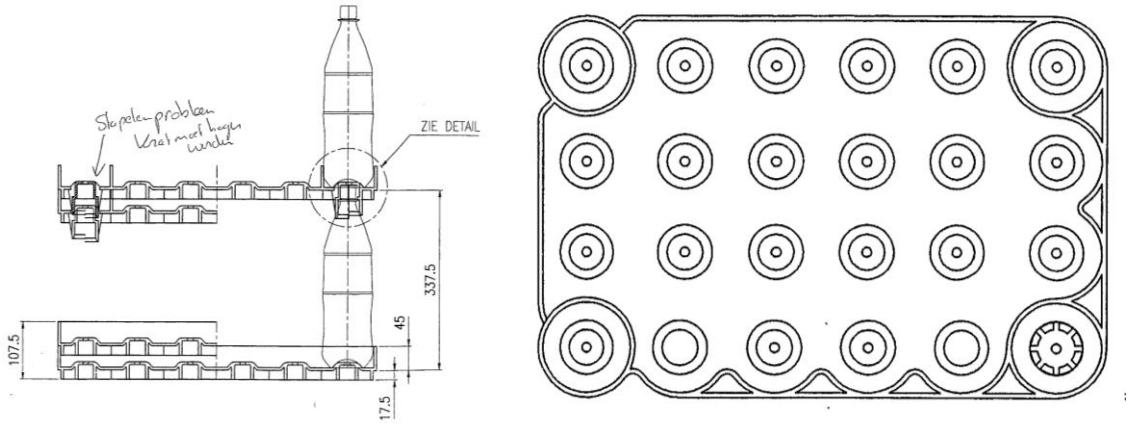


[2.17] Positioning of Coca Cola bottles on 600-400 mm tray

The earlier mentioned problem of the ball-shaped bottom was the most worrying of the two. In what way could a stable connection between the ball-shaped bottom and the trays be established in all directions? The ball shaped bottom was actually an optimal form to tilt the bottle in any direction without any great force. When pushing the units of 4 trays in the logistic chain, the units could easily fall apart with possibly highly dangerous results.

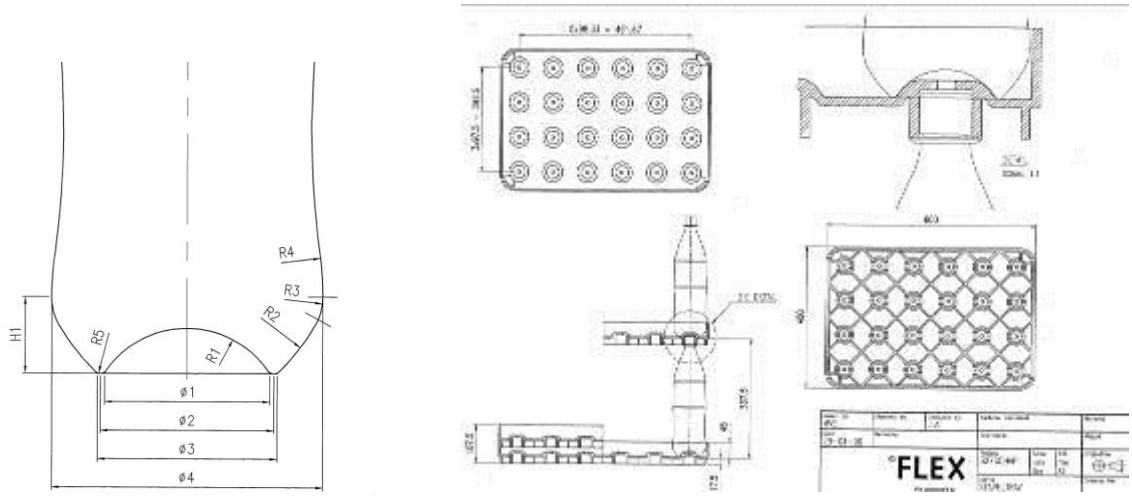
As we were, not surprisingly, not allowed to make any changes in the design of the bottle, all the answers had to come from an intelligent design of the tray. CocaCola was planning to stack the trays into units of four layers during the whole logistic chain from the factory towards the retail floor. In warehouse storage they were planning to go up to 16 layers! So the design team had to come up with an effective solution to create a really stable fixation between bottle and tray.

The first idea was to place all bottles into deep sockets so that neither of them could be pushed over easily without great force. This option would end up with a very thick tray, requiring a lot of material. A good compromise was found in using only the bottles on the four corners as stable ‘pillars’ by placing them in deeper sockets [2.18].



[2.18] Corner sockets on tray

The second solution was found by using the shape of the bottom-side of the bottle itself to stabilize it in its position. By exactly following the contour of this bottom side with the tray, we found that the bottle had to move upwards [2.19] when tilted.



[2.19] Final solution to solve instability of bottles

As this movement was blocked by the layer on top, this would establish a stable stack for all but the top, as this last one would not create the desired stability, being the only one not carrying any bottles or other load. The upward movement of the top tray could however be blocked by connecting the stacked trays as a whole, by putting on a strap around all the four trays and as such connecting the top tray with the bottom one. This would be necessary in the situations where the units would be in transportation [2.20].

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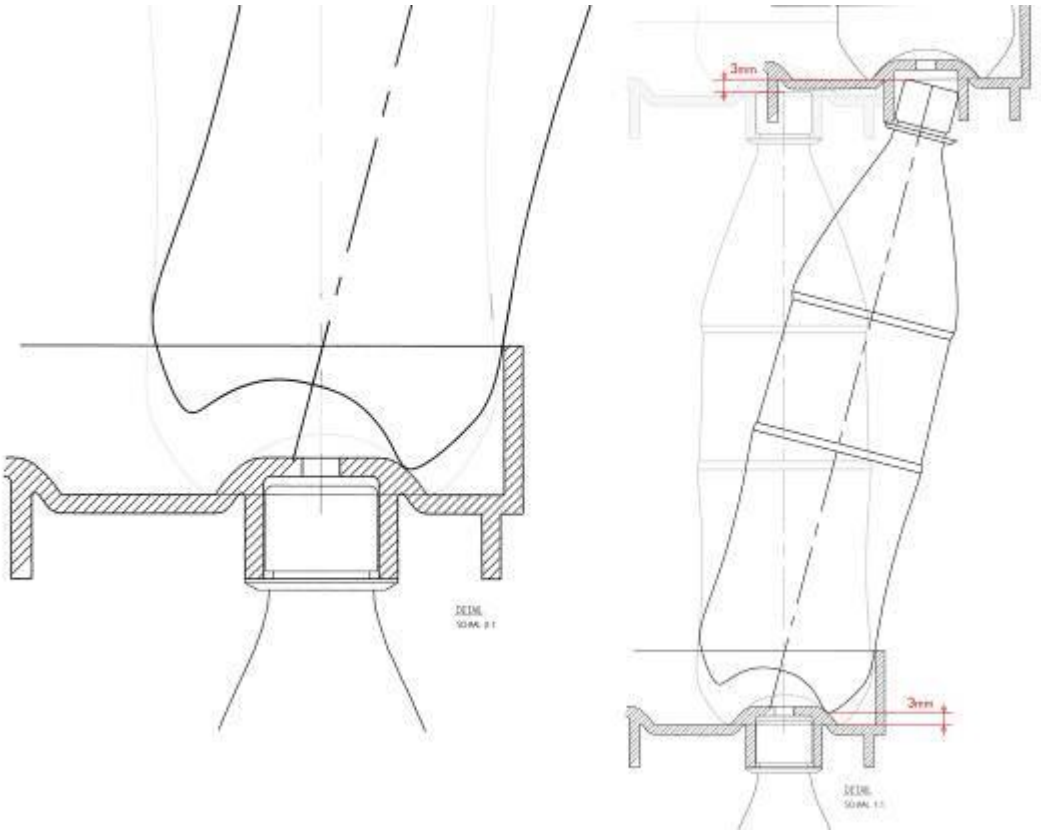
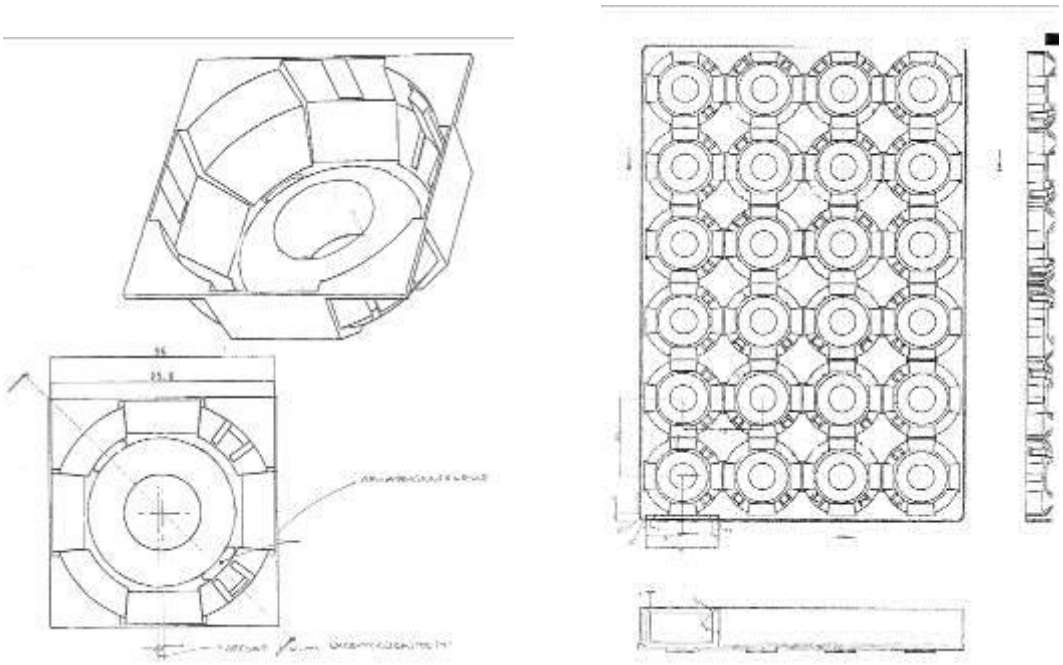


[2.20] Sideway movement transferred into an (obstructed) upward movement

The second option was chosen, especially because it was using a minimum of plastics and therefore it could offer a very cost effective solution. In the final design and engineering phase each socket of each bottle was provided with integrated plastic ‘springs’ to maximize the tension between the tray and the bottles. This optimization came from the engineers of Wavin.

Finally another detail was added: Each socket was given a drain so that the trays could be more easily cleaned and dried [2.21].

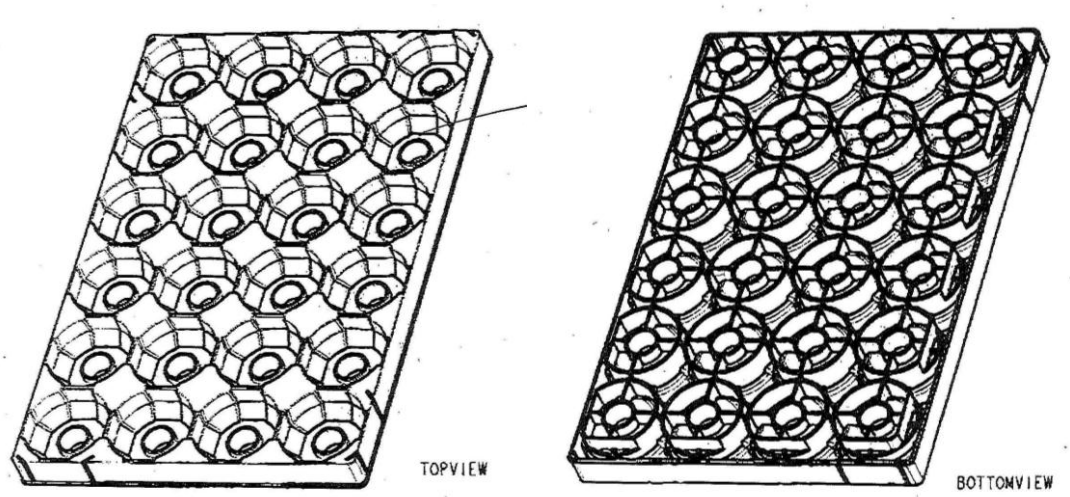


[2.21] Sockets including an individual drain

Until this phase all the design and engineering work of the project was done by FLEX. The last step was to make a working prototype of four trays that could be presented to Albert Heijn and Coca Cola [2.22]. This prototype was made by thermo formed PVC sheet and assembled to a testable unit of four trays. All the requirements and expectations where fulfilled by the prototype.

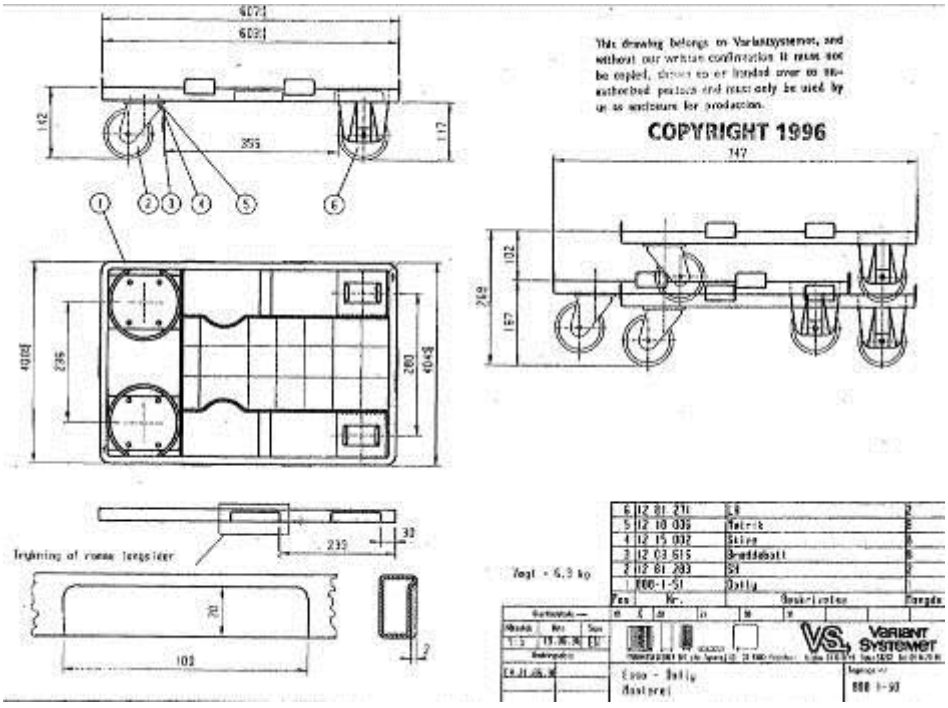
[2.22] Prototype of final design

From hereon Wavin Trepak took over the project for the final engineering, making test moldings using aluminum low cost tooling to create 10.000 trays to test the new logistic concept in practice [2.23].



[2.23] CAD visuals of mold cavities

Next to the tray design Variant Systemet in Denmark finalized their design of the 600 – 400 dolly [2.24]. Neither Wavin nor FLEX was intensively involved in this process, apart from the consideration that the team was very consciousness of the interferences between the dolly and the trays. This was checked on a regular basis during the whole process.



[2.24] Technical drawing of dolly

2.4 Coca Cola versus Albert Heijn

Soon after the successful test period of the first trays, a remarkable situation occurred. Albert Heijn foresaw potentially great savings in the use of the trays and asked CocaCola permission to use the tray concept also for other brands and drinks, like Spa and Vrumona. Both however were competitors of CocaCola in the soft drink sector while CocaCola had formally initiated the project and they had also been mainly responsible for the project costs. On the other hand CocaCola could not launch the new system without Albert Heijn. A long period of radio silence was the result during which there were no further developments in the introduction of the system to the market. Behind the screens both companies negotiated fiercely to solve this conflict of interests. I do not know how this was precisely solved. One peculiar result however was a change of color [2.25]. CocaCola originally intended to use their red color for the trays. As the tray now apparently was to be used by different other brands, a more neutral color had to be selected.

[2.25] Metallic grey trays in shop environment

Finally Coca Cola found a metallic grey in their corporate identity that they were willing to apply in this case and this silver-grey was ultimately also accepted by the other participants, like SPA, owned by Spadel.

2.5 Coca Cola tray; end result and conclusions

The new logistic solution for CocaCola and Albert Heijn started with a plan for first of all a redesign of a standard crate into a display crate and secondly into some kind of steel milk container [2.26]. Finally a totally new logistic concept was realized.

[2.26] Old Coca Cola crates

As this project started in the early years of FLEX this project was not an example of a new design approach. However, the project does show some remarkable characteristics of *reframing*, although at the time also this principle was not known to FLEX yet. The project also showed the value of the right creative spark and in what way this spark could be ignited; giving space, room and time for individual creativity to operate. In '*Making ideas happen'* Belsky [22] describes this as the development of a 'tolerance to ambiguity'. At the moments the whole team was becoming unsure that the project would lead to a satisfying end-result, the FLEX-team kept its patience, knowing that the creative spark would finally come.

The new CocaCola tray can also be seen as a disruptive or break through innovation. Analyzing this case one has to conclude that this was established by the following factors:

1. Wavin chose to use a fresh view on the project by using an external designer, as a so called 'wild-goose' within the team.
2. Within its own design team FLEX created enough space for individual creativity that ultimately brought the most important insight in the project.
3. The team had ample experience and knowledge to be able to bring the basic concept into a reality, from commercial, engineering to injection molding production knowledge.

[22] (Belsky 2010: p. 205).

4. Both developing companies, Wavin and FLEX, worked as a real team; sharing all the information with each other, not holding back any ideas, unsensitive to any (internal) politics.
5. The whole team, meaning Coca Cola, Albert Heijn, Wavin and FLEX, shared the belief in the possibilities of the basic concept and each member brought a maximum amount of energy into play to realize the final product.

One year after the introduction of the new concept, the team was brought together again by Albert Heijn to evaluate the results [2.27]. Albert Heijn had reduced their overall labor costs linked to the Coca Cola fast movers 1,5 liter bottles with approximately DFL 30 million per year. Second to that, the costs of the logistic carriers were much lower than in the old situation with crates:

- 60% less plastic material per bottle;
- tray of 1,4 kg for 24 Coca Cola 1,5 L bottles instead of the old alternative of normal crates with a weight 1,6 kg for 10 bottles;
- result: 50% less material use, smaller storage and transportation volume and less transportation kilometers;
- this reduction in material use resulted in a direct costs saving of DFL 2,8 million compared with the old situation of crates.

[2.27] End result in Albert Heijn retail environment

3. Case 2: AKZO/FLEXA 1-2-paint packaging

3.1 Project initiative

In the history of FLEX most projects were initiated by an inquiry of a client. A manufacturer needed to extend his portfolio with a new product or a manufacturer wanted to respond to a market introduction of a competitor: There are many reasons for a project launch. In some cases the start of a project could be the follow up of an earlier one. In the case of 1-2-Paint the project initiative was a personal one.

In 2002 I bought an old house that needed a lot of work. As designers do not belong to the group of wealthy professionals, I was forced to do a lot myself. Breaking down walls, renewing the electrical system, installing a new central heating system and of course a significant paint job: Many parts of the house were painted in an army green color and the exterior stone walls were painted white. Especially the last job took much more time and much more paint than expected. In the time squeeze of five months of renovation I got irritated by the poor solutions of all the existing paint tools. From this *irritation* I started to think of a better solution to solve the perceived frustration.

3.2 Innovation follows irritation

There are many starting points for a design and innovation project. Some of them:

- structured brainstorming;
- recombination of existing ideas and products to a new product;
- taking a solution from one market/product to another and different market/product (like the CocaCola project).

A very personal one is the urge to create something that performs significantly better than any other existing product on the market. It is a personal characteristic that I often use in regular projects and it is an approach and mind-set that I like to promote to my colleague designers at FLEX: A state of mind of which I think many more people can learn and use, by asking yourself the question: “Is the idea I just sketched really better and significantly different from all other existing products I know?” When you are really able to answer this question honestly and the answer is: “No…… it encourages one to think even more and harder. When in doubt it might help to ask others, especially the most critical persons you can find that are able to give you an honest opinion! It is the first P of Carl Franklin of his 3P-model [23]: *Power*…….”Is the product up to the task at hand and does it clearly perform better than its competition?”

[23] (Franklin 2003: p. 115).

This has been the starting point of the 1-2-Paint project. My personal analysis of the paint-job was:

- why is the paint bucket only containing paint?
- why does one have to buy extra paint trays?
- why does one need extra racks to take away the overspill of paint?
- why does one have to clean these trays and racks every time one finishes ones paint job?
- why does one have to prepare and clean tools for the next job?

When these questions are compared with the questions you are supposed to ask in a regular analysis phase at the starting point of a project, they show a lot of similarities. It means that a designer is able to force himself to make the right analysis, to ask the right questions and choices when he is able to act as a natural end-user. That is to place himself in the situation of that end user or to feel and act precisely as the end-user. This is the second P of Franklin-model [24]: *Performance:* the measure of how users actually are able to use the product in a clearly better way.

It is of course of vital importance to step out of this 'mood' directly after this conceptualization, to make sure the idea is not only a personal quest, but can be recognized as being valid and important to many more end-users. This is maybe the most critical phase in the establishment of an invention: Making sure that there is a real market need for your idea! It requires:

- self-reflection;
- self-criticism;
- commercial feeling;
- social bonding, and
- communication skills.

Back to the 1-2-Paint project: As a user I wanted to have a paint bucket that would make sure I did not need to buy and use any of the other extra tools:

- the paint bucket should also provide a paint tray;
- the bucket should eliminate the use of additional paint racks;
- it should make sure that you did not have to clean so many different parts every time you stop and start the next paint job, and
- last but not least, it should do all these things in a simple way without many extra materials and extra costs.

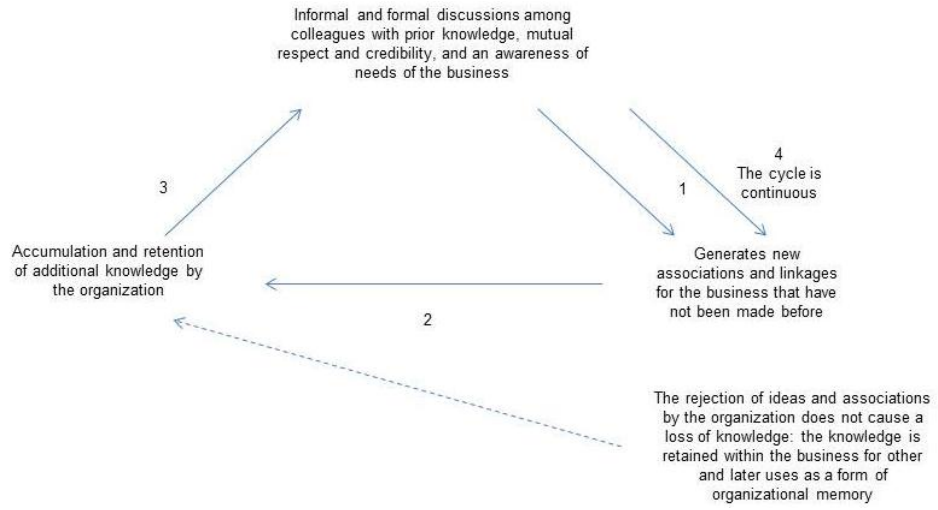
[24] (Franklin 2003: p. 115).

This last requirement stemmed from the fact that I was fully aware that if the new idea and solution would involve too much additional costs than a standard paint container, the idea would probably not be commercially successful.

3.3 The Idea

All those questions turned around in my head when painting my house and standing on the scaffoldings. And already on these scaffoldings the idea came to my mind that the paint tray and the paint rack should be integrated in the lid; by dividing the lid in two parts; one static part that would always sit directly and fixed on the container and another larger part – large enough to unroll the extra paint from the roller – that could be flipped open to present the paint tray on the other/bottom side of the lid. As I had worked with similar plastic parts, I knew that this hinge should be integrated in the lid as a so called 'film-hinge' that can be made in PolyPropylene. In this way one would hardly need any extra material and it would not involve a lot of extra costs. To make this functionally work, the size of the container would depend on the width of standard paint-rollers and, moreover, the container should be square instead of round or oval. In hindsight all these questions and 'virtual' answers were an example of what I would identify later as Creative Reflection. After the first creative spark, the concept was enriched with improvements such as better usage, optimized production and reducing cost-price.

The ability to operate in this way largely depends from the knowledge a designer or the design team has acquired. This is the case in an individual design performance but also in cases of a team performance. In the AKZO case the project benefitted from both aspects. The design process could be executed as fast because FLEX was quite familiar with this type of design. Trott[25] describes this as the internal knowledge accumulation process [3.1].



[3.1] Internal knowledge accumulation process, according to (Trott 2002)

[25] (Trott 2002: p.101).

The next day the idea was sketched [3.2] and a simple 3D-CAD model was made together with a colleague.

[3.2] First 3D CAD visualizations

The visualization was used for the next phase: the evaluation of the idea:

- are my colleagues as convinced and enthusiastic?
- does my father in law think it is a good idea?
- would the builder, working in the house, like to use the product as well?

These questions were all answered positively. This is a representation of the last P of Franklin's model [26]: *Perception.* Given the innovator's power and their performance, will users really adopt and buy it? The comments and remarks were similar to what I had asked myself already. It was a confirmation that the idea had potential.

[26] (Franklin 2003: p. 115).

3.4 Patent search

To have an idea is just a starting point. It's really only a *good* idea:

- when it is unique enough;
- when the core-intelligence of the idea differs significantly from other solutions;
- when similar solutions are less smart;
- when the necessary knowledge is present or accessible;
- when there are good possibilities to have it made and produced (accessibility of technology);
- when the idea offers a perspective on a proper price proposition and investment level and Return on Investments.

In the old days – before the mid '90's of last century – it was very costly and quite difficult to do a patent search, but nowadays it is more easy: On Espacenet www.espacenet.nl it is simple to make the first search on the web to look for similar patents. With the right searching method and the right keywords one might find threatening and conflicting patents. The search showed some similar packaging solutions that tried to solve the same problem. These ideas and solutions however were:

- using more material and parts;
- more difficult to produce;
- probably less air tight, so that could be expected that these solutions could not preserve paint as good and as long as in our 1-2-Paint container.

The conclusions were:

- the concept was strong and unique;
- a small market research showed that it was a valid idea based on the fact that other inventors tried to solve the same problem.

This brought Flex to consider the question of patents: Having a 100% unique solution is not always the best situation. Being the sole provider and manufacturer of a new product is not always the best option. When more parties and companies act the same way, it can be concluded that the product idea has relevance. Secondly, the product idea would be promoted by two – or more – independent companies. This supports the credibility of an idea and it supports the presumption that it has commercial strength and value.

Altogether FLEX applied for a PCT patent on the 1-2-Paint idea. The patent was written by a professional company and granted in 2005.

3.5 Designers as manufacturers

Since the early days of industrial design the population of designers can be roughly divided into three groups:

- industrial designers working as an employee of a manufacturing company. As part of the R&D department, as a staff employee of the marketing department or as an independent internal consultant;
- industrial designers working as an independent consultant; as an individual person or within a small or larger industrial design company;
- industrial designers that operate at the same time as an independent consultant and as manufacturer.

It is my personal believe that this last group was and will always be strongly linked and limited to:

- furniture industry;
- designing products where there is the possibility to have more or less direct contact with the end user;
- a type of industry with relatively small production volumes .

How different is the world of mass-production and the market of the (F)ast M)oving (C)onsumer (G)oods. Here larger investments are required to produce the products and the products need larger marketing and communication budgets to become known by the public. Due to this it was for this project necessary to contact a manufacturing party who was willing to make the necessary investments. In 2005 we approached AKZO for this reason.

3.6 New business thresholds

As FLEX was an outsider to Akzo, the first step in this initiative was to convince the manufacturing company of the potential value of the idea. Doing so one will encounter three main thresholds:

- the ‘not invented here syndrome’;
- the ‘M.A.N’ principle [27];
- not finding a product champion.

[27] Allegedly this ‘concept’ was first described by design agency MillfordBrandID

3.6.1 The ‘not invented here syndrome’

The ‘not invented here syndrome’ is a well-known and often described phenomenon. How can one convince a potential interested company to believe in the concept and how can one convince the company into making the necessary investments? The most important factor in succeeding to overcome this threshold is the right anticipation on the topics that form the basis for this phenomenon. In case of AKZO we were aware that:

- they would like to know what kind of investments would be needed; we had this prepared by making a first investment plan;
- when a company like AKZO is investing in a new product they want to be protected and supported by IP-rights, so we presented them a first patent search and a scan our patent agency made that showed that this patent was new and relatively ‘strong’;
- they would like to know what the estimated price of the new paint packaging would be, so we had already received first quotations from existing suppliers of plastic packaging and the investments in tooling;
- as packaging is part of a whole logistic concept that has to operate efficiently; it is important to ensure that all dimensions were according to a optimal pallet load and that the pack could be stacked;
- as a (F)ast (M)oving (C)onsumer (C)ompany it would like to execute a consumer research before doing the investments, so we had the visuals and product description ready for such an inquiry.

The aforementioned anticipation and preparation is obviously strongly based on business and marketing knowledge and experience. Most important is that in these situations designers need to put themselves into the shoes of the manufacturer.

Only when the outcome of such empathizing leads one to the honest conclusion that the idea has strong business opportunities, one has a change to overcome the ‘not-invented-here-syndrome’. Belsky[28] refers to this approach as a creative being an entrepreneur himself. A creative person should be willing to step into the shoes of the entrepreneur; he should be willing to consider himself to be the entrepreneur, in order to be persuasive and convincing to bring the idea into reality and to make ideas really sustainable. Of course these rational criteria need to be supported by credibility and more emotional criteria, like the right way of communication and presentation.

[28] (Belsky 2010: p. 211).

3.6.2 The 'M.A.N' principle

Overcoming the 'not-invented-here' syndrome is not the only barrier. Another one is a FLEX-specific one, where it was named the 'M.A.N' principle. It is a synonym for:

- Money
- Authority
- Need

The successful presentation of an idea to a company depends strongly to whom the presentation is delivered. The companies' representative should have direct or at least indirect access to the required budgets and funding. Leifer c.s describe this as: an executive being the patron. In ten companies they investigated a patronage could be identified that led to a successful innovation. "*One or more senior executives played the role of enlightened patron, variously providing organizational protection, resources, and encouragement"* [29]. Secondly the person to talk to, should have the authority within the company to push a project ahead. It is not imperative as such that this person should be in a high position of the hierarchy. A very ambitious young 'high potential' could also be suited for this role. Last but not least, the company and his representative should have a need. This need can be tangible or non-tangible. A young professional could have the urge to prove him or herself, another person could be tempted to adopt the idea because there is a competitive need, a market pull or a financial concern. Negatively formulated the idea could not be interesting because the same company just launched a 'similar' product, so the need was already fulfilled.

3.6.3 The product champion

In the case of AKZO, FLEX had the luck to find a young ambitious product manager who had the urge and energy to manifest himself within AKZO, so FLEX found the right *product champion*. He had the support of his direct superior, who in this case had access to the financial means the project required and he had the authority to direct the needed funding towards the project. Maybe most important, under the increasing competitive pressure of private labels, as an A-brand, AKZO wanted to establish a more innovative image in the do it yourself (DIY) market to improve on their competitors advantages and as such improving their own commercial margins. This was initiated by the CEO of AKZO, Mr. Hans Wijers, so there was an obvious need, felt at the highest level.

It is vital and crucial for a successful new business opportunity and project to respect these three thresholds; the 'not invented here syndrome', the 'M.A.N' principle and finding a Product Champion.

[29] (Leifer c.s. 2000: p. 162).

3.7 Development process

Having overcome the three aforementioned thresholds, a relatively long process started to finalize negotiations. FLEX and AKZO first signed a ‘letter of intent’ (LOI). In this LOI FLEX and AKZO formalized their intentions to pass the exclusive rights applicable from European law towards AKZO. Secondly both parties agreed on the required budgets, investments and planning of the packaging development. Halfway the actual development process, that started directly after the signing of the LOI, the actual contract was signed. That was not less than a year later, *two months before the actual market introduction*! Patience, accuracy and stamina are crucial to succeed in these kinds of projects.

So parallel to the negotiations, FLEX started the actual design and development the 1-2-Paint packaging. Without being aware of a real new design methodology yet, it was already clear then to FLEX that in the daily design and development process there was one big difference with the methodology as taught at the faculty of Industrial Design of Delft University of Technology: *speed* and *time to market.* As a traditional TU design process would start with an elaborate analysis before making one sketch, the working method in *this* project was to start the phase of conceptualization directly parallel to the analysis.

In this case the idea itself was guiding the need for information and not the other way around. Unnecessary information was banned and a lot of development time was gained by that. As the idea/concept was already there, FLEX was more than aware that it needed more additional information to guarantee a successful process and end result.

Another aspect was typical to this project. FLEX was the initiator and integrator in this project. As designers, we took responsibility for:

- project initiative;
- all project management and planning of the project;
- all the design and engineering activities;
- assessment of production and filling line;
- product optimization, consulting tool making and production preparation;
- internal communication within AKZO;
- consulting AKZO staff concerning the business case.

As design-company we were the integrator between the needs of the client, the available technology and the available capabilities of third parties and suppliers. We were also committed to the strategy of client. One could even defend that FLEX was in the lead during the largest part of the development process; FLEX was even asked to instruct the AKZO’s sales staff for the market introduction plan and the staff training towards resellers.

3.7.1 Analysis, Program of Requirements, Concept Refinement:

The next step in the creation process was collecting the necessary technical information that could be roughly divided into four categories:

Product

- what was the required volume?
- what was the required head space; extra volume needed during the filling process due to tolerances and filling speed?
- what were the specifications of similar paint packagings?
- Information about air tight seals, closures, etc.?
- what materials needed to be used?

Production of buckets

- geometry based on injection molding (draft angles, wall thicknesses);
- specification of in mold labeling on bucket and lid;
- nesting of packaging during storage and transport;

Production line of buckets

- Dimensions based on specifications of the available production sites (Groot Ammers – The Netherlands & Montataire – France);
- lid to be placed by pick and place robots;

Logistics and sales

- what were the dimensions (LxBxH, weight) based on optimal pallet load?
- what was the maximum top load while stacked?
- dimensions based on regular shelve sizes;
- what was the required shelve life?
- how were colors mixed at the DIY shops, what mixing machines are used,
- how could packaging be made suitable for conventional mixing machines with proper re-closure?
- how could the shelve impact be improved?
- how could it be guaranteed that the branding and the handle is always facing towards the consumer while the packaging is on the shelf?
- how could structural design together with graphics deliver the right ‘stopping power’; how can it attract attention of passing potential customers?

Consumer:

- content should be 10 L and 5 L including the option for action volume;
- clearly visible (u)nique (s)elling (p)oints;
- integrated paint tray should be suitable for most paint rollers [3.3];

[3.3] First test models

Using an old an existing paint container and rebuilding it to something similar to the 1-2-Paint container we were able to test the practicality of the idea. Especially in these days with a dominant role of 3D-CAD design tools, simple DIY constructions are often forgotten to evaluate ideas and mechanical principles. It is important to keep this possibility in mind; if it is only for the advantages of this pragmatic approach:

- low cost;
- more ‘in vivo’ than ‘in vitro’;
- delivering a high information yield.

In this case it showed us how the roller was pressed against the inside of the lid and it proved that a foot-pedal to withstand the force of the roller, that some team members thought necessary, was not needed. In this way we could save parts and costs in packaging.

All the data and outcome of this information was integrated into an improved design [3.4].

[3.4] 3D-CAD visualization of final concept

3.7.2 Consumer testing

Using a 3D-milling machine at FLEX/theWORKSHOP AKZO was provided with models of the 1-2-Paint containers [3.5]. With these models consumer research was done in which consumers were asked their opinion about the value and practicality of 1-2-Paint. The outcome was very positive. Some consumer spontaneously complimented AKZO that this was what they always had wanted. By these results AKZO set all lights on green for further development.

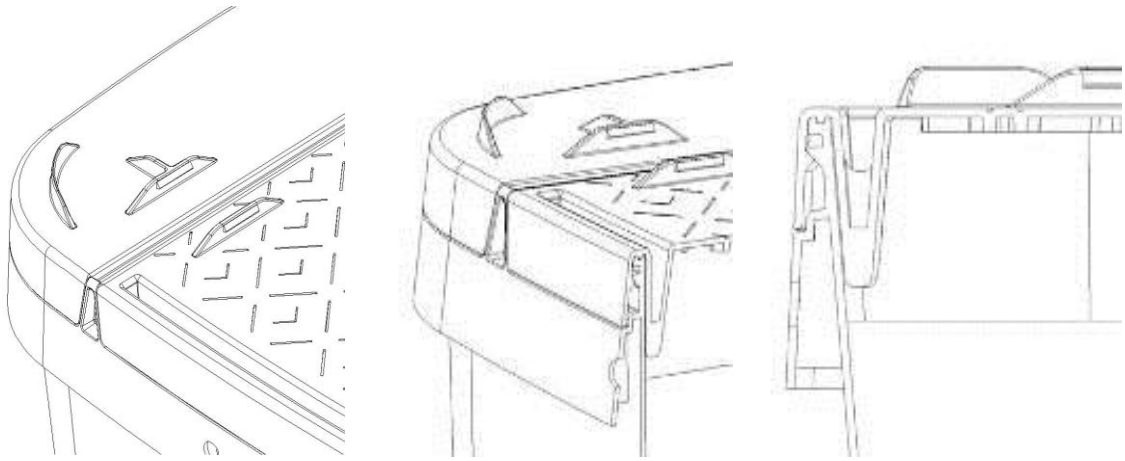
[3.5] Models/mock-ups of 5 and 10 liter pack

3.7.3 Engineering

The main topics of the engineering phase were:

- securing air tightness of the package;
- creating a simple solution for the fixation of the flipping part of the lid against the static part;
- withstanding the top load of 340 KG (4 times the weight of a mature person) when the 1-2-Paint-Pack is placed in a mixing machine.
- optimal use for the consumer; rolling against the inside of the lid, carrying and easy opening;
- creating solutions with a minimum of packaging costs and simple tooling.

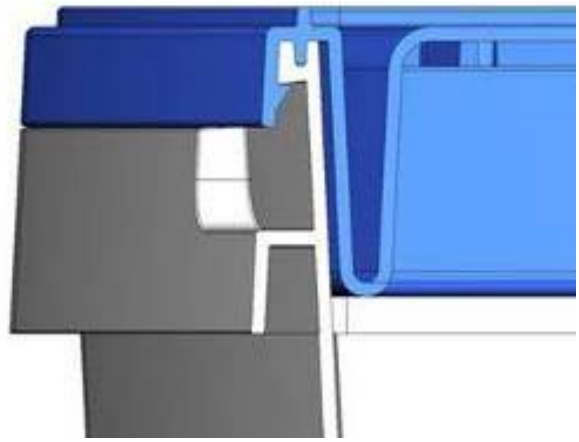
In a standard iterative process, a FLEX's design and engineering team, consisting of one project manager, one senior engineer supported by the author and some trainees for hands-on support, the team worked on the total engineering phase that took less than half a year. The team used 3D-CAD software of Solid Works and for the (F)inite (E)lements (M)ethod ANSYS was used. Maybe one on the most valuable and best decisions that was made in this project was the choice *not* to come up with a new air-tight rim-detail. An existing solution was used that the manufacturer of the other AKZO-FLEXA paint containers was already familiar with and that could be seen as '*proven technology'* [3.6] and [3.7].



[3.6] Different details: lid fixation and (standard) airtight rim detail

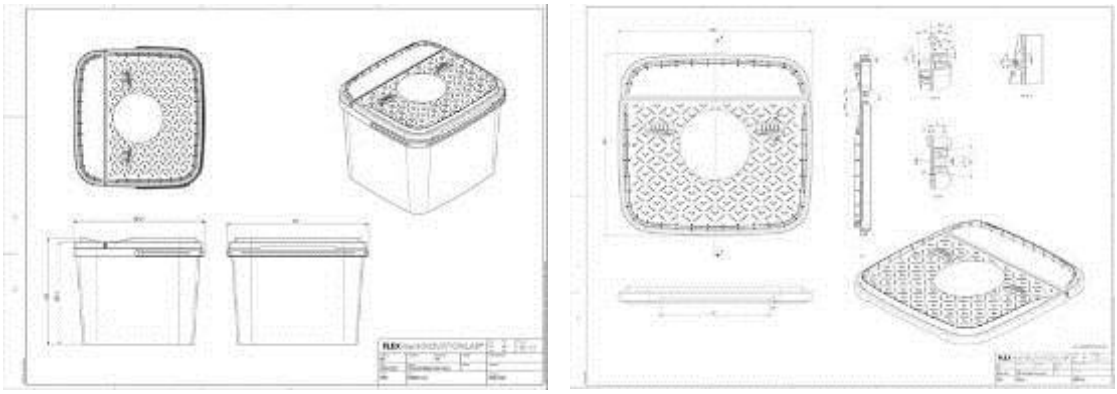
In development processes in general it is important to focus attention on a limited number of crucial technical issues and not to spill attention to all sorts of novelties. It is often a natural inclination of a design team to lose itself in the process and to come up with all sorts of new and fresh ideas.

It is important for the project management to keep track of the right focus. Doing so in this 1-2-Paint project we could emphasize focus on the flipping of the lid, the fixation of the lid and other important ergonomic issues. Next to the cost effectiveness this was the core-intelligence of this new packaging.



[3.7] Detail of rim securing air tightness

With respect to the relatively high investment level of this project especially in the tooling – around EUR 300.000,- - it was of vital importance to have a regular check-up of the design. Using rapid prototyping half-way the engineering phase we wanted to check on all the functionalities and the critical areas of the tool-making and injection molding. For this reason 3D-CAD files were prepared to make such prototypes [3.8]. It was decided to use (S)elected (L)aser (S)intering because of its mechanical strength [3.9].



