PERSPECTIVES ON MANAGEMENT OF PRODUCT DEVELOPMENT AND THE ROLE OF DESIGNERS: HOW DESIGN PROCESSES RE-DESIGN DESIGNERS

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ABSTRACT

The design processes and the role of designers in the concept development and launch phase of three high-end design chairs are analyzed as an outcome of fragile, changing, non-linear and dynamic network processes. Seven different views on how to understand design and design management are presented and distilled into five analytical perspectives on the management of design, and one of these is used for the empirical analysis. The analysis of the three chairs demonstrates how multiple human and non-human actors interact and in the processes not only produce the final proposed design, but how the design and the role of the actors mutates through these translation processes. The analysis shows how the final design is a bricolage where the traditional role of the designer becomes to be one among many human and non-human actors in a network that at one point in time is declared to be "the design". The designer is during the process her/himself re-designed through the need for being able to adapt to other actors in the network.

INTRODUCTION

Nowadays, design is considered a fundamental factor for competitive success across a wide range of products (Rothwell, 1994), (De Mozota, 2003). In 2002, Heskett opened his book on design asserting: "*one of the most curious features of modern world is the manner in which design has been widely transformed into something banal and inconsequential. In contrast, I want to argue that, if considered seriously and used responsibly, design should be the crucial anvil on which the human environment, in all its details, is shaped and constructed for the betterment and delight of all*" (Heskett, 2005). Design is defined in Oxford English Dictionary as the "*work of art and awareness of the order and arrangement of those elements"*. The present paper wants to address how the elements of design are being negotiated into order and how the different actors interact in the process that produces a certain design and especially the role of management and designers in that process.

Recently, design management has received attention both from practitioners and scholars. Firms consider design as a strategy to increase the value of products and services, and special attention of the academic journals is directed to explore the relationship between design and new product development (…), design and marketing (…), design and business performance (Chiva…). An increasing number of publications address design from theoretical angles (Bruce and Morris, 1994; Chiva, 2004a; Dumas and Mintzberg, 1989, 1991; Kotler and Rath, 1984; Olson, Slater, and Cooper, 2000; Walsh, 1996) and with empirical studies (Ahire and Dreyfus, 2000; Bruce, Cooper, and Vazquez, 1999; Dickson et al., 1995; Gorb and Dumas, 1987; Perks, Cooper, and Jones, 2005; Roy and Potter, 1993; Roy and Riedel, 1997; Swink, 2000).

In 2005 JPIM had two special issues on design management. The first issue (January 2005) concerns the impact of design in new product development and firms and industry performance (Hertenstein, Platt, and Veryzer, 2005), the use of marketing to achieve radical innovation (Veryzer, 2005), its link to design decisions (Michalek, Feinberg, and Papalambros, 2005), the role of design in influencing consumer choices (Creusen and Schoormans, 2005) and in improving product experiences (Oppenheimer, 2005). In the second special issue the topic directs to the intersection between marketing and design, decision making, leadership support and integration on the strategic level (Beverland, 2005; Feinberg, and Papalambros, 2005). Perks, Cooper, and Cassie (2005) focus on the different set of skills and management approaches by designers in the discrete phases of the new product development process and on the expected outcomes of the use of design. The notion of ‘‘User-Oriented Design’’ (Veryzer, Borja de Mozota, 2005) is explained as the relationship of user/consumer with design technology-based contexts. Swan, Kotabe, Allred (2005) discusses four capabilities (aesthetic, technological, quality and functional) linked to robust design to the firm performance.

A review of the existing literature has revealed a multitude of different approaches that seems to come from different schools of thought on what constitutes management of design (Christiansen et al., 2011) and that the different approaches also are separated into different research clusters.

Design, designers and lately design management seems to have their own outlets, which are different from the innovation and NPD outlets. Similarly, the recent growth in various schools for design, design education and designers, has not influenced the debate within innovation management much although there are prominent scholars within management of product development that has mentioned the important role of designers for product development, but merely as an input factor (Dell’Era and Verganti, 2009).

The paper brings together theories from the areas of product development, innovation management and design management. The analysis draw upon theories from the sociology of science and technology (Callon and Latour, 1992), the concept of framing (Christiansen et al., 2010 and 2011) and interessment (Latour, 1987) related to the innovation management literature (Akrich, Callon, and Latour, 2002a, b; Araujo, 2007; Barry and Slater 2002b; Callon, 1999; Callon and Muniesa 2005;

Christiansen and Varnes, 2007; Christiansen, Varnes, Hollensen, and Blomberg, 2009; Christiansen, Varnes, Gasparin, Storm-Vinter, 2010; De Laet and Mol, 2000; Latour, 1991; 1996; 2005).