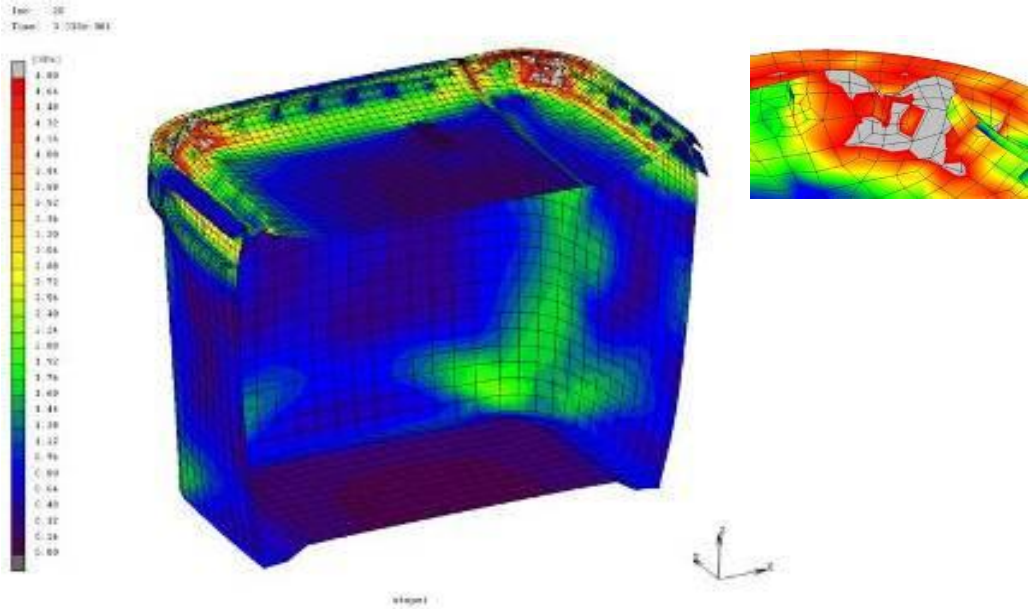
[3.8] Technical drawings of 10 liter pack

The SLS models were used for another internal consumer test to make sure that all the specifications and the complete program of requirements were met [3.9]. This was executed at the offices of AKZO and FLEX. The outcome of this was positive.

The most important change was that it was decided not to use a metal handle bar but a plastic one, the main reason being the improved carrying comfort combined with cost reduction.

[3.9] Testing with rapid prototypes (SLS)

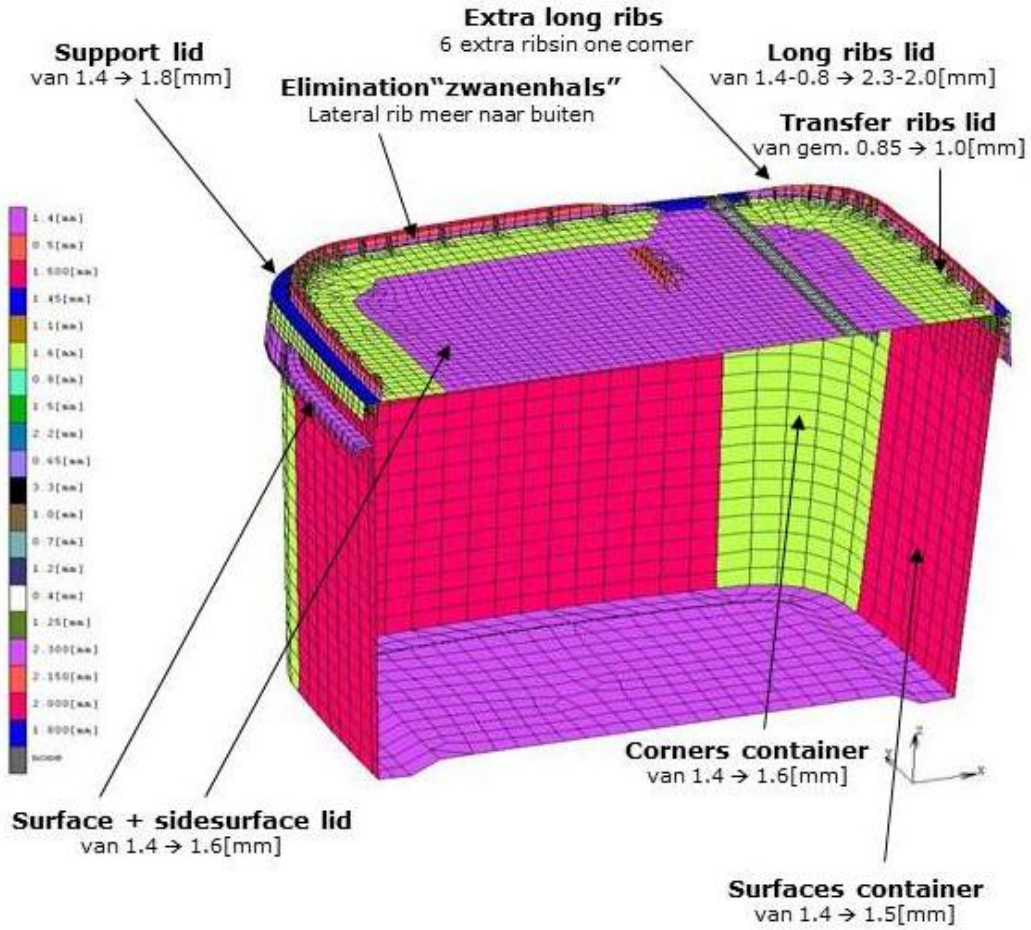
As mentioned earlier in the program of requirements the 1-2-Paint pack needed to be used in a mixing machine. These machines are used by DIY retailers. Containers with mostly white latex are opened in the shop, different colors of pigments are added to create latex in different colors. The lid is then closed and put into the mixing machine. The mixing process in these machines is quite violent and for that reason a pressure on the lid is needed of around 350 KG – 4 mature men! - to hold the container in it's place. With a desired small wall thickness of around 1,5 mm to minimize costs with a rectangular cross section in comparison to the most common round containers, this was quite a challenge!



[3.10] Visual of FEM strength and stress analysis

The first Finite Element Method or FEM-analysis and simulations showed too much shear in several areas while the container was under pressure [3.10].
For this reason the design was optimized in several areas [3.11]:

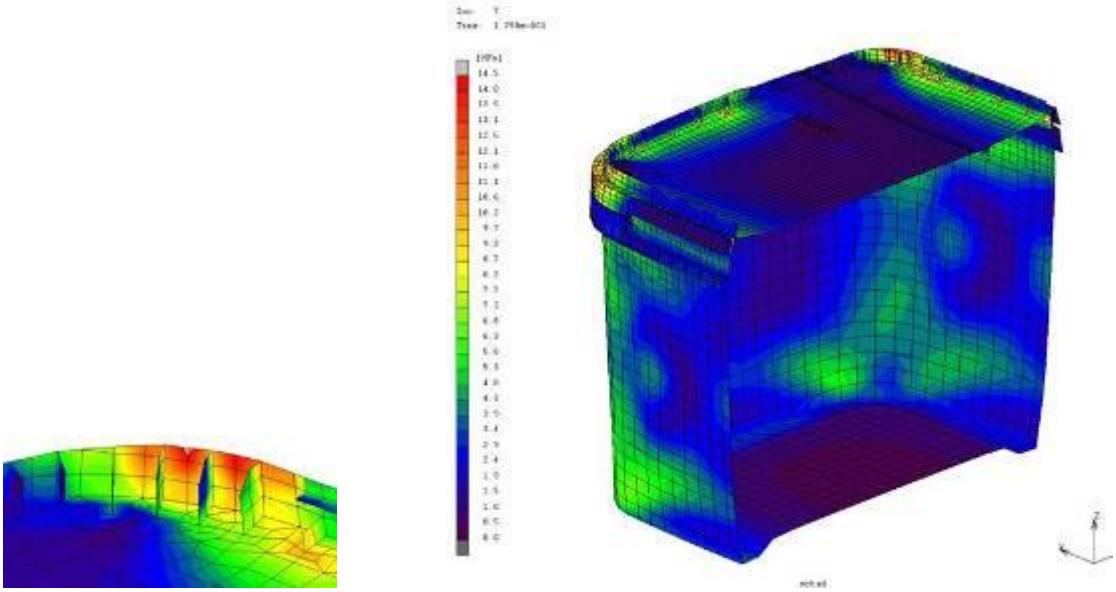
- wall thickness in corners was slightly increased from 1,4 to 1,6 mm;
- wall thickness of lid was increased to 1,6 mm;
- wall thickness of the most outer part of the lid was increased to 1,8 mm
- extra ribs on the top of the lid were added.
-



[3.11] Optimizations in wall thicknesses

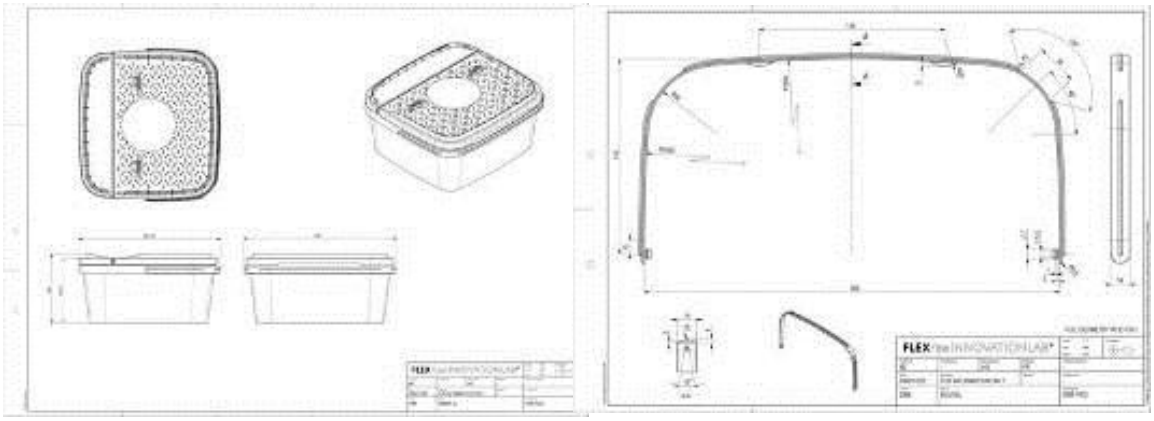
After several iterative steps and calculations the outcome was a paint container and lid with a minimal wall thickness, a maximum top-load, resulting in the most cost effective design [3.12]. Not only material costs are important, but also the cycle time in production is an important issue. A container with a small wall thickness is faster to cool and to produce than one with larger wall thicknesses. Speaking of a packaging with an estimated yearly production of around 500.000 units, costs have to be brought to an absolute minimum.

The small differences in wall thicknesses had no implication for thermal stress or deformation during and direct after the injection molding process. All results were regularly discussed and evaluated with the molder.



[3.12] Optimized design with improved wall thicknesses and acceptable stresses

All the results of the design and engineering phase and all the improvements and iterations were finalized into a final 3D-CAD model, 3D technical drawings with the main tolerances and a technical dossier [3.13] with material specifications and test requirements. After evaluation with the technical representatives of AKZO, the project information was handed to the injection molder, to start the tool making and production.



[3.13] Final technical drawings

3.8 Production

AKZO decided to enter the market directly with both sizes; the 10L and the 5L container. Both molds were made at the same time. In contrast with what maybe could be expected, the molds were not made in China or somewhere else in Asia, but in the Netherlands, Haaksbergen (Dijkstra Plastics). This molder had its own tool making facilities [3.14]. Mainly because of the required production speed and the lowest cycle time the mold had to be of the highest quality. A maybe less expensive tool with a significantly lower cycle time would in the end be less cost-effective. Secondly, with these large production volumes, the amortization per packaging is of less concern than with smaller production volumes.

[3.14] Part of tool of 10 liter container

The tool making took five months for finalization. After the first production runs with the first out of tool packagings, it was clear that no changes were needed. The peripherals around the machines for the in-mold labeling needed some optimization, but already after one week production was running on its maximum capacity [3.15].

[3.15] First packaging in production

The final technical problem was the realization of the filling process on the production line in Groot Ammers. The so called ‘capper’, the part of the machine that places the lid on the container, needed some changes. Moreover, the positioning of the lid needed more accuracy than expected.

It is important to mention that in the aforementioned phases, when a product comes closer to its finalization, the role of the industrial designer and his colleagues in the project, often engineers and project managers, becomes less frequent, intense and important. If this is not the case, it is a clear signal that something is wrong or not running according to expectations.

Knowing this, it is important that an industrial designer plays an active role in the adaptation of the project into his clients’ company. This part is often forgotten and designers think that their job is finished when they delivered their models, prototypes and 3D-CAD-files. This is a big mistake. In the perception of the client it is the most important phase: “Does the project deliver what was promised?” ”Will the new introduction create the commercial and financial results that were expected? Similar to the starting point and the beginning of the project a designer should be open and sensitive to these developments in this last vital step of a project!

3.9 Market introduction

And then you have to let go. As [3.16] shows, the graphic design of the 1-2-Paint packaging was changed during the last phase, before the start of the production.

[3.16] Preliminary and final graphic design

The main reason being that English customers ordered the largest volumes and they wanted to change the graphics. Design Politics!

Although it was not the job or responsibility of FLEX, these kinds of changes are never very pleasant to experience. Besides aesthetical reasons for not liking the design, the design also communicated quite poorly the unique features; the integrated paint tray. Disappointing sales results were expected, but this was luckily not the case. It is my personal opinion that sales could have been improved when the communication of the pack would have been better. This is supported by the fact that, as the rights of the 1-2 Paint package were sold to DULUX for the Asian Pacific area, their pack showed what the real potential of proper graphic design and the communication could do [3.17]. Accordingly, their sales results were much better!

[3.17] Graphic design of DULUX version

3.10 Design Awards

Design Awards have never been the central focus of FLEX' design activities, but only as a possible by-product of the final end-result indicated that the right creative process was followed. As 'Solutions that sell' has been the key proposition of FLEX for many years, it is clear that design has always been treated from a business perspective; a business activity as a means to fulfill economic purposes and not a goal in itself. For many years Dutch design colleagues had the opinion that this business orientation could never lead to design quality as indicated by design awards. FLEX always followed the believe that it was an insult to the end-user, that what they liked, could only lead to inferior design quality. At this time FLEX/the INNOVATIONLAB is the industrial design agency with the most design prices of all the Dutch design agencies.

[3.18] Alternative graphic design for "Couleur locale"

This view is corroborated by the fact that the design of 1-2-Paint has won many national and international prices [3.18]. It received the best of category in the Dutch Design awards in 2005, it has won a Red Dot award and last but not least it has won the prestigious ID award in the US in 2006 [3.19].

The jurors' appreciation and recommendation were formulated as follows:

The paint bucket with the innovative lid that serves as a paint tray has been granted a Golden IDEA (Industrial Design Excellence Award). This American award is sponsored by the Industrial Designers Society of America (IDSA) and the renowned Business Week Magazine and is seen as an honor only granted to the best and most striking projects in the world of international design. One of the jurors commented*: "In my opinion, 1-2 Paint represents what design is all about. Some products become commodities until a creative design idea adds new qualities to one of them. Then, the whole market is redefined. Paint containers will never be the same after this project."* (–Celso Santos, I/IDSA, President, Rio 21 Design).

The jury continued: The innovative product offers good opportunities in a market where it is hard for consumers to tell the difference between the available paint brands. Or as juror Chris Conley (IDSA, Principal, Gravity Tank) mentioned*: "What is remarkable about the 1-2 Paint System is that it addresses both a person's typical frustration with managing paint during use, as well as the environmental impact and economic waste produced by disposable paint trays. There are thousands of everyday problems like this that would benefit from the thoughtfulness exhibited by the designers of this packaging innovation. Bravo!"*

[3.19] Receiving 2006 ID award

3.11 Environmental responsibility

Environmental issues have been an important focus of attention during the development process of 1-2-Paint. A Life Cycle Analysis (LCA), conducted at an early stage of the development process, demonstrated in what areas design could have a profitable influence on the ecological aspects of the packaging. First of all, the new packaging solution eliminates the need for separate paint trays without adding material to the lid, thus saving material as well as cost. The use of materials has been minimized through FEM analyses in the engineering process. Another advantage is that spillage of paint is importantly reduced because pouring into and cleaning of trays is no longer necessary. This saves around 6 litres of rinsing water for the 10 L paint container! To make recycling easier all materials (lid, container and labels) are made out of Polypropylene, non-toxic and biodegradable and to top it off, the pack has a reusable design (when empty and after use, that is).

[3.20] 1-2-Paint in Dutch DIY market

3.12 Market results

In the first four months of distribution (October 2004 until January 2005) AKZO distributed eight times the usual volume to usual outlets. Consumer research showed that issues such as cleaning trays, spillage of paint, pouring etc. are of significant relevance to the consumer. It also showed that the innovative lid was recognized to offer the mentioned consumer benefits. The consumer research confirmed that paints packed with the new solution were preferred over other paints and that the packaging solution underlined the superior quality of AKZO's A-brands in latex wall paints. On top of that, the new pack has enabled AKZO to conquer additional shelf space in all DIY retail outlets. Before the introduction of the 1-2-Paint AKZO had an 8% shelf space on average [3.20]. After the introduction of 1-2-Paint this has grown to an average of 18%. Sales were up between 20 and 40% depending of the type of paint that was packed in the 1-2-Paint packagings.

4. Case 3: AHREND 360 multi-purpose chair

Ahrend is one of the most renowned Dutch manufacturers of office furniture. Recently the firm added school furniture to their activities. Ahrend has a long and well known reputation regarding design and more specifically *industrial design*. Maybe one of the best known designers of the early years of industrial design in the Netherlands – Friso Kramer – designed the Revolt chair for Ahrend and later the MEHES collection. These products are generally reckoned as Dutch Design Classics. Until today Ahrend has followed a pro-active role to initiate projects with designers. Within this policy Ahrend approached FLEX in 2008 to talk about the design of a multi-purpose chair.

4.1 Project start

In this case the project start was of course the sole initiative of Ahrend. To approach a well-known design company instead of a less professional but probably much cheaper designer stems from a sort of design professionalism that seems to become increasingly rare in many Dutch companies.

As a young designer, before FLEX was founded in 1989, I worked for three years for Vicon Landbouwwerktuigen (agricultural machinery) in Nieuw Vennep. The technical director of Ahrend in 2008 was at that time R&D manager in that company. In other words, we were familiar with each other before the project started. Having a network is very important for every designer. People should know you, in order to be able to approach you! Sometimes designers seem to forget to invest in such a network and wait for companies to approach them. Since the first years of FLEX in the early ‘90’s until today, FLEX invested intensively in such a network. After such an investment, a company –of course with the right design orientation – should be willing to grant you an assignment.

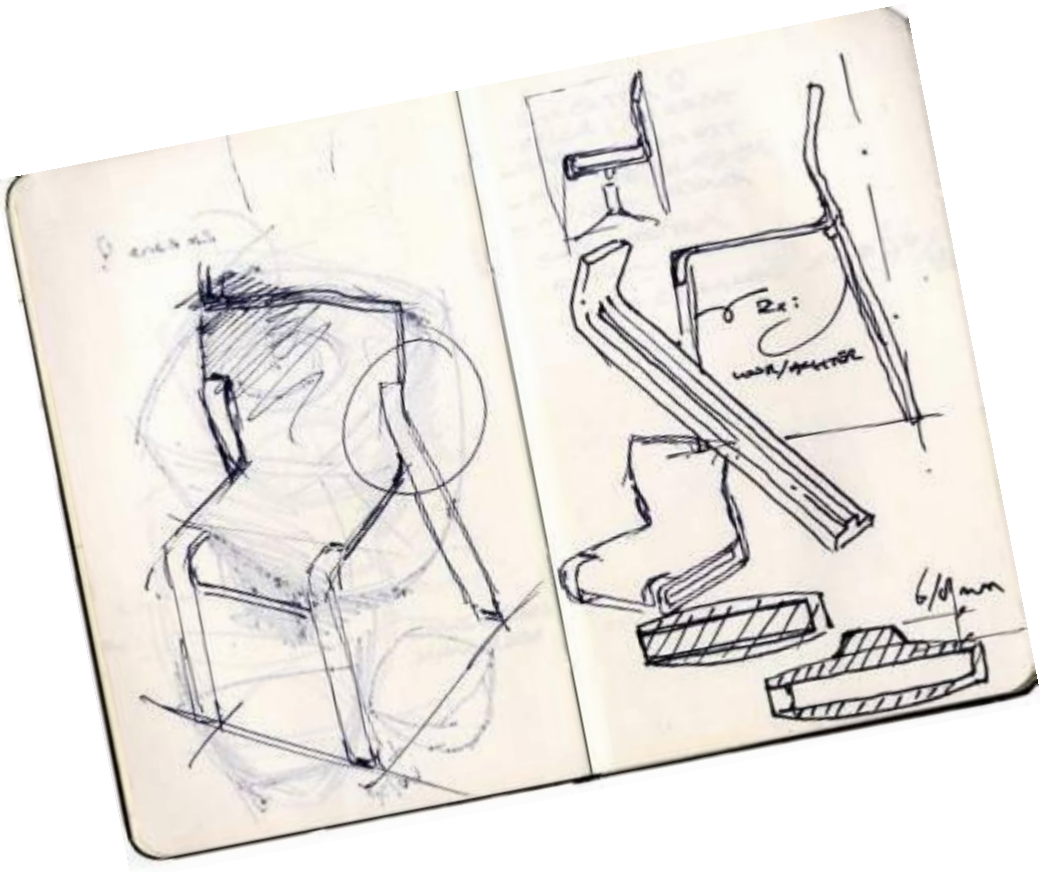
The actual start of the project was an open design-brief with a lot of freedom of the designers involved. In total four designers/design companies were approached. Parallel to this invitation Ahrend offered a concept for a royalty agreement, in case it would decide to continue with the project after evaluation of the first proposals. So, the first design and sketch phase was a financial risk for FLEX. Having some idea what the earnings could be if the design would be chosen, FLEX nevertheless decided to accept the invitation.

4.2 The first sketch

Given the nowadays increasing and predominant role of 3D-CAD and flashy CAD renderings, it cannot be stressed too much: The start of a design process with the first visualization of the mental concept is of crucial importance. The sketch should have such quality that it can guide the following 3D-CAD activities and that, in this way, it makes sure that not the 3D-CAD possibilities and restrictions define the final design! As the *éminence grise*, Wim Crouwel, of Dutch Design once stated:

"You can't do better design with a computer, you can only speed up your work enormously"

Having said this, subsequently the next most vital phase of the design process starts that is: making the right judgment of that first sketch. Based on experience in many projects, designers should train themselves to look very critical to these first sketches and they should learn to see the real value of them. During the next steps and phases in the process they should force themselves to look back at those first sketches to see if the current status of the design still solidly relates to that first impression [4.1]:



[4.1] First sketch in personal sketch book

The basic idea was an elegant, light weight, thin lined chair, featuring not more than one design element: A fluid overall surface with an optimal visual and constructive integration of the leg support. To have a strong and distinctive (U)nique (S)elling (P)oint, it was intended to use magnesium instead of the more common aluminum. As this material is 30% lighter than aluminum, it would strongly support the mobility of this chair in stacking and carrying. If the development process to use magnesium would succeed, it would be the first stacking chair constructed from this material.

In this type of projects where the initiative comes from a client to invite designers and to challenge them, the designer should always look for special opportunities for him or herself to stand out against the other entries. Using the first idea as the starting point, the original idea was repeatedly enriched with ‘shells’ of improvements; aesthetically, technologically, user-led and business oriented. It is vital for a designer to analyze whether this *creative process* still has the original idea somewhere in the middle of its optimization process. If the iteratively ‘improved’ design has drifted away from its origin, one can often conclude that the new design misses out on its original value and is not the right way to proceed. The creative process then should start again at the beginning, or the designer could try to find out where somewhere during the process the wrong design decision or assumption was made.

4.3 First presentation

The first phase ended with a so called design pitch, for which FLEX prepared a presentation. The outcome of this pitch would be Ahrend’s choice for the winning design! Trying to win a design pitch is always a delicate situation that requires a thorough analysis of the following questions:

- what would be the best answer to the briefing?
- how could the proposal really help the company in their further economic development?
- in what way is the proposal incremental enough to stay in touch with the clients’ and market requirements?
- in what respect can it be radical enough to embody a long term vision and to stand out against the clients’ competition?
- in what respect can the pitch entry be better than the entries of the other design agencies and individual designers?
- is the design proposal technically and economically feasible?

Our design was essentially based on the use of one fluent line [4.2]. In silhouette the whole chair is built from one 12mm thin strip, so the sides of the seat, frame and legs share the same dimension and thickness.

[4.2] First 3D-CAD visualization

Secondly, our stacking chair was intended as part of a whole range. A quick market scan showed that there were only a few high quality multi-purpose design chairs that also offered maximum functionality. Very often the existing chairs were either very ‘stylish’ and not very ‘functional’ or very ‘functional’ and not very ‘stylish’. Following the best Dutch Design and Ahrend design tradition, we had the ambition to have ‘best of both worlds’. Last but not least, we were eager to follow the strong policy within Ahrend to focus on a real Cradle-to-Cradle design. We had some confidence that other designers would not fulfill all these aspects at the same time. All our ideas and thoughts were transformed into a 3D-CAD model and a realistic visualization [4.2].

4.3.1 A product family

It was decided to present from the very start not only the design of one version of the stacking chair, but also several different versions, namely [4.3]:

- With and without armrests;
- Possibility for connecting chairs in a row with one and two arm rests;
- With either a plastic or a wooden seat;
- With an upholstered wooden seat;
- Light metal parts either powder coated or chromed.

[4.3] Different versions from the start

As the fundamental quality of the design was a very slim and elegant appearance, we knew we had the opportunity to create a very compact stacking chair. The overall concept was strengthened by innovative use of material, that is using magnesium as basic constructive material.

In the presentation we showed the chairs' potential. Compact stackability is generally seen as an important and strong competitive product feature [4.4].

[4.4] Stackability of the chair

4.3.2 Cradle-to-cradle design

Being an Ahrend brand-value, another USP would probably be found in the requirement that the chair should fulfill the Cradle-to-Cradle principle as best as possible. Without being able to guarantee the real potential on forehand, FLEX aimed at a design that would guarantee a 100% separation of the different materials involved. To enable this possibility, we aimed at a constructive principle that the magnesium frame could withstand all the loads as specified in BIFMA, the American office chair requirements, independently and that any combination with another seat material would be possible. In this way the total performance of the chair would be independent from the mechanical qualifications of the seat material or the combination of both parts. This is a so called '*design promise'*; it cannot be proven in the early stage of a design process, it is a project ambition. Taken together the goals were:

- Frame, legs, armrests injection molded in magnesium (thixo molding);
- The seat was made in injection molded Poly Propylene;
- The chair meeting the BIFMA specifications in full.

Despite the extreme US-specifications we aimed at a weight of the chair of 5 – 6 KG. We advised Ahrend to use FEM-software (ANSYS) to optimize to this target. After a first internal evaluation Ahrend's first choice was the FLEX stacking chair, their main arguments being:

- striking and at the same time simple and sympathic design [4.5];
- fitting the Ahrend brand;
- unique material; magnesium; never used before in a frame of a chair;
- good cradle-to-cradle potential;
- all requested functionalities integrated (stacking, connecting, armrests)
- technically feasible.

[4.5] Design in various colours

Seen from the perspective of the traditional DUT methodology, this first phase obviously was not a standard project launch. The 'pitch' created a situation that FLEX had to start the project more or less individually and that a 'standard' market en technological analysis at the start of the project could not be made. However, from the moment that Ahrend selected the design, one could speak of an approach according to the Delft method, but maybe more specifically: not so much according to the classical Roozenburg & Eekels approach as to the Delft Innovation Model[30]. The evaluation of the product use, the strategy and a part of the design brief formulation were incorporated in the pitch. From here on the design briefing was fine-tuned, by taking care of targeted clients and competitive offerings[31]. As such this project showed a combination of a more free-roaming creative process in the first part and a shift to a more classical design approach later in the project.

[30] (Buijs 2012: p. 43)
[31] (Buijs 2012: p. 72)

4.3 Final design and first model

After Ahrend's choice, it was decided to make a rough 3D-CAD-model and a real size model. After the initial investment of FLEX in the first pitch phase, from this moment on, Ahrend became the formal investor in all the following design and development activities. Ahrend took the central role in the design process:

- they knew the market best;
- they had the internal capabilities to mediated the exchange of information with other parties involved in the process;
- therefore they mediated the technology and the project information.

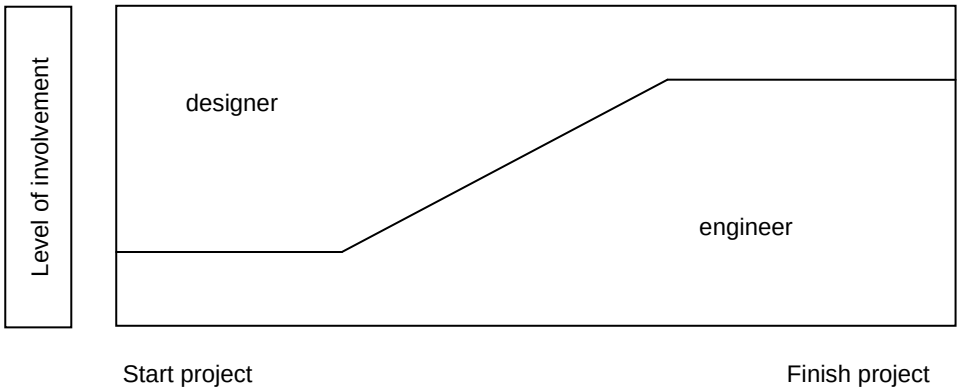
In this partnership, FLEX was committed at a strategic level as there was a high degree of mutual trust and belief in each other's capabilities.

From day one of the actual development it was clear that Ahrend wanted to push hard to fulfill all the promises that were made in the initial design: "It had to be a chair made of the unique magnesium!" From a practical point of view we anticipated on a move backwards towards aluminum, but nevertheless we put our ultimate effort to stick to magnesium. The first design phase and the model making granted a realistic model that was hard to distinct from the real chair [4.6]. After a positive evaluation Ahrend decided to enter the next phase.

[4.6] Image of first realistic model.

4.4 Engineering

First of all it is important to stress that engineers did not just enter into this project at exactly this moment. On the contrary, FLEX strongly believes that designers and engineers should cooperate directly from the start of a project. The involvement of a designer – measured in time – is of course larger in the first phases of a project than the role of an engineer and this situation is reversed towards the end of the project. The important thing however is that they work as parallel as possible, from start to end [4.7].



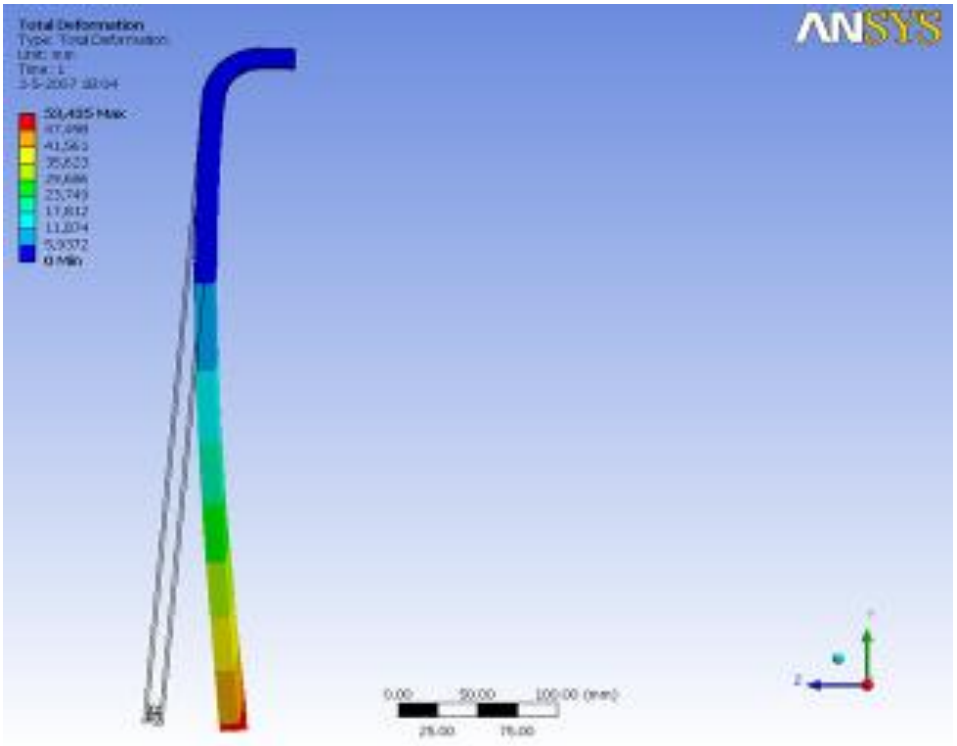
[4.7] Preferred cooperation between engineer and industrial designer

4.5.1 Strength and stress analysis

From a technical point of view the biggest issue was to make the chair strong and stiff enough while keeping the elegant thin dimensions of the legs and frame. We had the opportunity to use our high-end FEM software ANSYS, but at the same time a *calculated* stiffness would not render us an absolute and direct insight in the realized and more important *perceived* stiffness. The legs of the chair would most certainly flex, but exactly which flexible behavior would be perceived as uncomfortable? As the E-modulus of Magnesium is 30% lower than that of Aluminum, we knew we had to be extremely careful in our evaluations and judgments of the outcome of the CAD and ANSYS simulations.

The main problem areas were:

- front legs,
- back legs, and
- armrests.



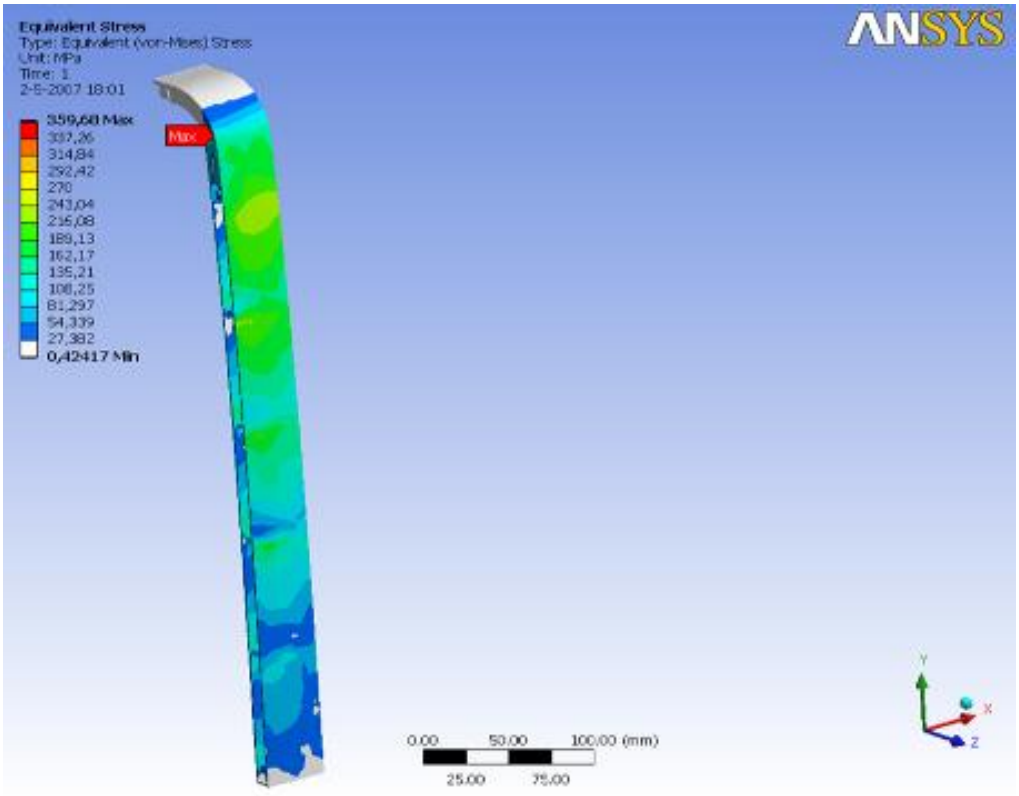
[4.8] ANSYS simulation of load and deformation on the front-legs

According to the NEN and BIFMA specifications the chair had to withstand the following load situations. No permanent deformation at:

- 334 N against the bottom front sides of the front legs [4.8];
- 334 N against the bottom back side of the back legs;
- 890 N surface load vertically on the armrest.

Allowing permanent deformation without sudden fracture, yielded:

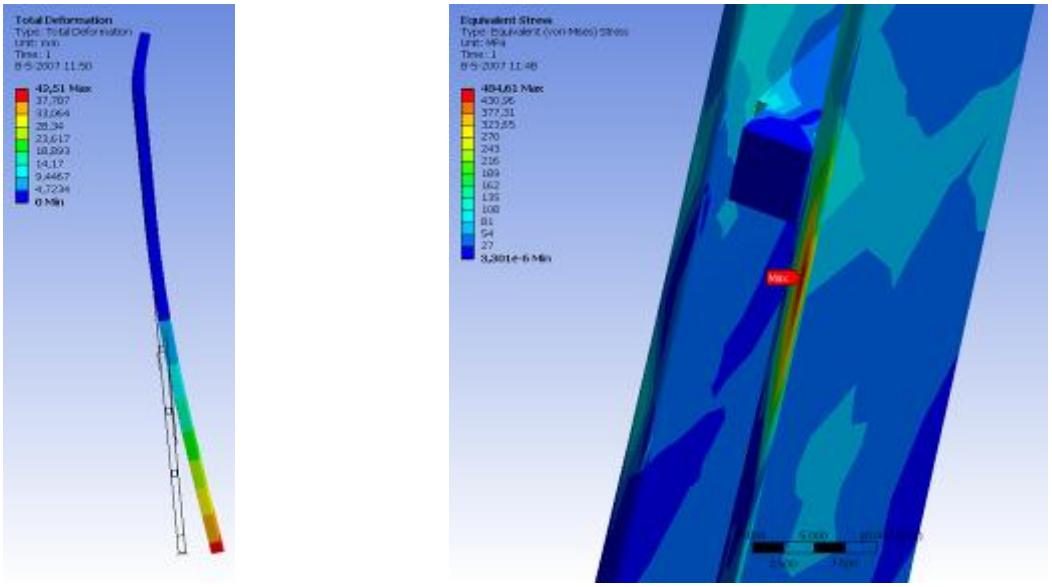
- 556 N against the bottom front sides of the front legs [4.9];
- 556 N against the bottom back side of the back legs;
- 1334 N surface load vertically on the armrest.



[4.9] ANSYS simulation of permanent deformation on the front-legs

After several iterations and design optimizations the chair fulfilled all the BIFMA requirements resulting in a front and back legs with 50% weight reduction and at the same time 25% increase in stiffness compared to the initial design proposal.

The front and back legs were decided to make hollow [4.10]. This solution improved the ease and speed of production due to the improved cooling and at the same time it reduced the weight and it increased the chairs' stiffness.



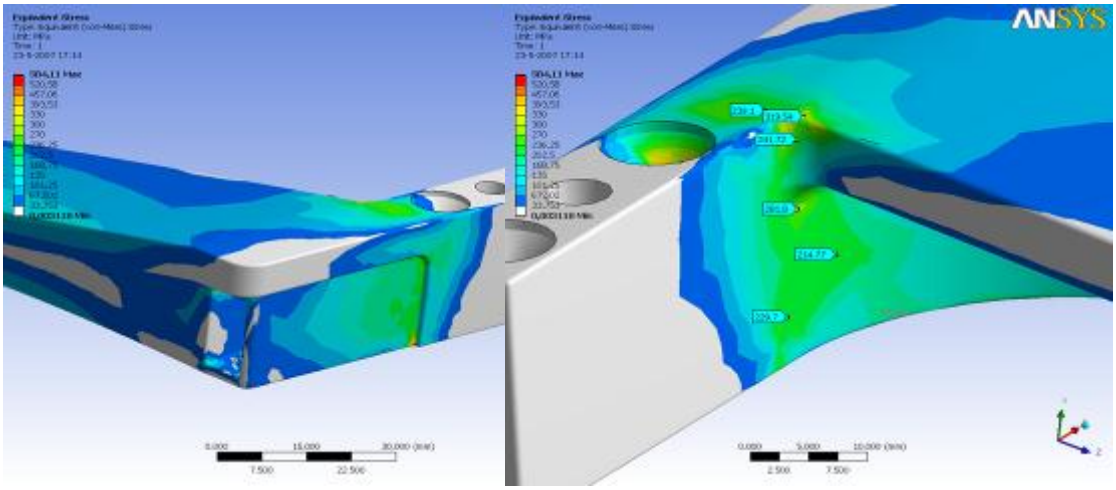
[4.10] ANSYS simulation of hollow shaped front-legs

Another design problem presented the armrests. Stemming from the overall slim design they had to be relatively thin, elegant and sharp, but at the same time they had to offer enough comfort for obvious ergonomic reasons.

[4.11] Alternative designs of arm armrest

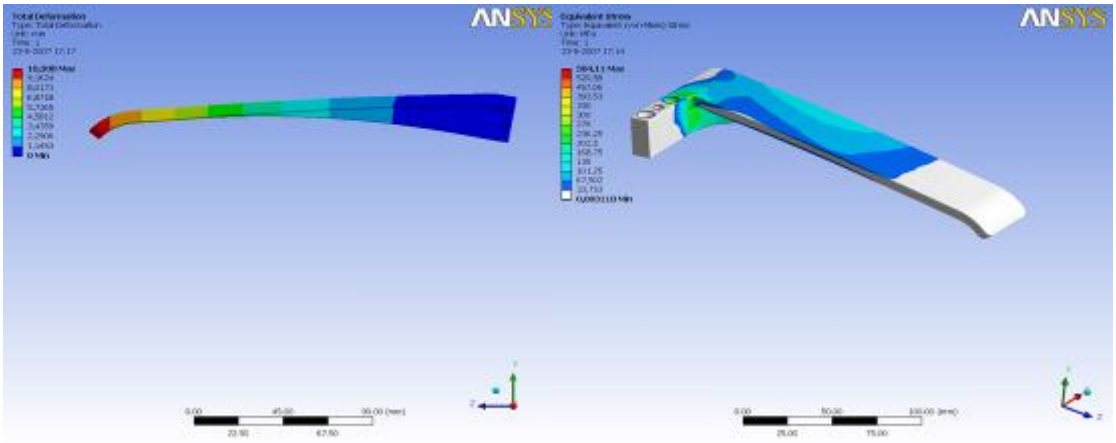
A number of different design solutions were developed [5.11] and tested with FEM analysis. Thicker ribs were investigated several smaller ribs and smaller and larger radii to avoid points stress and decrease high concentrated tensions.