The role of management is in this view to make a profit (performance) but also to realize that management is a process of shaping anything and establishing strong networks (performativity). Therefore, design management relates to the managerial processes of creating, developing, producing and launching a new product or service.

The aim of the present paper is to achieve an understanding of the dynamic and non-linear design processes and in particular the role of designers and management in the product development process and launch activities. We are going to analyze the role of designers and management in the innovation process. The question is: What is the role of designers in creating a strong and emergent design, and how is management carried out?

The analysis is based on three case studies of the three high-end design chairs from a important manufacturer in Denmark: Fritz Hansen, namely the Egg, the Serie7 chair, and the Ice chair. The three chairs have been chosen because they are considered to be radical innovations (new materials, new patent, new archetype) and the two Arne Jacobsen´s chairs (Egg, the Serie7 chair) have been able to become what critics of design have called classics and timeless Danish design. They are studied from the fuzzy front-end phase: ideation, product conceptualization and launch in the market.

The cases present the actors, the designers, the processes, and the mediators in the development process and launch phase. The launch phase, which is an important phase in the product development literature (Krishnan and Ulrich, 2001) is rarely taken into consideration in the design management literature, but the network around a new product is not closed - or black boxed - and design final before the first products reaches the market and therefore this phase is included into the analysis here.

The remaining of the paper follows from here: First, based on an extensive literature review seven different views on how to understand design and design management are presented and distilled into five analytical perspectives on the management of design. The different schools on design management are described, classified, and the role of designers is identified. Then the methodology is presented and the preliminary analysis of the cases are presented, as well as a discussion, managerial implications and directions for further research.

SCHOOLS OF THOUGHT ON DESIGN MANAGEMENT

As discussed above here, design management is a diversified discipline. In order to identify the different streams of research we designed a literature review, and applied a method from medicine, used to recognize and categorize outcomes of the study in a particular subject (Higgins and Green, 2006; Dahlander and Gann 2010).

Articles have been identified for by for using the EBESCO database searching for “design management” in the topic field, including title, keywords and abstract. This search resulted in 8216 articles downloaded in a database. This search, however, provided also articles that had little to do with design management, for example more

related to managerial practices, or how to design configurations or systems in the companies. Subsequently, the sample was refined by reading the abstract and keywords and the sample was purged to 200 articles. Since the EBESCO database does not include books, books were searched using Google and included into the database.

The identified research could be ordered into seven different views on management of design presented in table 1 below here.

View on design	**Objective**	**Management of design is considered as**	**Authors**
Design is the outcome of complex mental and analytical processes	Problem solving	Stimulation of creativity	
An ongoing multitude of micro-processes	Exploring the multitude sources of design	Ongoing concepts organizing processes to fill gaps, exploring iterate and using bricolage	
Managing product aesthetics and industrial design	Improving industrial products as support corporate reputation	Analytical breakdown and modularization, sometimes with design methodologies	
Design as strategic asset	Contributing to the business	Understand the role of design as communication	
Managing as designing	Designers as inspirations	Lateral thinking	
Design as proposal	Radical new design proposal to the market	Interaction with interesting/strong interpreters and knowledge brokers to stimulate radical innovation	
Design as an outcome of fragile networks	Successfully enroll human and non human actors	Interessment, valuation, framing and re-framing and qualification.	

Table 1: Views on management of design based on literature review

These seven views subsequently has been reduced from seven to five by reducing overlapping and redundant concepts: 1) Design as the outcome of complex mental and analytical processes; 2) managing product and industrial design; 3) managing as designing perspective 4) design as proposal or design driven innovation; 5) design as an outcome of fragile networks.

These five perspectives explained in the next section, clarifying them from a management perspective, looking for the definition of the concept of design in each of them, what constitutes how value of design is considered in each case, and the processes involved.

Perspective 1: Design is the outcome of complex and analytical processes

Designs are "instructions, based on knowledge, that turn resources into things people use and value" (Baldwin and Clark 2006). This view is leaning towards one of the previous definition of design by the English Design Council (1992): "design is the process through which technological ability is focused on customer needs in terms of performance, human factors, and appearance, and value for money" (Design Council, 1992). This approach is still used in engineer- based companies and in the automotive industry, which are asserting to utilize modules and optimization processes. This perspective is related to the studies of decision making by Simon, 1996.