The main concern came from the concentration of stress in ‘the corner’ of the armrest [4.12] and [4.13]. From an aesthetic point of view the inside of the corner had to stay relatively sharp, but we knew that to reduce stress we had to increase the radius and had to add material. So it was decided to add material at the bottom side with a small recess which assured that the side view would still remain the same elegant line.



[4.12] ANSYS simulation of stresses in arm rest

Finally we ended up with an armrest that would be able to fit both the NEN and BIFMA requirements. Up until today the Ahrend chair is the first Dutch-made-chair that fulfills all these demands.



[4.13] ANSYS simulation of deformation of armrest

4.5.2 Optimization of costs and investments

Parallel and simultaneously to the engineering and the FEM iterations, it was important to keep control of production costs. The chair should have an attractive market price and for that reason it had to be produced according to strict cost and investment limits.

As mentioned earlier we tried to establish a well-engineered design in which we would use as less material as possible. At the same time we aimed at a geometry in which each individual part would make it possible to have it relatively easy produced with no complex tooling. Also in the assembly we tried to be as efficient as possible. It turned out that it was possible to assemble the chair with only six screws that were – invisibly – screwed from the bottom side of the magnesium frame into the bottom side of the Poly Propylene plastic or wooden seat. Many of the requests for quotations to potential suppliers were done in close co-operation with the involved management of Ahrend. From especially this phase on clients in general are supposed to draw the project more and more into their own daily business. It is essential that in this phase the actual manufacturer builds up its own knowledge, becomes familiar with the project and its characteristics and so makes the design its own. When this co-operation works well, the assimilation of the design phase into the production phase will run more smoothly.

The outcome of many negotiations with alternative suppliers and discussions with the project team of Ahrend, ended up in the following costs and investments. In general all based on official bids of suppliers involved [4.14].

Stacking chair	Mg parts	PP parts	Wood parts	Finishing	Assembly and divers	Total
With armrest	€ 41,15	€ 15,79	€ 12,66	€ 7,42	€ 15,16	€ 79,52
Without armrest	€ 46,91	€ 15,79	€ 12,66	€ 7,42	€ 15,16	€ 85,28
Investments	€ 208.490,-	€ 165.000,-	€ 10.455,-			€ 383.945,-

[4.14] Cost breakdown

With an estimated market price of somewhere between EUR 200,- and EUR 250,- Ahrend felt confident about the business case and decided to give green light to the tool making. The magnesium parts were granted to a Malaysian supplier and the plastic parts to a German molder.

4.5.3 Detailing

Parallel and as an integrated part of the whole process and all the technical optimizations the combined FLEX and Ahrend design team took good care and paid a lot of attention to the quality of the detailing. In this phase, three design convictions are crucial:

*The details are not the details. They make the design (*Charles Eames)

When I am working on a problem I never think about the beauty. I think only how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong. (Richard Buckminister Fuller)

*A Designer knows when he or she has achieved perfection not when there is nothing left to add, but when there is nothing left to take away (*Antoine De Saint-Exupery).

The end result of this design process illustrated the belief that these convictions are valid:

- the 12mm thin side-line was respected, despite the required strength;
- without the use of very often badly designed extra parts all the required functionalities could be integrated; stacking, connecting, etc.;
- no screws or connection material were visible.

Last but not least, the final chair still looked very similar to the first sketch, as we were able to protect and keep the original intentions of the very first sketched idea. When this is the case, it is a clear sign that the design is strong and that it has character and quality. When the original feeling of the first sketch is lost somewhere during the process (and of course this sometimes happens) the final design is very often not convincing.

4.5.4 Testing

Especially during the negotiations with the thixo molder of the magnesium parts, part of the deal was to receive some first out of tool parts (FOT-parts) for preliminary testing, to make sure that the calculations of the required stiffness had actually resulted in the correct and comfortable feeling while the chair was actually sit on. Apart from that the chair had to exhibit the same stress behavior compared with the ANSYS CAD simulations. For this purpose a simple test-rig was made [4.15].The outcome showed that some additional stiffness was required. The first tooling anticipated on such an optimization, so the tools were slightly adapted and the production parts were finally approved of.

[4.15] In-house testing-rig

4.6 Production, purchasing, tooling

The role of the design company in this phase of a project is normally limited. It mainly consists of checking on the technical drawings, checking the tolerances and approving the FOT parts. This was also the case with the Ahrend chair. Tools and the first parts were checked in Germany and Malaysia [4.16].

[4.16] Tool for Thixo moulding

Here the molds of the Magnesium frame are shown [4.16], the FOT parts of the front legs [4.17], and, on the right size, the sizeable injection molding tool of the PP-seat [4.18].

[4.17] First out of toolof magnesium front legs and [5.18] tool of the PP-seat

4.7 Product portfolio

We wanted the assortment of the stacking chair to be supported by a carefully chosen color scheme. With these colors we wanted the chair to have either a more office-like feeling, or a more playful canteen feeling or a more trendy warm feeling. To make sure that the overall design would not ‘fall apart’ we chose for a ton-sur-ton color scheme. As the direction of the colors was clear, we felt that a specialized designer was needed to give us the right final direction [4.19]. For this reason Scholten & Bayens was approached.

[4.19] Color studies

It is commonly known that many industrial designers and agencies are not very open and willing to cooperate with other designers, as already during their education design students are often taught that they are the right persons to give all the right answers. In practice however, I became convinced of the fact that the more experience you have as a designer, the bigger the chance is that you become more and more aware that you know less and less. In this case this is illustrated by exceptional quality of the highly specialized work of Scholten & Bayens. The colors they suggested, varied from crisp and bright green and reds, shifting to delicate more neutral 'grayish' colors [4.20].

[4.20] Color variations in product portfolio

4.8 Market introduction

Together with the Ahrend sales team FLEX was asked to play an active role in the sales preparations. We briefed the project presentation to the sales people and were involved in the correct formulations and descriptions in the various brochures and web-site presentations. The final result was that the Ahrend 360, as the chair was named, could be found in:

- Reception rooms;
- Meeting rooms;
- Restaurants;
- Schools.

This implied a larger spectrum of ‘fitting’ to the market opportunities than was thought of at the outset of the project.

	100	150	200	250	300	350	400	450	500	550	6(
Ahrend 350											
Ahrend 250											
Ahrend 240											
Ahrend 230											
Ahrend 360											
Ahrend 330											
Ahrend 262											
Ahrend 312											
Ahrend 460											

[4.21] Price positioning of Ahrend 360 within the Ahrend range

As can be seen in the matrix [4.21] the Ahrend 360 fitted very well in the rest of the Ahrend assortment. Also in the more high-end segment of the market the design quality of the A360 could flawlessly withstand the competition! [4.22]

Ahrend 360

€ 270
Armrest
Connectable to a row
Stackable
Contemporary
Distinctive material
Cradle-to-cradle

Vitra Chair.03

€ 360
No armrests
No connecting possible
Stackable
Contemporary
Not cradle-to-cradle

Thonet S361

€ 250
No armrests
No connecting possible
Not stackable
Not contemporary
Not cradle-to-cradle

[4.22] Ahrend 360 and two competitive chairs of Vitra and Thonet

A last creative act of FLEX was the meaning of the code 360 that was given to the chair by Ahrend. Code 360 was an arbitrary code that Ahrend had chosen. The FLEX design team was not very happy with this name, until my colleague Jacco de Haan came with 360 as an explanation of a proper “Full-Circle Design”. The Ahrend 360 had the right and perfect balance between:

- Aesthetics
- Ergonomics
- Production
- Durability

The last characteristic referred to the excellent fitment with the Cradle-to-Cradle principles, as all parts can be separated from another to be reused for other production purposes.

[4.23] Final design

4.9 Optimal client behavior

A last aspect of this project was the quality of Ahrend as the project principle. In the Dutch design world one often speaks of '*goed opdrachtgeverschap'*. In this project Ahrend showed what this meant:

- They wrote the right project briefing creating only the important boundaries and leaving plenty of room for the designers to excel in their creativity;
- They supported the design selection process with clear insights in the financial revenues;
- They proposed professional royalty contracts;
- They took care of sufficient funding for the actual design process;
- They anticipated on the required investments in tooling and production;
- They pushed as hard as the external design team FLEX on quality and the design promises that were made in the early stages of the project;
- They protected the most important project values like cradle-to-cradle;
- They supported the whole design process with high quality project management, design knowledge, engineering and overall quality control.

The Ahrend 360 project was an example of: "*A designer is as good as his best design principle"* and consequently the Ahrend 360 received several Design Awards, the first in the US, the ID Good Design Award and lately in Germany the Red Dot Award of 2009 [4.23].

5. Case 4: Innovation of Otto Ooms stairs and platform lifts

Otto Ooms BV is a family owned company that manufactures and sells chair and platform lifts. The first contact between FLEX and Otto Ooms BV dates from 1992, only three years after FLEX was founded. In this case study the relevance and the value of using the traditional versus a new design methodology will be discussed. Secondly, the key success factors of an individual design firm working for a medium sized, privately owned company will be touched upon. Such a relationship is typically built on:

- building mutual trust;
- internal design team motivation;
- transparent and at the same time very critical judgment on deliverables;
- solid financial co-operation;
- delivering full and sometimes extra services;
- synchronicity (growing up together);
- celebrating mutual success;
- patience.

In the following the above characteristics will be discussed in more detail.

5.1 Pitching strategy

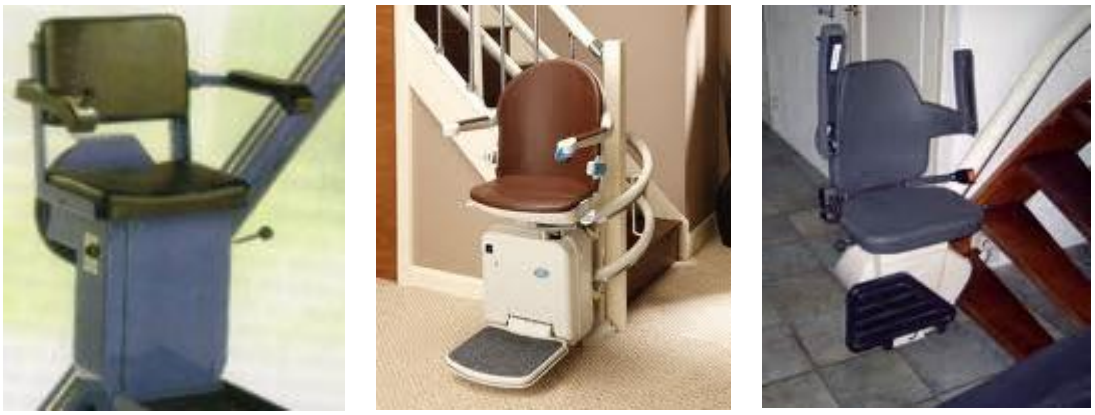
What is specific on working for a smaller privately owned company? Another client of FLEX once said: “The more I pay you, the less remains of my heritage”. A similar company stated: ”I have the strategy to pay you a bit extra to make sure that I’m first in line and to make sure that I can ask for the best service you can give me!” Although this is not the complete story, these phrases do tell part of it: In a privately owned company all the companies’ activities are very close intertwined with each other. This means that an owner or main shareholder of such a company behaves quite differently from a managing director of a multinational organization. The possible implications of decisions are directly felt by the same person or otherwise his family members. In general this cumulates into an intense exchange of good arguments as a foundation of decisions before the final decision is made. Decisions in this circumstance are generally made based on a more long-term vision, compared to ones of employees of multinational companies that often seem to be more focused on the short-term consequences for their own carrier. However, once these decisions are made, the following process is fully supported. With Otto Ooms BV this was exactly what happened.

In 1992 FLEX and three other agencies were approached through mediation of Syntens (at that time called: “Innovatie Centrum”, Innovation Centre).

One of the other candidates was a TNO division, the so called ‘Product Centrum’. The other consultancy was a well-established engineering company with a small design department and the last competitor was one of the larger Dutch design agencies at that time.

The briefing of the first meeting was to show the ideas for a new mechanical principle of a new rail system intended for a new design of a chairlift. FLEX was told that Otto Ooms already ended a project with another department of TNO that had not been able to come up with an answer to a similar question a year earlier. As the youngest and less experienced agency of all four, FLEX decided to focus completely on the design of a new chair and keeping the rail and the mechanism practically unchanged. The reason for only answering part of the briefing was based on the analysis of the TNO project, that had not been able to come up with an answer in a study of more than one year. How could FLEX, with less experience, answer a more or less identical question in less than two weeks, the time that was given until the first presentation? The second reason was that there were, in our opinion great opportunities to improve the overall design of just the chair. The competition had foregone this and the development risks and costs were a fraction of the required budget for the original briefing. Last but not least, with this strategy FLEX could stay close to its real strength; the creation of a striking new design in which FLEX was fully convinced to succeed. So in essence the decision was made *not to answer the full briefing* but only part of it, fully aware that it was a risky one.

Subsequently the design proposals were presented to the client. The central focus of our presentation was a unique design strategy. Our strategy was based on the observation that the whole market of chairlifts was using a type of design that was easily identified as a product for handicapped people. All the existing suppliers were all using powder coated thick metal sheet parts in combination with simple and roughly shaped Artificial Leather Cushing [5.1].



[5.1] Ooms chairlift, Stannah and Brinkman Jan Hamer chairlift

FLEX' philosophy was that this chairlift should be part of the interior design of a homely environment. It should look like a 'regular chair' that was incidentally fixed to a rail. In three alternative design directions this philosophy was presented [5.2].

[5.2] Chosen concept of redesigned chairlift and old design, 1993

In the meeting both two brothers that were – and still are– running the company were present. Their first response was 'minimal'. The briefing they had given us, was not fully answered. Why? They had to be convinced that our strategy was a better one; a strategy with less technical and financial risks, less costs and potentially greater commercial opportunities. It could be seen that they were both positively surprised by our design proposals, but at the same time also unsure. Questions were asked like: "Were we really sure that all the existing technical components of the chair could fit into our elegant design?" Here the work was done carefully; their own technical drawings were used as an underlay for the sketches, so these questions could be answered positively. This kind of preparation is crucial for a presentation like this. If one is stretching the boundaries, make really sure that you know exactly where these boundaries are located! If not, especially in the case of a family owned company, you will immediately lose your potential client's thrust. But still, the two brothers were not fully convinced. So they called in several other company representatives to give their opinion. They were positive but at the same time they too were unsure that such a 'simple answer' – no heavy engineering, but only soft design work – could be enough for a successful new development. Finally both wives of the owners were called in and both responded spontaneously: "What a beautiful chair, can we really make this?" Absolutely positive but still not enough for a final decision to go ahead.

During several weeks after this first presentation there was frequently personal contact with one of the brothers, both during and outside office hours. In almost every conversation the question was asked: “Do you really think that this design will be the right strategy? Do you really think the market will respond positively?” Without giving guaranties, we stayed optimistic and showed our motivation and interest, also by mentioning that the development of a whole new mechanism would mean a much bigger budget for FLEX and that this would be beneficial to FLEX, but as the benefits for Ooms were concerned, we had more confidence in the cheaper solution. Apart from that, a new mechanism could also be developed later. In this way FLEX was showing their willingness of an ‘indirect’ investment in the cooperation; invest now and collect later.

At that time Otto Ooms was producing around 1000 chairlifts per year. It was our assumption that the turnover was between EUR 8 en EUR 10 million per year, EUR 4.000,- per chairlift. With a percentage of 2 % of R&D this would leave a yearly development budget of around EUR 150.000,- including tooling and other parallel internal R&D projects! A total project budget including tooling of EUR 80.000,- was in FLEX’ view a right and responsible investment. The estimated budget of FLEX at that time was – excluding tooling - EUR 50.000,-. FLEX knew that another remaining candidate proposed a budget of more than EUR 150.000,- for indeed a whole new rail system and chair. By showing the right insights in the ROI, FLEX showed to be more than just designers. Similar to the 1-2-Paint project FLEX showed that is was able to view a design problem in a broader entrepreneurial context[32].

Within a month after the first meeting, FLEX was granted the project and it turned out that FLEX had to strive for a market introduction on a fair 8 months later! In this first phase we had in fact invested only in building up trust for our company. With all types of projects this is important, but for projects for small and medium sized privately owned companies it is crucial.

[32] (Belsky 2010: p. 211)

5.2 Long term relationship

It is the experience of FLEX that it has been easier to establish long term relationships with small and medium sized privately owned companies than with for instance multinational fast mover consumer goods (FMCG) companies. In bigger sized companies, job rotation, carrier-push and internal politics are creating a situation in which a person stays on one position only for a short period with often a maximum of 2-3 years. After that, a successor wants to manifest himself with his own initiatives and contacts. In general this has being experienced by many of FLEX' design colleagues and together we all share the same opinion: it is leading to a loss of knowledge and experience and in the end it even can lead to a serious loss of quality.

Looking from a design perspective, knowing that with the right design approach a company can establish a clear, consistent and valuable corporate identity, the conclusion is warranted that the use of design as an asset within any company should per definition be a long term, strategically driven activity. It is the experience of FLEX that this is more often and more easily realized with small and medium sized companies and this holds especially with privately owned companies. Bigger companies might have the opportunity to work with their own internal product and design managers, but very often these persons change jobs within three years. This lack of continuity works very contra productive for an effective design-strategy. In the current case of Ooms, FLEX had been able to build up the brand through the strategic use of design during almost 20 years from the first project. The growth of approximately 1000 chairlifts that were produced by Ooms when we started our cooperation, to more than 12.000 lifts per year today, illustrates the potential of a long term relationship that allows for a long term strategy.

5.2.1 Building up trust

Building up trust is important in any relationship and this holds too for business relationships. But as mentioned earlier, it is especially vital in dealing with privately owned companies, as they have the feeling that they put their entire future and those of their children in your hands.

Now, how do you create this feeling of thrust? Starting from the first years of cooperation towards later years, trust can be established through:

- showing real interest and insights into other relevant company processes that are linked to the design process;
- showing clear added value within the above framework that is wider than just the design project;
- clear, effective and efficient communication and providing full insight into the design process;
- work clearly towards the promised deliverables;
- meeting financial arrangements with painful accuracy;
- keeping room for the so-called WOW-factor; clients still want to be surprised! Always make room for Design-Magic: unexpected uniqueness;
- keep a very strong focus on the commercial results of both the project and of the company as a whole.

These points of attention show that design is only a part of the process of building up trust. It is important to teach designers during their education and within a design company that this is how it works in practice. Too often designers tend to put themselves into the central focus of attention. If they do so, they miss a lot of their potential. Industrial designers should think of their work as delivering the best service. Even the result of the design process – the proposed design – should be presented and communicated as such. “What is the *value* of the design for the client?” Proposals should be explained within this framework and not – what is often done – from a ‘designers’ perspective only.

Nevertheless the core competence is still design; so how to present it? Before presenting proposals to a client, it is always helpful to ask yourself the question: “Are the ideas really significantly better than all other existing products?” Is something established that is really better?” “Are all the most important questions on the feasibility of the ideas really covered and answered?” [33] Most of these questions have to be answered positively. The owners and main shareholders are very often in such close contact with their products and their markets, that they will most certainly also ask these same questions! So be prepared: When you have three concepts to present that are really strong and one other might be interesting from a pure design perspective, but would leave the evaluation with too many uncertainties, this concept could undermine the credibility of the others. It is then better to leave this last one out, especially when dealing with this type of companies.

[33] (Franklin 2003: p. 115)

5.2.2 Constant high quality level

Working with the same company representatives and given their personal involvement, a constant high quality design level is crucial for a long term relationship. In follow-up projects for Otto Ooms, FLEX has been constantly aware of this factor. In every next project FLEX continued the same quality level and made sure that the same design strategy of '*a chairlift with the aesthetics of an interior product'* was brought to an even higher quality level with every new market introduction [5.3]. This is especially important because of the very serious personal implications of 'failure' in this type of projects. Moreover quality is in these cases not only directly linked to design. It is important on many levels:

- good price – quality performance;
- smooth communication;
- sensible investments and good production opportunities;
- commercial success.

[5.3] Chairlift type T60, 1998

5.2.3 Internal design team motivation (patience)

Sometimes the ambitions of a client cannot be met with those of the designers involved. This has also been the case with Ooms. Within Flex itself the (design) quality of the work was regularly questioned, but not for the correct reasons and with the right arguments. Indeed, FLEX did not win many design prices with the work we did for Ooms in the first years of the cooperation. On the other hand the Ooms products were of much higher (design) quality than all the other products in the market. With these designs we were already stretching the boundaries from the start onwards, but not so much as to risk the chance that the potential customer in this case would lose interest in the product.

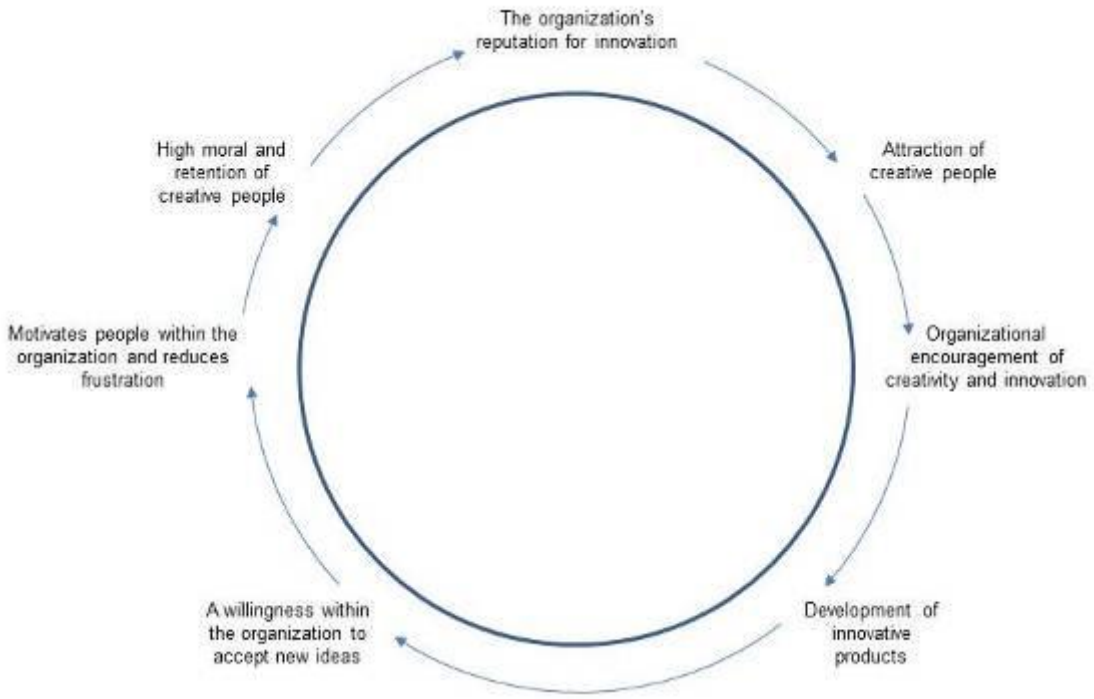
Since the first years, we realized several designs that could be qualified as ‘Most Advanced Yet Acceptable’, the so called MAYA concept of Raymond Loewy. [34] The interpretation of this concept strongly depends of course on its perspective. In my opinion the only correct interpretation is the market perspective and that of the end user. This perspective can only be interpreted correctly when made with sufficient market knowledge. Very often designers overestimate their knowledge. Building up such knowledge is very much a mentality-concept. When designers are taught that they should ‘teach’ the market with the right designs, designers are indirectly told that they are in the position to change market conditions. Although this is not the case in all design schools, it is certainly the case in ‘art’ induced design education. Many designers should be made more aware of the essence of this principle and should be better thought and trained to create this mentality. In an interview I once stated that designers should have a strong social awareness and consciousness. As FLEX we really want to serve society; FLEX *wants to be of value*.

Having worked almost twenty years for Ooms successfully, it is easier to convince other Flex’ designers of the right approach for Ooms: we proved by our enduring cooperation itself to have the right approach. And with the design quality of the Ooms’ products we were able to stretch the interest and importance of design in the whole market. So, both FLEX and Ooms grew to an unquestionable higher design level.

During this process over the years, having a strong long term focus on the right and balanced design strategy and working from the MAYA principle, it is important to keep explaining and showing why the work should be done in the way a design company wants; not only to the client, but also internally to the design team. Explaining the context of the right design approach is important to keep the team motivated. Designers are generally high educated people. Sharing the project information, the vision and the context of the work instead of ordering them to do as asked, is much more effective. And on the way they are thought other important aspects of designing.

[34] (Loewy 1951: pp. 277 – 283).

This process of motivation was once called ‘the virtuous circle of innovation’[35], stressing the importance of a process of active propagation [5.4] and motivation of the development team by the management.



[5.4] Propagating a virtuous circle of innovation, according to Trott

5.2.4 Transparent and critical judgment on deliverables

Family owned company Ooms is today managed by the second generation. Two brothers are running the company, one responsible for production, the other general manager and personally intensively involved in new product development processes. Over the last twenty years the second was also FLEX’ direct contact person for their projects.

Being in charge of the technical development, the general manager is very well informed about every detail of the Ooms’ products. In this way the general manager serves as a critical counterpart for FLEX in the development process. Knowing all the consequences of all design and development steps and decisions, a client like this demands a very well equipped and prepared design team. In every meeting FLEX had and has to perform to the maximum potential to prove that it could and can meet the expectations.

[35] (Trott 2002: p. 77).

5.2.5 Solid financial cooperation

As stated before, working for small and medium sized companies is different from working for multinational companies. The direct contact with the well informed owners asks for a constant high quality approach that also guarantees positive financial results. The financial ethics between these types of companies can be described as follows:

Large (FMCG) companies (often multinationals):

- Difficult to establish long term relationships;
- Continuous competition with other design service companies;
- Working from one project budget to another;
- Reasonable secured payment; in the end they will almost always pay;
- Long installments; often 60 – 90 days or even longer.

Small and medium sized, privately owned companies:

- Primary differentiation between high and low financial risk profile; many are trustworthy, but some are risky to work with. It's important to identify one from the other before the project starts;
- If based on mutual success, quality of work and trust, there is a possibility of a long term relationship (ten years and more);
- Shorter installments; around 30 days or even shorter.

Ooms is clearly a company in the last category. It pays its bills within thirty days, seemingly operating from the philosophy; "If I pay you in time, I *can* demand the maximum service and quality. And when different clients ask to deliver the right quality at the same time with limited capacity, I will be first in line. Last but not least, it has probably to do with an old credo: *"the grant factor".* Although it might be based on an older business moral, it is to be expected to become an asset of increasing importance in the (design) business in the coming decades. If both parties have the same 'grant-moral' it will always work both ways. If a client like Ooms is granting us a solid, sound and beneficial relationship that also performs well financially, we will 'grant' Ooms the best quality, we are able to give.

As design is a profession that has lots to do with working from a personal conviction, this mutual 'grant-factor' seems to fit well into the design culture. In short; designers will not have a problem in granting the best quality; it's already in their nature. As durability – also in business relationships – seems to become a more and more important factor for the next years, it's likely to expect that there will also be more and more clients that are willing to build long term (design) relationship within the grant-factor.

5.2.6 Delivering full and sometimes extra service

Having established a long term relationship with these types of companies, it's important to understand that the relationship is not only based on the correct execution of the design projects. The design-consultant will become directly involved into the core-activities with this type of firms. That is, the design consultant should feel and behave more like a colleague than as an external consultant. Asking how the company is doing in other activities can also provide some information on issues like whether he could be of value in other areas and to give advice in these areas, such as:

- a better website;
- an optimization of their PR;
- advice to optimize their project organization;
- sharing your vision on the employees you have worked with;
- giving advice to work with other and better suppliers;
- organizing the supply management for them when a certain type of supplier is hard for them to manage;
- taking care of the design of the user manual, CE-markering, interface design.

Some of these extras are important to provide, without charging the hours. In this way the design consultant stimulates the company to share more information, because it knows that it will not be directly charged in hours. In this way the designers will actually receive more information that will possibly lead to actual new forms of advice activities that fit the core competences of the company and that can later on lead to additional paid contracts. In the case of Otto Ooms and FLEX this extension of the relationship has led to many more design and development activities, like prototype testing, specifying a correct test program and specifying the functionalities of new electronics [5.5].

[5.5] Testing several prototypes of chair lifts

It’s also important to be aware of questions and requests that seem to come back more than once. These requests should lead to the question to what extent the design company should execute this itself and to add as such these new activities to its core competences. Over the years FLEX has become responsible for all the manuals, certifications, parts list, CE-markering and user manuals for Ooms and in this way FLEX extended its knowledge – internally and with some external partners – to do this with the right and required quality level.

5.2.7 Synchronicity (growing up together)

Synchronicity is hard to manage. With synchronicity is meant the way the designer as a consultant and his client share a parallel development in their mutual interest and needs in design. Of course their interests should be similar both at the beginning of the relationship, but they should also be somewhat equal during the relationship and at the end of a project. In fact it is vital for a design-business-relationship that the client should ideally develop the same design-professionalism as the designer, especially in situations where both parties are seeking a durable relationship. I’m referring to chapter 5.2.3 and the MAYA concepts. The MAYA concept is not only a ‘marketing’ principle it’s also a ‘consultancy’ principle. Coming from market developments and market demands, the designer should be able to follow the requested development of the manufacturer. The manufacturer from his side, should be willing to share the same design philosophy the designer is deriving from his vision on the market.

In the case of Ooms, the client asked FLEX in the course of the relationship to become more than a design consultant. After the first projects they also would like to use our mechanical engineering knowledge, experience and capacity. Due to the general company vision, other projects and of course the Ooms’ request, two of these types of engineers were added to the staff of FLEX and they are both still working within FLEX. On the other hand, Ooms has given room and trust to follow the increased design quality level of FLEX. Of course this was the consequence of the market success of the early design advices provided to Ooms.

The conclusion:

- synchronicity is largely depending on the mutual market success of the design projects;
- synchronicity is a cultural aspect of both parties; both should be open to adapt to their mutual tempi;
- synchronicity is part of an internal company ‘MAYA principle’; the shared interest and belief of the designer and the client into the establishment of a correct ‘MAYA interpretation’ can lead to a similar approach of the market and hopefully to a positive and successful market response.

5.2.8 Celebrating mutual success

The most crucial moment in the relationship between Ooms and FLEX was the first presentation of the first common project of Ooms and FLEX at the ‘Support’ exhibition in Utrecht in 1995. ‘Support’ is a two-yearly fair for suppliers, manufacturers and other related companies that are dealing with the market of provisions for handicapped and disabled people. It was the first time that Ooms presented itself on an exhibition. Of course it was a decision that was made by Ooms, but FLEX did play an active role in the internal promotion of this new company’s activity. Before the fair, Ooms was still doubtful on the value of the design, the appreciation and recognition by potential clients and the presence on the fair in general. All doubts vanished however as the presentation proved to be a large success. This fair was a great success and so was the product and the appreciation of customers. In retrospect it can be seen as the most valuable element in building a fruitful and durable design relationship.

Another important aspect was the fast increase in sales that was realized since the beginning of the cooperation between Ooms and FLEX. Before FLEX was cooperating with Ooms in 1992, Ooms was manufacturing around 1000 chair lifts per year. In 2010, so eighteen years after FLEX and Ooms started their cooperation, Ooms was selling more than 10.000 of its chairlifts. The design was certainly not the only factor in this success, as it was primarily defined by the excellent management of the company, but nonetheless it has played a valuable role in the success and it was and certainly still is an important asset.

Comparing the original design from 1992 with the 2006 version, a clear design quality improvement can be seen [5.6].

[5.6] Evolution of the design since 1992 until 2006

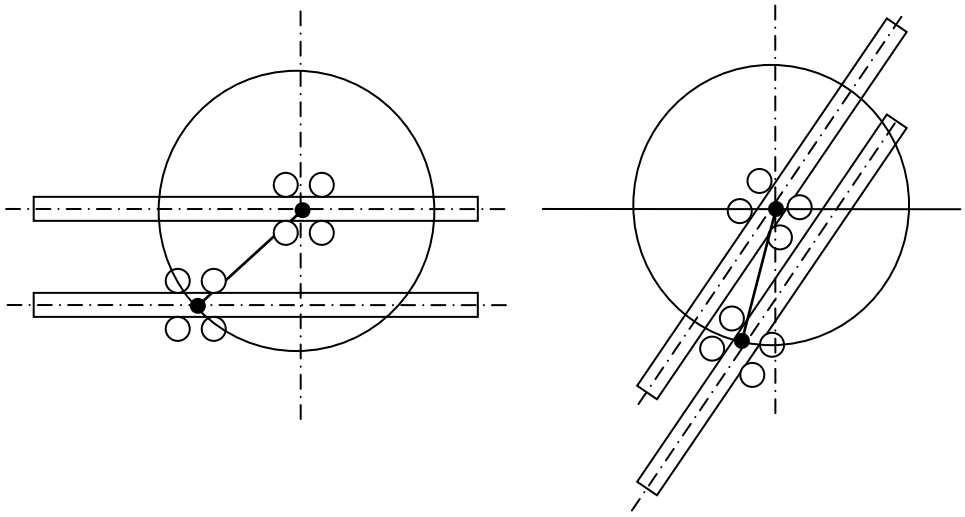
A more recent product – the Emerald – is likely to increase the production volume another 10% [5.7]. So even until this day establishing and celebrating mutual success is vital for a fruitful future.

[5.7] Design of a chairlift from 2006

5.3 A recent project: The Monorail Smaragd

The most recent project FLEX executed together with Otto Ooms is a chairlift based on a - technically speaking - new guiding system: a one-rail-principle. Otolift produced and sold chairlifts that were either using straight steel or either extruded aluminum rails or curved steel rails using two tubes. The mechanical principle of this last double-tube-rail delivers a very steady movement. There are however two disadvantages:

The first is that the two tubes create together a rather large rail that is positioned 200-400 mm above the steps of the stairs. Therefore it can *not* be seen as satisfying from an aesthetical viewpoint. The second disadvantage is the fact that this rail-principle is limited to a maximum inclination of around 60 degrees, caused by the following: When the inclination angle approaches 60º the chair-rail connection become increasingly unstable as it has almost no stability left to prevent the chair to turn and twist around its vertical axis and there is hardly any space left to accommodate the wheel sets between the two tubes [5.8].



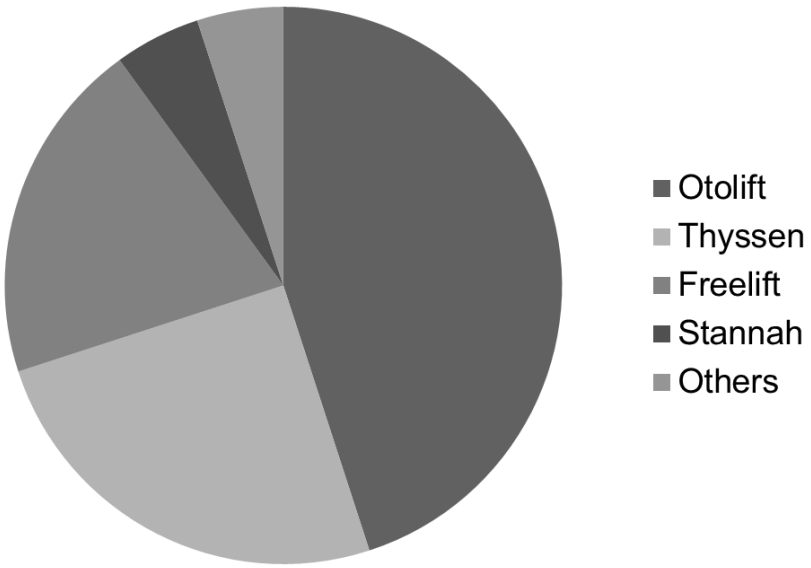
[5.8] Old two tube guiding system in horizontal and inclined situation

But why should a limitation of the inclination angle be a disadvantage? In case of a winding stairs it has to do with the difference of the average inclination angle of the outside of the stairs compared to the inside of the stairs. In the same stairs the average outside inclination angle can be around 45º, the inclination angle right at the inside corner will often be around 70-75º or more. So, using the existing mechanism Otolift was not able to place the chairlifts in the inside corners of the stairs, where, from a viewpoint of spatial efficiency, an optimum could be achieved.

Seen from a *commercial and usability* point of view this creates an additional disadvantage; when placed on the stairs a chairlift takes in a relatively large space. When placed in the outside corner this is the exact same place that will be used by the non-handicapped users. When it can be positioned on the inside, it uses another area on the stairs that is not frequently used by others. Otolift's competition had already entered the market with so-called mono-rail chairlifts. However, in the first years, from around 2004-2005, these lifts had a lot of mechanical problems. They were not very durable and were not very safe. There had been even some fatal accidents! So until that period Otolift was not too eager to enter the market with anything as a monorail. Because its image was strongly based on 'safety and reliability' Otolift only wanted to enter the market when it could be sure to offer the best and safest product. To anticipate and to adequately react on these developments Otolift assigned FLEX in 2005 to investigate the possibilities to develop a unique Otolift monorail that would not inflict any existing patents of competitors and that would have the opportunity to create its own intellectual property rights.

5.3.1 Competition

As mentioned earlier, the market of chairlifts is extremely competitive. In 2006 there was an extremely violent clash between two other players in the market, being *Stannah* and *Freelift*, the first accusing the other to inflict on their patent. After a long IP-fight and after EUR 3 million of lawyer costs Stannah won the case and Freelift had to overcome an enormous financial set-back. Otolift wanted to make sure that nothing like this would happen to them and asked FLEX to start the development with an extensive patent search and a thorough investigation of the working principles of the products of its competitors.



[5.9] Market share of manufacturers in Dutch market of chairlifts in 2005

The strongest competition came from Thyssen[36]. This company has the largest Dutch market share [6.9] next to market leader Otolift. Next to that, Thyssen is the European market leader. Their home market Germany is five times larger than the Dutch market. Because of this potentially much larger total market volume and potentially larger production and sales volume, this company can be expected to create larger budgets for this kind of technologically fundamentally and complex developments than Otolift. Together with Otolift FLEX had to be very careful not to underestimate their possibilities and its own (financial) limitations.

Second to that, the mechanism that was used and patented by Thyssen was generally seen as one of the best. In the early years there were some severe and even fatal accidents with the system, but after several years of optimization the latest versions seemed to be reliable and durable. The chairlift offered by the third party Freelift (now owned by Handicare) had one big disadvantage; the inclination angle was still limited, so it could not cover all potential as a ‘monolift’ to be used on the inside of the stairs. Therefore FLEX and Otolift decided to use the Thyssen Flow [5.10] as benchmark of this project.

[5.10] Thyssen monorail Flow

[36] Formerly known as Thyssen De Reus and now fully owned by Thyssen Krupp.

The key driving factors for this project can be described as follows:

- the Ototlift monorail should be at least equal to or out-perform the other exiting monorails of competitors;
- it should have a very stable driving-mode like all the other Otolift chairs;
- it should have an inclination angle to a maximum of 75º;
- it should be very compact in size and should have an off-set from the wall of no more than 340 mm when in rest-position;
- it should be very reliable;
- the Otolift monorail should not inflict into any existing patents;
- the concept of this new monorail should create it's own valuable and strong intellectual property rights;
- from a user and commercial point of view it should be better than the competition, that is:
    - better in ergonomics
    - better in aesthetics
    - more user friendly integrated functions (safety belt, automatic swing, etc.)
- the design should be fit for a very cost effective production (for the first time the production volumes could create the possibility to use injection molded plastic covers and parts with a significantly lower part-price than metal sheet covers and parts).

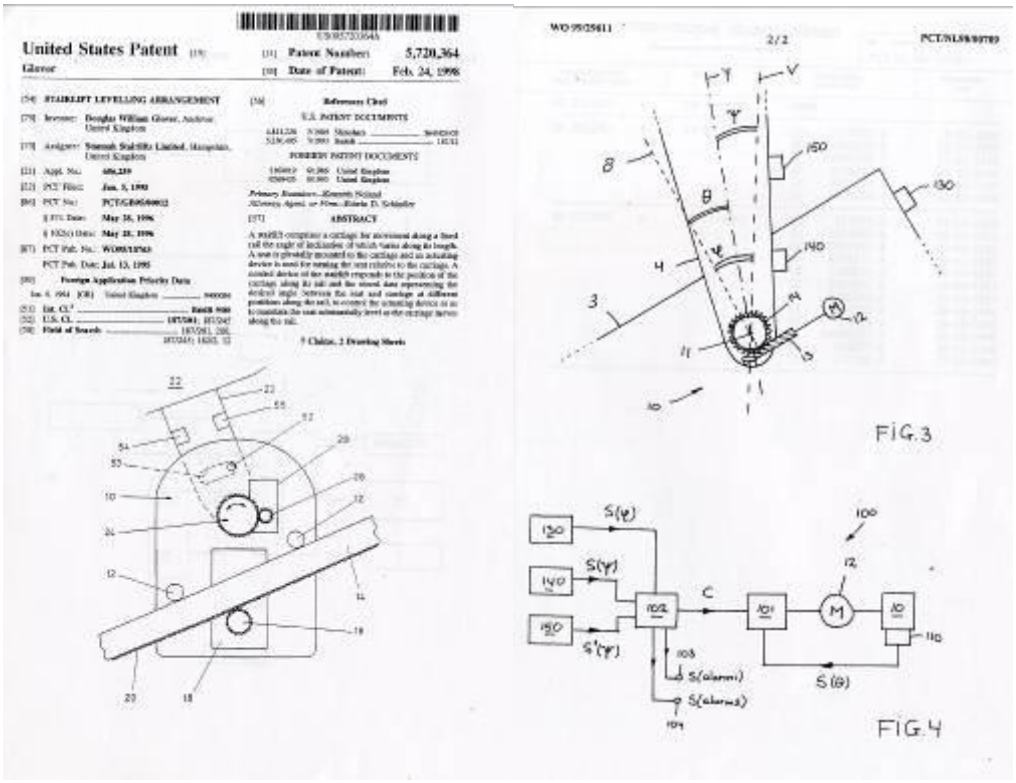
The team working on this project consisted of two engineers, a designer and a project manager at FLEX and - on-and-off - two to three people at Otto Ooms. Most of the time the author played the role of project manager based on his long lasting personal relationship with Mr. Alex Ooms. In a later phase of the hardware and software engineers from a third external partner specialized in the development of electronics were added to the team. The project as w whole was guided and managed by FLEX. Since the start in 2005 this project was interrupted several times. There were several longer periods were Otto Ooms decided to stall the project, caused by external development as well as internal situations. Externally there were several moments that the market lost trust and interest in the monorail principle due to the earlier mentioned accidents. At these times Ototlift was unsure to proceed with the project. The other, more internal moments, were caused by uncertainties about the feasibility of the mechanical principles and increasing development costs.