The role of designers in this perspective is to communicate the nature of complex things (products and processes) by reducing them to the interactions of their parts, or to simpler modules: a complex system is nothing but the sum of its parts, and an account of it can be reduced to accounts of its individual constituents. Designers and managers have to decide upon how to create value through the substitution of alternative designs. Designers, after an attentive investigation, decide if the value (intended as money or the promise of money) made by a new design experiment (or new design product) is worthwhile, meaning if it is appropriate to start the production using the new design. Experiments yielding new design of products and/or processes are aimed to understand which alternative has more value for the firm: if to introduce a new design, or if it is better to augment and ameliorate the older ones. After having evaluated these options, designers have the right but not the obligation to take an action (intended as use a new design). Value is understood as an acting force operating on and through design. New design is suggested to be introduced if it is better than the old, otherwise, keep the old ("*optional substitution*"). Substitution is the process by which one product or service supplants another in performing a particular function or functions for a buyer. The analysis of substitution applies equally to products and processes, because the same principles govern a buyer´s choice.

The first step in substitution analysis is to identify the substitutes an industry faces. This seemingly straightforward task is often not easy in practice. Identifying substitutes requires searching for products or services that perform the same generic function or functions as an industry´s product, rather than products that have the same form. The function a product performs depends on its role in the buyer´s value chain. The value activity in which a product is used may be connected to other activities through linkages. Designs have the property of *optional substitution*, understood as a module (that which can be changed without changing something else). Thus option value resides in modules.

Design decisions are made on choosing the shapes, forms, colors and materials for the items. The main challenge for managers and design managers is to understand first, how to foster creative design work, and how it is possible to manage creativity, novelty, originality taste and uniqueness, and second how to take decisions.
This involves a creative link between needs and means that is then worked on to move the good idea to a successful artifact which is accepted and widely used (Porter xxxx).

Perspective 2: Managing product and industrial design-

Design in this perspective refers to "*the conception for the completed form of an object, often a sketch, model, or set of instructions that is a preliminary stage of the process that leads to a finished product*" (Barnstone, 2005b). The British Design Council has enlisted a series of activities into the definition of design: "*applied arts, architecture, fashion design, game design, graphic design, industrial design, interaction design, interior design, product design, process design, engineering design, instructional design, web design and service design*".

Design, in this perspective, is intended as all the activities related to contrive, to formulate, to project, to draw, to plan, to sketch out, to devote or apply to a particular purpose. Design is also about planning, scheming, and arranging different forms and colors. Thus an analysis of design may reveal the intricacies or eases of construction, address issues of use such as durability, efficiency, or convenience, and consider the exploration and transformation of materials, and the relative complexity or simplicity of the arrangement of forms (Barnstone, 2005).

Since design is considered part of the engineering process to develop a new product, it is interesting to note that Frascati Manual on R&D section considers design work geared towards production processes and as such is not classified as R&D: "*[T]he vast bulk of design work in an industrial area is geared towards production processes and as such is not classified as R&D. There are, however, some elements of design work which should be considered as R&D. These include plans and drawings aimed at defining procedures, technical specification and operational features necessary to conception, development and manufacturing of new products and processes*" (p. xxx, zzzz) . The Oslo manual considers design as "*[A]n integral part of the development and implementation of product innovations. However, design changes that did not involve a significant change in product functional characteristics or intended uses are not product innovations. However, they can be marking innovations (…)*" (p. xxx, zzzz)

Product design is defined as the choice and the configuration of elements, materials and components that give the product particular attributes of performance, appearance, easy of use, method (Roy, 1997).

From a managerial perspective design, according to De Mozota (2003) and Baldwin & Clark (2006), is a process of decision making and designing space: the design decisions create the need for other subsequent decisions, and at the same time it becomes a space bounded by prior decisions; it is considered to be a problem solving, creative, systematic, coordination and cultural and artistic activity (De Mozota, 2003).

Design is here intended as a tool for product development and innovation managers to develop new products, to increase innovation and to make the company more profitable by presenting superior value for the product, by conceiving, designing, and establishing dependencies between design spaces, and their scope/complexity (Baldwin and Clark, 2004).

Designers acquire the role of catalyzers: they purposively use design to increase creativity throughout the process of innovation, which entails combining function

with materials to increase the effectiveness of the production, and combining style with appearance to increase the appeal that products can have towards customers. Thus, managers and designers are asked to perform design as an activity primarily concerned with problem solving. Designers are also expected to create something that has as an output aesthetics, cost issues or functionality, which is the result of a process that translates ideas, opportunities or triggers into something through the consistent deployment of creativity. Creativity based on design is the generation of novel ideas, and the ability to combine ideas in new ways to solve problems and exploit opportunities, finding modalities for changing patterns of consumption, taste and commercial imperatives.

Designers are also frequently asked to become active in managing the innovation process, intended as the successful application of new ideas in practice of the form of new or improved products, services or processes (Bruce, 2006). In drive for innovation in products, services and processes, creativity is crucial and, by integrating design into the core activities of a company, its innovative potential may be exploited more fully (Brigitte, xxx) (Bruce, xxx). A firm adopting a positioning approach to competitive strategy, the role of the designer, at least as fast as top management are concerned, is to design products that have all the necessary features and compelling extras so that target customers will be impelled to buy. In this case the designer acts as a craftsperson, by applying a distinct skill set to the task after a brief.

The development process follows a linear sequential process. In this view design is a well managed linear innovation process (Christiansen & Varnes, 2007) based on structured design and innovation models (Cooper, 1990), (Kumar & Wellbrock, 2009). The linear perspective involves an identification of customer needs, the definition of product specifications, the development, the generation, the selection, the testing of the concept, and the building of the product architecture, prototyping and finally launch into the market. Design is considered critical in each phase but especially in the first phases, when it is considered as a "part of a problem solving activity beginning with a perception of a gap in the user experience, leading to a plan for a new, and resulting in the production of that artifact" (Ulrich, 2011; Ulrich, 2006). The process starts with the phase in which the designer senses the gap, defines the problem and then searches for solutions, looking also at the involvement of external groups (Kumar & Wellbrock, 2009; Ulrich, 2006b; Von Hippel, 1986), (Swan, Kotabe, & Allred, 2005; Ulrich & Ellison, 2005). The management activities related to design in this perspective are focusing on identification of user- needs, market research and technology scouting, to construct an appropriate concept to meet the required specifications.

The value consists in having a stylish, aesthetic, with high quality, attentive to the customer needs product, able also to enhance the company´s reputation.

Perspective 3: Managing As Designing - We Are All Designers

According to Buchanan (2004) and Boland & Collopy (2004) design is a strategic discipline of management, whose aim is to facilitate the relationship between people and objects, the recognition of different typologies of knowledge and expertise

for managing organizational operations, taking into account the critical importance of accounting, finance, human relations, strategic planning and visions, as well as the socio-cultural context. Already (Simon, 1969) mentioned that the design of organizational structures was about to get attention (Bentzen et. al. 2011). "*The role of manager as designer is hardly mentioned in the literature, and barely acknowledged in business practice. ...Managers practice "silent design"...the many decisions taken by non- designers who enter directly into the design process, no matter how unaware they or others may be of their impact*" (Mintzberg, 1991). "*Managing as designing means, in part, the monitoring, containing, and reversing of compounded abstraction*" (Weick, 2004). Engestrom (2004) defines managing as designing, as the re-configurative production of visions and articulated production of decisions. Weick (2004,b) presents the concept of Thrownness (Being-in-the-World); a principle from the philosopher Heidegger, meaning that we are always (thrown into) in the middle of doing something, we are always in a situation with an history, with actors, cultural norms and path-dependent infrastructures and laws. We are constantly re-designing, interrupting, re-contextualizing. Weick (2004b) states that persons cannot avoid acting, cannot step back and reflect on the decisions taken, the effect of the actions cannot be foreseen, because the representation of the situation is not stable and we are in a constant stream or flux.

In this view, design processes are perceived as an opportunity to explore. "*Design is a paradox: on the one hand it creates nothing. By itself, design is an empty vessel waiting to be filled with people, meanings and actions. It is dead form that has no life or energy itself. Yet on the other hand, it creates everything since the organizational design will have a fundamental framing effect on people's expectation and perception setting the context for organizing activity, the social construction of roles and relationships through which the structure is enacted. Design is a mental concept of human relationships in a world of exploding complexity and diversity*" (Weick, 2004).