As an external design and development partner it is crucial at these moments to have a strong long term focus and vision of the project. In case of Ooms we had to learn from the accidents and ask ourselves the question whether our new mechanical principle could perform better than the competitive benchmark that had shown earlier fatal problems. Without looking too much to the implications of ending the project to the design agency the question had to be answered positively. And if so, the client had to be convinced of the value of this positive answer. The commercial validation was more difficult to answer; was the market still waiting and open to another – better – monorail? Altogether both questions were finally answered positively and therefore the project continued after some interruptions of sometimes half a year. It's important to consider that both questions are strategically business orientated questions. A designer should be willing and able to ask himself these types of questions and must be willing to tackle them.

5.3.2 Patent research

In the first phases of this project it was crucial to analyze in what way the monorail of Otolift could create its own intellectual property rights without infliction into any other existing patents. Together with a patent-agency a search was set up for as many relevant patents as we could find. In the end this resulted in a dossier of around 60 patents that were studied carefully. The main outcome was that there were three main patents that most probably would cause a lot of problems for new intellectual property positions.

The first one was entered by Freelift [37].They patented a mechanical and/or electronically memory to control a horizontal leveling of a chair on a randomly moving carrier [5.11]. This patent made it impossible to work with some sort of a memory to control a horizontal leveling of the chair. The second problem was caused by Stannah; they patented a real-time-controller system to level a chair in the right horizontal position.



[5.11] Patent of Brinkman Jan Hamer; description of electronic and mechanical memory

The last patent with a lot of implications was the one of the stairlift of Thyssen named Flow. They patented a mechanism of the carrier that made sure that the wheels and the motor could be fixed tightly to the rail with a so called tandem wheel principle [5.12]. All carriers were struggling with the fact that the entry of the first wheel into a corner was causing the gearwheel to be pushed out of the gear rod. Thyssen had a very simple and smart solution to this by interlinking both wheel sets. When entering a corner the first wheel set pushes the gearwheel forward and the second wheel set to the outside. This is initiated by a very simple but effective double lever system, something that seemed to be very hard to improve on, because of its simplicity.

[37] At the time of entry under the name of Brinkman Jan Hamer.

(12) UK Patent Application (19) GB (11) 2 301 811 (13) A

(43) Date of A Publication 18.12.1996

(21) Application No 9611607.4

(22) Date of Filing 04.06.1996

(30) Priority Data
(31) 9511508 (32) 07.06.1995 (33) GB

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(51) INT CL[6]
B66B 9/08

(52) UK CL (Edition O)
B8L LCB LFB L24
B7L LGC LV L65 L68

(56) Documents Cited
GB 1477132 A GB 0636355 A EP 0019014 A1
WO 95/29867 A1 WO 92/14673 A1 US 5123495 A
US 4335805 A

(58) Field of Search
UK CL (Edition O) B7L LGC LV , B8L LA LB LCA LCB
INT CL[6] B66B 9/06 9/08
ONLINE : WPI

(54) Stairlift

(57) A stairlift has a chassis (17) driven, in use, along a guide rail (10) and a load carrying chair (18, 19, 20, Fig.1, 21) pivotally mounted on the chassis. An adjustment arrangement is provided to ensure that rollers (28,29) carried by the chassis (17), by means of respective pivotably mounted supports (30, 31), maintain correct engagement with the guide rail (10) as the chassis is driven therealong. The orientation of the rollers is adjusted through angular movements of the supports (30,31) effected by the engagement of respective followers (39) with the guide rail (10), so that the correct engagement is maintained whatever the shape of the guide rail, i.e. straight, convexly curved or concavely curved. Preferably the followers are mounted on arms 40 and biassed by torsion spring 31a. Preferably, control means for sensing the inclination of the chair and adjusting it when necessary by means of a ram (37) to keep it horizontal are provided. The control means include a pendulum providing a vertical reference and a dynamic accelerator detecting a change of seat inclination.

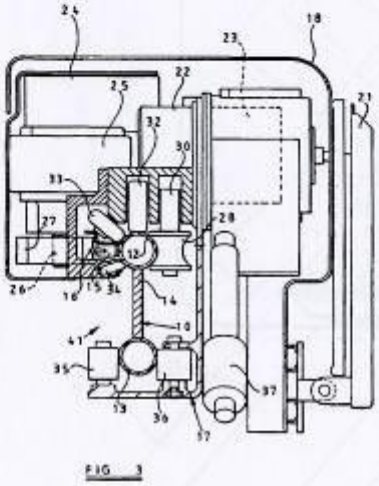


FIG 3

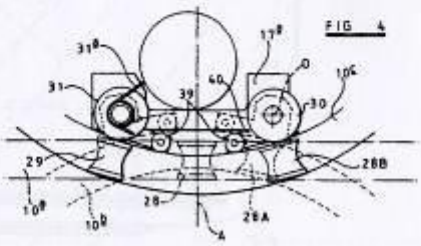


FIG 4

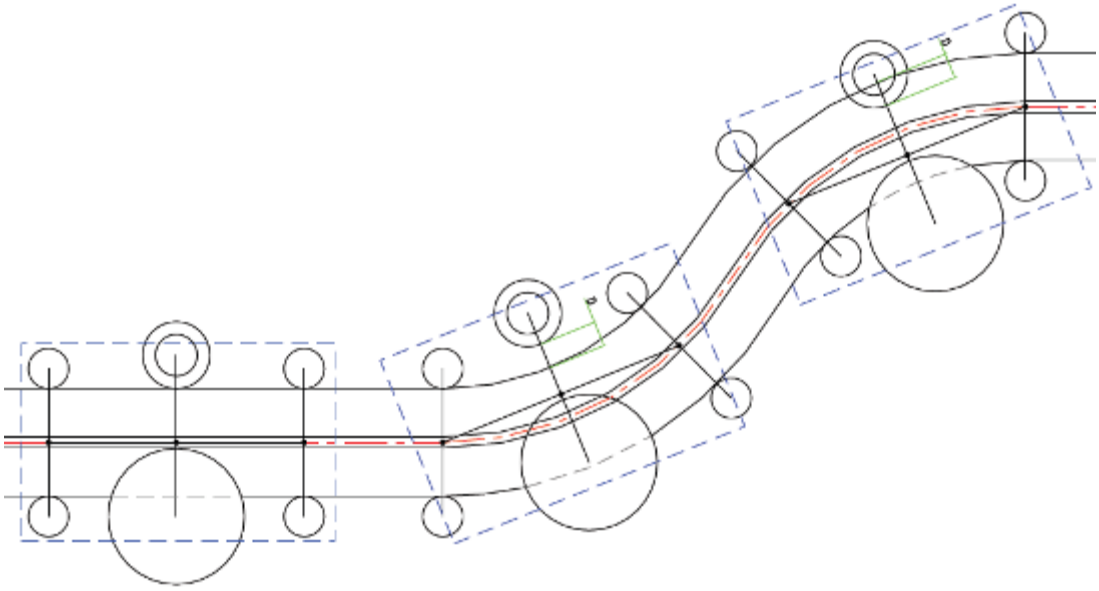
GB 2 301 811

[5.12] Thyssen Patent of the Flow

5.3.3 A new and better working principle

The development of the monorail coped with two essential problems. The first one was to find a simple mechanical principle of a carrier that could be tightly fixed on a round tube that was winding up and down a staircase bending in different corners with different radii and different inclinations.

The mechanism should have an equal or even better fixation as the benchmark lift ‘Flow’ of Thyssen and it should preferably also be as simple to produce. This geometric problem can best be described with a drawing [5.13]. When a fixed mechanism with a double wheel-set enters a radius the central gear is pushed into the rack and in case of an outside radius the gear is pushed out of the gear. Thyssen solved this with a so called fixed tandem gear.



[5.13] Geometric problem of (double) wheel sets moving in and out a bended corner

During one of the several free and structured brainstorm sessions with the FLEX design team the following fundamental question was raised:

“Do we know other principles or mechanisms where the propulsion is moving the carrier in a certain direction but were there is only a limited fixation of the propulsion to the carrier?”.

Where Thyssen solved the problem of entering the corner with a very smart but fixed mechanism; we tried to find the answer in quite the opposite direction. “Let’s forget a proper fixation” as we only want the carrier to move up and downwards; How it is done and how accurate the propulsion is, is not important!” This question was seeking for principles to overcome the difficult search for the ultimate new accurate mechanism, by just altering the rules.

Two of the associations that were made were:

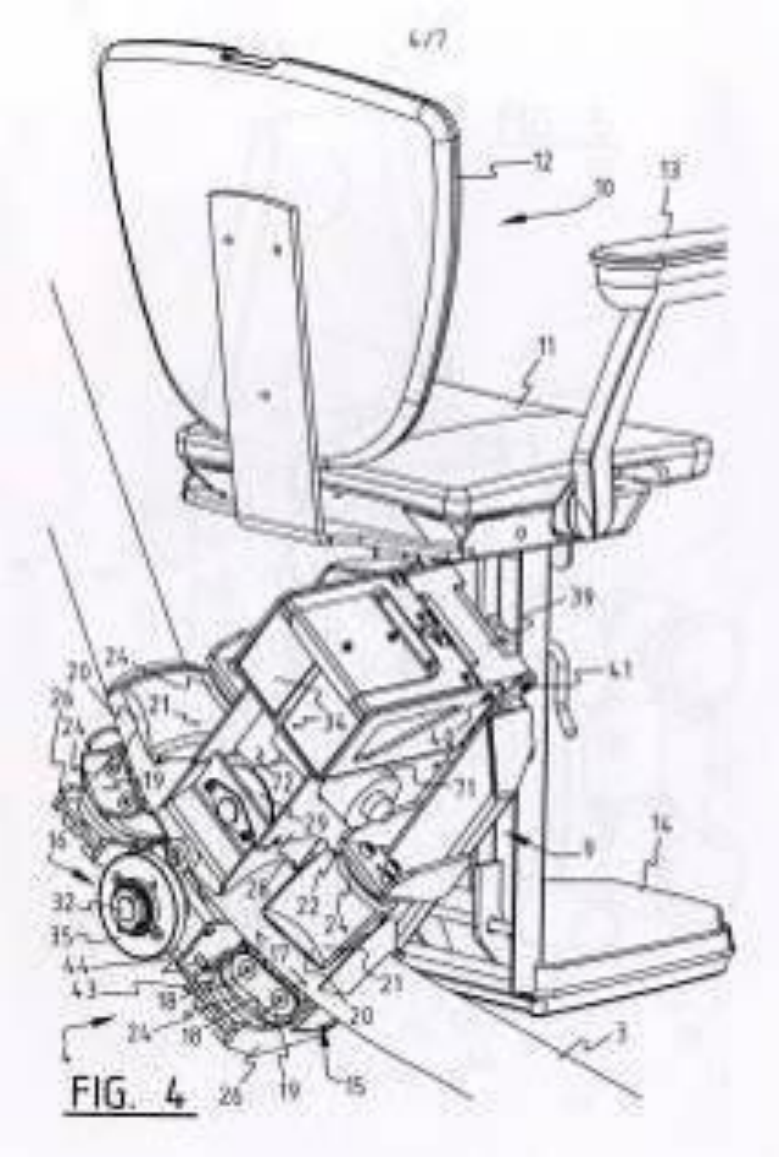
- A classical locomotive train with push heads; the locomotive is pushing the wagons of the train but they are both not completely fixed with each other. In this way the movements coming from the inaccuracies in the rail are compensated by a loose connection. This is a classical example of a technological domain transfer. A method that can be sought and used in many similar design issues [5.14].

- The second association was that of the so called ‘dog-car’. Underneath a hand-car a dog is loosely connected, the dog walks in somewhat of the right direction; the final direction is defined by the person standing and walking behind the car [5.15].

[5.14] Push of classical locomotive train and [5.15] Dog-car

Converted to the monorail situation the common solution for both problems was *to create a loose connection between the two sections*. The locomotive section could now be seen as the motor and the wagon as the chair-section. Both sections are closely and accurately connected to the rail but only loosely connected to one-another. Positioned in the middle, the motor section pushes the actual cart-chair-section up and down the rail. Doing so the motor-section can move relatively to the cart-chair-section while entering a corner and leaving a corner.

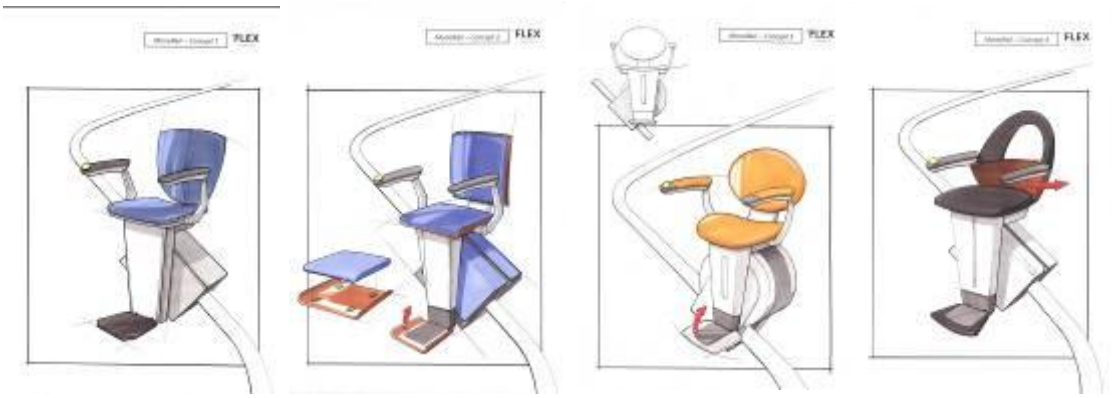
This mechanism was presented to a patent agency that decided that this principle was new and did not inflict with any existing patent. More important, it created a strong new intellectual property position for Otolift. A prototype would have to prove whether the movement would feel comfortable and accurate!



[5.16] Patent drawing of Ototlift monorail

In the above patent drawing [5.16] can be seen how the mechanism was conceived and constructed. The motor section with gear wheel 35 is situated in the middle and connected with a double hinge 40 and 41 with a frame onto which the two left and right cart-section are connected. These two sections each have an accurate connection to the rail with the wheel sections 18, 19, 20 and 21. Entering and leaving a corner in this way the gear-wheel will be closely connected to the gear-rod underneath the rail.

Parallel to the patent search and the technical development work was done on the ergonomics, the integration of several additional functions like foot-rest, controls, armrests and safety belt. The following sketches are an indication of the way this process developed [5.17].



[5.17] Different design concepts

Next to the sketches FLEX also decided to make a real size foam model of the new design. Based on earlier experiences with Otolift and with other clients the team was aware of the impact and therefor the importance of having a convincing model to ensure the client of the realism and feasibility of the overall design.

[5.18] 1:1 foam model of the monorail

5.3.4 The design and engineering process

Having decided on the mechanical principle and the overall design we divided the second part of the development into three parts:

1. the technical and mechanical development of the carrier section;
2. the technical and mechanical development of the chair section;
3. the mechatronic development of the leveler;
4. the overall design of the monorail.

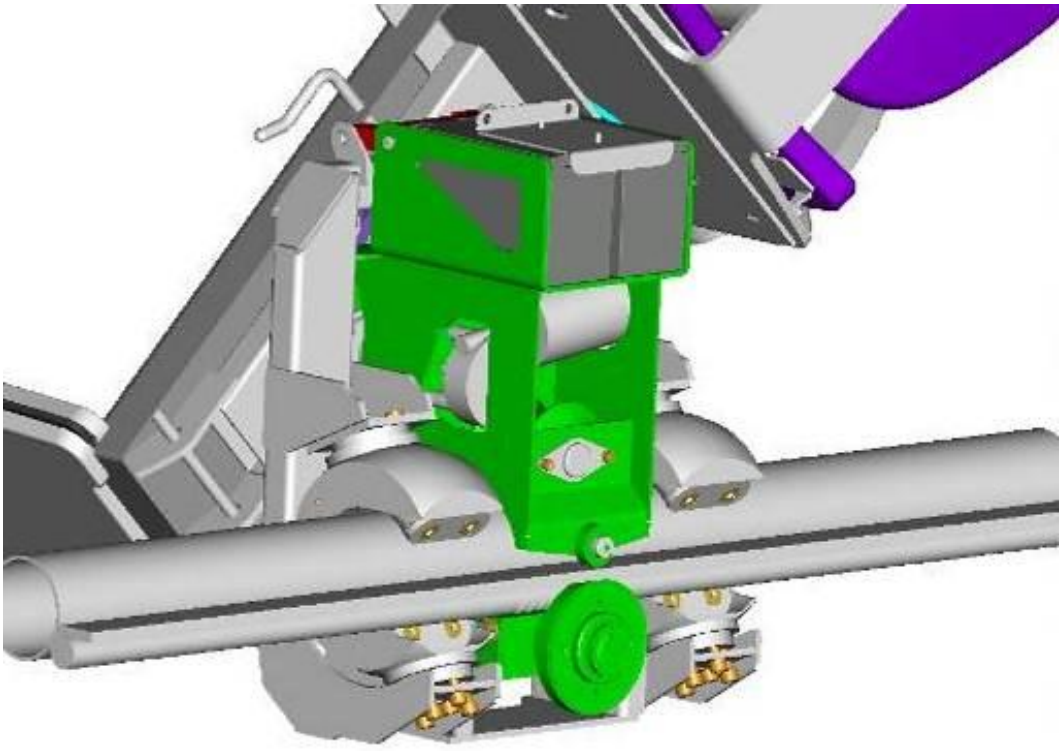
5.3.4.1 The carrier section

In the mechanical development of the carrier different issues had to be solved. First of all the right mechanical principle had to find to establish the free movement of the motor section within the carrier section. This principle should be stable under different stress and load situations.

At first a sliding principle was tried [5.19]. The motor-section would be able to move from the carrier due to long slots, as shown in the red and yellow parts. The blue part represents the motor section. Based on calculations that were made on the height of the occurring frictions between the two parts, we decided to look for an alternative.

[5.19] Motor section slides in between the two wheel sections

The alternative was found in the use of a double hinge principle. This proved to be much better as the two axis were able to withstand the forces much better without any negative implications concerning a smooth operation [5.20].



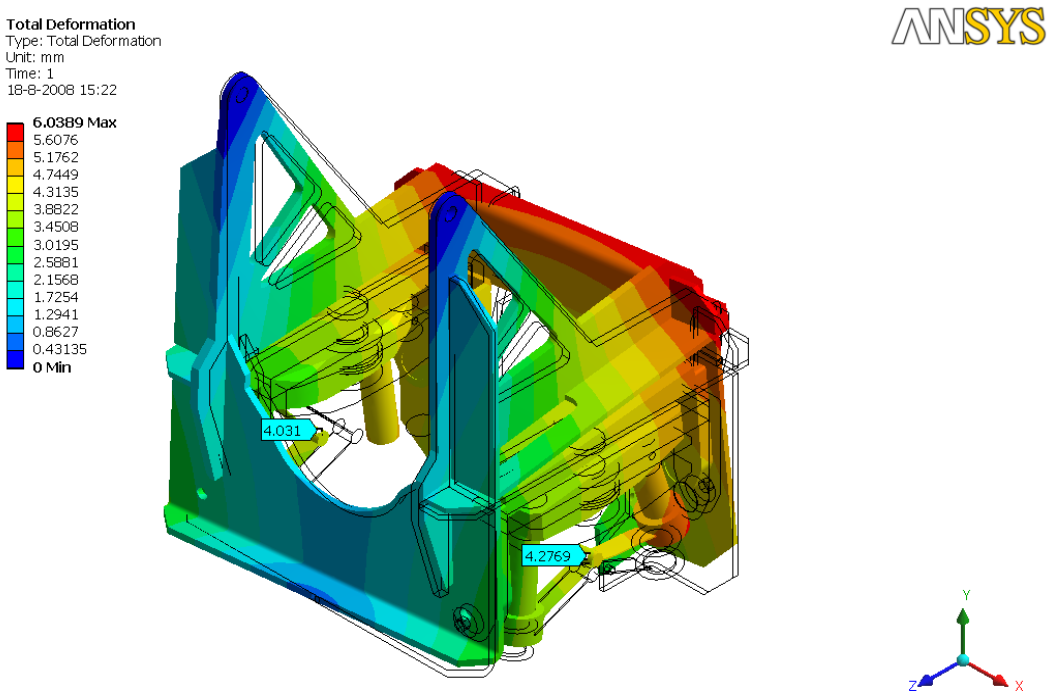
[5.20] Motor section (green) connected with double hinge to (grey) double wheel sections

This principle was analyzed more in detail. The most critical aspect in the engineering of this principle seemed to be the extremely high tensions in several parts of the construction; especially in the motor and support frame. The weight of a person of 130 kg including a 25% safety margin, sitting on the chair caused the following load and stress situations during the so called drop-start[38]:

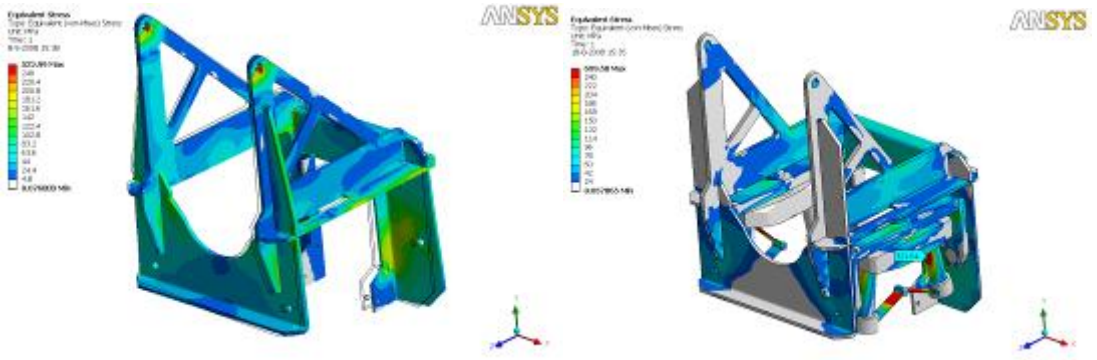
Stress in metal plated steel parts:	< 180 MPa
Stesses in hardened axis:	< 320 MPa
Surface tensions on wheels:	< 70 MPa
Stressed in Casted Nodular Steel:	< 300 MPa

[38] The start at the beginning of the rail in a 90º vertical angle is called a 'drop-start'

Using a FEA method all the critical parts were analyzed and optimized [5.21], which resulted in an optimized carrier [5.22].

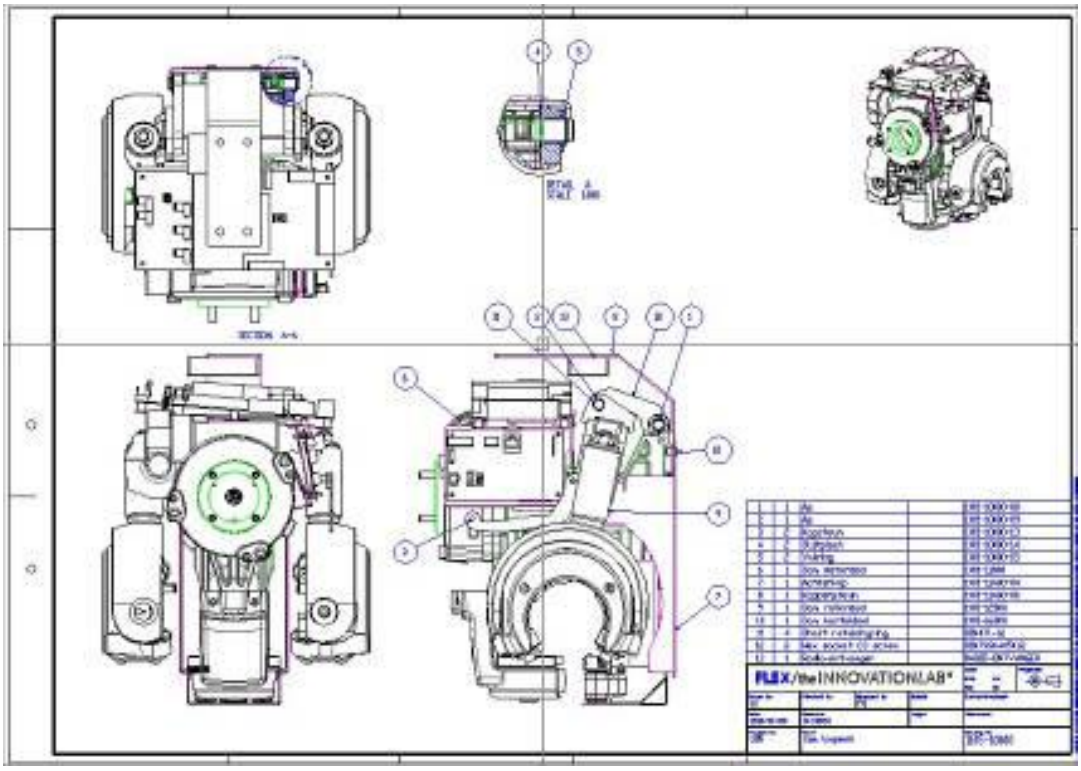


[5.21] First stress analysis of motor frame with high tension in different parts



[5.22] Optimized motor frame with acceptable tensions in different parts

Of this design technical drawings [5.23] were made and a first rough prototype was built [5.24], to see whether all the assumptions were correct. Especially the tension in the wheels was still very critical. Therefore the prototype was severely tested during several weeks to see whether this would probably become a problem for the whole concept.



[5.23] Assembly drawing of the carrier

The second important learning of the prototype would be to see whether the three dimensional movement of the whole mechanism on the bended tube would be as the team expected. The CAD model did show that it should be possible, but it was necessary to see whether the prototype would confirm the digital analysis [5.24].

[5.24] First prototype on a section of a rail

5.3.4.2 The chair section

Having defined the carrier as the most crucial mechanical component of the whole product, more attention was given to the chair section. One of the key issues in the whole development was cost reduction. The construction of the chair should be as simple as possible and therefore be as low-cost as possible. Still it also had to provide some important functionalities and requirements, like:

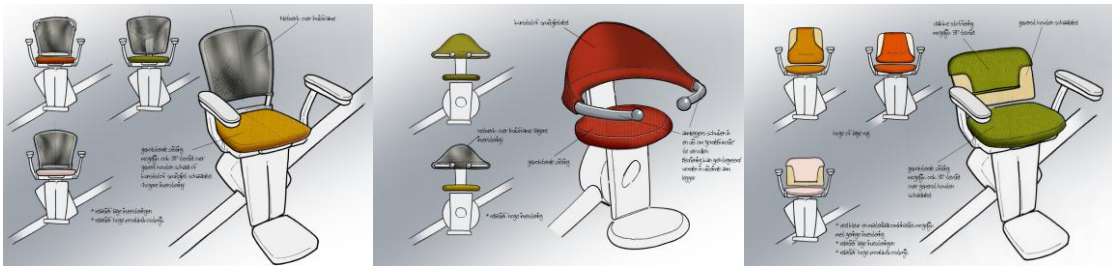
- chair should have a pivoting point for the armrests on the right and left side; both points should be integrated in the same construction;
- turning of the chair should be able to be activated manually as well as electronically;
- seat should be foldable or should be made smaller when the chair is in rest position;
- seat and chair should be able to carry a load of 130kg with a safety margin of 2.0;
- the arm rest should be foldable;
- the arm rest should be able to withstand a load of 100kg with a safety margin of 1,5 at the front of the armrest;
- all the controls and wiring should be integrated in left or right armrest;
- safety belt should be integrated in arm support in a visually subtle way;
- the chair should be leveled in an absolute horizontal position!

Of course the list above was much longer, but the items above were the most important ones and all together not easy to realize in a simple construction. To find the best construction we experimented with different options [5.25]:

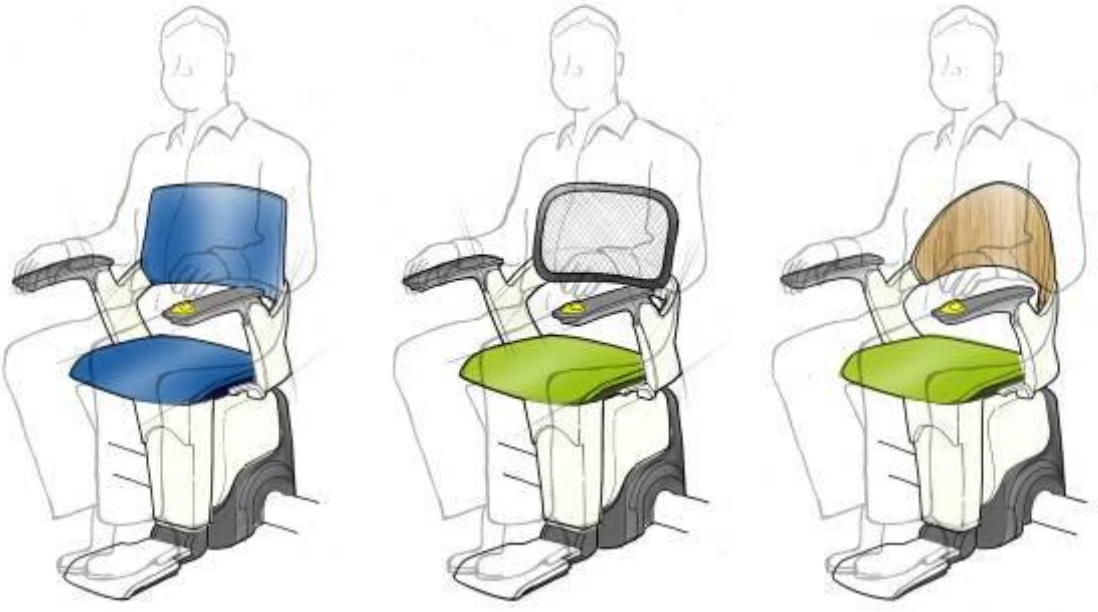
- we looked at integrated armrest in the backrest;
- we looked at a sheet-metal concept;
- we looked at a non-ferro-casting part;
- we used tubing frame parts for the arm and back rests;
-

[5.25] Alternative constructions of the chair

Design concepts were made of each of these constructions, making sketches [5.26] and cost price calculations together with suppliers and the production department of Otolift.



[5.26] Sketches of alternative designs of the chair



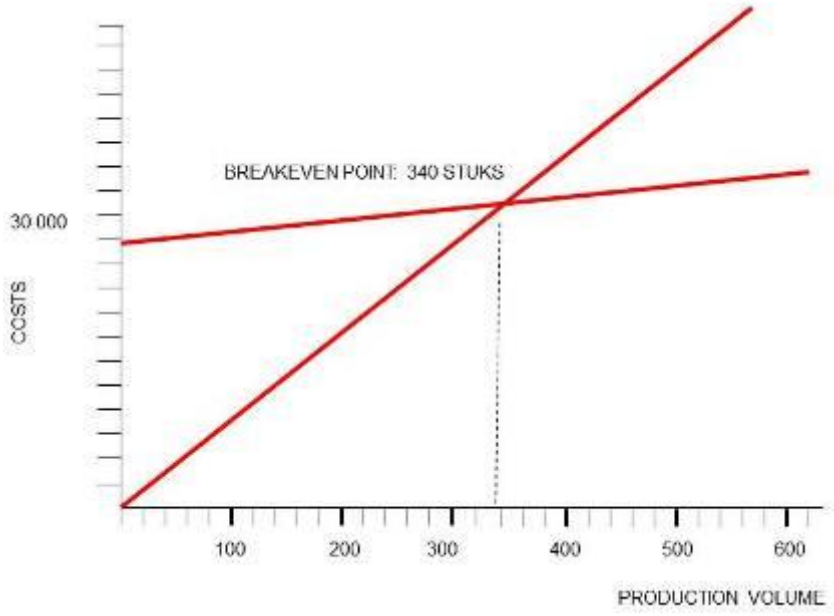
[5.27] Sketches of different simple back rest solutions

One of the most defining parts in the design of the whole chair was the choice of the right production method for the seat and back rest. It does not seem to be a very complex issue from a technological viewpoint, but the implications in cost and investments were significant. In the existing chairlifts of Otolift a complete set for a chair – a seat and back rest – including the upholstery was costing almost EUR 100,-. The construction was however still very traditional, using a wooden support, foam upholstery and a textile cover.

A very important cost-price improvement was the use of a completely injection molded seat and back rest. A set plastic injection molded parts without an upholstery turned out to be a bit more than EUR 12,-. However it required an investment in tooling of EUR 30.000,- for both parts, where the existing method did not require any significant investments.

Producing an estimated 1000 – 2000 monorail stair lifts that would use this seat and backrest costing EUR 88,- less, a simple breakeven analysis convinced Ooms that this was a good investment. The breakeven point could be reached within half a year.

To improve even more this investment we decided to design both parts in such a way that they could be used in all other chairlifts of Ototlift as well. This could increase the production volume to around 6.000 sets per year. In this way we could increase the production volume to improve the amortization of the investments in tooling [5.28].



[5.28] Breakeven analysis on investments in tooling of injected molded seat and backrest

A second important issue was to convince Ototlift that these ‘plastic’ parts could not only look nice, but they were also sufficiently comfortable. The only way we could do this was by showing parts we made in our model shop, have them sprayed and texturized and then presented to the Ototlift management! So also here we played a very pro-active role to show the potential of a new design direction and saving a lot of money at the same time.

5.3.4.3 The leveller

As mentioned in paragraph 5.3.1 the hardware and software development of the leveler was outsourced to a specialized company, briefed by FLEX. The briefing was based on:

- forthcoming the patent research the leveling principle should be based of a real-time measuring device as a combination of an electronic leveler device and an electronic acceleration sensor . It should keep the chair in a guaranteed horizontal position with a accuracy of no more than 1 degree offset with every defined acceleration;
- the leveler should guarantee a smooth ride. It should not have an under and or overshoot;
- the leveler should have a double safety system in the situation that the primary measuring shouldn't operate properly. This safety system should stop the chair within 1,5 seconds from moving when a fault angle of 3 degrees would occur;
- the hardware of this sensing system should be as compact as possible to safeguard a optimal integration in the housing of the chair.

The main role we played as FLEX to manage the hardware and software team was to work with the given timing and to make sure that the main requirements were covered. As the company was completely new to this market segment it was important to explain why the requirements were as they were formulated. The requirements were a result of a proper competitors analysis and the specs that came from the quality that Otolift was used to offer to their users; a safe and stable ride.

5.3.4.4 The overall design

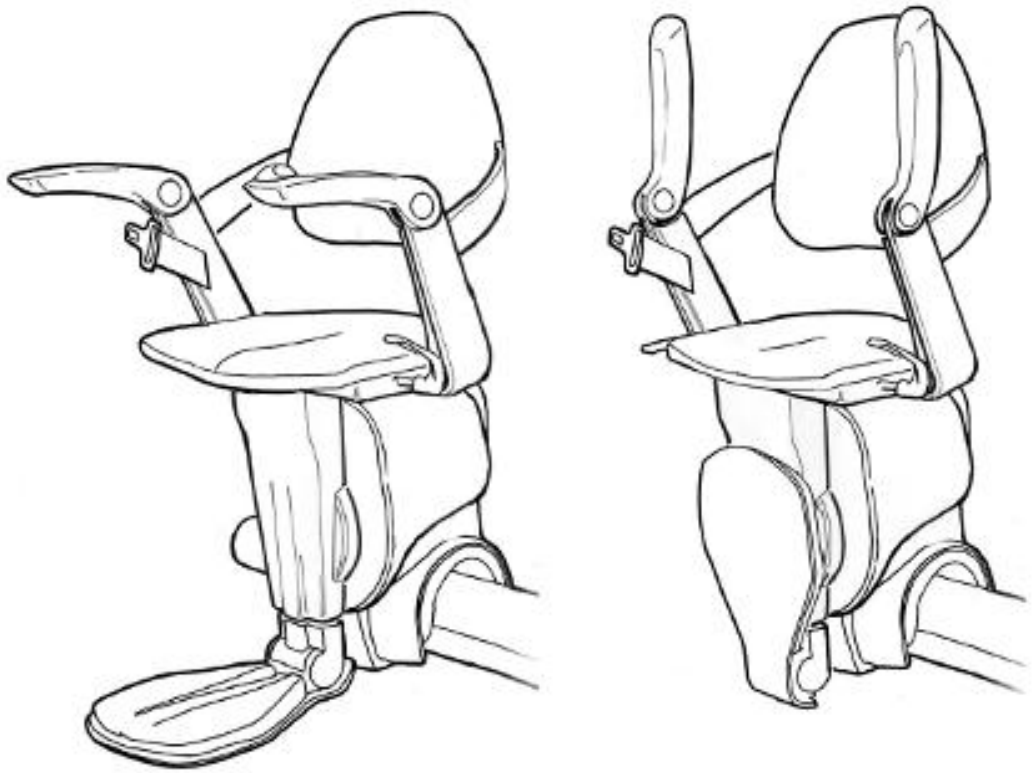
For the design and the aesthetics of the monorail the following criteria were formulated:

- the monorail should 'fit' to the design philosophy of Otolift; the design should have the character of a 'normal and homely' interior product and should not look like a traditional product for handicapped and disabled people;
- the design should be clearly distinctive from the designs of the competitors;
- as chairlifts should look compact as they are generally seen as 'obstacles' on a chair, the design should be as compact as possible and should also have a similar visual compact appearance;
- different options like controls and safety belts should be integrated in the design and should not be treated as clearly add-ons;
- for reasons of efficient and economic manufacturing the design should be feasible to be produced with the right production methods and materials and with realistic investments and costs.

In the first design-concepts we tried to establish a distinctive design through relatively sharp line and detailing as not any of the competitors were using this type of styling. The parts covering the technical components at the inside were planned to be manufactured with plastic injection molding parts. In this way the complex movements of the different components could be effectively covered. This was necessary because of the safety regulations. The moving parts should not cause any crushing or injuries to the end user. The use of injection molded parts was also relevant to realize a compact and aesthetic design; sheet-metal parts could never shield the interior in the same way due to their limited three dimensional shaping possibilities.

[5.29] Design proposals

These proposals were presented to Otolift and also to some important potential users and clients. The general comment was positive. However, we were asked to make the design less ‘sharp and edgy’ as some of the respondents evaluated the aesthetics as less user friendly [5.29]. In several simple sketches we tried to find out in what way the design could become more friendly and ’gentle’. Additional, several sketches were made to soften the overall design [5.30].



[5.30] Hand sketches of softened design

Apart from that renderings were made in which could be seen in what way we changed the design [5.31] and [5.32].

- the seating and back rest received a rounder shape;
- the armrest and support received a softer and more integrated styling;
- all the dimensions were made smaller to make the design more elegant.

[5.31] 3D-CAD rendering of softened design compared to competitive design

[5.32] 3D-CAD rendering of the softened design

Finally the design was photo-shopped in its intended environment [5.33]. This visual and many more items were discussed with the client and especially some of their sales people to receive comments whether this was the right design direction. All the comments were positive and the management of Ototlift decided to finalize this design towards production.

[5.33] Photoshop rendering of monorail in its environment

5.3.4 Final prototype

Almost parallel to the finalization of the overall design of the monorail, the team worked on the realization of a second optimized prototype. The ‘still’ [5.34] shows a test version how the mechanical principle and the leveling system was tested in several different types of bends.

[5.34] ‘Still’ of testing the second prototype

These same parts of this second prototype were used to prepare a final product for testing of all the plastic covers. The assembly was important to check whether all the multi dimensionally curved plastic parts would fit on the mechanical parts at the inside. The covers should in no circumstance interfere in their movement. For this evaluation we used our in-house rapid prototyping based on an Objet printing principle and impregnated SLS parts for the parts that had to endure more mechanical stresses.

With only some minor optimizations all the plastic parts functioned well. There was one very important learning point that came out from using the prototype. During testing it was clear that in situations of steep climbing angles and inward corners the arm could be compressed between the back and side of the armrest and the rail. For this reason we decided to change the design and to eliminate the round back support of the backrest and to move to a more traditional construction of the seat and the armrest with a central connection between the two parts [5.35].

[5.35] Rendering of monorail with old armrest principle and sketch of altered design

After some iterations of especially the software to improve the reaction time, under and overshoot of the leveling system, all other evaluation points of the mechanics and the electronics were finally evaluated positively.

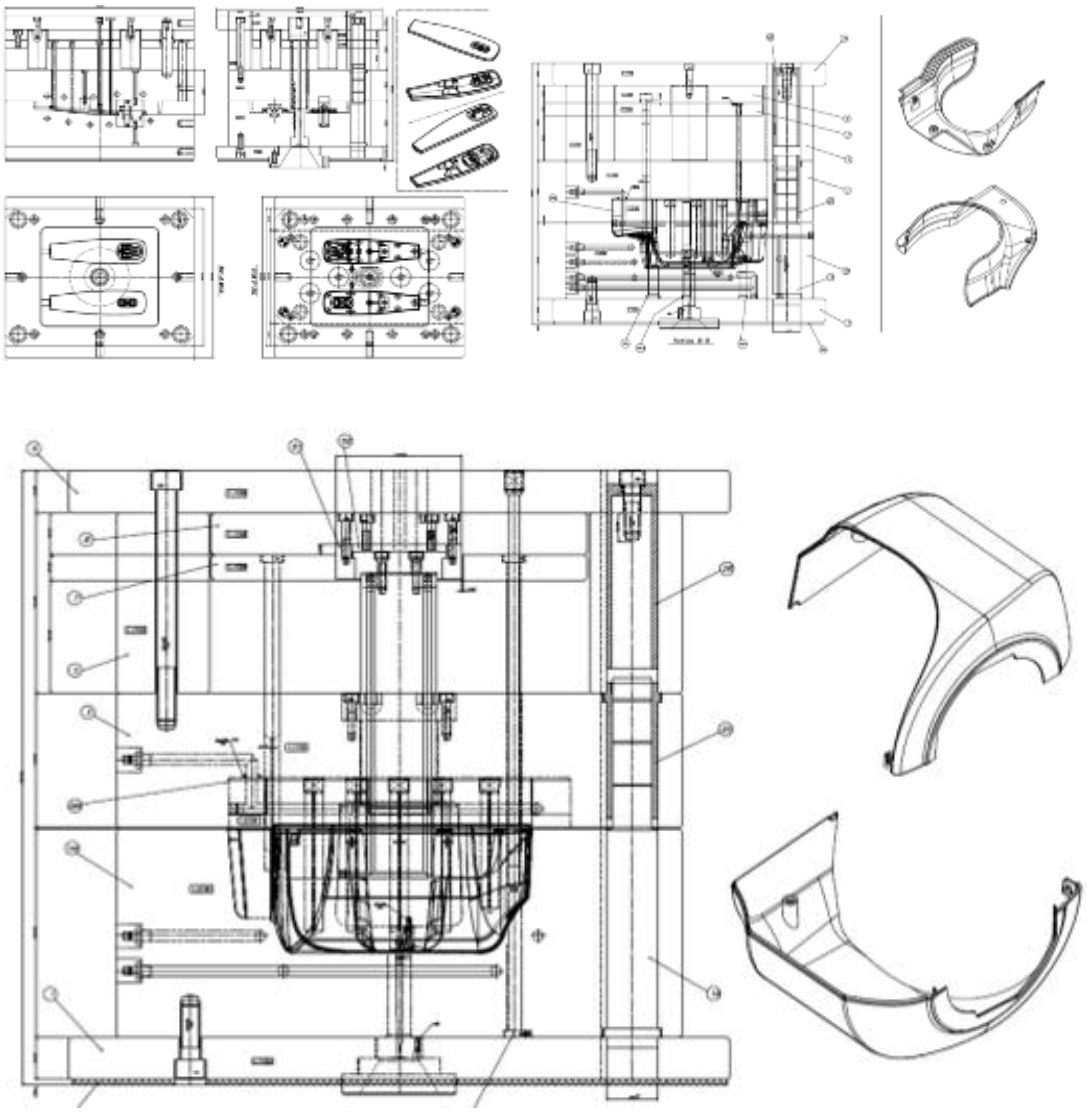
5.3.5 The final result

The final result of this long design and development process was first presented at the Support Fair in Utrecht in June 2010 [5.36]. In every way the new product and the new design proved that the right decisions had been made along the way. Compared to the competitors' products the design showed to be better in the following aspects:

- the mechanism showed a very stable 'ride';
- the mechanism showed to be very silent;
- all the movements of the footrest, the armrests and the turning of the seat was executed flawlessly;
- the public visiting the fair, being representatives and buyers from different councils and private persons and even sales people of competing firms let Otolift know that they preferred this design above all the others;
- International representatives introduced themselves to Ototlift to inquire if they could have a contract to sell the 'Emerald' or 'Smaragd' in Germany, Italy or Spain.

[5.36] Presentation of the monorail on the Support 2011

Soon after the fair, all sales activities started and FLEX was asked to finalize all the last technical issues concerning the tooling of the injection molded parts. Before sending the CAD information to the selected molders all the plastic parts were thoroughly discussed with them to find whether there were no problems with the tool making and the injection molding process. Second to that minor optimizations were made to integrate specific preferences of the molder regarding the injection points, the most optimal positions of the ejectors and the choice of the right surface textures of the plastic parts [5.37].



[5.37] 3D CAD model and CAD drawing of tooling of plastic covers

We also took care of the manual, the BOM list (bill of materials) and made all the up-dates of the parts lists.

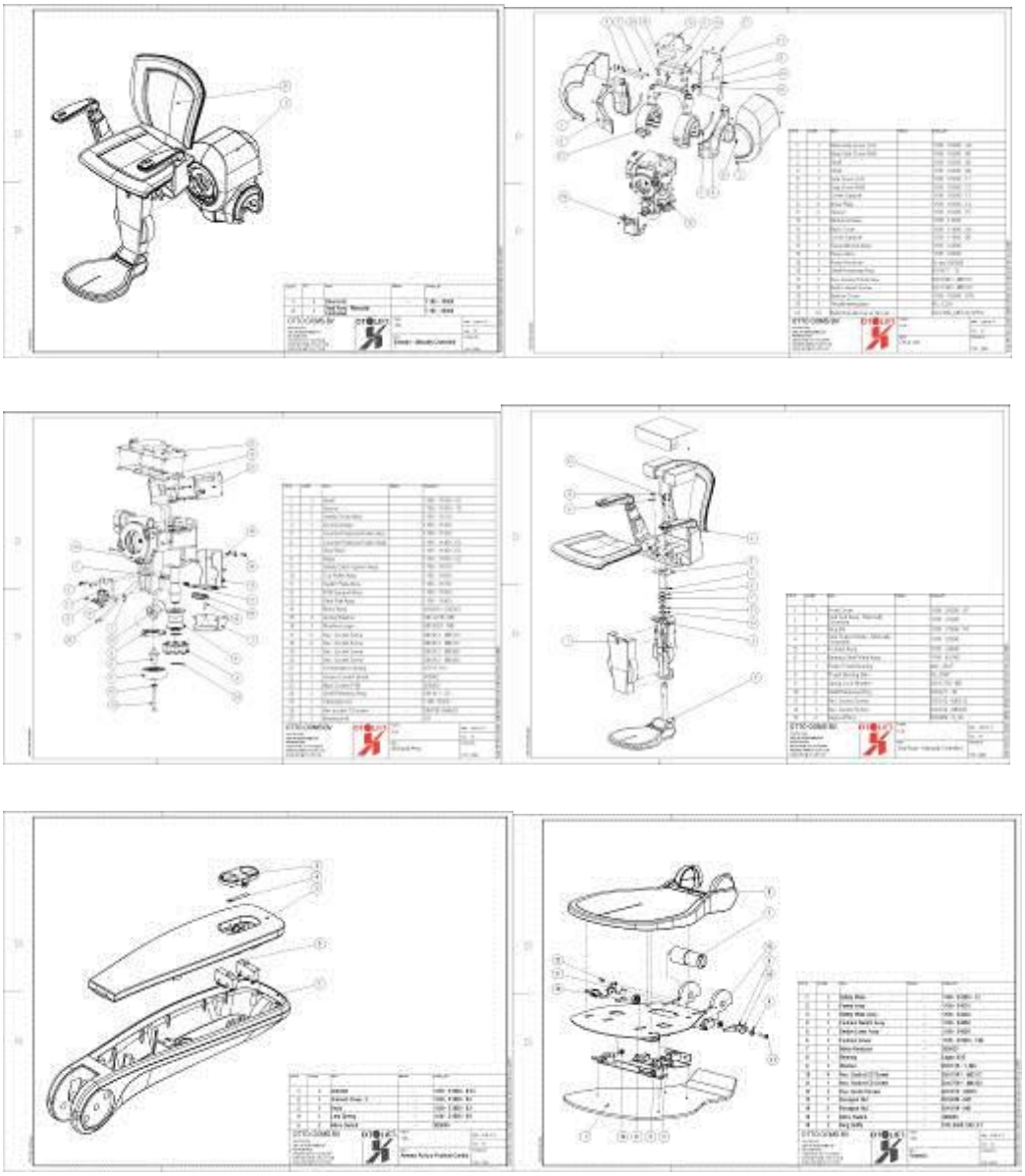
Parallel to all these technical aspects we were asked to provide text for the brochures and to support Ototlift in the photography for their brochures [5.38].

[5.38] Presentation of the monorail in the Otolift brochures

5.4 Technical dossier

In preparing the actual launch and sales it is vital for any company to be fully ready for all the after-sales activities. As Ototlift was not only selling the Emerald in the Netherlands, but almost directly after the fair they were also asked to sell the new product in many other European countries like Germany, Italy, Belgium and Spain, these sales teams had to be supported by a well-equipped sales team in Bergambacht. The expected increase in turnover of Otolift due to this new product was between 10 and 20%!

As FLEX was dealing with all the CAD files Ototlift, was provided with the required parts list for re-ordering and the BOM-lists for the production. Underneath six of these sheets are shown [5.39].

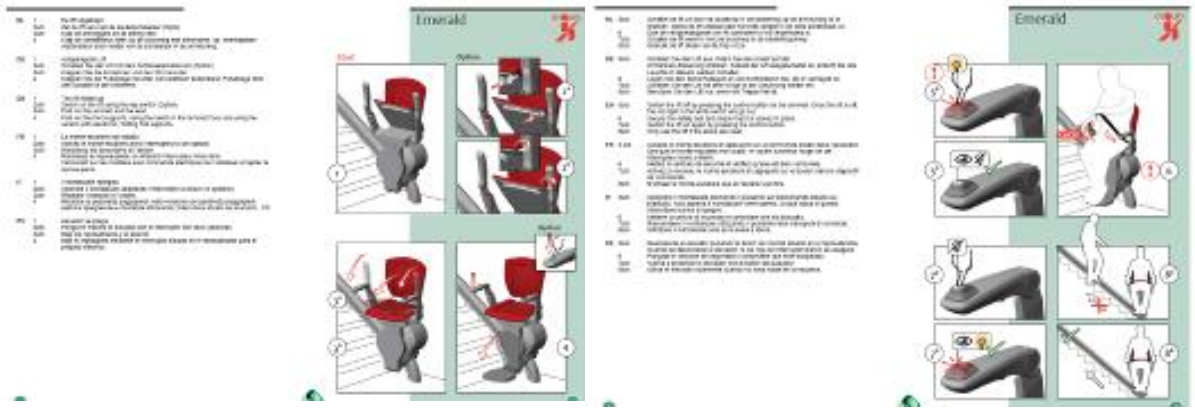


(5.39) Pages in technical dossier

5.5 User manual

Defined by the international Lift Institute every chairlift has to be provided by a user manual for every end user. As we made such manual already for other chairlifts of Ooms, also in this case we were asked to make such a manual. In IN-Design we made the manual and the translation in different languages was done by Ooms [5.40]. The manual of the Emerald has the following chapters.

- user instructions;
- trouble shooting;
- lift maintenance;
- diagrams, notes and additional information.



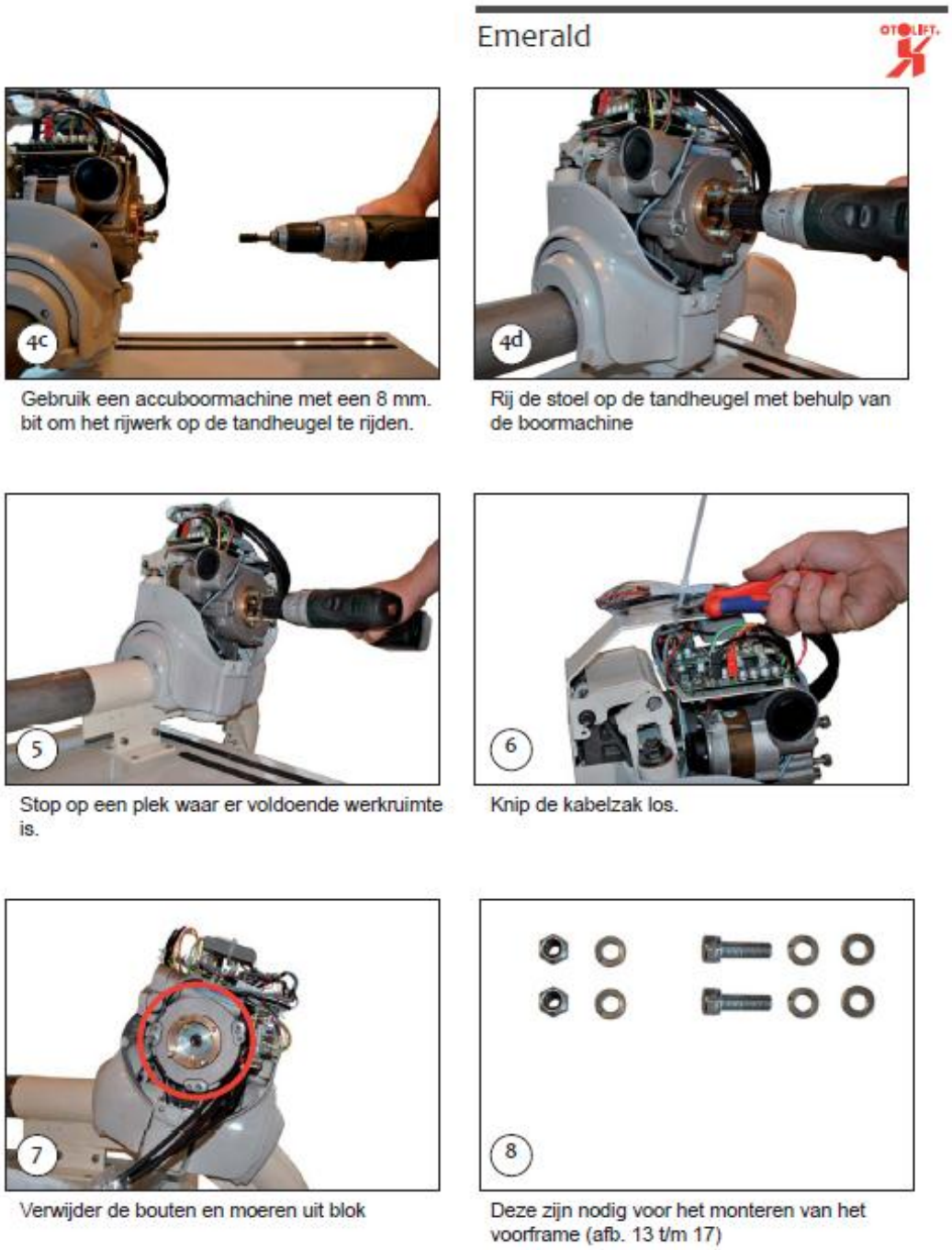
[5.40] Pages in the user manual

A manual should have the following characteristics:

- it should be as compact as possible;
- it should deal with the usage of a product step-by-step and in a chronological order;
- it should deal with the most important and vital function first;
- it should use as little text as possible and as many pictures as possible;
- text that is used should be in short and clear sentences;
- pictures should be as realistic as possible without unimportant details;
- the layout should be fully supportive to the information transfer; clear, transparent and simple.

5.6 Instruction manual

Parallel to the creation of the user manual FLEX was also responsible for the realization of an instruction manual [5.41] for installation of the monorail as well as to be used by technical servicing people.



[5.41] Pages in the instruction manual

5.7 Evaluation

The Otolift project can be characterized as follows:

- to cover relatively complex projects, this project shows that Demand Driven Designers still need extensive design processes, project management, design methods and techniques;
- the project shows that designers and more specifically Demand Driven Designers are capable to design and also engineer relatively technological complex products; this project dealt with a lot of high-end mechanical issues;
- it is a development in a technologically competitive market with a lot of risks of infringement on IP-rights of competitors;
- also for FLEX the role that was played for this client was quite extensive; FLEX was responsible for the strategic orientation of the design process and also took care for the manual and other supportive information;
- the project shows how intensive project managers should handle the interest of the client and at the same time the personal interests of project members;
- the project shows the importance and potential value of a long term design relationship between designers and clients.

Playing this extensive role for a client puts a lot of pressure on the team. The designers and engineers should be versatile in different areas. Therefore the design team should have the right consistency. Roughly the team should consist of a ‘dreamer’, a ‘doer’ and an ‘incrementalist’ [39]. Dreamer and doers are in general best paired with each other. The ‘incrementalists’ are said to make ideas happen and play a more solitary role. Managing an incrementalist is a subtle task; often a dreamer pushes the incrementalist in a more doer mode and the doer often leads the incrementalist in a dreamer mode. It is the project manager’s role to understand the tendencies of all these team members.

A more refined identification of key individual roles within an innovation process is provided by Trott[40]. He describes five roles: Technical Innovator, Technical/Commercial Scanner, Gatekeeper, Product Champion, Project Leader and Sponsor.

[39] (Belsky 2010: p. 116).
[40] (Trott 2002: p. 76).

Looking back at especially the monorail project for Otto Ooms, one could conclude that these roles were fulfilled:

- Technical Innovator:
  expert in one or two fields. Generates new ideas and sees new and different ways of doing things; also referred to as the ‘mad scientist’.
  (the role and involvement of one of the FLEX engineers in the project)
- Technical/Commercial Scanner:
  acquires vast amounts of information from outside the organization, often through networking. This may conclude market and technical information.
  (the role and involvement of the CEO and owner of Otolift)
- Gatekeeper:
  Keeps informed of related developments that occur outside the organization; serves as an information resource for other in the organization.
  (the role and involvement of the two senior engineers of FLEX)
- Product Champion:
  sells new ideas to others in the organization; acquires resources, aggressive in championing his or her cause, takes risks.
  (alternating role between the senior engineer, the CEO and myself)
- Project Leader:
  provides the team with leadership and motivation, plans and organizes the project, provides necessary coordination among team members, sees that the project moves forward effectively, balances project goals with organizational needs.
  (my second personal role and involvement in the project)
- Sponsor:
  Provides access to a power base within the organization: a senior person, helps the project team to get what it needs from other parts of the organization.
  (the role and involvement of the CEO and owner of Otolift)

As the overview shows one person can fulfill more than one role in one project. Project management should be aware of all these different roles and characters. The project management should lead the way in these varied areas and should find external support when knowledge and expertise of the team is insufficient to support the demands and questions of the project. The project management and of course also the whole team should be quite experienced and should act holistically. Maybe this last characteristic is the most important one to be able to perform in the way that is needed.

In hindsight it is also interesting to analyze why especially this last project for Otolift was so *successful*. What clues does it hold to success in general? Franklin[41] refers to a paper of White and Graham; it is argued that successful innovation can be identified by looking at the power of the core technology and its implications for business. This seems an interesting analysis for this specific project. Four essential success factors are isolated: the four merits of innovation:

- Inventive merit:
  the extent to which the innovation relieves or avoids the constraints of the existing way of doing things.
  (this was clearly covered in the monorail project)
- Embodiment merit:
  improvements in the physical form that allow full expression of the inventive merit.
  (for the whole product, but especially with the mechanism of the carrier we aimed at a better (more silent and smooth) movement than the competition; tests showed that this was realized)
- Operational merit:
  the extent to which the innovation simplifies existing practices
  (some of the functionalities, like the mechanism of the carrier and the folding of the seat proved to be much simpler than other solutions)
- Market merit:
  the extent to which the other merits address or open up markets
  (pushed by especially the overall design quality, many new international markets representations offered themselves to Ooms to become reseller of this new product)

During the design and development process working with these merits instead of working with the time consuming program of requirements, can guide projects in the right direction, leaving enough room for inspiration.

Next to all this, it is important and vital to be fully aware of one's strengths and weaknesses to make the right decisions. Honesty above commercial hunger for selling more design and engineering hours is crucial. On the other hand FLEX can enjoy a lot of appreciation when the end results are as they are in case of this Otolift project. FLEX played an important and vital role in the development of this mono-lift. When the dead-line was made for the Support in June 2010, we celebrated the success to show appreciation to the team with a special mono-rail cake.

[41] (Franklin 2003: p. 210).

6. Case 5: Verstegen packaging; linking 2D and 3D design

Originally FLEX started its activities as a traditional industrial design agency. Although until 1995 essentially FLEX' focus was still industrial design, its business orientation was somewhat different from its competitors. Where others were strongly focusing their work on the value of design for Musea and Design Prices, FLEX wanted to approach its work from a business orientated view. The reason to start packaging design activities was mostly driven by a strategic analysis and a necessary shift of the business orientation. In the mid '90's FLEX became convinced that it needed to be less vulnerable to economic recessions as was the case in the conventional industrial design sector. At that time Dutch and Western European Design agencies were practically all focusing on:

- consumer products;
- professional products;
- furniture;
- public furniture.

The manufacturers of these products – agencies' clients - seemed to be hit simultaneously by economic ups and downs. With more and more classical oriented industrial design agencies coming to the Dutch market in the early- and mid-nineties, this would mean that a critical situation could occur, when the economy would turn into a downshift.

Based on simple economic analysis, it was clear that the food and beverage industry was less sensitive to economic down-turns than the above mentioned sectors, the simple explanation being that people always need to eat and drink, while they can postpone their buying decisions on (semi) durable household products and durable products more easily. These so called fast moving consumer good (FMCG) companies need to be close to their market for two reasons. For marketing reasons, they want to stay in close contact with their customers, to understand them and to know them better. The second reason is their logistic process: reducing time and distance to deliver their goods to their customers. The transportation of these products needs to be as efficient as possible.

Thus for economic reasons, FLEX decided to become active for the FMCG market.

The question then of course was: How could FLEX produce added value to these companies? The following options offered themselves:

- retail design;
- vending (machine) design;
- packaging design.

Although retail design was – and still is - seen as an interesting opportunity, FLEX decided to choose for Packaging Design. Retail design was already practiced by many other agencies (SVT, VBAT, Eden). In retail design the orientation was and is also more geared towards (interior) architecture then to industrial design, so FLEX would have gained a relatively small competitive advantage. Vending machine design was also already covered by other industrial design agencies, and even more important, the design and development of these machines was mostly initiated by the manufacturers and not by the FMCG companies themselves. Therefore FLEX chose packaging design as its new design service.

The next question was: As a packaging design of a FMCG product like (food); mayonnaise or drinks, or (non-food) like paint and detergents consists of a structural part – the jar, the bottle – and a graphical part – the branding, the graphics, the product information, the color coding – would that mean that FLEX would also start to develop 2D graphical design as one of its competences?. The decision was made to do only the structural design and to leave the 2D graphical design to the specialized agencies. There were two reasons for this decision:

- design culture and design quality;
- commercial considerations.

6.1 2D and 3D design culture and design quality

The culture of a graphic design studio is fundamentally different from that of an industrial design agency, the main reason being that the background and education of the people working in the first design area is very different. In an industrial design agency the designers are generally educated in technical oriented poly-techniques or technical universities.

They have an academic background and although they are sometimes trained and educated to do the opposite, they rely more on a rational approach than on an emotional one. On the other hand product designers educated at Art Schools[42] do learn how to link their emotions with product design, but when working in an industrial design environment for the industries where marketing is more pivotal, they generally cooperate within a team where a more rational business approach is leading.

Next to that, creating three dimensional products is essentially different from designing in two dimensions. In 2D there seems to be less restrictions and limitations than in 3D. 3D designers have to use more technical data, concerning materials, production facilities, functionalities and ergonomics, where 2D designers are mainly focusing on 'look and feel', information transfer, visuals and typography.

Combining these different backgrounds in one company is theoretically possible, but it will not attract the 'best-in-class'. The best 2D graphic designers will look for their own optimal design environment. Generally this is a specialized 2D agency with its own specific culture. A similar analysis can be made for industrial designers looking for an optimal working environment. Therefore trying to mix both types of designers in one company will probably not create the best design propositions in both fields at the same time. It will always be an organizational compromise to please both 'cultures'.

For these reasons FLEX decided for their 3D packaging assignments not to incorporate 2D graphic designers in its own company, but to establish strategic alliances with the best independent graphic and branding agencies externally. In this way FLEX was able to create a company culture that is exactly in line with the needs of the best 3D-packaging designers and in doing so becoming a leading 3D packaging design agency.

[42] For instance: the Design Academy in Eindhoven or the Gerrit Rietveld Academy in Amsterdam.

6.2 Commercial reasons

In the mid-nineties agencies for branding and 2D-packaging design were well established. In some ways they were even more matured than ‘classic’ industrial design agencies, as they had often a longer professional history, were very often linked to advertising agencies and had already established solid and lasting relationships with FMCG companies. However, not one of these market leading agencies did anything in the area of 3D-packaging design, as their expertise in this field was absent.

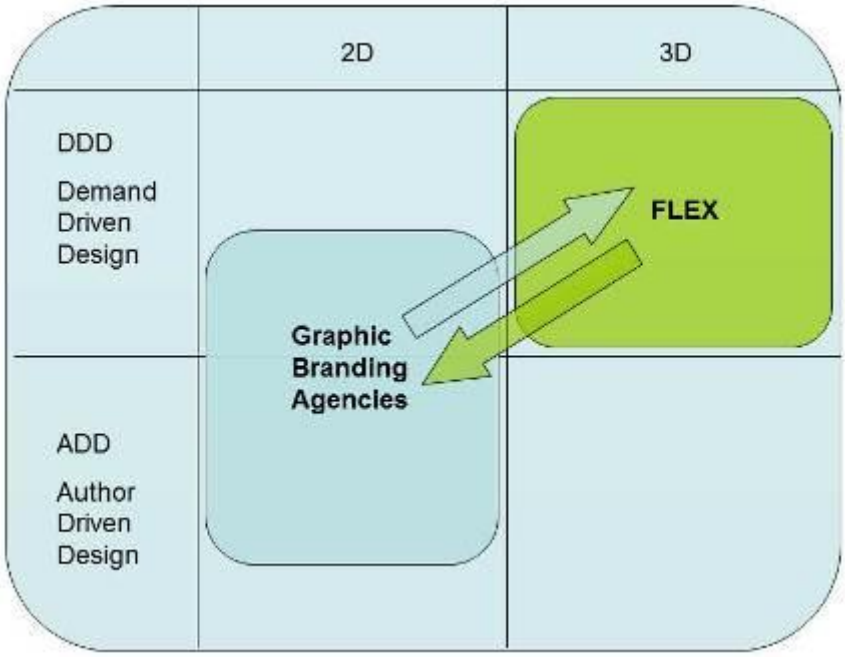
Incorporating 2D-packaging design into its own services would mean that for 2D-graphical and branding agencies, FLEX would become a direct competitor and in this way it would not be easy for FLEX to cooperate with these 2D agencies. As the relationships between FMCG companies and branding agencies are often formalized in long term contracts, this implies that it would be hard for FLEX to enter into the 3D-packaging-design-market. On the other hand, when FLEX would refrain from offering 2D-design-services, it would not be considered as a competitor and FLEX could establish a position for itself as an independent 3D-packaging-design-specialist. In line with this analysis FLEX started in 1996 a strategic alliance with Millford van den Bergh, a leading bureau specialized in 2D packaging and corporate design. During the next years more strategic alliances with other branding and 2D packaging agencies followed.

6.3 Differences between 2D and 3D design

Despite the aforementioned strategic alliances, it was not clear from the start that cooperation between a branding agency and an industrial design agency would be a good thing in every respect. As stated before:

- the two were coming from different educations;
- their approaches, processes and methods were different;
- their knowledge was different;
- their business orientation was different, and;
- their technical orientation was very different.

Referring to the description of Author and Demand Driven Designers [1.5.3] the following comparison can be made between both disciplines [6.1]. In general graphic designers forming the heart of the creative activities, working at packaging and branding agencies, are more Author Design Driven than industrial packaging designers.



[6.1] Packaging designers; author driven graphic designers and demand' driven industrial designers

The explanation for this is that, like Author designers, graphical designers are taught at Art Schools. Their education is largely based on intuition. One of the most well-known academies in the Netherlands[43], describes a graphic designer as follows:

As graphic designer you are trained to be a specialist as well as a mediator. 'Specialist' means that as a designer you are capable to develop a creative or autonomous concept and to use meaningful visual identity. Research and experiment are very important; at the WdKA you are taught from the principle that reflection and innovation are basic requirements in this.

So how in fact can both design disciplines work fruitfully together? What can be gained from a new design approach for Demand Driven Designers and Author Designers that can be applied to improve the cooperation between graphic designers and industrial designers?

[43] Website of The Willem de Koning Academy (WdKA) in Rotterdam.

Although the reason in working together with these agencies was at first commercially driven, working with the Author Driven Designers of the graphic and branding agencies, we learned ‘by doing’ how both disciplines could indeed work together in a new approach. There were three reasons to be convinced of such a possibility.

First of all the aforementioned branding agencies, especially compared with the traditional graphic agencies, are working within a strongly marketing driven culture and these companies are often managed by people with an advertising and marketing background, so their company culture is much more ‘commercially’ orientated in comparison to the traditional ‘art’ driven 2D agencies. This provides them with a willingness – and necessity - to set creation and design in a position to support business and marketing objectives, instead of leading them. Here common ground is found with the approach of the industrial packaging designers within the first fuzzy frond end of the design process, that is: in the orientation phase, as this offers a mutual insight in the same project orientation.

Secondly, most ‘graphical’ branding agencies are becoming more and more multidisciplinary companies, covering other and new activities like web design, offering renewed insights into design processes different from the ones taught at Art Schools. For these activities designers need more structured processes than just relying on their intuition. On the internet the following methodological steps for web-designers can be found, that are characterized by a very ‘Ulmean’ twist:

1. Analysis phase;
2. Design phase (Functional, technical design, graphic design);
3. Construction phase;
4. Quality phase;
5. Acceptation phase;
6. Launch phase[44]

It is neither difficult nor surprising to conclude that this need for an orderly structured process is the consequence of a greater complexity of web-design in comparison to the design of a poster or business cards. It is corroborated by the fact that these agencies count among their employees many designers with a technological university background! We perceived this as a mutual interest in a new *structured* design approach, closing the ‘gap’ between the Author Design graphic discipline and the Demand Driven industrial Design discipline.

[44] See for instance: www.moonaconsulting.com/over-ons/onze-**methode** or www.internetwebbureau.com/nl/werkwijze/methodologie

Next to the market development described above this last point too led to an increasing believe in a design process that would create an optimal cooperation between both types of designs and their company cultures.

6.4 Integrating 2D and 3D design

So in what way can industrial designers and graphic designers work together in an effective and inspiring way? Needless to say that this is a process that respects the more ratio driven complex technical environment in which an industrial designer has to operate and at the same time challenging them to create more emotion and semantic meaning in their work, while at the same time the process leaves enough room for inspiration, ‘magic’ and intuition for graphic designers, respecting the technical restrictions of the industrial design. Based on the experience of almost 15 years of packaging design projects, all projects showed a constant pattern in which three phases could be identified:

- orientation;
- creation and design;
- execution; engineering and production.

The first characteristic is: a commonly shared marketing orientation. Most essential is a mutually shared kick-off of the project. Both types of designers have to share their design vision in the fuzzy front-end phase of the design process, where decisions are made on the overall design direction on a highly abstract level. Here aspects as the right business proposal, brand values and consumer insights are playing a crucial role.

Having decided on a mutually shared project orientation, in the next ‘creation’ phase 2D and 3D designers can work more parallel to each other. The 3D designers start this with extensive technical assessments of the filling and production lines, transforming the *learnings* into ‘technical’ concepts and combining them with the outcome of the project orientation phase. At the same time the graphic designers create the first visual transition of the result of the orientation phase, like the market analysis and the specified brand values into the first 2D artwork proposals. At the end of this phase 2D and 3D proposals are integrated into different design concepts that are evaluated by the combined design-team and, of course, their client.

In the third and last phase the chosen design concept is prepared for production. For the quality of the design it is important that the selected 2D/3D design concept is respected as an integrated design and that not too many changes are made in this last phase.

Ideally a fruitful cooperation between 2D and 3D design should start with a *mutual* design orientation: *framing the project*. Both disciplines should have the opportunity to create and to dictate each-others boundaries: *the project frame*. Later, in chapter 7, this will discussed more in detail. For Verstegen two packagings were designed. In the first project there was no opportunity yet to use a fully integrated 2D/3D design approach. In the second project however we could integrate both disciplines from the start of the process. Therefore it is interesting to analyze the differences between the first (Chapter 6.5) and the second project (Chapter 6.6).

6.5 Verstegen Herbs Case; the first project

In 2004 FLEX started their first project for the Dutch company Verstegen. In the following two projects will be described, the first *initial* project and a larger 2D/3D integrated packaging design project. In both projects a coherent system of packagings for herbs were designed. In the first project there was no opportunity yet for a fully integrated 2D/3D design process, following 'creative reflection'. In the second project the client could be convinced to step into an integrated 2D/3D project, and so it proved a typical example of the specific 'FLEX-approach' in which the first glimpse of working with the new approach can be seen.

6.5.1 Historical background

Verstegen Specerijenhandel en Fabriek van Conserveermiddelen (Verstegen Herbs trading and manufacturing of conservation additives) was founded in 1886 by Mr. Verstegen. Under the management of C. Diederik and J. Man in 't Veld, the company engaged in the trade of spices, tropical fruits and baking ingredients [6.2]. In 1914, due to antitrust law, the firm was split into three parts. One of them was and still is the contemporary firm Verstegen.

[6.2] Verstegen Specerijenhandel (Herbs Trading Company Verstegen).

The company prospered particularly after World War 1. Despite the great crisis, the company managed to survive, by supplying excellent quality, service and reliability. Thus Verstegen acquired a large and permanent core of customers, that ensured a steady growth of the company. In 1939 the first member of the Driessen family joined the company, which turned the company into a family business.

During World War 2, the company's premises at 104 Hugo de Grootstraat in Rotterdam were completely destroyed. When the war was over, a small supply of some raw materials enabled a hesitant start from a garage. It was not until six years after the end of the war that Verstegen again had business premises comparable to the pre-war situation. After about twelve years, these premises again became too small. In 1964 Verstegen moved into a new business premises where production still continues until today.

In 1979 the first Mr. Driessen took his leave, his position being taken over by his son Mr. Jan Driessen. In 2009 the third generation of the Driessen family gained control. During the last decades Verstegen Spices & Sauces has grown at a very fast pace.

6.5.2 Orientation of first packaging design project

Until the late '90's Verstegen focussed their business mainly on the professional market, that is restaurants, other horeca-businesses and butcher shops. Then Verstegen decided to broaden their scope by entering the consumer and retail market. The retail market was until that moment dominated by Silvo with almost 50% market-share in the Netherlands and Euroma with an estimated 10%, the rest of the market being in the hands of a number of much smaller private labels. In the late '90's Silvo introduced a new packaging series; their identity was considered to be innovative and quite professional, but at the same time not very inviting and tempting towards the consumer.

Among professionals Silvo's shop display was nicknamed "The Golden Cage", which had a definite negative association [6.3].

[6.3] Silvo's display rack, the "Golden Cage"

After some time Verstegen reached a 5% market share in the retail market. A new marketing director for retail decided to focus on acquiring a larger market share. The decision was made to design and develop a competitive packaging concept as an alternative to the Silvo range and FLEX was asked to execute the project. The existing packaging design of Verstegen was based on the requirements of the professional user, Verstegen's original target group. The packaging was simple, no-non-sense and functional [6.4].

[6.4] Old Verstegen herbs and spices pack

To this ‘back-to-basics’-concept CEO-owner Jan Driessen added a purely personal touch to the design; the use of the colours green, red and white, based on his intimate association with Anthroposophy. The founder of Anthroposophy, Rudolf Steiner developed a colour system based on four basic colours. Black stands for the darkness and the mind's image of the dead, while white stands for light and — through cosmic experience — for the sun. The colour green is the strongly represented in the green of nature. The colour red is the "colour of human incarnation" – the "colour of human skin"[45]. Even the interior of the company’s premises was based on this very same colour scheme, which indicates the intense personal involvement of the owner’s vision into his products that was of serious consideration for our project approach, as this was our first project for this company.

One of the more technical key-elements of the existing pack was the closure with a Low Density Poly Ethylene (LDPE) lid. Over the years this cap became almost synonymous for the Verstegen brand and proved to be a very reliable and effective closure, especially compared to the poor closure of the Silvo lid, its most important competitor. On the Silvo dispense opening and lid [7.7] we concluded that it was:

- too small for proper dispensing of the larger ingredients;
- not tight enough to keep humidity outside; which is especially; problematic in the care of hygroscopic ingredients like salt, curry, etc;
- opening and closing of the lid was not very ergonomically designed; that is: it was difficult to handle the lid properly with humid hands.

[6.5] Closure of Silvo packaging

[45] (Steiner 1980).

6.5.3 Design Consciousness

We became early aware that our design approach in this project should be very specific. First of all we had to earn the trust of a less ‘design’ experienced client who had very strong personal ideas. Second it was Verstegen’s first major 3D packaging project with important strategic implications as it was their first entry into the retail market. And last but not least, it was our first experience with the delicate ingredients; herbs being sensitive to humidity and with specific filling line restrictions in order to cope with dust forming.

The client did not have a specific design consciousness, had no background in this area and had practically no technological packaging knowledge. Moreover we had to balance between the strong ambitions of the marketing director and the more conservative ideas of the other members of the board, the last being very anxious that we as ‘crazy designers’ would come up with too radical designs for Verstegen and that we would not respect the red-green-white Steiner inspired coding of the existing Verstegen packagings. In this project we acted as the integrator between the several departments of Verstegen and the suppliers, we led the design activities, we suggested the strategy and we made the choices for the suppliers that fitted best with the specific project and design needs.

It was important not to stretch our design ambitions too much in order not to lose trust of the owners and not to put the marketing director in an awkward situation. On the other hand we were aware that the new design should make a difference to the end-user as our task was to create a better performing design than Silvo. This dilemma is often present in design projects, especially in situations with clients with less – practical - design experience.

In this project the ambitions and commercial targets were very high. Verstegen had the ambition to acquire at least 10% market share in retail, that is: twice its existing volume. At the same time they were not willing to invest on a large scale into new tooling or to change their production line too radically. At the same time we were actually asked to ‘redesign’ the red-white-pack for a totally new market segment with very different commercial and technical requirements.

FLEX could fulfill this role only because it was committed to the strategy of the client and it had the required knowledge. As it is generally very difficult to alter a client's ambitions without losing their trust, the only effective approach was to use the given means to the maximal level:

- it was accepted that the existing filling and production line should be used without major changes;
- it was accepted that somehow the existing colour coding (of Steiner) had to be incorporated and that the packaging still had to stand out on the shelves in the supermarkets;
- it was accepted that the pack should be relatively easy to mould without complex tooling or extra peripherals like sleeving machines.

6.5.4 Creation Process

In the initial phase FLEX first tried to focus on the essence of this packaging, an example of *framing the project*. In the case of Verstegen we emphasized the quality and special character of the ingredients: herbs, beautiful colours, striking structures and herbs with intriguing shapes; we wanted to show the quality and richness of the herbs in the packaging [6.6].

[6.6] Different herbs and species; pepper, cinnamon, rosemary

Next to the beauty of the ingredients we also tried to stress how delicate the whole process of preparation of the herbs was [6.7]. This was something to show to the consumer! As an outsider it is often easier to see the beauty and attractiveness of a product compared with what the client is able to see after working for such a long time with products that are so familiar to him.

[6.7] Food preparation with different herbs

So it followed that the packaging should be as clear and transparent as possible as “to proudly show the ingredients”. Silvo already used transparent PolyPropylene, but not as transparent as it could be. In fact the top part of the existing Silvo pack used a lot of plastic layers that together with its label hided the interior and its ingredients from sight [6.8].

[6.8] Silvo’s pack with large label area

Next to the above requirements, the most important technical criteria were:

- the new Verstegen packaging should use the same Eurolock shelve system that Silvo was using;
- the packaging should have an equal or better amount of units/meter, compared with Silvo;
- the packaging costs should not be higher, compared with Silvo;
- the identity of the pack should fit the existing Verstegen brand;
- the design should be inviting and more tempting than the Silvo pack;
- the content of the packs should be 50 and 100 ml.

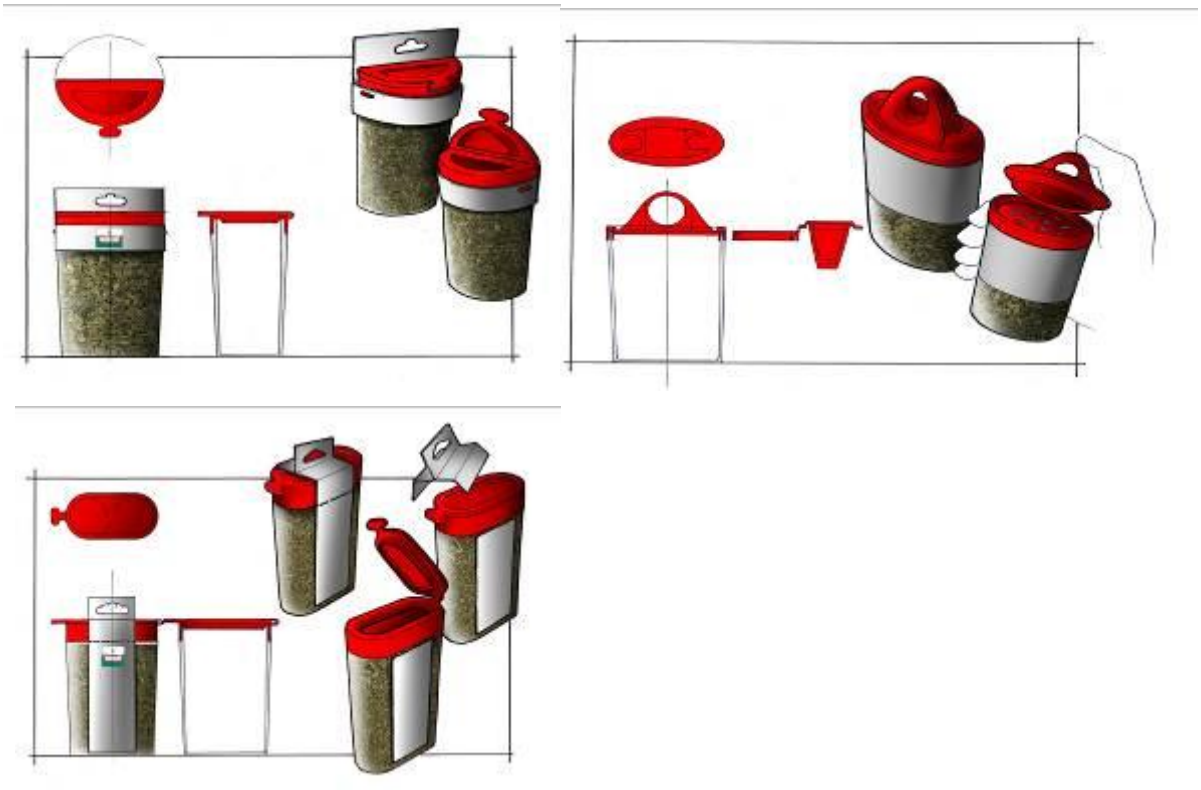
Stemming from the design strategy and the project analysis, the focus of this first packaging design project for Verstegen was:

- doubling the market share;
- fitting the existing visual Verstegen brand assets; obligatory use of color red in the closure;
- an incremental design step; (L)ow(D)ensity(P)oly(P)ropylene in closure;
- better overall performance than the Silvo pack: easy opening, perfect; grip, tight closure and stable;
- using existing production facilities;
- redesign of only the 3D-packaging, using same graphic design;
- stressing the quality and richness of the herbs by using a ‘neutral’ shape with a maximal transparency;
- offering a more ‘foodiness’ appearance;
- fitting all the remaining technical requirements.

Although at the time of this project the new design approach was not yet available, in comparison with the extensive analysis and extensive list of requirements the Delft design methodology required, in hindsight this approach showed already some first characteristics of the later developed framing approach (Chapter 7.3).