The management focus in this perspective is concerned with the understanding of a multitude of micro-processes and decisions spread across the organization each participates in the design of structures, processes and visions. All the persons involved in the organizational processes become part of the design processes and are in way designers.

Designers are, in this perspective, inspirational figures that managers can analyze and try to apply their characteristics and methods in their managerial processes.

The management of design and products (and services) thus involves many actors and managers focus on the design of the processes and interpretations. The outcomes might not be easily predictable as they - as in the next perspective - are more an network effect than the result of carefully managed phase models.

Value is created thorough the creation of an appropriate organization architecture and organization structure by a creative leadership style.

Perspective 4: Design As Proposals Of (New) Meaning

Verganti defines design as (2009): "*the etymology of design goes back to the*

Latin de + signare and means making something, distinguishing it by a sign, giving it significance, designating its relation to other things, owners or goods. Based on this original meaning, one could say: design is making sense of things". Thus design according to Verganti (2009) is composed by the product's aesthetic appearance, the functionality, and the product's emotional and symbolic value- and meaning, suggesting a system of values, a personality and identity, that may easily go beyond the style. New products and designs are in the perspective focused on the introduction of new radical product meanings. Design is not about the establishment or the development of a new technology or features, but it is about the creation and incorporation of new or significantly altered concepts and ideas (Utterback et al., 2006) through the process of design driven innovation (Verganti, 2006). Design is considered a collective and networked research process on meanings and design languages (Verganti, 2008, 2006; Dell'Era, Marchesi, & Verganti, 2010; Dell'Era & Verganti, 2007; Verganti & Buganza, 2005; Dell'Era & Verganti, 2009), and can be represented as a stream of symbols.

The designers are considered as specialists and the key-players in the radical innovation process. They are those who are able to identify changes in the socio-cultural and business field and come out with new product meanings that represent customer's unexpressed values. Design is not only an instrument to produce a nice form, but it anticipates a need, and proposes a vision. Design- driven innovation is based on the capability of designers to inquire the changes of culture, society and technologies, and make proposals to influence the emerging dynamics in the socio-cultural models (Utterback, 2010). A proposal is considered a vision about possible new product meanings that customers have not though about but that they were waiting for (Verganti 2006). "Design must convey a message to consumers" (Utterback, 2010). Designers act as knowledge brokers, they serve as intermediaries, or brokers, between otherwise disconnected pools of ideas.

One challenge for managers is to identify the suitable designers able to connect with the firm and the market; another is to select the right design proposal among the radical proposals that the designer presents to them. Other management activities in this perspective is focused on the identification and nursing of one or more visionary and knowledgeable specialists (designers). It´s about how to manage innovations that customers do not expect but that they eventually appreciate (Verganti, 2009). A design driven innovation, by definition, differs substantially from the dominant meaning in the industry.

Value is created through the ability of design driven innovation to produce products and services which has a radical new meaning to customers, that differentiates the products and services towards others in the market, represents a proposal into the future market, might (re)define the market and make it possible to acquire a higher price as compared to competitors.

Perspective 5: Design as a network effect

Within this theoretical framework design becomes a network effect and the management of the design process involves what has been called the translations and

interessement of both human and non-human actors into the network. The Oxford English Dictionary describes framing as (1) “the action of making profit” and (2) “the action, method, or process of constructing, making, or shaping anything whether material or immaterial”.

The purpose of management is to initialize, guide and produce performance and in this view management becomes a process of “shaping” (performativity). This understanding of what constitutes ‘management’ is suggested in recent works within sociology of innovation and management (Callon, 1999; Akrich, Callon, and Latour, 2002a and b; Callon and Muniesa, 2005; Christiansen, Lefevre, Varnes, & Wolf, 2008; Muniesa, Millo, & Callon, 2007; Christiansen, Varnes, Hollensen, and Blomberg, 2009 and Christiansen, Varnes, Gasparin, Storm-Vinter, 2010).

Design and products and services are in this view the outcome of fragile networks of human and non- human relations that are more or less stable. Framing rely on the participation of several actors in the qualification-requalification processes, the notion that the meaning of a product transforms through qualification-requalification processes, and the notion that the product (network) is able to connect to (mean) many different things simultaneously due to its permeable boundaries.

This is view is a constructivist perspective on the relationship between markets and companies (Christiansen, Lefèvre, Varnes, and Wolf, 2008). Within the constructivist perspective the market is a temporary construction: what constitutes a market at a given point of time has dynamic characteristics, as it is continually constructed. Elements such as customers or a product is the outcome of a stabilization of certain characteristics for a longer or shorter period.