6.5.5 First concepts

In the sketches [6.9] the results of the first phase are shown. To meet the requirements from the existing Eurolock shelve system, the packagings had to have the same overall dimensions as the Silvo pack. The second important feature was the use of the red coloured LDPE closure on all concepts. Although the second concept – on the right - was our personal favourite, the last more conservative concept – on the bottom - was chosen by the client.



[6.9] First 3D packaging design sketches

6.5.6 Final design, engineering and production

As stated above we were handed over all the responsibilities to finalize the chosen concept and so we had to prepare all the necessary steps and activities to prepare for the production of the pack and to make sure that the pack could be filled on the existing filling line without major changes. The only opportunity we were not granted was a change in the 2D-graphic design and artwork. As mentioned earlier the members of the board wanted to stick to their existing supplier and did not want to change the graphics.

In the pre-production phase we were responsible for:

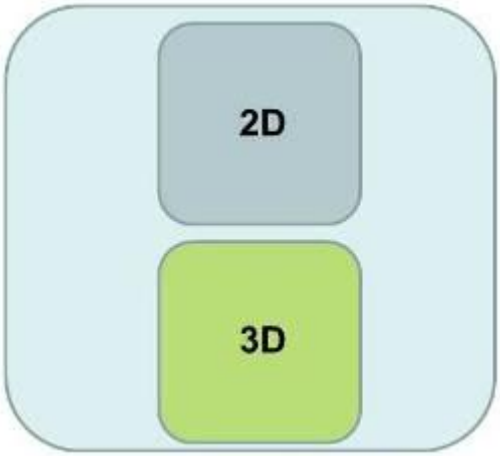
- final design [6.10];
- final material choices;
- optimal closure (which we established by making several prototypes);
- optimal transparency (choice of a supplier of PP clarifiers);
- minimization of the material weight;
- cost optimization and optimization of investment costs;
- making of a long and short list of suppliers and manufacturers;
- choice of the injection moulders
- coordinating the graphic design (dimensioning, positioning and coordinating the labelling process in production)
- approval of (F)irst (O)ut of (T)ool products
- starting up the production and filling line

[6.10] Final design of the product

6.5.7 Project evaluation

In this project FLEX showed that it was able to respect the ideas of its client and that it was seriously willing to cooperate in the design process. We proved not to be the type of designers that ‘took over’ and in that way tried to create their personal design. Secondly we proved to have specific knowledge of the manufacturing process of the packs and that we respected fully the production and filling line requirements.

One thing we did *not* achieve was the best 2D/3D integrated design. In this first project for Verstegen the two disciplines 3D industrial packaging design and 2D packaging design were still separated from each other and so both creative activities could not benefit from each other [6.11].



[6.11] *Project frame* with separated 2D and 3D activities

All in all it did lead to a design that performed better than the Silvo pack and that was easy to integrate into the existing production plant. Most importantly the new design was soon adopted by the Superunie with their Spar and C1000 supermarkets and this meant a market share of almost 25% within one year after introduction. The Verstegen pack proved to be a ‘selling solution’, and far more so as was envisaged at the start of the project.

Internally we knew that we could have achieved more from a semantic point of view, especially where the integration of 2D and 3D was concerned. There was even an internal discussion within FLEX, namely whether this design was worthy of the FLEX design quality. Being a Demand Driven Design agency and acting as such we had to convince the more author oriented designers within FLEX that this was not the aim of this project. This project was essentially about building up trust with the client; although from a purely semantical perspective one could speak of a sub-optimal achievement.

Looking at the market results, this demand driven design process proved to be the right approach for this project and this client. In this, I personally was a strong defender of the achieved (sub-optimal) results. In my personal opinion design should still be a means to reach other goals and a higher company strategy. As this project led to a market share of 25% - instead of the ambitiously planned 10% - FLEX had used *design* in the right way. At the same time FLEX had built up trust with the cooperative CEO and the very capable and ambitious marketing manager (the M.A.N: in control of Money, Authority and Need). It was likely that other projects with probably more 'creative' and 'artistic' freedom would follow.

6.6 Second (2D and 3D integrated) packaging design project

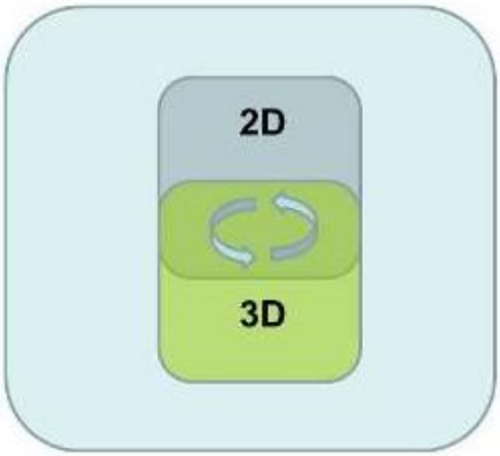
As said, the first packaging project for Verstegen proved to be a commercial success. Due to impeccable marketing and sales activities and supported by a much better cost price performance than Silvo, that enabled the retailer to obtain better margins, the Verstegen series quickly gained the planned larger market share. After approximately one year after the introduction, Albert Heijn (AH) followed its competitor Superunie, which led to an additional growth of the market share to almost 40%.

With these results within one year Verstegen approached FLEX for a second project; table-herbs in glass jars for both the high-end retail market and the professional (restaurant) sector.

6.6.1 Orientation; project frame

Being asked for a new table-herbs-design project and knowing the even higher ambitions of Verstegen in this project, we reused the well-established relationship and trust to increase the design options. We felt responsible to convince Verstegen to start an integrated 2D and 3D design process in close cooperation with a brand and packaging agency we had been working with for already many years; MillfordBrandID. So in this project we finally could execute the design activities in an integrated manner.

As a team we could realize a parallel, simultaneous and synergetic design process to maximize the benefits of a close cooperation between 2D and 3D [6.12].



[6.12] *Project frame* with integrated 2D and 3D activities

Two arguments were used to convince Verstegen to work accordingly to this integrated approach:

- Verstegen especially wanted to gain contacts with leading food retail concern AH, as many other retailers would follow afterwards. Millford was an agency that already worked with AH on many projects and was familiar and fully accepted by AH;

- the even higher ambitions demanded for a higher overall design quality could only be established by an integrated 2D and 3D packaging project;

- in the high-end market the old design and the existing graphic agency did not comply the market demands; a better graphic agency should be selected.

With this basic information already the first ideas and shapes were conceived [6.13].

[6.13] First sketch in personal sketch-book

This shows the potential value and importance of *inspiration* and *intuition* that was - in this case - based on the experience and the creative database that was already constructed in the first project for Verstegen. In several mutual design sessions the two agencies FLEX and Millford cooperated closely together. The two disciplines exchanged each other boundaries and opportunities; delivering a description of alternative project scenarios, their ambitions and the overall vision in the following way.

6.6.1.1 Business (commercial and strategic considerations)

Concerning business aspects within the creative frame of ‘Creative Reflection’, the following aspects were important:

- As mentioned in the first part of this chapter, AH was an important party in this project. One of the ideas that came from the framing sessions was the suggestion to offer a new Verstegen high-end packaging design and at the same time combining it with an AH-private label alternative, using the same production line. In this way the investments required for only one new packaging could be shared with a second alternative packaging. This would be beneficial to the return of investments as the same investment would be divided by more packaging units.

- Inspired by this option the design team acquired an important extra benefit in the first phase of the project. The design project delivered two alternative packaging designs – one for AH and one for the Verstegen brand - *that both could run on the same filling line without any mechanical changes*.

6.6.1.2 Semantics (2D and 3D design)

Within the project frame, the following semantic aspects were important:

- Similar to competitor ‘Droqueria & Alimentaria’ [6.14] the design should have table worthiness; the packaging design should have a decorative value in restaurants, however in a new and modern way;

- The new design should have sufficient connection to the existing Verstegen (brand) values; one of which was the outspoken red colour.

[6.14] Packaging of competitor ‘Droqueria & Alimentaria’

- As said one of the brands with the most important competitive packaging was Droqueria & Alimentaria. They were offering one of the most ‘foody’ packaging. The packaging design was however heavily leaning on old nostalgic brand- and food-values.

- In the framing sessions it was discussed in what way the team would try to make the overall design look more contemporary than the ‘Droqueria & Alimentaria’ design. It was decided to aim at a more modern 2D graphic design and to ‘compensate’ and ‘balance’ this ambition with a modern but more modest and less extremely shaped 3D packaging; to end up with the right overall balanced design.

- Consistent with the planned contemporary 2D design it was decided to use real and original food-graphics and to use photography of the actual herbs(plants) on the pack to emphasize the naturalness of the ingredients.

- To establish a similar quality feel it seemed to be obligatory to use glass for the jar and not to use an alternative plastic jar as it would be inferior from an aesthetically point of view and because of a poorer visibility of the ingredients.

- Content should be well visible; label should not fully hide the ingredients.

- The graphic designers decided to look for a warmer and more contemporary alternative red colour namely warm burgundy red;

- The 3D packaging design proposals were inspired by contemporary versions of geometrical shapes; using classical shapes and shapes of Greek sarcophagus and vases as inspiration.

6.6.1.3 Technology

The following technological aspects were important:

- For reasons of timing and technical risks it was decided not to develop a new closure, but to search for standard options, using existing suppliers.

- FLEX made a technical web-based assessment of available closures and their manufacturers, like flip-tops, caps and lids with integrated grinders for the use of pepper ingredients.

- For all the required closures and caps the necessary geometrical and technical information was collected from potential suppliers. In this way all the concepts were anticipating on the actual possibilities and limitations in the final production.

- In the first phases of the project, based on a quick production-scan and filling-line-assessment, already in the first sketches all the most important and vital technical restrictions and requirements were integrated in the overall shapes and dimensions.

6.6.1.4 User

The most important user aspects were:

- The new design should have better ergonomic performance than the competitive; with easy opening, closing and grinding.

- The packaging should comply to as many existing storage systems in kitchens, like racks and cupboards, as possible.

6.7 Creation; 2D and 3D concept design

In a period of roughly 6 weeks the two agencies co-worked intensively on the actual 2D/3D designs. The outcome was *three* different design directions. The directions varied from more incremental and traditional towards more innovative and differentiating. During this whole first ideation phase we kept in mind in what way we could realize a Verstegen version of the AH-proposals, but essentially we first focussed on the best integrated 2D/3D design concepts for the AH brand simultaneously.

6.7.1 Concept 1

Referring to the characterizations of the alternative design scenarios, in the first concept the 3D structural design was strongly leaning on the design of the existing AH glass jars [6.15] and [6.16].

[6.15] Existing AH packaging

[6.16] Perspective view concept 1

The overall dimensions however were changed quite radically to end up with a more ‘funny’ and likeable shape [6.16] and [6.17]. As the 3D shape was quite outspoken the 2D graphic design was made somewhat more traditional compared to the other 2D proposals. The label used a simple colour coding to support the identification of the ingredients. The design was strictly following the filling line requirements.

[7.19] Front view new concept 1

6.7.2 Concept 2

This second concept was trying to ‘match’ the appreciation of the classical brand values and shapes of Droqueria & Alimentaria, but tried to use these same values in a more contemporary way [6.18].

[6.18] Front views of concept 2

This was achieved combining a more classical ‘sarcophagus’ 3D design with a more modern 2D graphic design. Authenticity was sought in the 3D shape and showing the ‘real’ plants where the herbs originate from in the 2D graphic design. Also in this range we strictly followed the existing filling line requirements. As will be shown later, especially this concept showed great opportunities to make a Verstegen and a AH version in the same overall design at the same time.

Next to the body, the cap also received a label, as many of these jars were stored in drawers as a result of which consumers would benefit from product information on the top [6.19]. In the graphics the real and original shapes of the herbs were shown; ‘foody’, tempting and evocative.

[7.21] Perspective view of concept 2

In the brand navigation the AH logo is message number one, the product name is on the second level. On the third level the visuals supported the overall look, feel and brand identity. There was no extra colour coding as the photography of the real herbs with their natural colours already carried the required identification.

6.7.3 Concept 3

The third design concept used a similar geometry as the Verstegen pack in the first project to create a coherent brand identity from a 3D perspective. However we used several optimizations and modifications. First of all to make the overall visual performance aesthetically more attractive and *'playful'*, but very importantly also because it could be expected that AH would maybe be less enthusiastic of this Verstegen identity. Therefor we tried to link the 2D graphic design more to the design of the existing AH private label. The design was pure and clear, using strong typography instead of photography as this fitted best to the AH-brand identity. And again…….all the existing filling line requirements were respected [6.20] and [6.21].

[6.20] Perspective view of concept 3

[6.21] Top and front views of concept 3

Considering all the requirements the best 2D3D design was concept 2, based on the following arguments:

- the design had the best options to realize a AH version and a Verstegen at the same time using a small differentiation in the overall shape;

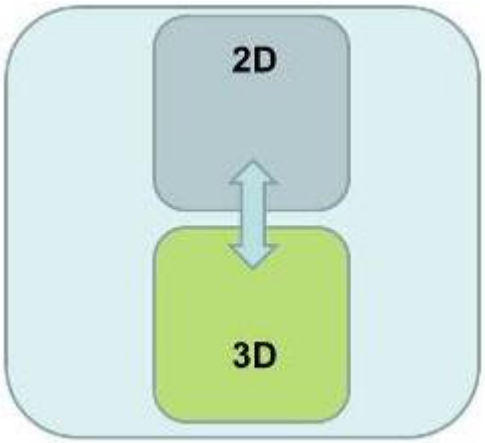
- the packaging should especially be better than the one of Droqueria & Alimentaria without being too different. This design seemed to have the right balance in being similar for being accepted quickly and to be appreciated on a longer term, as it was more modern;

- all the filling line requirements and the specific specifications of the suppliers could be integrated without any large technical risks or investments;

- Last but not least we held the opinion that this concept had the best table worthiness of the three, as it was using a cylindrical shape with a classic character. With the right graphics we were sure to give it the right ‘edginess’ to be contemporary and to be stylish.

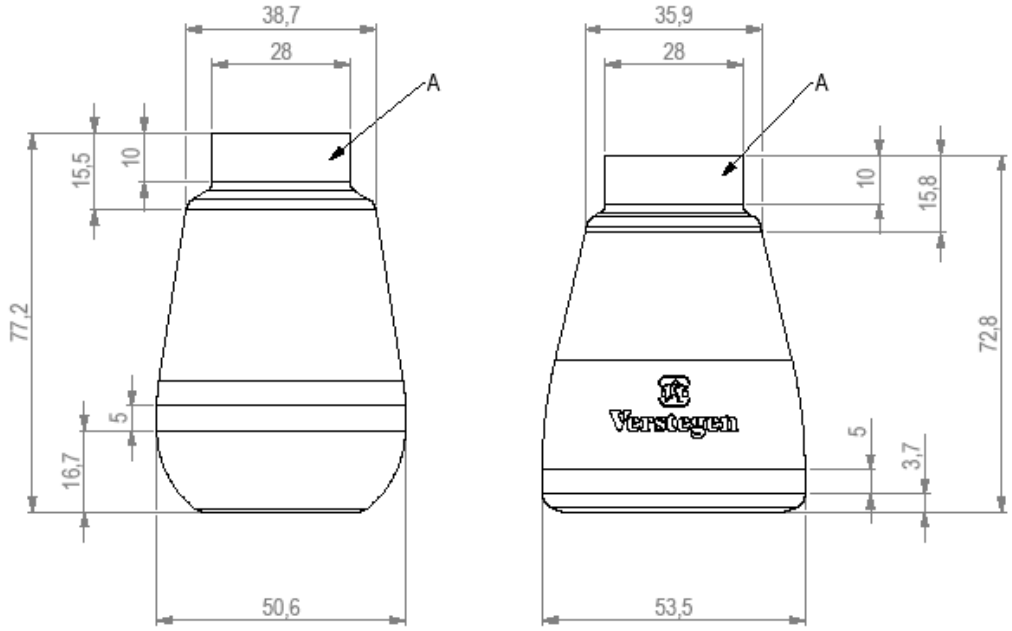
6.8 Implementation; final design and engineering

In the third phase the two design agencies worked more parallel to each other. However, as a design team including the client there were frequent common meetings to make sure that all the promises and ambitions of the first project framing phase were as much respected as possible [6.22].



[6.22] *Project frame* with 2D and 3D interaction in realization phase

In this implementation phase, FLEX anticipated immediately on the use of *one* design for the AH jars and the Verstegen jar at the same time as this was one of the most important technical directives stemming from the first phase [6.23].



[6.23] Minor differences between AH version of the left and Verstegen version on the right.

The height of the AH-version was 77,2mm compared to 72,8mm for the Verstegen version. With this difference of only 4,4mm the packaging could be closed by the same ‘capper-machine’. The diameter only differed 2,9mm. On the same filling line and transportation belt this was technically speaking within the acceptable range of tolerance.

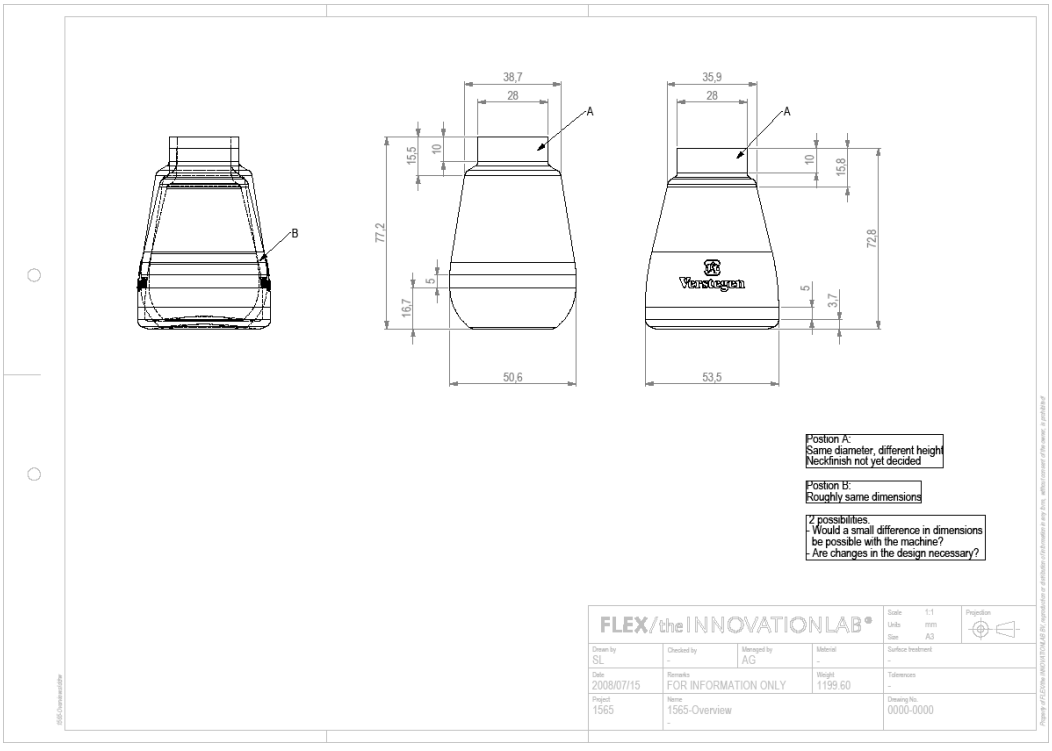
[6.24] 3D differences in 3D-CAD, between AH version of the left and Verstegen version on the right.

In 3D the designs of the AH version and the Verstegen version [6.24] were differentiated from each other using the following aspects:

- shape of the cap;
- subtle change in the overall shape of the conical body.

In this stage of the final design FLEX took care of the overall project management. In this phase the following main activities were executed:

- coordination of the industrial design activities on the structural design/engineering of the packaging and the branding and graphic design activities executed by MillfordBrandID;
- model making to evaluate the 2D/3D design;
- parallel development of the AH and the Verstegen version;
- technical detailing of the glass jar and the closures (flip-cap & grinder);
- minimization of glass weight, cost optimization and optimization of the investment costs [6.25];
- optimization of the graphics.



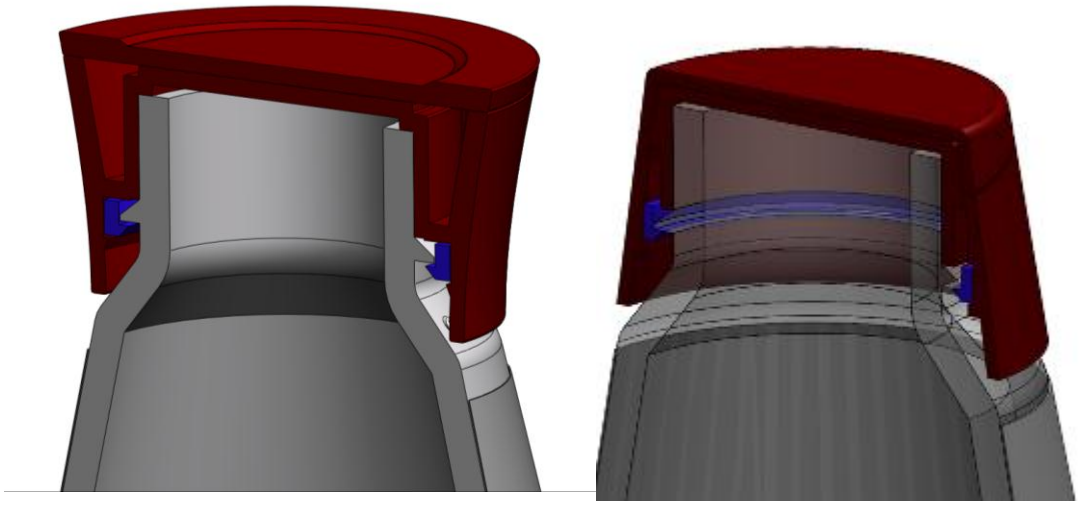
[6.25] Technical drawing

The technical information was shared with the glass manufacturer to optimize the design, the glass weight, the packaging costs and investments.

Parallel to the optimization of the body the closures were designed and engineered. In the final design and engineering phase of these plastic parts there were several critical points of attention:

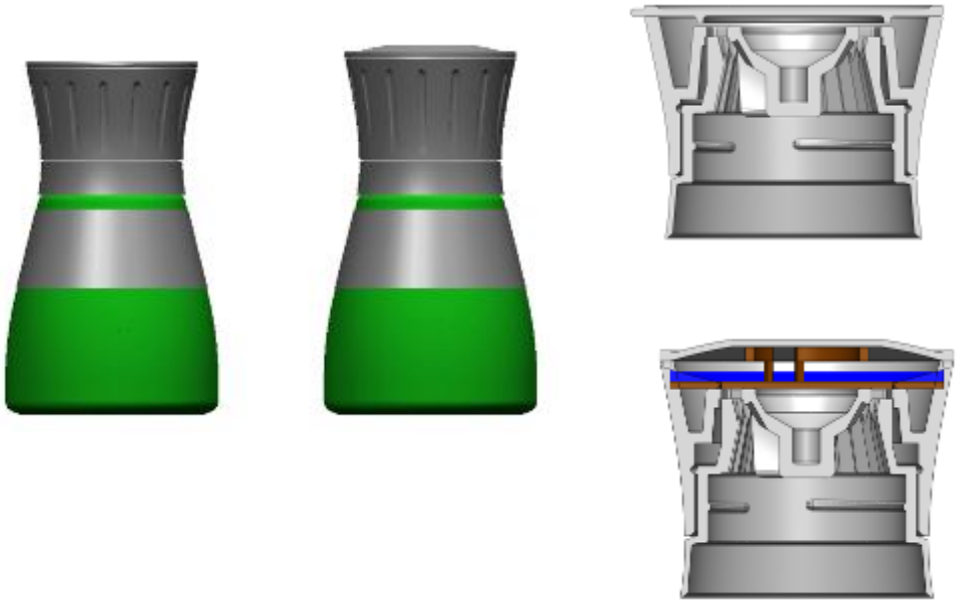
- optimization of the design for optimal use (easy opening and closing);
- minimization of materials (reduction of costs and production time (cycle time in the injection moulding machines);
- making designs suitable for the large production volumes; often millions and often multi cavity tooling;
- solving temper evident issues (safety requirements on the *unintentional and/or uncontrollable opening* of closures);
- in this case special attention to the use of two different types of closure for the same type of pack;
- filling line restrictions (line speeds, line acceleration, line stability; how high/low is the point of gravity of especially an empty volume, capper height, etc.);
- monkey proof (anyone can understand and use the closures) and durability of the pack.

In sections [6.26] the two different versions of the caps are shown.



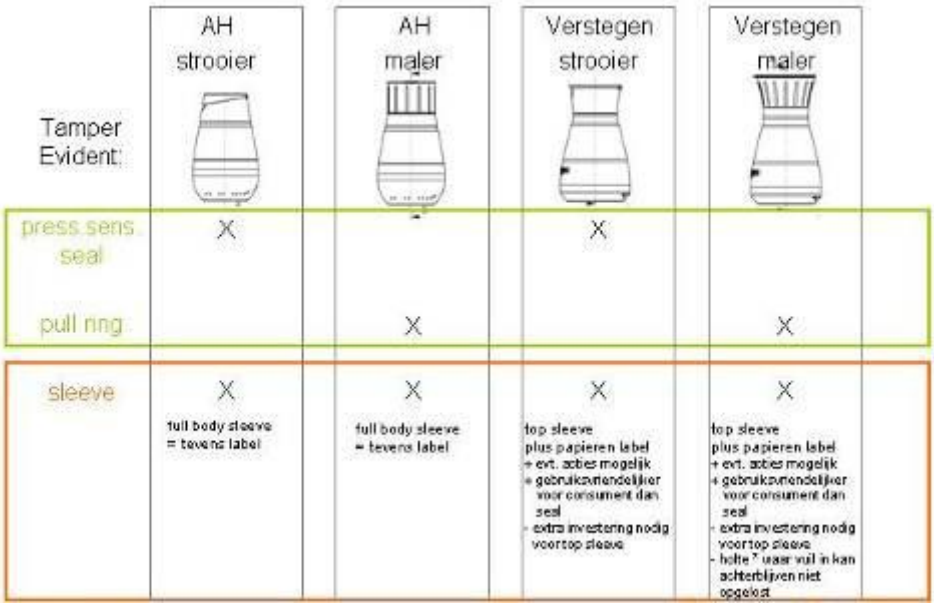
[6.26] Sections of AH and Verstegen closure

Next to a normal cap and closure, the series also needed a grinder for some ingredients like pepper corns. Our essential thought was to use exactly the same glass jar and similar neck finish for this grinder, without major changes. For this particular part FLEX worked closely together with one of the largest and most well-known manufacturer of grinders; Global Grinders in South Africa. Because there was no strict need to develop an unique new grinder principle and because of the fact that such a development was very risky, FLEX decided and advised Verstegen to use a standard grinding principle. These types of risks usually stem from liability issues caused by undesired plastic residues produced by the grinding process into the grinded corns. This risk was not worth taking so therefore a standard grinder and supplier was chosen; Global Grinders. In close cooperation with this manufacturer FLEX was responsible to transform and to adapt the technical and functional parts into the overall design of the AH and Verstegen version [6.27].



[6.27] Mechanical principle of the Verstegen grinder

All these design decisions led to one product family [6.28]. It clearly showed the differentiation between the two brands from a geometrical point of view.



[6.28] Packaging family of the Verstegen packaging

Next to a differentiation in the geometry of the jars and caps, in close co-operation with FLEX, Millford worked on a unique and specific (ownable) Verstegen visual brand identity, that would stand out against the AH branding. Where FLEX, from mainly a technological viewpoint, was working within a Demand Driven Design process, the parallel work of Millford could be seen as an example of Author Design. The striking (and price winning) end-result was based on two main characteristics:

- the name of the different herbs was written with its own leaves, fruits and sticks [6.29];
- the old primary colour red was replaced with a rich somewhat metallic red burgundy colour; obviously this proposal was done by Millford.

[6.29] 2D graphic design of MillfordBrandID

Given its Steiner inspired red, the change of colour from red to burgundy was a big step for the CEO of Verstegen. However, we and, maybe more importantly the marketing manager of Verstegen, could convince him of the importance of such a change; the required table worthiness would not be achieved with the old primary red colour; such a primary colour red would emphasize the ‘packaging’ feeling of the design and it would feel as a kitchen product instead of an on-table product. Although one could state that this design proposal was specifically Author Driven, stemming purely from Millford, these were obviously also Demand Driven arguments [6.30].

[6.30] Final 2D graphic design of MillfordBrandID

In the final (graphic) design of AH, we clearly created a more traditional retail and more ‘packaging’ feeling [6.31]. Maybe more important, the two designs felt very different from each other despite the geometrical and technical similarities. The result of all this was a further increase in the production volume within the Verstegen factory.

[6.31] Final 2D graphic design of AH

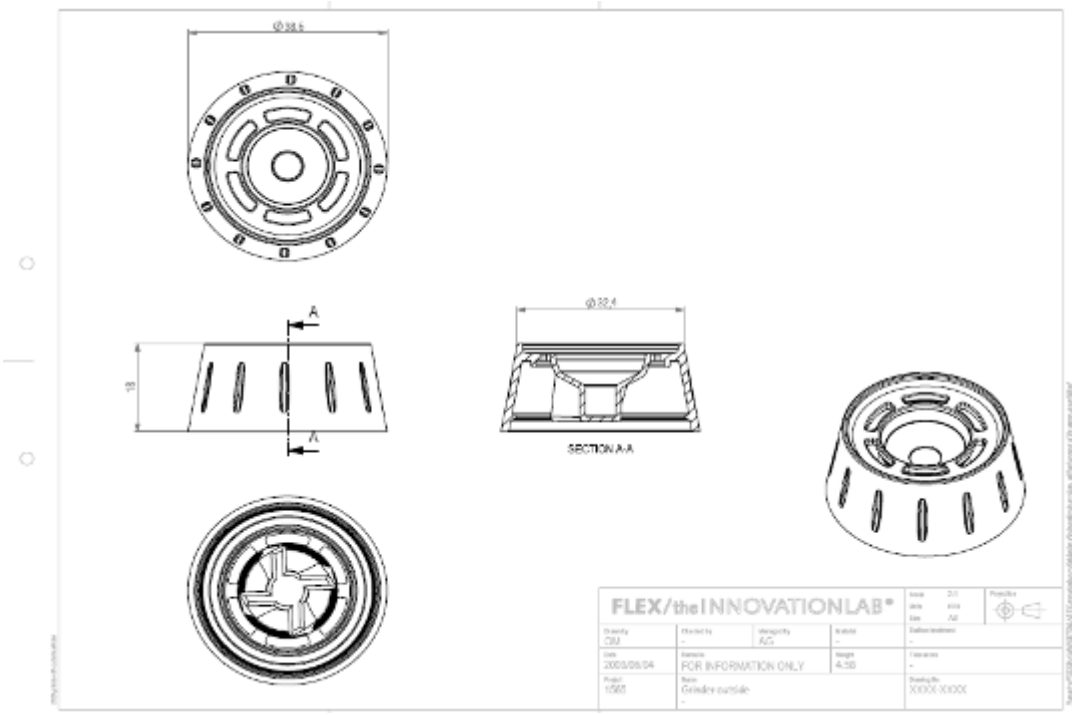
For the series of mixed herbs with pepper the grinder series also received the burgundy colour and the same graphical approach. Also here the ingredients were part of the graphic and visual message [6.32].

[6.32] Final 2D graphic design of pre-mixed herbs for Verstegen

Both caps received the top-label to take care of the readability and identification from the top when the jars are stored in drawers [6.33].

[6.33] Top-labels on both Verstegen and AH caps and lids

At the time MillfordBrandID was finishing the branding and graphics, FLEX took care of the manufacturing of the jars, caps and grinders. We acted as the intermediary between Verstegen and its suppliers. We provided the technical drawings [6.34], the line assessments, the quality control on the tooling and all other activities the production preparation required.



[6.34] Example of technical dossier

6.9 End result and project evaluation

This project for Verstegen was one of the projects that led to an increasing insight into the need and the development of a new design approach.

Next to that, it showed what Demand Driven Designers could learn from their Author Design colleagues; in this case ‘traditionally’ trained graphic designers. It showed in what way these two disciplines could work together in a synergetic, parallel and simultaneous process. Although the ultimate proof cannot be given, it is very likely that the quality of the end result was particularly enhanced by these aspects. In comparison to the first Verstegen project, where an integrated process could not yet be followed, the difference in quality is striking. That the quality of this second project was generally considered to be outstanding, is suggested by the fact that the result received many – international – design awards, like the RedDot in 2010, the PentaAward in 2009 and a nomination in the Dutch Design Ward 2010 [6.35].

With all their new products and the line-extension with the AH version, Verstegen grew to a strong and solid market share of approximately 60 – 70%. So next to these design awards, also retailers and consumers showed their appreciation. It does not seem exaggerated to state that this project was a clear example of the potential value of integrating ‘Demand’ and ‘Author’ design.

[6.35] Logos of Design awards

7. Industrial Design in Theory and Practice

The first chapter was in fact a professional travelogue in time, sketching the path the author, co-founder of FLEX, followed during the first 25 year or so of his career as an industrial designer. Developments recounted in chapter 1 aimed to elucidate particular circumstances which influenced and affected choices made and reasons for doing so. Combined, these elements gradually changed him from being a professionally trained, but practically un-experienced industrial designer to become a practically shaped and - for better or for worse - experienced one.

In chapters 2 – 6, five projects were described. It is important to emphasize that work on all of them was done by a design-team in which, next to the author in his role of chief-designer, other designers and engineers were involved. The projects were executed over the years, spanning from 1995 (Coca Cola) until 2009 (Verstegen), in which the gradual development of a new approach can be observed. The reasons why these particular projects were selected are:

1. They span a relatively long period during which practical experience was accumulated, starting out using the traditional classical design methodology but feeling an increasing need for something extra. This culminated in the development of a new design approach, use of which is best illustrated by the last project to be dealt with - that for Verstegen. This period runs largely parallel to the market developments as described in chapter 1.

2. In his role of chief-designer in all these five projects, the author is able to offer both an inside perspective and first-hand account of all the ins and outs of the projects.

3. Each of the five projects shows different elements paving the way to the development of a new design approach:
   - 3.1 The Coca-Cola project illustrates the need for reframing;
   - 3.2 The 1-2-Paint packaging for Akzo shows the importance of what I have called the *creative spark;*
   - 3.3 The 360 stacking chair for Ahrend defines the importance of respecting the first idea throughout the entire design and development process;
   - 3.4 The stair lift developments for Otolift provide an example of the limitations of Creative Reflection, in which the complexity of a project demands for the more sequential classical approach, but in which well-organized creative activation *should* also still play a vital role;
   - 3.5 The two Verstegen packaging projects demonstrate the differences between the more traditional 2D/3D separated design process and a fully 2D/3D integrated Creative Reflection approach.

In the first place, to avoid any misunderstanding on what this chapter is all about, it seems prudent to start by answering this question in a negative way, that is, to stress from the outset what it is *not* about, and two things need to be emphasized in this respect:

1. Although the so called 'classical' design methodology[46] is criticized from a practical – and not from a theoretical – viewpoint, the intention of what follows is not to deal with it in the sense of dismissing it altogether as being of no practical use. On the contrary, it is stressed that the classical approach is a useful practical tool for a specific type of design problem, namely those that are characterized by a high degree of technical complexity combined with relatively low degree of innovativeness (re-design). So, the essential point being made in this chapter is that the classical methodology *is* of practical relevance in design, but in a more limited sense than sometimes is assumed.[47]

2. This chapter is also not intended as a contribution to *prescriptive* design methodology[48], as the literature on this topic is not extensively dealt with, but only hinted upon where and when it is thought to be clarifying the points made. There is a good reason for this: As the author considers himself a trained design practitioner - and so: not a professionally trained design theorist – he was aware that the Dutch proverb "Cobbler stick to your last" should be written in large capitals on the wall of his study, when crossing the border from practice to theory in design. Moreover, this text is (as it was repeatedly stressed) essentially a justification of five technical designs, and *not* a dissertation in design methodology, which is something completely different.

So, what then is this chapter about, formulated in a positive way? Essentially it is an essay in self-reflection by a design practitioner, hovering on the relation between theory and practice in design, intended as a modest contribution to *descriptive* – as in contrast with: prescriptive - design methodology.

[46] For a summary of what is subsumed under 'classical methodology' in this context, see: par. 7.1.

[47] In fact, this is not a completely new viewpoint. Recent - and not so recent - literature time and time again stressed the limited practical applicability of so called 'prescriptive' methodologies (of which the 'classical' model is a classic example) due to their necessarily generalized nature, vis a vis the huge variety and heterogeneity of design problems in general, asking for a more 'case specific approach' in order to enhance practical applicability.. See for instance: (Dankers & Lutters 2010: pp. 1-2; Nieberding 2009; Tomiyama, Gu, Jin, Lutters, Kind & Kimura 2009). The problem was already hinted upon in (Lutters 2001: pp. 17 -35). This point is elaborated in par. 7.1.

[48] The distinction between prescriptive and descriptive methodology comes from (Finger & Dixon 1989). Ng quotes (Buchanan, Dillon & Corner 1999) who define: "… Normative models describe how decisions should be made, while descriptive models describe how decisions are made, and prescriptive models describe how decisions should and can be made…" (Ng s.a.: p. 1).

In that sense, the description of the five submitted projects (Chapters 2 – 6) serve as a some sort of five primitive - and, due to the nature of this text, necessarily: ex post - 'roadmaps' that are at the heart of descriptive design methodology,[49] that, taken together, form the basis for reflection on the following questions:

1. What was I supposed to do, as a designer, according to the prescriptive methodology, offered by the classical approach that was taught to me as a student of industrial design?

2. Why and when did I deviate from the 'road' that was suggested to me by classical methodology?

3. When I deviated from the prescribed road, what else came along as some sort of guiding principle for the further development of the design problem at hand, and how was this new principle related to the final result?

At the risk of prematurely fading gun-power, I will reveal here that the substituting principle that apparently guided my work, when and where the classical approach fell short, was something that I have called 'Creative Reflection', and that in my opinion seems to give more room for intuition and free roaming creativity than the classical approach seems to allow for. Whether this –no doubt, rather elusive – concept of 'Creative Reflection' should be incorporated into prescriptive methodology, and if so, how this should be done, I will ("Cobbler, stick to your last") of course leave to design theorists. In that sense, this chapter also could have been aptly labeled: Creative reflections on 'Creative Reflection'. No more than that, but also no less.

49 Cf.: (Dankers & Lutters 2010: p. 3): "…A roadmap, therefore, does not prescribe the processes that need to be executed (…). It rather gives an overview of the information that is (…) gathered during a development process…".

7.1 The 'Classical' Methodology of Industrial Design

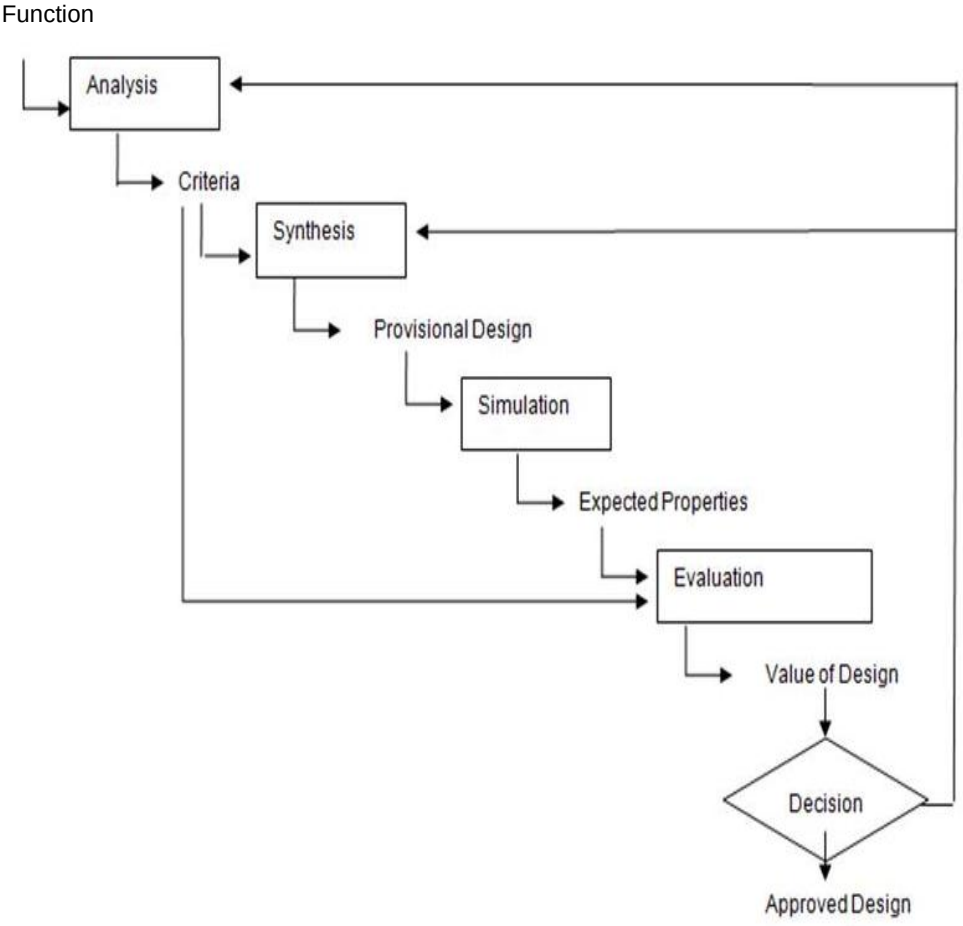
Industrial design education in The Netherlands has been – and to a large extent still is – dominated by the curriculum used by the faculty of Industrial Design Engineering at Delft University of Technology.[50] The design methodology at the heart of this curriculum has been – and again, to a large extent still is – based on a model developed by Roozenburg and Eekels[51]. Their model is a perfect example of what can be aptly named the 'classical' methodology of industrial design[52]. In order to understand what is at the heart of this methodology, it is useful to summarize the model and list its most important characteristics [7.1].

[50] This was certainly true in the 1980s, when the founders of FLEX, Ronald Lewerissa and the present author were students of industrial design, as, at that time, Delft University of Technology (DUT) was the only technical university in The Netherlands offering a MSc (ir.) in industrial design engineering. Industrial designers were also trained at various polytechnics and art academies – the most influential of them being the *Academie voor Industriële Vormgeving* (AvIV, now: Design Academy) at Eindhoven – but these institutes too were influenced by the 'classical' methodology. This situation remained unchanged until,1999 when Lidewij Edelkoort was elected chairwoman of the AvIV., She renamed the institute and initiated a radical paradigm shift, resulting in a severe methodological split between the curricula taught in Delft and Eindhoven. From that time onwards, the Design Academy educated what I have labeled 'Author Designers', while Delft continued to produce those I call 'Demand Driven Designers'.