The manager's task and management technologies are different from the other perspectives. The management processes is concerned with the assemblage of the heterogeneous actors into a stable network, trying to handle struggles and by framing the network formation. Multiple actors might try to frame and reframe the network in different ways and directions simultaneously.

In this lens the design process is not a question of ‘forward and backwards’ in the never-ending process, or to manage the product along a linear progressing product-life-cycle, but to manage the framing of products ‘inwards and outwards’ (ref. xxxx). Designers - as individuals - have the choice - or opportunity - of being enrolled in the network, or the network can actively try to translate the Designer into the network so the Designers becomes interessed into the network. If they become connected to the product development network, Designers are participating in the innovation process, with others. All those who participate in the innovation process can thus influence the final outcome, and thus could be regarded as being a collective of Designers. Thus, within this view those human and non-human actors that decide to be part of the product-network or are being enrolled are the designers.

According to actor- network theory products emerges and presents themselves as a fragile network of human and non-human relations (Christiansen et al., 2010). The design management process thus is not a question of ‘forward and backwards’ in the never- ending innovation process but to manage the framing of products ‘inwards and outwards’. This perspective is the newest on management of design.

This perspective means that the management activities is focused on the handling of the processes of interessement, translation and framing. Besides, management might involve trials where the strength of new (product) networks are tested, and struggles between different human and non-human actors. The concept of fragile networks, also stresses how designs are open for negotiations, internally and towards resellers and customers.

The value and the success of a product are in the hand of the consumers in this perspective. Only consumers and buyers can add value to a product or service by wanting to relate and connect to it. Below in table 2 we have summarized the five perspectives on design and their implications.

Design is:	**Outcome of complex and analytical processes**	**Industrial design**	**Managing as designing**	**Design driven innovation**	**A network effect**
View on what constitutes a design	Instructions, based on knowledge, that turn resources into things people use and value	Design is the purposive application of creativity throughout the process of innovation	Management and design: bridge people from different fields, being diversified.	Propose new meanings through designs	A network among human and non-human actors so stable that it can be black-boxed and launched on the market
Role of the designers	Rule setters	Innovation catalyzer	Inspirational guide	Interpreter	One among a multitude of actors. Spokesperson.
Management	Guide decision-making process (under constraints of physics, logic and cognition)	Problem solving activity. Provides the creative link between needs and means.	Designing organizations and processes by taking inspiration from designers´ activity	Hire the most appropriate knowledge brokers (designers).	Network stabilization: A host of actors need to be enrolled into the network and to negotiate proposals for value constructions.
Managerial processes	Building the metrics for decision making. Following analytical steps in decision making	Linear phase models with phases and decision points with analytical decision making	Organizing	Creating space for knowledge brokering and different innovation strategy and meaning creation.	Interessement, framing, facilitate and/or directs negotiations, facilitate translations, manage trials and act as a spokesperson for the company.
Value creation	How well does the product or service deliver functional and aesthetic values as identified relevant by consumers	Innovative products delivering functional and aesthetic values as identified relevant by consumers	An appropriate and efficient design of the organizational architecture, the processes and structures.	Strenght of anticipated need, and vision. How well does the proposed vision make sense for consumer and how well it relates to meta meanings and trends.	Value is co-created by the network, and the value is in the hand of those who connect and consume.

Table 2: Five analytical perspectives on design and the management of design

RESEARCH DESIGN AND METHOD

The literature review reveals that a large amount of prior studies falls into the category of "design management". Researches in the field have been concerned with capturing, measuring and explaining the interdependence of design activities in a pretty sectorial way, most of the time with a monolith structure. The different perspectives analyzed have followed a rational and linear way of looking at design, even if the focus is very variegated: decision making in design process (Michalek, Feinberg, and Papalambros, 2005), performativity of design, design as a strategy to increase the innovation processes, the impact of design in new product development and industry performance (Hertenstein, Platt, and Veryzer, 2005), the use of design in marketing to attempt radical innovation (Veryzer, 2005), the use of design to improve consumer choices (Creusen and Schoormans, 2005) and experiences (Oppenheimer, 2005). Other researches hit on the different set of skills and management approaches by designers in the discrete phases of the new product development process and on the expected outcomes of the use of design (Perks, Cooper, and Cassie, 2005).
The aim of this article is to move the approach of management of design to a more sociological conception.