[51] The Roozenburg & Eekels method was originally published in the form of a series of internal lecture notes in 1978 (Eekels & Roozenburg 1978). A book version in Dutch was published in 1991(Roozenburg & Eekels 1991), to be followed four years later by an English edition (Roozenburg & Eekels 1995). Even in 2008 the highly influential QUANU Research Review stated that "…Roozenburg & Eekels (1995) is the standard work on the design process in companies and educational institutes around the world…." (QANU 2008: p. 26).

[52] Although not explicitly acknowledged by them, the Roozenburg and Eekels approach is rooted in the so called 'Ulm model' which originated from the legendary *Hochschule für Gestaltung* (1953 – 1968) where an 'applied-scientific' approach to industrial design replaced the traditional 'applied-art' version. Similar methodological models for industrial design, like those of and Koberg & Bagnall (1972) and Bürdek (1975; 1991) all go back to a model formulated in 1960 by designer and Ulm-teacher Hans Gugelot. These models became the standard methodological framework for Western academic curricula in industrial design during the second half of the 20th century, hence the epithet 'classical' seems fitting in this context. A seminal article in *CIRP Annals – Manufacturing Technology* shows however that this family of models is in its turn part of a much broader 'extended family', rooted in the methodology of German manufacturing going back as early as the mid-nineteenth century (Tomiyama, Gu, Jin, Lutters, Kind & Kimura 2009).

The model is derived from the well-known 'empirical cycle'[53] which describes the process of empirical scientific inquiry. Design is presented in the model as a strictly iterative-sequential process which leads the designer from a specification of desired functions of the object to be designed, via a series of discrete consecutive steps and iterations to a result (the 'Approved Design') which complies with the bundle of functions specified at the beginning.



[7.1] The basic cycle of design, according to Roozenburg & Eekels (Roozenburg & Eekels 1995: p. 88)

Modification of the empirical cycle is needed because of fundamental differences between the ultimate results reached through a process of empirical scientific inquiry set against a design process. In any scientific inquiry, research is "..triggered by a discrepancy between the facts and our knowledge …(and) the aim of the process is adjustment of our knowledge to the facts …, (while) the problem at the onset of the design cycle is a discrepancy between the facts and our valuation of the facts, the aim of the process is adjustment of the facts to our values and preferences …"[54]

[53] The empirical cycle became widely known by the work of Dutch psychologist A. D. de Groot (De Groot 1969).
[54] (Roozenburg & Eekels 1995: p. 117).

This statement is so self-evident that it is almost a truism, but elaborating on it, Roozenburg and Eekels, arrived to views that were, at least from a practical design viewpoint, highly controversial and that, to my best knowledge, had not been pointed out before. They wrote: "..Designing is the construction of *possible* worlds in which the designed product or process could appear and function. There is but one actually existing world, but there are many possible worlds. Possible worlds exist only in the domain of the mind. *A flawless design process can thus take place entirely in the domain of the mind*…"[55]

While this may be correct from a theoretical point of view, it is less useful on a practical level. In design practice there is – contrary to design theory – no such thing as an abstract bundle of functions at the start of any design problem which exist only in the mind. For product design at least, these bundles of functions are, from the very beginning, always connected to the existing, material world.[56] Technology is from the very start at the heart of product design.[57] While *possible* solutions may exist in the mind, *both possible and technically feasible* solutions should be found in the real world, and even at the start of the process of product design, a crude, primitive set of them is present.[58] Indeed, the essence of product design can be thought of as a selection procedure, starting with a set of both possible and feasible ex-ante-solutions that more or less meet up to the bundle of functions specified, to end up as a final ex-post-solutions in which these functions are complied with in a superior way.[59] The implication of this is that product design is, *in practice,* of a substantially different nature when compared with the procedure the classical model indicates the case to be. It is *not* the systematic search for brand new solutions to a bundle of desired functions that have never been met up to before, as the classical model propounds. In practice it consists mainly of a transformation process, whereby existing solutions for a given problem in a certain – *material, not spiritual* - domain, are transformed into another domain. The purpose of this is to combine these solutions and comply with a set of functions that has to date been met in a material solution perceived as being unsatisfactory.

[55] (Roozenburg & Eekels 1995: p. 177 my italics).

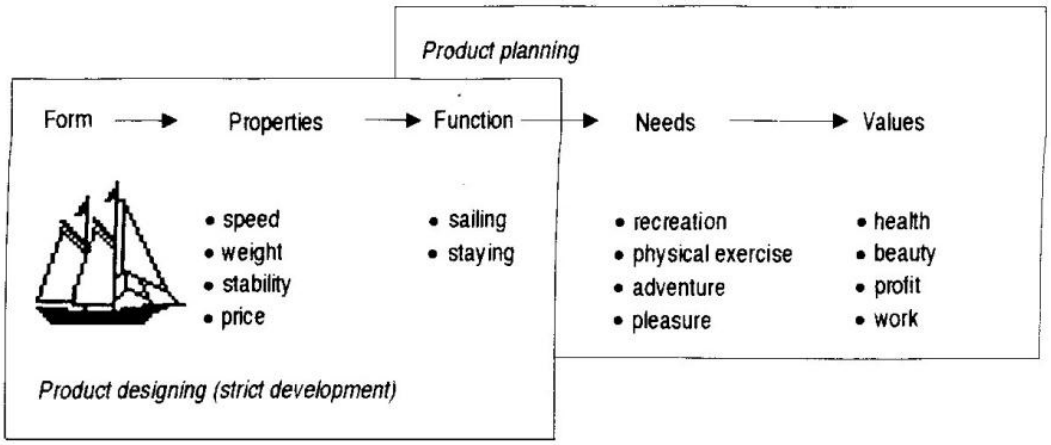
[56] This point is nicely illustrated by a persistent anecdote that haunts the world of product design for a very long time. Shortly after the introduction of the CD as a superior alternative for the LP-record, a famous product designer was asked by Philips to design some sort of staking device. His first – and final - report (a stunning example of a 'flawless design process, taking place entirely in the domain of the mind") consisted of one short sentence: "CD's stack themselves". His client was amused, but less so, when he discovered that the designer had presented along with his report a request for the payment of the previously agreed honorarium of several thousands of guilders.

[57] This does not of course mean that technology is the only thing at the heart of design.

[58] Note that in contrast the Delft Innovation Model (Buijs 2012) starts with a phase "product in use'! See par. 7.8.1.

[59] Naturally, this does not imply that all possible and feasible solutions are present at the beginning. It may very well be that the solution which best satisfies the overall set of desired functions, pops up somewhere along the way of the design process.

A second point on which the classical model is clearly at odds with design practice, concerns the assumed relationship between bundles of properties in a product and the corresponding bundles of functions in it. As Roozenburg and Eekels put it: "…A product is a material system, which is made by people for its properties. Because of these properties it can fulfill one or more functions. By fulfilling functions a product satisfies needs, and this gives people the possibility to realize one or more values…"[60] On first sight, this quote seems to be nothing other than a neatly formulated summary of the role of design in relating material form – via properties and functions – to needs and finally from there into values. What can be wrong with that? However, elaboration on their own example – a sailing boat – used to illustrate the relations involved reveals that the relation between properties and functions is in fact more complicated than their example seems to suggest. [7.2]



[7.2 The function as a link between product planning and product designing, according to Roozenburg & Eekels (Roozenburg & Eekels 1995: p. 54)

The point is that the sailboat-example is characterized by a sequence that runs in exactly the opposite direction; it starts with the final *result* of a design process (in this case some sort of sailing contraption). From this materialized form, a set of properties are deduced that, in turn, provide a set of functions that satisfies a set of needs associated with a corresponding set of values. In other words; a *known* materialized form is by way of deductive reasoning analyzed into a set of components (properties) which allow the performance of a *known* set of functions. However - also according to the classical model itself - a design process runs exactly the other way round: It starts from a set of *known* functions[61] that are supposed to be performed by a set of properties, embodied in an as yet *unknown* materialized form. The confusing element in this is that the model implicitly assumes it is possible to operate – to a considerable extent – in both directions in more or less in the same way.

[60] (Roozenburg & Eekels 1995: p. 54).
[61] Also according to Roozenburg and Eekels: See [7.1] above!

This is not the case in practice, however. *Deducing known* functions from a *known* form – as in the sailboat-example –, is fundamentally different from *inducing* an *unknown* form from *known* functions. Going from left to right in the model is far easier than the other way round, simply because in the first case, you start with a *known* form from which you can deduce a - perhaps never exhaustive - list of properties. Travelling in the other direction – design in practice – you start from a set of desired and so *known* functions in order to reach an as yet *unknown* materialized form. This has far reaching implications for design in practice. To illustrate, let us look once again at the sailboat example, but now from a practical design point of view, travelling in the model this time from right to left. That is: from *known* functions towards an *unknown* form.

The first thing to note is that the set of specified desired functions known to the designer is always undetermined and moreover, elements in the set are more often than not in conflict with each other, even to the point of being mutually exclusive. In terms of the example ‘sailing’ and ‘staying’ are two functions the unknown materialized form will have to fulfill, but what about ‘surviving’? This function may be taken for granted as far as sailing on recreational waters is concerned, but it becomes a crucial factor – if fact, the most crucial of all … - when it comes to ocean sailing. As such, the addition of ‘surviving’ as a function would not be outrageous, and so on - the set of functions can be expanded, literally without end.

Now, let us view the set of functions from a practical viewpoint. Here one has only to compare any existing pleasure yacht with any existing ocean racer to realize that ‘staying’ and ‘sailing’ are in fact conflicting functions. Ocean racers are designed for maximum speed, and as ‘speed’ and ‘weight’ are properties that bear an inverse relation to one another, weight is reduced to its utmost. The resulting interior, stripped with everything not absolutely necessary for ‘staying’, is consequently completely Spartan and the bare minimum possible.

On the other hand, pleasure boats are all, to some extent, a compromise between the functions ‘sailing’ and ‘staying’, as every tiny bit of materialized form aimed at ensuring a comfortable stay, is, by adding weight, paid for in terms of speed.

The same problem haunts the set of properties. Continuing with the same example, every ship designer knows that adding weight increases stability, but reduces speed. By comparison, every cyclist knows that speed and stability are positively related, a law of nature which holds true for sailing boats as well as bicycles. Introducing other – rather obvious – properties makes things even more complex. Think, for instance, of the concept of ‘safety’ as one of the main properties that is positively related to the function of surviving.

In the first place ‘safety’ is a property, embedded in and affected by *all other* properties and, to make matters even more complicated, in a manner highly unpredictable and often ambiguous.[62] Linking this with our example; ‘stability’ is always positively related to safety, but ‘speed’ can be positive (avoiding a collision) or negative (man overboard).

Therefore, functions are often contradictory and properties are related to one another in a highly unpredictable manner. What does this mean for design in practice? Simply that it is often impossible to analyze the main problem (set), especially in the so called ‘fuzzy front end’ of a design problem, and to formulate a set of more manageable sub-problems (its constituent elements), without losing track of the complex and often unpredictable relations between these sub-problems that may in the end prove to be of vital importance to the final solution. In other words, analysis may enhance clarity when dealing with a fuzzy problem, but this inherently shrouds the ‘wholeness’ of the problem. And if there is any kind of problem where the dictum ‘The whole is more than the sum of its parts’ is applicable, it is the problem of design. The solution is always some sort of ‘whole product or product system’, which is essentially different from a ‘form, seen as a bundle of different properties’.

The foregoing holds important consequences for the practical relevance of classical methodology. In practice, a design problem does indeed start with the question whether there is a materialized form imaginable that would function in such a way that would improve a perceived “adjustment of the facts to a set of values and preferences”.

This start is no different from that of classical methodology. And yes, there are some analytical steps taken in order to come up with a rough, provisional idea about what the intended materialized form should be able to perform. In practice however, a procedure now sets in that is intended to keep track of the ‘wholeness’ of the solution. In other words, right from the very beginning or from the fuzzy front end of the design problem, a type of *synthesis* always accompanies each analytical step taken. This is necessary in order to prevent the blurring of the complete mental picture of a number of different *overall* concepts, which is, by definition,[63] the inevitable consequence of any analytical procedure.

[62] A notorious example is found in a famous research project, carried out in the faculty of industrial design engineering of DUT in the 1980s on behalf of the Norwegian fishing authorities., It indicated clearly that the, in the course of years, increasing number of warning systems required by governmental regulations on professional fishing boats, actually correlated significantly with the number of fatal accidents. The simple explanation was that the overwhelming number of different warning systems created a chaos of whistles, buzzers and flashlights on board, so captains tended to disconnect these devices in order not to be disturbed by them, should circumstances become tense.

[63] Analysis is from the Greek αναλύσει, that is: to cut into pieces.

There are two other aspects of classical design methodology that severely limit its usefulness in practice and which have not gone unnoticed in recent literature. The first is; classical design methodology acts as a straitjacket as far as creative thinking is concerned.[64] The second, in the words of Nierberding; "… (Design methodologies) should preferably have universal application, owing allegiance to neither traditional discipline, industry or product …[65], (while for practical usage) models should be tailored for each project to meet the requirements of each individual project…."[66] Even though the last point cannot be considered a serious blow to the validity of classical methodology, as it points to the universal problem of applying a general theory to a particular case, it is nevertheless undoubtedly true from a practical viewpoint. The first point, however, is a little more puzzling. Why should the classical approach stifle and not enhance creativity? The explanation for this can be found in the fact that the cycle classical design methodology uses is derived directly from the cycle of empirical scientific inquiry.[67] The point is that the empirical cycle is essentially about hypothesis *testing* and omits any mention of the process of hypothesis *finding*. In other words; the empirical cycle leads one to believe that a hypothesis drops into the mind of the researcher like manna from heaven, which, once settled there, adheres to a strict sequential stepwise procedure in order to discover the extent to which it is fruitful in solving the problem at hand. The procedure itself prods the researcher to remain in the direction pointed towards by the – apparently 'God given' – hypothesis, something which will inevitably clear his mind of any different hypotheses as well. If the word 'hypothesis' is substituted with 'provisional design' in the previous sentence – and this is exactly what Roozenburg and Eekels do, – it becomes clear immediately why the classical model stifles creativity. Creativity is essentially a process of playing around with different 'provisional designs' in a way similar to that of a juggler maintaining a dynamic balance between several different balls at the same time. Again, in the words of Nieberding, "… (the) development is more than a rigid, pre-determined set of tasks. It is clear (…) that intuition, imagination (and) the use of presuppositions[68] (…) are real, legitimate, useful parts of the creative, heuristic process to develop products…" Note that these words are not those of a design practitioner, but from the author of a Ph.D.- thesis on design, and as such a theorist.

[64] See for instance: (Tomiyama, Gu, Jin, Lutters, Kind & Kimura 2009: p. 562).
[65] (Nieberding 2009: p. 34).
[66] (Nieberding 2009: p. 35).
[67] (Roozenburg & Eekels 1995: p. 115).
[68] Presuppositions can be seen as provisional, not-yet-tested and more or less vague hypothetical ideas about all possible aspects of a number of different provisional designs.

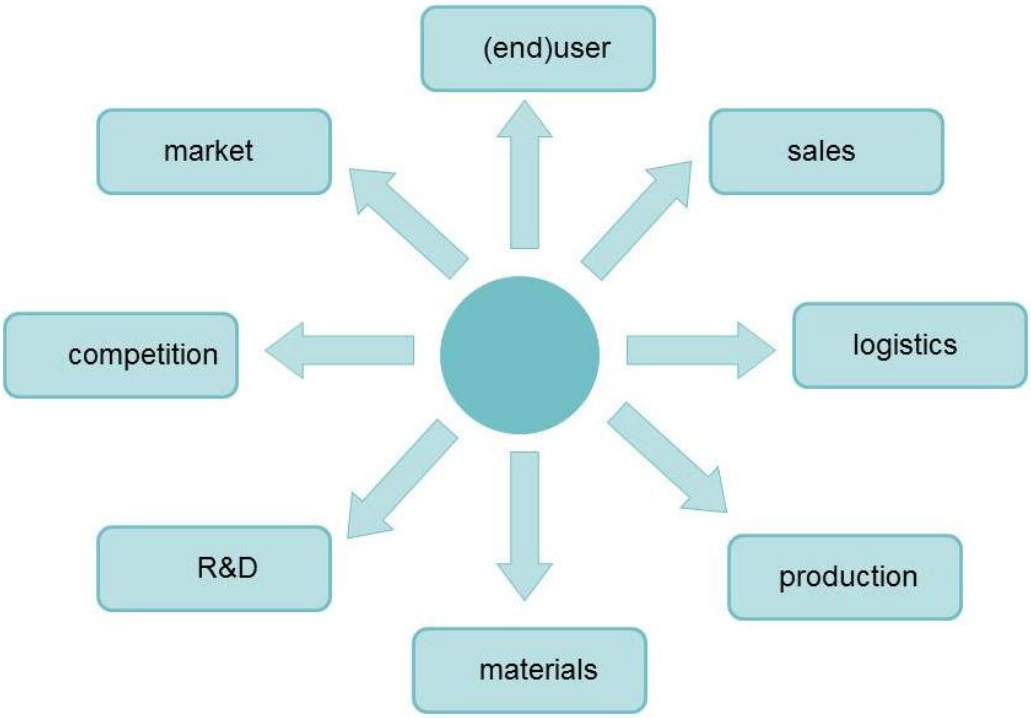
Speaking personally as a design practitioner, I could hardly agree more. However, more remarkable is the fact that two other – first rate - design theorists seem to agree with Nieberding, and they are no less than … Roozenburg and Eekels themselves! Commenting on their own sailing boat example, they conclude: "…The reasoning *from form to function* is – as we have already seen – a form of reductive reasoning. This means that the conclusion (the design) does not indisputably follow from the premises (the functions to be fulfilled), and that, in principle, there are many good solutions. The reasoning from function to form is a creative process, which can be encouraged methodologically, but cannot be logically guaranteed…"[69] While these words are surely true and wise ones, at the same time it cannot be denied that these same words seriously erode the useful practical applicability of the model they themselves advocate.

Needless to say it *cannot* be concluded from the above that classical methodology is always useless in practice, it only infers that its practical use is limited. Indeed, all design projects are of a more or less "*chaordic*" (that is partly chaotic and partly ordered) nature[70]. To be more precise, the outset is chaotic, but the project becomes more ordered in the course of the design process itself – that is to say at least when everything works out well ... It goes without saying that some design projects are more chaotic than others. It is less chaotic when the aim is to improve an existing solution (re-design) than when endeavoring to find a completely new solution (innovative design) to a given problem. Besides this, the level of technical complexity of the design problem at hand is inversely proportional to its overall clarity and manageability. Remembering Nieberding's earlier quoted words, ("..model should be tailored for each project to meet the requirements of each individual project .. ") and taking a small step in the direction he suggests, it follows that classical design methodology is indeed a useful tool in solving design problems that are from the outset in essence fairly well-defined. This holds even truer when the problem in hand is technically highly complex. In other words, the classical approach is an indispensable tool in solving design problems that are, from the onset, fairly well ordered by nature (re-design).

When the problem in hand is, from a technical point of view, highly complex, this is the case as well once the most chaotic early phases have transpired and the most promising concept has been selected from a number of earlier ones. Classical design methodology is less useful, even to the point of being detrimental, when applied to design processes requiring a radical breakthrough where finding a not-yet-existing solution for a problem is the aim.

[69] (Roozenburg & Eekels 1995: p. 54).
[70] (Drukker 2009: p.7).

By way of summarizing this section; the most important characteristic of classical design methodology is disintegration of the overall design problem in the first analytic phase. The approach taught - and still taught - to students of industrial design is to start by stripping the design question into smaller parts and questions and to solve these as separate entities. Note, however, that this procedure aims essentially to link a set of desired functions to a set of properties that will perform these functions. In other words, the design problem is seen essentially as a technical problem, and in such cases the classical approach is a valuable tool . In practical design assignments, however, the technical aspects range among many others the designer has to deal with. Furthermore he has to deal with all these aspects simultaneously, in a way compared earlier with a juggler manipulating a number of balls at the same time. If the designer follows the classical approach and analyzes all these aspects separately, then – elaborating on the same metaphor – balls will be flying in all directions and he is likely to lose his grip of the problem as a whole even in an early phase [7.3].



[7.3] first phase of the classical design methodology in practice

A second impediment encountered in classical methodology is its tendency to stifle creativity through the fact that it derives from an empirical cycle (dealing with hypothesis testing *not* finding).

7.2 Rules for Unruly Design

As spoken of in the first chapter, the last quarter of the 20th century saw the rise of highly successful 'Author Designers'. They contrasted considerably with the 'classical' industrial designers. The suggestion was made that in all probability, part of their success was due to the fact that they were not hampered by classical methodology or, for that matter, by any prescriptive methodology at all. This meant they were able to work more intuitively giving ample scope for personal creativity. It is in this context relevant to examine *their* approach to design a little more in order to find out whether complete absence of classical design methodology actually means their way of solving design problems has no identifiable method underlying it at all.

Eggink has made a recent attempt to clarify the approach of Author Designers. [71] He showed in his *Regels ter Ontregeling* (Rules for Unruliness) that the seemingly completely unhampered and free roaming creativity characterizing the work of Author Designers can in fact be neatly categorized into five different approaches to the design problem in hand:

1. Combination of different domains [7.4]
2. Inspiration from a popular context [7.5]
3. Lust of form [7.6]
4. Ready-mades and objets-trouvés [7.7]
5. Aberrant use of material [7.8][72]

[7.4] Combination of different domains: Tawaraya, Massanori Umeda, Memphis (1981).

[7.5] Inspiration from a popular context: Wink chair, Toshiyuki Kita (1980); Juici Salif, Philippe Starck (1988).

[71] (Eggink 2011: p. 199).
[72] (Eggink 2011: p. 237).

[7.6] Lust of form: Kettle, Michael Graves (1985); Heatwave radiator, Joris Laarman (2003).\

[7.7] Ready-mades: Mezzadro, Achille and Pier Giacomo Castiglioni (1957); Chest of Drawers, Tejo Remy (1991), Lamps Chandelier 85, Rody Graumans (1993)

[7.8] Unconventional use of materials: Concrete Stereo, Ron Arad (1985); Rag Chair, Tejo Remy (1991); Fragile Bottles, Hella Jongerius (2000).

Eggink identifies and describes exactly the designs that prompted many industrial designers to rethink their own profession. As asked in the previous chapter: “Why were these designs so much more inspiring?” “How did these designers come to these inspiring results?” “What could it be that was missing in classical industrial design approach seeing that almost none of these designs were the brainchild of designers (such of those at FLEX) with an technical university background.?” However, the flaw is that while Eggink neatly classifies five different approaches, the question as to exactly how the designs dealt with, were conceived or created, is left unanswered. Although his classification contributes to clarifying the inspirational context of the work of Author Designers, it does not provide solid support for an actual new design approach itself.

Nevertheless, it is not impossible to offer a hint to the answer to that important question. It is easy to identify that the common element in the approach to all these designs is a complete reversal of that used in classical methodology. In each case it is not about '*testing*' a given provisional design, but rather about *'finding'* a completely new provisional design and endeavoring moreover to come up with a feasible solution that, at first sight, is a highly improbable successful candidate; a chandelier for the top-end of the furniture market being sold at present for more than 6000 US-dollars? Start with ordinary bulbs, and do not add anything else. How to connect the upper part of a bottle with a different lower part? Use tape! What material is best suited for a highly exclusive chair? Rags of course!

Viewed from this perspective, these 'unruly designs' add, each in its own way, support to the earlier mentioned point that classical methodology and creativity appear to exclude one another to some extent This raises the question whether it is possible to look for a different design approach that would alleviate the seemingly inherent obstacles to creativity present in the classical approach, while still retaining its positive aspects. To summarize this; the new approach should ideally facilitate:

- Integration, alongside analysis;
- Creativity, alongside testing existing solutions;
- Intuition, alongside rational thinking;
- Originality, alongside adaption of existing solutions;
- Meaning, alongside functioning in the sense of usability;
- Multi-, or even random directional creation, alongside sequential creation.

To provide a basis for this, it is necessary to look more closely at the mechanisms of creativity.

7.3 Towards a new design approach

Ideally, a new approach should contain attributes which remove as many of the obstacles described in the foregoing section as possible while, at the same time, positive aspects of traditional design methodology are still retained. In order to achieve this, a better understanding of the way creativity and intuition work is needed.

7.3.1 Creativity and knowledge

How can these fuzzy types of problems, that design problems so often seem to be, be solved? Robert Sternberg[73] sought to clarify the relationship between creativity, knowledge and intelligence by means of an interesting experiment. In this, undergraduates of other disciplines were asked to solve complicated physics problems. Completely lacking the knowledge required to tackle the assignment, it is not surprising that they were unable to offer any solutions at all. The same assignment posed no problem whatsoever when given to people educated and trained in the area involved. Sternberg makes reference in this respect to creative persons like Picasso, the Wright Brothers and Edison all of whom reached their highest creative achievements using knowledge gained from earlier projects and activities. This would suggest that creative thinking is rooted in the past and possibly linked to gained knowledge. Besides differences in levels of knowledge gained, it is obvious that differences in individual levels of creative thinking will exist as well. This raises the question whether there is a basic difference between a creative and a non-creative thinker and whether, assuming an equivalent level of motivation, each would offer a different level of creativity to a certain situation. De Bono[74] reminds us however, that, in order to solve a certain (creative) problem, one should adopt a fresh perspective. The fresh perspective he offers in his examples, is often provided by an outside person. From this one can infer that De Bono considers gained knowledge to be an impediment to creativity to some extent at least.

Sternberg's experiment proves that creativity is positively linked to acquired knowledge and experience in that it facilitates recognition of similarities in different problems. In that sense, part of the creative process is pattern recognition. This however, hampers – almost by definition – the adoption of a fresh perspective to a certain problem (De Bono). To put it succinctly; acquired knowledge is linked to creativity, but only to the extent that it does not stand in the way of discovering completely new ways of looking at the same problem.

[73] (Sternberg 1999: pp. 226 - 229).
[74] (De Bono1973: p. 194).

Designers are confronted with this ambivalence in each and every design problem where innovation – rather than re-design – is at the heart of the problem. Fortunately, experience has equipped them to deal with this paradox.

If knowledge/experience and creativity needs to be combined, it is necessary to think simultaneously 'inside the box' (experience), and 'out of the box' (free roaming creativity). The latter, according to experts, means even to come up with 'crazy' ideas. It is apparent, that apart from free roaming creativity, another mental property is required. This is something we call 'intelligence', which, when dealing with practical problems, translates into 'ability'.

7.3.2 Creativity and intelligence

The most conventional definition of what creativity is in relationship to intelligence is that creativity is a subset of intelligence. Precisely what the nature of their mutual relationship is, is unclear. The temporary and rather inconclusive outcome of this debate is interesting in the sense that the relationship is of apparent relevance to creativity in design. Sternberg[75] defines three basic aspects of intelligence that play a crucial role in creativity and which need to be present concurrently:

- Synthetic intelligence/ability,
- Analytical intelligence/ability and
- Practical intelligence/ability.

7.3.2.1 Synthetic ability

Synthetic ability is the mental power needed to generate ideas that are novel, of high standard and task appropriate. To possess this ability, a person needs a certain meta-skill that enables him to redefine problems in way often very different from the way others would. This creative person is, by way of speaking, able to "defy the crowd" and tackle challenges in a new way. The skill required is a combination of ability and attitude[76]. There are other relevant attributes a creative person should have high levels of:

- ability to insightful thinking;
- ability to distinguish between relevant and irrelevant information;
- ability to select and combine bits of relevant information in novel ways.

[75] (Sternberg 1999: p. 255).
[76] (Sternberg1999: p. 256).

7.3.2.2 Analytical ability

Analytical ability is the quality to:

- judge the value of one's own ideas; to decide which ideas are worthwhile pursuing;
- evaluate the strengths and weaknesses of ideas;
- suggest ways in which ideas can be improved.

An idea can be judged properly in a number of ways. The most traditional ones make use of an extensive list of requirements to which the new idea should adhere. These are similar to the well-known program of requirements used in the 'classical' Roozenburg & Eekels model. Franklin offers an interesting and more open and intuitive method with his 3P-model [77]. In this the three P's stand for Power, Performance and Perception providing designers with a simple tool with which to quick-scan in an intuitive manner the value of their ideas.

Power:
An objective measure of what the innovation can actually do; is it up to the task at hand and will its performance be significantly better than that of any competitor?

Performance:
A measure of how users will actually be able to use the product in a way clearly better than anything available at present.

Perception:
Given the innovator's power and past performance, will users really adopt and buy it?

More than twenty years of experience at FLEX suggests that a more intuitive and faster selection of ideas in the early stage does indeed support the creative process positively. Traditional methodologies often use extensive lists of requirements with which the design concepts have to be compared and evaluated. This is a very time consuming activity and often experienced by designers as a handicap to their creative activity. The new design approach therefore, should enhance creative freedom and in this Franklin's simple quick-scan could be a useful starting point for a faster selection procedure.

[77] (Franklin 2003: p. 115).

7.3.2.3 Practical ability

The third factor involved in creative performance is *practical ability*; the capability which enables one to use his or her creative skills in an everyday context. As creative ideas are often unexpected, they can easily be rejected at face value. A creative person should be capable however of communicating his ideas effectively and to convince others of their value. Stated plainly; a creative person should be able to *sell* his ideas successfully. With reference to radical innovations, Leifer cs. [78] named practical ability focused on proper communication of creativity the 'building of project legitimacy'. Brown[79] and other authors after him coined the phrase 'storytelling'. Whereas other business consultants usually need to base their advice on actual reports, a designer can communicate his ideas directly to his client in a way whereby they too can visualize the solution. As clients are generally more sensitive to visualizations and even better, prototypes, the opportunities open to a designer to communicate his advice in a potentially more successful way than many others can do give him a considerable advantage.

All of the above attributes point towards a set of practical skills designers need to acquire through education which subsequently need to be developed further through actual design practice. How does this translate into a new design methodology?

7.4 Design Thinking

Design thinking, a 'buzz- expression 'of recent popularity, is something through which designers apparently hope to discover their ultimate destiny. The concept infers that because of the way designers think and operate, they possess the key to the solution of a range of problems broader than just product design. This means that the discussion about design thinking is in fact taking place within a context extending beyond the overlap and differences between the working areas of Author and Demand Driven Designers. Nevertheless, it presents an interesting starting point, not only to learning more about the concept, but also to examine its possibilities as far as new design methodology is concerned. A recent paper by Banny Banerjee of Stanford University[80] provides an interesting insight regarding the differences between traditional analytical problem solving approaches and the way designers tend to operate in this field.

[78] (Leifer c.s. 2000: p. 68).
[79] (Brown 2009: pp. 129 – 149).
[80] (Banerjee 2011: p 6).

Banerjee states that design thinking is: “a process to *rapidly generate* innovative *solutions*, strategies, systems and paradigms.” In his view the most important distinctions between *design thinking* and the *traditional problem solving* strategies are:

Traditional: analysis based strategic decisions
Design thinking: synthesis based strategic decisions

Traditional: pure logic and evaluative deduction
Design thinking: induction, situated cognition

Traditional: think it all through before acting / investing
Design thinking: think while doing, rapid prototyping as an efficient way to eliminate risk.

Prior to Banerjee, a more or less similar comparison of creativity and more traditional problem solving was put forward by Verganti, who compares researchers and creative (design) teams, showing the following contrast [7.9] [81]:

	Forward-looking Researchers	**Creative teams**
Output	Proposals, vision, framework	Answers, ideas
Process	Depth, research and experiment	Speed, brainstorming
Dynamics within the circle or team	Convergence	Divergence
Assets	Knowledge, scholar	Methodology, ignorance of constraints
Quality metrics	Robustness of the vision Impact of the vision on society	Number and variety of ideas Solution to a problem
Vision of society	Strong personal vision	Culturally neutral
Attitude toward existing sociocultural paradigms	Challenging the dominant paradigm	Playing with the existing paradigm

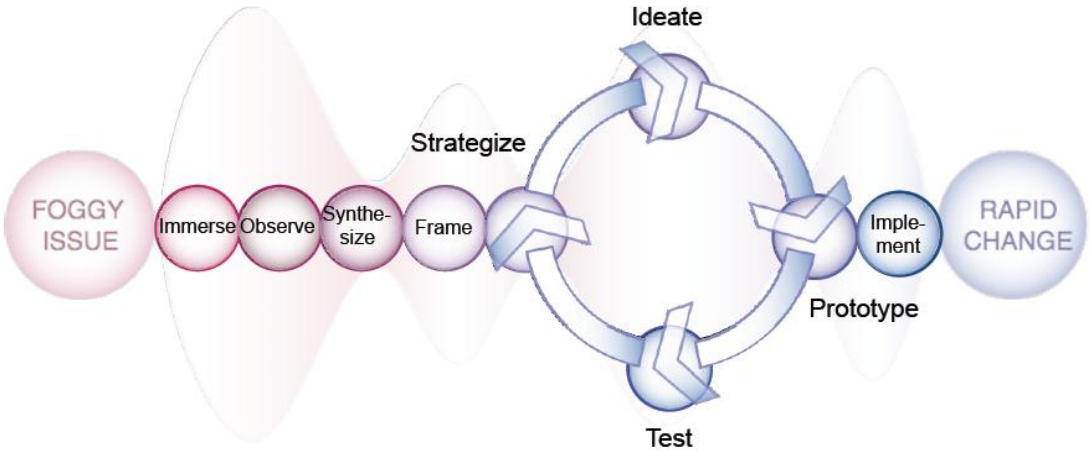
[7.9] Comparison between researchers and creative teams; Verganti (2009)

The differences both Banerjee and Verganti identify between an analytical (deductive) and a synthetic (inductive) approach define the contrast between ‘researchers’ and ‘creative’ teams’. The most essential and distinctive characterization of a design thinking approach would appear to be the way in which a designer tends to focus on *synthesis by induction* and *doing* rather than on *analysis by deduction*.

[81] (Verganti 2009: p. 152).

The crucial question now is: “How can a new design methodology support the growing interest of Demand Driven Designers in design thinking approach?” Banerjee presents a model in his aforementioned paper which comes close to the above description. It provides more scope to free roaming synthetizing creativity than the classical models discussed earlier[82].

It provides in addition ample room for compact analysis leading to the ‘framing’ of the project from where it moves quickly to prototyping in order to judge and present the outcome of the creative process to the client or end user [7.10].



[7.10] Stanford model for the process of innovation/creative thinking

Although this model is clearly less strictly sequential than the classical model, it does not indicate a fully parallel process wherein creating, analyzing, communicating and acting all occur simultaneously. The Stanford model still shows divergent and convergent activities and the start of the design process is still characterized by gathering data from many areas. Examples given are: collecting ethnographic data, reviewing patents, interviews with end-users, looking at competitors and manufacturing processes, thus ending up with an impressive accumulation of data and information. Subsequently, the synthesis consists of interpreting the collected data and transforming this into a coherent ‘story’; the so called ‘frame’. Whatever their merits, neither the Stanford model nor Brown’s story-telling approach provide insight to the ‘magic’ process; the *creative act* of extracting meaningful patterns from masses of raw un-interpreted information [83].

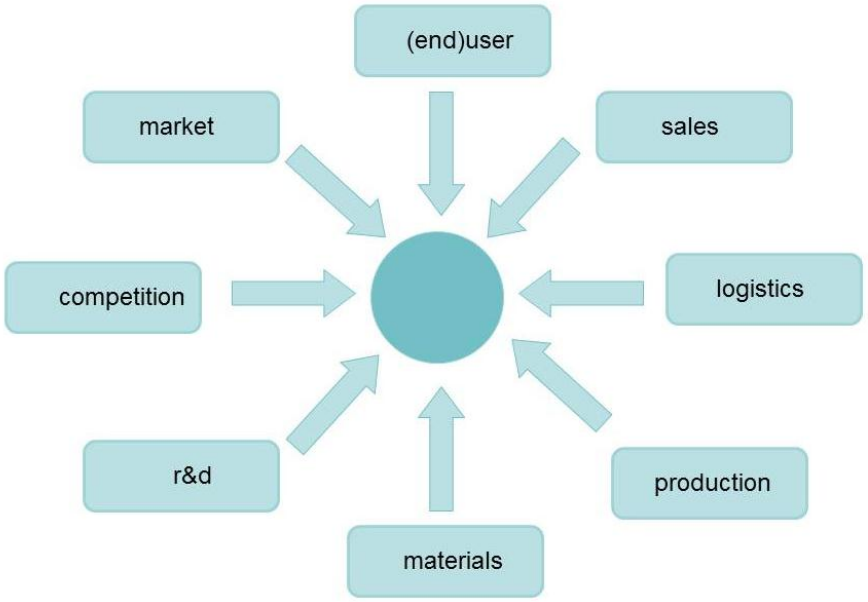
The clue missing in the search for a more creativity supportive methodology can probably be found in the clarification of this ‘magic process’. To this end a comparison of the classical model and the new approach is useful.

[82] (Banerjee 2011: p. 73).
[83] (Brown 2009: p. 70).

The following comparisons can be made:

	CLASSICAL	NEW
-	analytical	synthetic
-	deductive (from the whole to the parts)	inductive (from parts to the whole)
-	fragmented	holistic
-	step by step, part by part	integrated
-	thinking before acting	thinking by acting

This comparison stresses once again how classical methodology follows a pseudo-deductive sequence, from the whole to the parts and only after that, a pseudo-inductive synthesis, from parts to whole. Use of new insights in design thinking, learning from Author Designers, research in creativity and intelligence as well as drawing upon personal practical experience point to a more integrated, holistic approach right *from the start* [7.11].



[7.11] new holistic methodology: compare with [7.3]

Sternberg emphasizes that the chance for success using this holistic approach is strongly dependent on the quality of the database existing in the mind of the designer; the richer the internal database, the greater the chance for success. Designers today can use internet to fill their database much faster and more efficiently, intuitively and effectively than ever before. Even so there is no support offered as to how a designer equipped with an internal database of high quality should operate in practice or how new methodology could assist him in this.

7.5 Parameters for a new design approach

Lessons gleaned from the preceding section indicate that a new design approach should enable concurrently:

- *synthetic* ability to come up with new ideas;
- *analytical* ability to evaluate the quality of those ideas;
- *practical* ability to communicate these ideas properly and effectively in order to persuade others of their value.

Furthermore it should provide ample scope for:

- *intuition*, as opposed to pure *rationality;*
- *synthesis from the onset* and not after analysis;
- *holistic approach* to avoid fragmentation and loss of focus;
- *integration* to avoid fragmentation caused by rigid step by step analysis;
- *thinking by acting* instead of thinking before acting;
- *randomness* instead of sequential linear approach;
- *inductive reasoning* (from parts to a whole) instead of deductive reasoning (from a whole to parts).

It is important to note that these prerequisites are strongly process orientated. They do not provide an answer to the question how a new design approach can enhance creativity by extending the existing database of the designer.

The practical worth of a simultaneous design process has been recently affirmed by several authors[84]. IDEO [85] refers to a design process characterized as: *thinking by acting that* is analyzing and synthesizing simultaneously, with the ultimate goal to come up with the final concepts that fit the assignment[86]. It is in this respect illuminating that Kelly, general manager of IDEO, stated that IDEO has moved steadily over the course of time in the direction of *direct prototyping of ideas*. This in fact implies, that IDEO perceives prototyping as a shorthand route to *innovation*[87]. Prototyping from day one of a design project forces the design team to ask essential questions from the word go about the required functionalities and business opportunities the design has to fulfill. However, the IDEO approach does not provide help in suggesting the type of questions which should be asked in this respect. How then can a new design approach fulfill this need while still preserving its simultaneous character?

[84] Note that the Delft Innovation Model (Buijs 2012) is also much more in line with this view than it is with the 'classical' model, see also the end of this paragraph and the Epilogue.
[85] IDEO is the world's largest industrial design agency and regarded generally as the most respected. IDEO is known for its active role in the creation of new design theories.
[86] (Kelly 2001: pp. 35 – 41)
[87] Kelly 2001: p. 101).

7.6 Creative database

It is essentially in the first phases of the design process that a new approach should substitute the sequential, analytical approach characterizing the classical methodology for a simultaneous, holistic approach. A new and serious problem emerges by doing so however: How to avert complete chaos if all aspects of the design problem in hand are from its onset approached simultaneously? How to prevent the design process turning into an unpredictable, chaotic trajectory even in the early stages? The solution is to be found in the concept 'framing' introduced in the Stanford-model [7.10]. Framing means the pinning down of design problems and restricting them to a limited number of parameters which are considered to be of essential importance to the process.

The Stanford-model labels these parameters: Business, Human and Technology. By concentrating strictly on these three issues, a design team can conceptualize various project scenarios and possible designs in a more intuitive way. Doing so will, at the same time, keep them ,focused on the essential features of the problem in hand based on the client's project and design brief and enable them to come up with a limited number of clear strategies. The three parameters may consist of the following [7.12]:

Human:
- End user (desires, functionalities, ergonomics);
- Market (trends, future developments, own-able u.s.p's);
- End of life performance.

Business:
- Competition (similar products, pricing, unique functionalities);
- Logistics (efficiency, optimal handling, cost optimization);
- Sales approach (portfolio management, pricing, add-ons, accessories);
- Finance (return on investments, cost optimization).

Technology:
- R&D restrictions and possibilities (planning, budgets, capacities, etc.);
- Alternative materials to use (specs, strength analysis, etc.);
- Production alternatives (make or buy, capacity, training, etc.).