In the analysis, the scientific work of Latour and Woolgar (1979) has inspired us. As described in the paper, there are similarities between new product development, and the process of construction scientific knowledge. Similar to new product development and new designs, the construction of scientific knowledge is a process, perceived as mysterious and involving acts of genius. Latour and Woolgar describe how the facts are constructed in the laboratory: materials are part of the fact building processes; experiments are translated in inscriptions (the "design") etc. We use these the elements from the ANT theory, to explore the question:

What is the role of the designer in new product development, who is participating in the design that emerges, and how does management happen in the observed design processes?

The research process consisted of two activities: an initial explorative part and a historical ethnography conducted in a leading design company, Fritz Hansen located in Denmark.

Fritz Hansen´s official business strategy is twofold: to exploit the value created by the classic items, and to rejuvenate the brand by launching every year a new product in the market (at *Fuori Salone* design fair in Milano), with the hope it will be the new classic product in a near future. The design philosophy currently adopted by the company consists of design ambitions and core values, which are used as guidelines for developing new products: the design philosophy continuously seeks the "obvious" visual (original pure, long lasting), emotional (genuine, serene, Danish), rational (superior, quality refined, aging with beauty). The company considered the selected three cases presented here a radical innovation.

The data collection has covered a period of two years, first initially in 2009-2010 and then another year in 2011-2012. More than 20 interviews have been conducted supplemented with observations and participations in meetings and the collection of various written materials. For one year, the company has been visited in different occasions, and during some months with visits and stays 2-3 times a week.
The warehouse, where the company documents from the 50s, 60s and 70ties are located, was open for investigation. Newspapers, marketing material and brochures between 1955 and 1965 and 1999-2002 (the years of the respective launches) have been exanimated, photographed and stored in a database. A visual analysis has been carried out with special software. The data emerging from the ethnographic observations have been triangulated with 8 extra interviews: The Design manager twice, the PR manager, two interviews with a retired designer working in the company for 50 years, The external designer Kasper Salto, the former design manager, the CFO). The interviews latest between 1 hour and 2.5 hours, and all interviews have been recorded, transcribed, coded and analyzed with software for qualitative research (Dedoose). All the visits in the company have been extensively documented in a field note journal. Two workshops and two presentations of the preliminary results have been carried out to validate the results. The steering committee consists of the representatives of the company and of the university, and had meetings, on average, every 4- 6 month, to discuss the observations.

The three cases studies were selected in close consultation with the managers and approved during the first steer committee meeting. The cases were selected according to the Davila (2000) definition: a change in at least one of the areas including technology, organization, and customer interaction. After this analysis the cases identified were the Serie7, the Egg, and the Ice chair.

This study is exploratory (Drenth, Thierry, and Wolff, 1998, p. 15; Kotler, Adam, et al., 2006, p. 122), aimed to understand how a certain design has emerged, and which has been the product development process able to sustain it.
As methodology and theoretical framework, the ANT perspective was adopted. This perspective claims that organizational life is emergent, fragile and temporal, and to understand it, we have to look at how it is mobilized and how it makes a difference in organizing activities (Christiansen et al., 2011). The approach is in line with parts of the sociology of technology that consider technology as a network effect, and its understanding is related to the context of the network of which it is a part. In such a perspective, a phenomenon like innovation is co-produced by the heterogeneous network of elements that constitutes it, *"actors and organizations mobilize, juxtapose, and hold together the bits and pieces out of which they are composed*" (Law, 1992).

ANALYTICAL FRAMEWORK FOR THE EMPERICAL ANALYSIS

As the presentation of the perspectives on design and management has highlighted, there are different managerial implications from each perspective. The perspectives are different ways of approaching design and design management. The actor-network perspective is inspired by the studies of Akrich, Callon, and Latour and others and prior used for analysis in the furniture industry, with the case study of Fritz Hansen

(Christiansen et al., 2010). This perspective allows studying the design in making, and all the multitude of micro- processes that are not analyzed in the other perspectives, which allow for a comprehensible understanding of the design process. Moreover, this perspective does make it possible to include the post- launch phase, which in some parts of the innovation literature is considered vital to the success of the product (Akrich et al., 2002a,b; Akrich, 1992; Latour, 1987; Callon, 2005 and Henion 2000).