[7.12] the three parameters of the innovation model of Stanford University (Banerjee 211: p. 26)

Note that while the Stanford-model differs in approach from the classical model, the elements it consists of do not differ greatly from those put forward by Roozenburg & Eekels for example. They list:

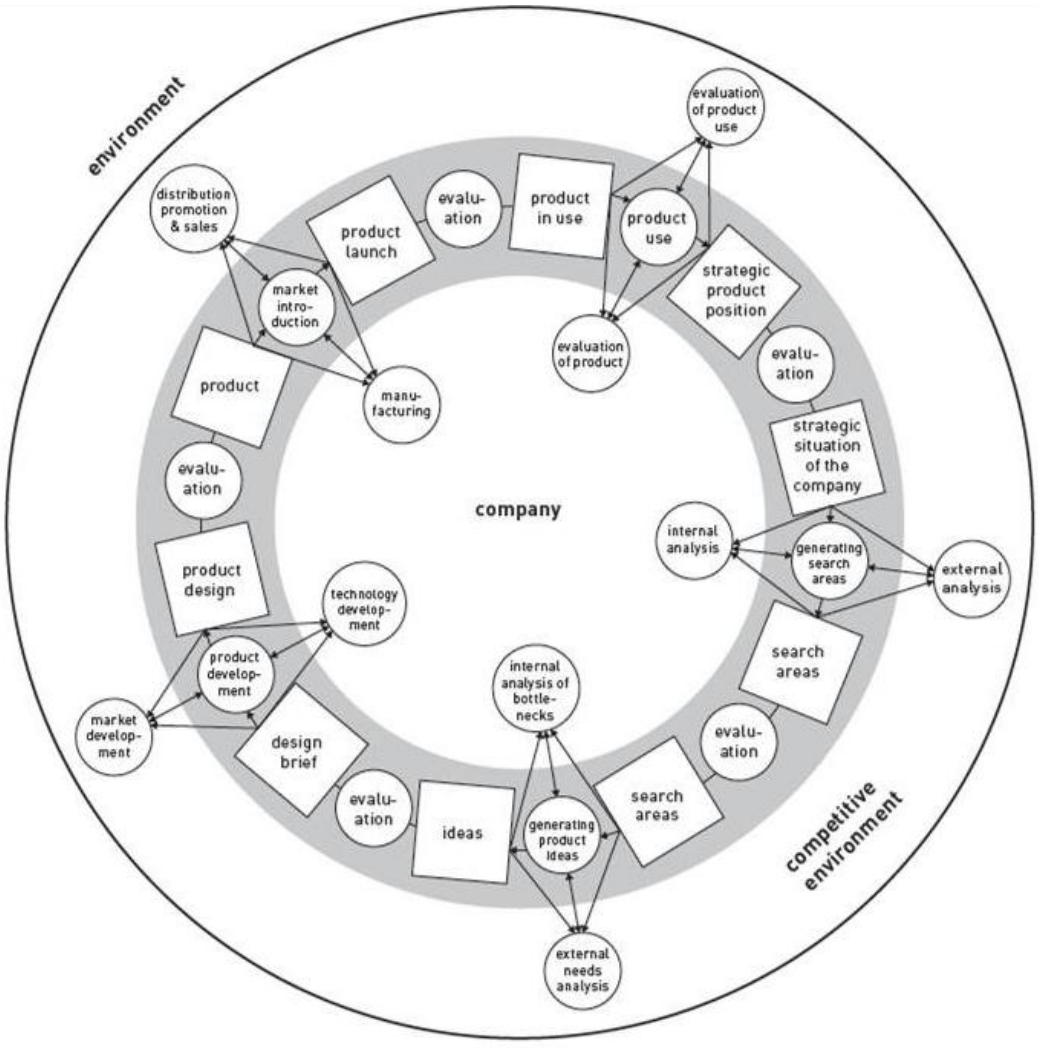
- Ergonomics (Human),
- Marketing (Business),
- Construction (Technology) and
- Aesthetics (not mentioned in the Stanford model)[88]

Anyone engaged professionally in product design knows that aesthetics (apart from usability) is one of the discerning features influencing consumer decisions. It is, as such, an issue which merits separate consideration and the following paragraph will place it within the broader context of meaning and semantics.

[88] (Roozenburg & Eekels 1995: pp. 251 – 264)

Buijs[89] recently published the Delft Innovation Model [7.13]. The model is characterized by five elements:

1. A circular process view;
2. Five stages;
3. Each stage similar visually in building blocks, shape and size;
4. Viewpoint taken is from that of the company;
5. Connection is made to different external contexts the company is working in.



[7.13] the Delft Innovation Model (Buijs 2012: p. 46).

The model refers to the parameters: Product (in use), Strategy/Business and Technology within a Market, Social Cultural context; confirming the relevance and importance of these three parameters to a new design approach[90].

[89] (Buijs 2012).
[90] (Buijs 2012: pp. 50 – 82).

7.7 Meaning and semantics

Anyone engaged professionally in industrial design, will agree with the author of the Stanford-model that the three parameters which combine to constitute 'framing' are indeed of essential importance to any problem of product design. However, based on more than twenty years design process experience at FLEX and with reference to both chapter 1 and par. 7.2 of the present chapter, its author fears that one essential feature is missing. It is an element which figures prominently in the work of Author Designers at least; namely *semantics*, encompassing the sum of 'meanings' the product radiates, or in other words all the aspects that influence the overall appreciation of a product, except for its ' usability'. Part of semantics is aesthetic appreciation. Therefore, by including semantics as the fourth parameter, the element 'aesthetics' of the Roozenburg & Eekels model will be covered, albeit be it subsumed in the broader context of 'meaning'. Two examples – both taken from Demand Driven Design rather than Author Design - illustrate the point.

The first example is from the concern IKEA, whose products are identified worldwide using Swedish names. After a new type of children's bed with the name 'Viken' was introduced in Germany, IKEA changed the name very quickly once they realized that a similarly pronounced German word did not have the meaning most people would associate with a child's bed! This example illustrates clearly how 'meaning' can be of extreme importance in the appreciation of a product even to the point that all other aspects including 'aesthetics' can be 'overruled'; There are few German customers who would buy their child a bed by the name of 'Viken', whatever its aesthetic qualities may be.

The second example is provided by the German car manufacturer AUDI. Its marketing department realized that Audi cars radiated different meanings in different cultural settings. In Europe AUDI was associated with well-to-do, liberal and elderly people, and so its main competitor was considered to be VOLVO. In the United States, AUDI was seen to be a car especially attractive to young urban professionals, so it competed with PORSCHE. In South-America however, AUDI was regarded as the car par excellence for politicians and leaders of organized crime (members of whom are not easily distinguished from each other in a number South-American countries at least). How could AUDI possibly find one 'frame' on which to center its international publicity campaigns?

As we all know, the solution was to frame their brand and its publicity on *'Vorsprung durch Technik'* (Ahead by technology) as this was thought to be a feature attractive to all three different groups of potential buyers.

An additional argument for the importance of semantics comes from the manufacturing group of which the AUDI-brand is a member; Volkswagen. The different brands of this group share a similar platform as well as technology. The main differentiation comes directly from the positioning of the brands:

- VOLKSWAGEN; innovative, responsible & valuable;
- AUDI; innovative technology, sportive, comfort and top quality;
- SEAT; sportive and passionate;
- SKODA; proven technology and value for money.

This differentiation is not an issue exclusive to AUDI only. Improved technology is increasingly more at hand for any manufacturer and as such, it is becoming increasingly difficult and expensive for companies to create new and unique products which are clearly distinctive from a technological point of view from those of their competitors. This can sometimes reach the extent that different brands of products are produced at the same manufacturing plant, making designs, brand, values and aesthetics; that is to say semantics the *only* discriminating features.

Aware that the technology used by various brands and manufacturers does not differ much at all, consumers have become more sensitive to values other than technological features such as meaning, status and fashion. Manufacturers reinforce this through marketing and publicity, aimed at creating an image of a consumer interested only in the way a brand contributes to his or her personal social status. As a force driving consumer's purchasing decisions, branding appears to be a more and more predominant aspect of products. This is a development already foreseen by Utterback and Suarez [91] in 1995 when they introduced the concept of 'dominant' design.

Viewed from any angle whatsoever, the above examples provide a clear indication that 'semantics' is an essential feature of product design, whether Demand Driven or Author. For this reason 'semantics' has been chosen and named specifically as the fourth parameter of a new design approach.

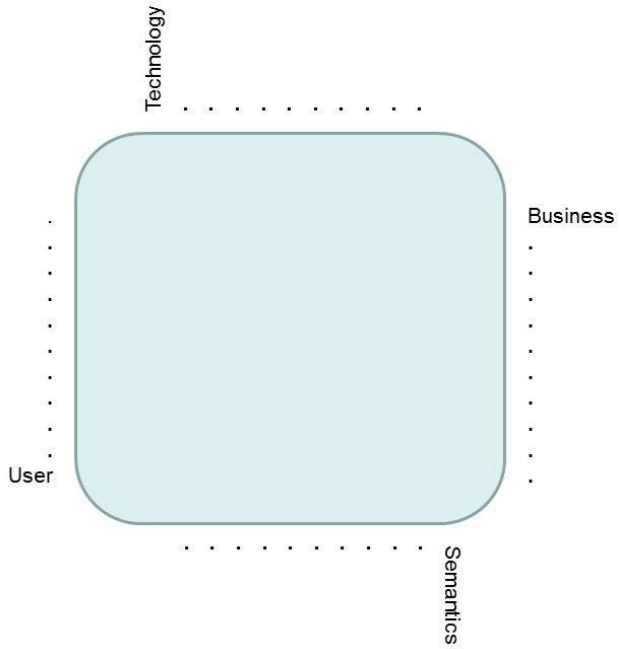
[91] (Utterback & Suarez 1995)

7.8 A New Design Approach: Creative Reflection

A new design approach should incorporate as many as possible of the insights gleaned from the studies summarized in preceding sections:

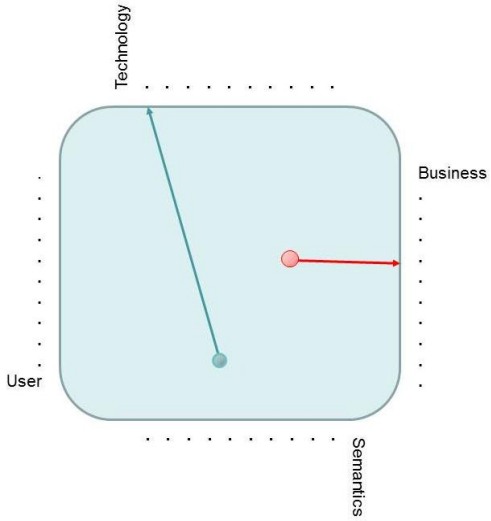
- *synthesis from the start*
- *holistic approach to avoid fragmentation*
- *integration to avoid fragmentation*
- *thinking by acting*
- *randomness*
- *using of and stimulation of one's intuition*
- *from parts to a whole*
- *functionality and meaning*

The new method should fundamentally be an *integrating* design process rather than a *dissecting* one. Where traditional methodologies tend, through close analysis, to disintegrate the design problem into ever smaller and less complex questions and problems, the new method should place explicit reliance on readily available and accessible information and knowledge as well as the designer's intuition and ability to interpret this. He should be able to interpret the information in such a way that independent facts and factors become *inter*-dependent and which combine to constitute the essence of the design problem. The new approach has a starting point which can be viewed as a 'frame' [7.14] within which the design problem is pinned down. The parameters '*business'* and '*technology'* are taken from the Stanford-model, '*human'* is changed to '*user'.* The fourth parameter '*semantics'* has been explained above.



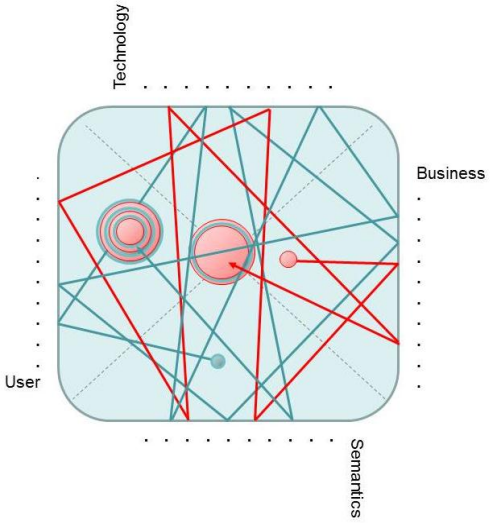
[7.14] The four parameters of the new approach

Initial data and information relevant to the future design should be put into the four dimensions of the frame. It is important to emphasize that Demand Driven Designers following this approach should start the creative process immediately in an intuitive way, while adding more and more data concerning all dimensions as they proceed. [7.15].



[7.15] Initial ideas (creative sparks) are influenced from all sides of the parametric frame

By adopting this dynamic, inductive creative process, designers free themselves and have ample scope for a creative spark. It enables them to abandon the blinkers classical analytical and sequential methods have imposed on them. It will be only the most significant technological requirements or the most important business considerations to be fulfilled which will pin down or 'frame' the problem at hand. Once the intuitive idea is optimized, the process continues, bouncing and reflecting randomly from one parameter to another. The first spark -– or creative nucleus – is enhanced and enriched to become a mature creative conceptual design; it is added to layer by layer [7.16] in a process I have named CREATIVE REFLECTION.



[7.16] factors coming from different parametric fields influence mutually the creative spark to generating simultaneous CREATIVE REFLECTION

By ‘bouncing’ between the limits provided by the four parameters one or more creative sparks can ignite in the form of provisional solutions to the problem in hand. Speaking in practical terms, this boils down to providing answers to:

- “What questions” followed directly by
- “How questions”.

These questions should be condensed and as concise as possible, asking only what is essential and valuable to each parameter of a particular design project and how this can best be solved and fulfilled. Possible user, technology and business questions regarding, for example, internal and external analysis, financial analysis, consumer research, strength and weaknesses analysis, opportunities and threats can be found in many existing methods and innovation theories. Perhaps even better, would be to base them on the concepts found in the 3P-model introduced in paragraph 7.3.2.2 Examples could be:

“What would really help future users establish better and or practical usage?”
“How can the design provide the best ergonomic solution to this?” (User)

And after sketching the first ideas:
“What would be an opportunity to create a design significantly better than that of competitors?”
“How would the improved design best capitalize on this opportunity?” (Business)

Following on directly with the next questions:
“In what way can this opportunity be produced using existing production facilities?”
“How can it be produced best at a responsible investment level?”(Technology)

Following on directly with yet other questions:
“What kind of aesthetics would ensure that this design differentiates strongly from other brands?”
“How can the semantic value tie in best with existing values of the brand?”

And now following the next optimized sketches:
“Is this really an attractive design?” (Semantics)

With reference to Sternberg, it is possible for the designer to analyze and synthesize at the same time as he is forced to answer questions raised at random in every quadrant. Even though a Demand Driven Designer is stimulated in this way to use his free roaming creativity, inspiration and intuition, he is at the same time supported in the gathering of valuable data along the way which enables him to arrive at a more grounded creative conceptual design. It is its holistic character which makes creative reflection vital and it should facilitate creative insight in more than one dimension; preferably in all four creative quarters!

The result of the above should be a visual and written description of several alternative designs defined in the following way:

- Descriptor of important functionalities;
- Project ambition(s) and first idea generation in words (so called ‘story telling’);
- Description of different design scenario’s (from incremental to more radical);
- First sketches of different design concepts/scenario’s (from incremental to more radical) and preliminary evaluation and selection;
- Insights into the use of interesting shapes, colours and materials;
- Simulations in models or sometimes even simple prototypes.

The impact of this depends to a great extent on a specific quality; the practical ability to communicate ideas properly and effectively in order to persuade others of their value. Attention should be paid to this during a designer’s education in order to help him develop this quality.

Once the essential features of a particular design assignment have been framed successfully, the designer, or as in most cases, the design team, may start with an alternative sequence in order to find another design concept and generating several creative ideas – in other words holistic, integrated design concepts framed by the four parameters now defined. Finally, depending on the type of assignment, the team will end up with three to five design concepts. Should a designer be of the opinion that the quality of a certain solution to a question is not high enough, the question should be raised whether the merits of the other solutions carry enough quality to compensate? In certain situations the assignment may even need to be ‘reframed’.

It is apparent that the education offered at present to Demand Driven Designers is lacking in the training of this inductive and intuitive approach. The existing curricula of technical universities do not suffice in this respect and extra attention is necessary to familiarize students with this new approach and provide them, future Demand Driven Designers, more with the required knowledge and skills.

7.8.1 Creative Reflection within the Innovation Process

Creative Reflection is especially tailored to design in practice. It is important to emphasize that it is only one part of the broader process of innovation. The Delft Innovation Model defines five stages of innovation[92]:

1. Product Use;
2. Strategy Formulation;
3. Design Brief Formulation;
4. Development;
5. Market introduction;

The Stanford model identifies seven steps[93]:

1. Immerse;
2. Observe;
3. Synthesize;
4. Strategize;
5. Ideate;
6. Prototype;
7. Implement;

Practical experience at FLEX has taught that design projects in 'real life' boil down to the following; every project starts with a design brief from the client and then runs in *three* phases:

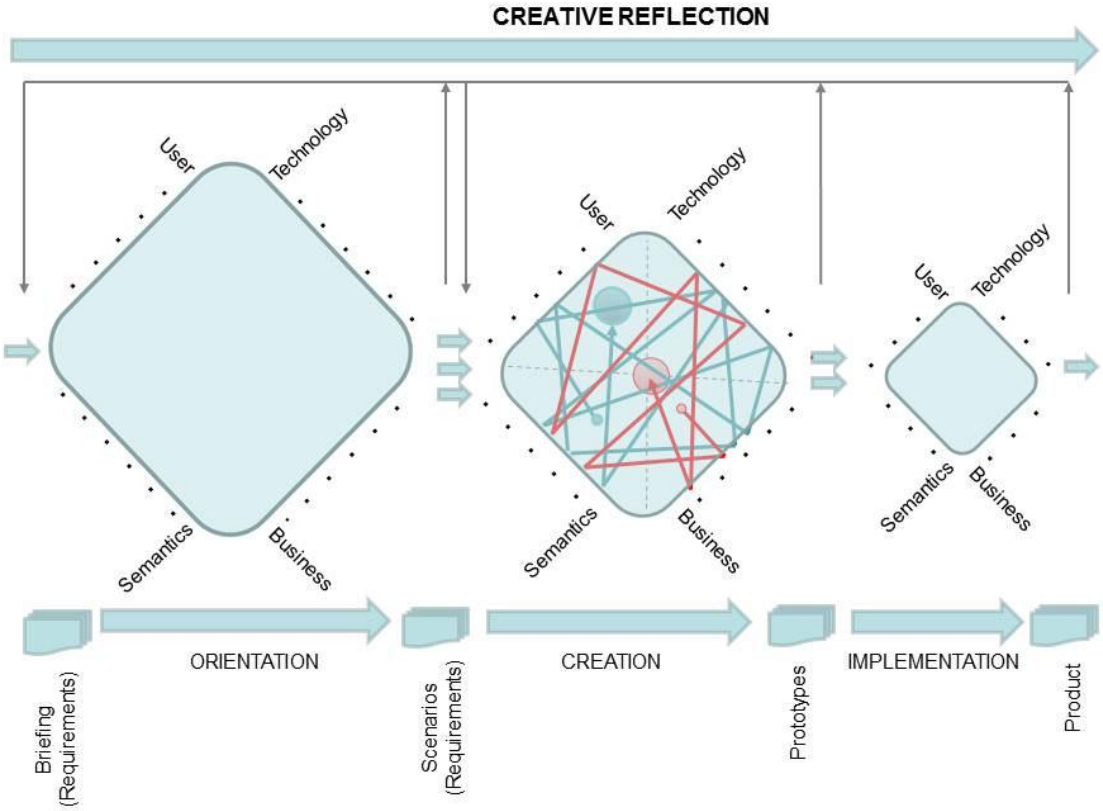
1. Project orientation
   (Delft model: Product Use, Strategy Formulation)
   (Stanford model: Immerse, Observe, Synthesize and Strategize)

2. Creation
   (Delft model: Design Brief Formulation)
   (Stanford model: Ideate and Prototype)

3. Implementation
   (Delft model: Development and Market Introduction)
   (Stanford model: Implement)

[92] (Buijs 2012: p. 47).
[93] (Banerjee 2011: p. 72)

The question remains whether Creative Reflection can be valuable in other phases of the innovation process as well; not only during project orientation but in the implementation phase for instance? Although this requires further investigation, practical experience at FLEX suggests that it is likely that Creative Reflection offers the opportunity to combine analysis, synthesis, creativity and intuition with relevant project data in every phase of the design process (7.17).



[7.17] Creative reflection in three phases; orientation, creation and implementation

It is presumed that the framing-parameters are identical for all three phases. Once a new project briefing has been received and all its aspects and requirements are well grasped, the first step to be taken is *project orientation*. This entails pinning down the essence of the design problem in hand and generating alternative strategic-oriented design scenarios to which the designs adhere. Making concurrent use of the parameters business, technology, user and semantics, the first *orientation* phase of Creative Reflection could embrace the first stages of the Delft and Stanford models:

- Delft Innovation Model: Product Use, Strategy Formulation
- Stanford Model: Immerse, Observe, Synthesize and Strategize

In the orientation phase it is likewise the case that parameters are offered simultaneously rather than in a sequential manner. The data filling up these parameters is possibly more business focused than in next phases. Information can be gleaned directly from the brief as well as by use of aforementioned traditional analysis methods such as:

- internal and external analysis;
- financial analysis,
- consumer research,
- consumer insights
- strength and weaknesses analysis,
- opportunities and threats.

In practice this all boils down to providing answers to the questions:

- *What is really essential and valuable to this particular design project?*
- *What alternative scenarios are possible to create strong, unique and discriminating new designs which fulfill the project brief?*

The value of Creative Reflection in the last phase, *implementation*, is maybe a little less evident. Certainly, more research is needed to clarify its role at this stage of a project. However, it is recommended that the most important requirements from the second phase *creation* be distilled and funneled into an operational 'program of requirements' during *implementation*. The purpose of doing so is the optimization and detailing of the selected design in order to accomplish an even better final result. It is vital in this last phase to make sure the original concept – the essence of the design resulting from the first two phases – is well attended.

However, as the focus during this phase is more on the realization of concepts in the sense of its mass production, it will, generally speaking, be led by technical specialists and not designers. This means that a different type of information will be fed into the four parameters. Based on design projects at FLEX, experience has shown that two elements in particular become increasingly important and call for extra attention; testing and securing the supply of required components. Frequent testing – of prototypes - is needed to accelerate the process. Early cooperation with suppliers is essential nowadays as almost any manufacturing process depends heavily on an extensive global supply chain.

A return loop in the sequence of the Creative Reflection process is possible should any step result in negative evaluation. The essence of creativity in all three phases of Creative Reflection, is that it bounces back and forth between *all* given requirements both simultaneously and in a relatively random way so that the search for and discovery of solutions can happen together.

7.8.2 Limitations of Creative Reflection

The important test of this new approach is whether it will work equally well for both types of designers and for all types of design projects. It is reasonable to assume that the value and success of the approach depends a great deal on the quality of the – largely intuitive - decisions made by the designer, or, as is more commonly the case, the design team. As such ‘talent’ and ‘experience’ are likely to dominate the feasibility of the results of the process; the more design references or in other words, the richer the database the designer or the design team has at their disposal, the more likely it is that they will collect and select the most relevant information and make the wisest choices.

Summarizing, the main advantages Demand Driven Design projects are offered by adequate use of Creative Reflection appear to be twofold:

- CREATIVE REFLECTION can lead to a faster and more efficient design process and thus pave the way to a shorter time-to-market period.

- CREATIVE REFLECTION offers designers more scope to utilize and excel in creativity leading to design which is more innovative, of higher quality and with more originality and ‘meaning’ than before.

8 Epilogue

Industrial design is a relatively young profession. Having its origins in the first Industrial Revolution, its history does not go back much more than 200 years. This might be seen as one of the explanations why still a lot can be gained in its further development. This belief is strengthened by more recent developments, like Memphis and Droog, as described in this essay. In addition to this, in the last decades the value of industrial design, branding and design in general is more and more recognized and appreciated. By some the value of design and creativity is even regarded as the next main cause for the up-swing in the Kondratieff cycle! In the Netherlands this conviction has recently led to the appointment of the Creative Industry as one of the *'top-sectors'* in Dutch economic policy, next to the more 'traditional' sectors like High-tech, Life Sciences and Agrofood. However, the definition given to the Creative Industry also provides reason for concern. The Creative industry also consists of even younger creative professions, like new media design, web and gaming design. This seems to lead to a situation where these representatives are more inclined to look what separates them from each other, instead of what unites them, in order to gain a more important and prominent role within the Creative Industry policy as a whole. However, it is the author's believe that even more can be gained by looking at what the connection is within the creative spectrum. This is even more important because the traditional boundaries between different professions with the creative industry are changing and sometimes even disappearing, offering new perspectives and new creative business opportunities. Several attempts have been made to respond to these developments and to bond the Creative Industry together. Some are speaking of *'creative thinking'* or *'design thinking'* that seems to be the ultimate shared quality of all *creatives*. What exactly is meant by this characterization is however neither well described nor explained.

In the foregoing I have tried to make a first step in describing the actual design process: *Creative Reflection*, as an approach that should not be limited to industrial designers only, but that should also be useful to other branches of the Creative Industry.

8.1 The Delft Innovation Method, Creative Reflection & Intuition

Being a former student of DUT it might not be a surprise that the orientation of examining the opportunities of a new creative approach was from the start strongly influenced by the curriculum of DUT. Also over the years my daily *industrial* design activities have strongly contributed to this. It is therefore interesting to see that also DUT has made a parallel development with a similar outcome.

When this text was on the verge of being completed, its author encountered *The Delft Innovation Method: A Design Thinkers's Guide to Innovation* by DUT-professor in management and innovation Jan Buijs.[94] And although its date of publication was too late to give it a well-deserved place in the appropriate chapter 7 of this scientific justification – it was only briefly touched upon - , I will not forgo the opportunity of evaluating my results against the essential features of the Delft Innovation Model.

It is important to note that the Delft Innovation Model, stemming from exactly the same academic background as the 'classical' Roozenburg & Eekels model[95], is in fact very different from it. While the 'classical model' is conceived on a highly abstract level, the Delft Innovation Model is much more 'down to earth', viewing the process of innovation from a strictly business point of view, and, apart from that, not in the first place as a scientific model in itself, providing some sort of 'ideal' of the process of product development, but simply as a practical guide for innovators: ". . *The Delft Innovation Method* is oriented towards helping companies to become more innovative…"[96] Keeping this in mind, it is interesting to take a closer look as to what extent the Delft Innovation Method – based on *scientific analysis* of practical innovation projects - and my views - wholly and *only* based on practical experience – are consistent with one another and to what extent they contain different viewpoints.

In the first place, it is striking that my critique on the 'classical' model[97] is shared by Buijs. Although it is impossible to point at one particular part of *The Delft Innovation Method* where the Roozenburg & Eekels model is explicitly criticized – which is obvious, the subject not being very apt, given its main concern - , it criticizes time and time again the strict linearity and supposed predictability that is characteristic of the 'classical model'.

[94] (Buijs 2012). The book was already shortly mentioned in chapter 7. I am indebted to professor Buijs for providing me with a provisional printing proof of the book before actual publication, which made a timely evaluation of my text in the light of the Delft Innovation Method possible.
[95] Both models were for many years essential bluiding blocks in the DUT-curriculum in industrial design engineering. Although the 'classical' Roozenburg & Eekels model - its first conception dating from 1978 (Eekels & Roozenburg 1987) - came earlier into existence than the Delft Innovation Method – rooted in (Buijs 1984) -, there is a considerable overlap, as can be seen from the fact that the last version of Roozenburg & Eekels was published in 1995, while the final version of the Delft Innovation Method came to the market in 2012.
[96] (Buijs 2012: p. 17). This difference in viewpoint is wholly consistent with the difference in background of the two models, as the 'classical' model is derived from the – theoretical - cycle of empirical scientific inquiry (Roozenburg & Eekels 1995: p. 115), while the Delft Innovation Model has its roots in (Buijs 1984; 1987), which is essentially the description and scientific analysis of a number of innovation projects *in practice*.
[97] See: chapter 7.

To give but one example: "...theoreticians and researchers in the academic domain suggest that if you follow this sequence of seven innovation process steps, the wanted result, the innovation or new product will come more or less automatically…"[98], which is reason for Buijs to comment: "…Traditional logical descriptions of any process with sequences of steps suggesting that for instance step 20 will always and automatically lead to the start of step 21, without any trouble, and that step 21 will be executed according to plan and will lead to step 22, and so on. *Real life however is completely different*."[99] And a bit further: "…Innovation processes can be organized in a number of several stages, which rationally seem to have a logical sequence, *but in practice, the order will vary*…"[100]

Secondly, as I argued in chapter 7, the analytical, sequential nature of the 'classical' model is a useful - maybe even indispensable – tool in carrying out relatively well structured design problems (essentially: re-designing a product) and this holds even more so if the problem at hand is technically speaking highly complex, but at the same time, the same characteristics impede the so called 'free roaming thinking' that is the essential for creativity, and – as I argued - creativity is an essential ingredient for carrying through radical innovations. The *Delft Innovation Method* seems to support my views – at least implicitly – by stressing the point that "*Innovation means making mental leaps*"[101] and this involves a 'free roaming' mental attitude*, not* restricted by 'path dependency' which is the inevitable consequence of following a strictly logical, step-by-step, analytical procedure. In this respect, Buijs quotes approvingly Johnson, who describes the ideal 'mental climate' for innovations to come into existence and survive: "… Go for a walk, cultivate hunches; write everything down, but keep your folders messy; embrace serendipity; make generative mistakes; take on multiple hobbies; frequent coffee houses and other liquid networks; follow the links; let others build on your ideas; borrow; recycle; reinvent. Build a tangled bank…"[102] If there was an ever a poetical description of what I, in the forgoing, have referred to as 'creative thinking', it is this text by Johnson.

[98] (Buijs 2012: p. 28).
[99] (Buijs 2012: p. 30) My italics.
[100] (Buijs 2012: p. 35) My italics.
[101] (Buijs 2012: p. 17) My italics.
[102] (Johnson 2010: p. 246) quoted in (Buijs 2012: p. 23).

The consequence of all this is that Buijs, setting himself well apart from the 'classical' approach, stresses again and again the importance of ".. a combination of right- and left-brain thinking.."[103] in realizing successful breakthrough innovations. This comes very close, no, almost coincides with my concept of 'creative thinking' and it should follow from this that 'intuition' is seen by him – exactly as I argued in chapter 7 – as an indispensable ingredient for innovative design, although the concept in itself is almost antithetical to 'scientific analysis'. Well, we are indeed at our beck and call, as he mentions in *his* epilogue as one of the characteristics of design thinking: "… the ability to switch at will between a rational and structured approach *to a more emotional, intuitive approach* .."[104] It is not exaggerated to conclude that Buijs and me, coming from two totally different directions, finally meet at each other at exactly the same spot.[105]

Emotion, intuition and – very importantly – the random character of a creative process have to be incorporated in a new creative approach. Creative Reflection provides this specific character. Within *The Delft Innovation Method*, Creative Reflection could be seen as the actual creative activity that takes place within the modules of the innovation stages. As such it can be seen as further detailing of the innovation model to make it even more practical.

Coming back to the five designs, I submitted for a doctoral defense, and so closing the circle: The only one that could have been conceived, following the 'classical' model, is the case of the 'Otolift monorail, being essentially a technically complex re-design. The other four would never have seen the light without what I have labeled 'creative reflection', in other words: Intuition played a crucial role. This was my conclusion, based on 25 years of practical experience, in early Spring 2012. Only a couple of weeks later, *The Delft Innovation Method* fully corroborated my point.

[103] For instance (Buijs 2012: p.105), but also elsewhere in his book in places too numerous to mention.
[104] (Buijs 2012: p. 105), quoted from Roscam Abbing (2010). My italics. Note that the other characteristics Roscam Abbing lists, are exactly the ones I came up with in my alternative approach in chapter 2!
[105] "..coming from two totally different directions..?" Well, different indeed, but 'totally different'? That is to be seen: In 2009 an unusual Ph.D-thesis, *De innerlijke kracht van de ontwerper: de rol van intuïtie in het ontwerpproces* (The inner strength of the designer: The role of intuition in the design process) was successfully defended at Delft University of Technology (Groeneveld 2009). For his thesis Groeneveld interviewed 19 leading Dutch designers, asking them what was, in their view, the most essential ingredient of successful design. The overwhelmingly unanimous answer was … intuition. Groeneveld's first Ph.D.-supervisor was – not surprisingly – Professor Jan Buijs …

9. References

Abrahamse, J.E. & Noyon, R. (2007), *Het oude en het nieuwe bouwen. Amsterdam, de markt en de woningbouw*. Uitgeverij TOTH: Bussum.

Alexander, Christopher (1964), *Notes on the synthesis of form*. Harvard University Press: Harvard MA.

Alexander, Christopher, Ishikawa, Sara & Silverstein, Murray (1977), *A Pattern Language: Towns, Buildings, Construction*. Oxford University Press: Oxford (etc.).

Bakker, Gijs & Ramakers, Renny (Eds.) (1998), *Droog Design: Spirit of the Nineties*. 010 Publishers: Rotterdam.

Banerjee, Banny (2011), *Paper Educating Change Agents*. Stanford Design Program: Stanford University.

Belsky, Scott (2010), *Making Ideas Happen: Overcoming the Obstacles between Vision and Reality.* Penguin Books Ltd.: London.

Betsky, Aaron & Eeuwens, Adam (2004), *False Flat: Why Dutch Design is So Good*. Phaidon: London.

Blotkamp, Carel (Ed.) (1982), *De beginjaren van De Stijl 1917-1922*. Reflex: Utrecht.

Blotkamp, Carel (Ed.) (1996), *De Vervolgjaren van De Stijl 1922-1932.* Veen: Amsterdam.

BNO (2005), *Innovatie en Design, beschouwingen, overwegingen en aanbevelingen ten aanzien van de rol van design in innovatietrajecten (als reactie op Ons Creatief vermogen (EZ publication).*Bond Nederlandse Ontwerpers: Amsterdam.

Brown, Tim, (2009), *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation.* Harper Collins: New York.

Buchanan, J., Dillon, S. & Corner, J. (1999), “A comparison of descriptive and prescriptive decision making theories”, *Paper, presented to the International Decision Science Institute Conference*, Athens.

Buijs, Jan A. (1984; 1987), *Innovatie en Interventie* (sec. rev. & augm. ed. 1987). Deventer: Kluwer.

Buijs, Jan A. (2012), *The Delft Innovation Method: A Design Thinker's Guide to Innovation*. The Hague: Eleven International Publ.

Bürdek, Bernhard B. (1975), *Einführung in die Designmethodologie*. Redaktion Designtheorie: Hamburg.

Bürdek, Bernhard B. (1991), *Design. Geschichte, Theorie und Praxis der Produktgestaltung*. DuMont: Köln.

Bürdek, Bernhard B. , Fischer, Volker et. al. (2000), *Design als Produktsprache : der "Offenbacher Ansatz" in Theorie und Praxis*. Form Verlag: Frankfurt am Main.

Dankers, W. & Lutters, D. (2010), "A descriptive approach for supporting product development: Roadmap development initiated by a behavior design perspective", *Paper, presented to the International Conference on Competitive Manufacturing* "COMA '10". University of Twente: Enschede.

De Bono, Edward (1973b), *Lateral Thinking: Creativity Step by Step*: Harper Collins, New York

De Groot, A.D. (1969), *Methodology: Foundations of Inference and Research in the Behavioral Sciences*. Mouton: The Hague.

De Rijk, Timo (Ed.) (2003), *Designers in Nederland: Een Eeuw Productvormgeving.* Ludion: Amsterdam, Gent.

Desmet, P.M.A. & Hekkert, P. (2002), "The basis of product emotions", in: W.S. Green and P. Jordan (Eds.), *Pleasure with products: Beyond usability*. London: Taylor & Francis, pp. 61 - 68.

Doctorate Board of the University of Twente (2011), *Doctoral Regulations University of Twente, Adopted by the Doctorate Board at its Meeting on 15 June 2011*. Universiteit Twente: Enschede.

Dormer, Peter (1990), *The Meanings of Modern Design: Towards the Twenty-First Century*. Thames & Hudson: London.

Drukker, J.W. & Velzen, Marjolein van (2009), "Overseas Trend: 1920: Anti-technological avant-garde design in the 19th and late 20th century: Arts & Crafts and Dutch Postmodernism (Part 1)", *ZHUANGSHI*, (August 2009), pp. 51 – 59; (Part 2) , *ZHUANGSHI*, (September 2009), pp. 44 – 53.

Drukker, J.W. (2009), "*Things to Come": een economisch-historische visie op de toekomst van het industrieel ontwerpen: Rede uitgesproken bij het aanvaarden van het ambt van hoogleraar designgeschiedenis (Inaugural Lecture)*. University of Twente: Enschede.

Eekels, J. & Roozenburg, N.F.M. (1978), *collegediktaat iv6A/B* (Lecture Notes). Delft: Technische Hogeschool Delft.

Eggink, Wouter (2011), *Regels ter Ontregeling: lessen uit de geschiedenis van het tegendraads ontwerp* (Ph.D.-thesis). University of Twente: Enschede.

Esslinger, Hartmut (2009), *A fine line: how design strategies are shaping the future of business.* Jossey-Bass: San Francisco.

Fanelli, Giovanni (1978), *Moderne Architectuur in Nederland, 1900-1940*. Staatsuitgeverij: Den Haag.

Finger, S. & Dixon, J.R. (1989), "A review of research in Mechanical Engineering Design. Part 1: Desceiptive, Presriptive, and Computer-Based Models of Design Processes", *Research in Engineering Design*, 1989 (1), pp. 51 – 67.

Florida, Richard L. (2002), *The Rise of the Creative Class, and how it's transforming work, leisure, community and everyday life*. Basic Books: New York NY.

Florida, Richard L. (2005), *The Flight of the Creative Class: The new global competition for talent*. Harper Business: New York NY.

Franklin, Carl (2003), *Why Innovation Fails, Hard Won Lessons for Business.* Spiro Press: London.

Freedman, Alix M. (1987), "Forsaking the Black Box: Designers Wrap Products in Visual Metaphors", in: *Wall Street Journal*, March 26, p. 39.

Goncalo, Jack A. and Staw, Barry M. (2006), "Individualism-Collectivism and Group Creativity*", Internal Research Paper.* Cornell University of California: Berkeley.

Groeneveld, R.P. (2006), *De Innerlijke Kracht van de Ontwerper (Ph.D.-dissertation)*. Delft/Rotterdam: Delft University of Technology.

Hekkert, P. & van Dijk, M.B. (2011), *Vision in design: A guidebook for innovators*. Amsterdam: BIS publishers.

Jaffé, H.L.C., (1956), *De Stijl, 1917-1931, The Dutch contribution to modern Art.* Meulenhoff: Amsterdam.

Johnson, S. (2010), *Where Good Ideas Come From: The Natural History of Innovation*. London: Allen Lane/Penguin.

Kelly, Tom (2001), *The Art of Innovation: Lessons in Creativity form IDEO, America's Leading Design Firm.* Random House Inc.: New York.

Koberg, Don & Bagnall, Jim (1972), *The All New Universal Traveler: A Soft-Systems Guide To Creativity, Problem-Solving, And The Process Of Reaching Goals*, Crisp Publications: Menlo Park CA.

Lauwen, Toon (2003*), Dutch Design van de 20ste Eeuw*. Uitgeverij THOTH: Bussum.

Leifer, Richard c.s. (2002), *Radical Innovation: How Mature Companies Can Outsmart Upstarts.* Harvard Business School Press*:* Boston MA.

Loewy, Raymond (1951), *Never Leave Well Enough Alone*. Simon & Schuster: New York.

Lutters, D. (2001), *Manufacturing integration based on information management* (doctoral dissertation). Enschede: University of Twente.

McDonagh, D., Hekkert, P. van Erp, J., & Gyi, D. (Eds.) (2003), *Design and Emotion, Episode III: The experience of everyday things*. London: Taylor & Francis.
Ng, K.W. (s.a.), "A critical analysis of current engineering design methodologies from a decision making point of view*", Research paper National CAD/CAM programme in advanced manufacturing*. Selangor Malaysia: Advanced Manufacturing Technology Centre.

Ministerie van Economische Zaken & Ministerie van Onderwijs,Cultuur en Wetenschappen (2006), *Ons Creatieve Vermogen*.The Hague: Ministerie van Economische Zaken.

Nieberding, N.H.M. (2009), *Selecting and Tailoring Design Methodologies in the Form of Roadmaps for a Specific Development Project (PhD-dissertation).* Stellenbosch University: Stellenbosch SA.

QANU (2008), *QANU-Research Review Industrial Design Engineering Delft University of Technology*. Utrecht: Quality Assurance Netherlands Universities.

Radice, Barbara (1985), *Memphis: Research, Experiences, Failures, and Successes of New Design*. Thames & Hudson: London.

Ramakers, Renny (2002), *Less + More, Droog Design*. 010 Publishers: Rotterdam.

Roozenburg, N.F.M. & Eekels, J. (1991), *Produktontwerpen, struktuur en methoden*. Utrecht: Lemma.

Roozenburg, N.F.M. & Eekels. J. (1995), *Product Design: Fundamentals and Methods*. London: Wiley & Sons.

Roscam Abbing, E. (2010), *Brand-driven Innovation*. Lausanne: AVA Publishing.

Steiner, R (1980*), Das Wesen der Farbe* (3rd ed.). Dornach: Rudolf Steiner Verlag.

Sternberg, Robert J. (1999), *Handbook of Creativity*. Cambridge University Press, New York NY.

Teunen, Jan, Crouwel, Wim & Van Hinte, Ed (Eds.) (2002), *Bruno Ninaber van Eyben: With Compliments*. 010 Publishers: Rotterdam.

Tomiyama, T., Gu, P., Jin, Y., Lutters, D. & Kimura, F. (2009), "Design Methodologies: Industrial and Educational Applications". *CIRP Annals – Manufacturing Technology*, 58, pp. 543 – 565.

Trott, Paul (2002*), Innovation Management and New Product Development.* Pearson Education Ltd: Essex.

Ullman, D. (1991), "The status of design theory research in the United States", *Design Studies*, 12 (4), pp. 204 – 208.

Verganti, Roberto (2009), *Design-Driven Innovation: Changing the Rules of Competition by Radically Innovating What Things Mean.* Harvard Business Press: Boston MA.

White, Michael (2003), *De Stijl and Dutch Modernism*. Manchester University Press: Manchester.

Wichmann, Hans (Ed.) (1985), *Industrial Design. Unikate, Serienerzeugnisse*. Prestel: München.

Wilde, Johanna (1997), *Passie voor Productontwikkeling, de professionalisering van de ingenieur Industrieel Ontwerpen (Ph.D-Thesis).* Lemma BV: Utrecht.

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