From these sources we derive the central assumption, how design can be understood as a product of networks: the network formation that emerges and are established in the development process. As demonstrated in Christiansen et al. (2010), the interpretation of a design object can change if the network changes and that what is from the outside presents itself as product with a certain design, is created and recreated, due to the strength of network relations.

The design, as we argue in discussion section, is a collective action, the result of multiple modifications and interactions between heterogeneous actors in the network. As scholars have already done within other disciplines (Henion, 1997, 2000 with the music industry for example), this article has brought together two disciplines that have until now rarely been connected before (Christiansen et al., 2011): namely the theory of ANT and design management.

CASES

Serie7 chair (1955-56).

The serie7 (3107) is a stackable chair, made of plywood, which is a wood panel made from thin sheets of wood veneer, considered a very innovative material in the 50s. This material was already known in the Second World War, and it was used for military purposes in relation to airplanes. Charles and Eames Ray, two American designers, during the Second World War, got familiar with a new production technique, creating objects made of layers of veneer. Charles Eames, for example, invented prosthesis and laminated wood curved leg guard for injured war soldiers.

The veneer was considered an excellent material, because it could be modeled and bended, and this would make its structure stronger. The technique of bending the wood was the same that Aalto used in his experiments for bending the skis and the chairs in the late 30s. When he moved to USA, he brought and displaced this knowledge to the designers over there. The technology developed was an exploitation of the wood´s grain and new synthetic forms of glue laminated. After the war, companies were exploring different potentialities of the material, including how it could be employed in the furniture industry. The new technology enabled American furniture designers Charles and Ray Eames, supported by the manufacture Knoll and sponsored by Saarinen, to craft the first glass fiber chairs an in 1946 a plywood chair. These chairs were brought to Europe by some visionary furniture makings, among whom Søren Hansen, manager of Fritz Hansen. In the post war, the contacts between American and European manufacturers were frequent, and Søren Hansen was travelling often to USA. Fritz Hansen owned a flag shop in New York, and many

furniture exhibitions were held in that city. Søren Hansen used to bring to Denmark many samples of the most innovative chairs, proactively trying to inspire Jacobsen. He was among the first in the late 1940s to purchase furniture by Eames, Saarinen and Aalto, he used to first display them at the yearly furniture fair in Copenhagen, and then in the warehouse of Fritz Hansen.

Fritz Hansen was run since the ´30s by the grandsons of the founder, Fritz and Søren Hansen. After the war, when they took full control of the company, they began a process of modernization and industrialization. Søren Hansen was also a designer for his company, producing various chairs and updating the Thonet chair suitable for Danish café houses. Fritz Hansen bought the patent for the technology of bent wood from Thonet to use steam bended beech. This technology has been used for a couple of chairs in Fritz Hansen, and Arne Jacobsen was aware he could use the patent if needed. The Serie7 was created as an answer to the criticisms to Jacobsen´s first successful chair, "the ant".

The Ant was build to be put in the canteen of the Novo Nordisk pharmaceutical company, commissioned by the CEO of Novo Nordisk, Simony. Simony already knew Arne Jacobsen, since he projected his villa and wan many competitions for the factory. Simony appreciated the capacities of Jacobsen of innovating and challenging the current design in a constructive and purposeful way. Arne Jacobsen started the collaboration with Henning Simony in 1940 for the construction of the factory, of the laboratories and the canteen for the employees. Arne Jacobsen was asked to think also about the interior of the canteen, and he saw this as an opportunity to mobilize Søren Hansen and the technology he owned to create something innovative.

Henning Simony as the CEO of Novo pharmaceutical company was the most important regular client throughout the years. The office of Jacobsen received a significant number of commissions after winning the first prices in competitions, praised by foreign critics in the most important design exhibitions (Milan, London, Glasgow, Hanover, Paris).

At that time, Jacobsen had not designed a chair for nearly 20 years. He went on a trip to France, and he took some pictures of café chairs over there for inspiration. Back to the office, he showed them to his collaborators, that were six, among whom Henning Lassen and a young Verner Panton, who just joined the team through the acquaintance of Poul Henningsen (the designer of the PH lamps and good friend with Arne Jacobsen). Verner Panton was the one in charge of drawing for preparing the chair, and he made a number of steel- wire sketches. The number of sketches was so consistent that they were filling a couple of boxes on his desk. Jacobsen and Panton chose only one of them and sent off to the smith to have a full size prototype. When the smith came with the prototype, Arne Jacobsen sent him away with the prototype. He was not satisfied at all.

The process of sketching started again when Arne Jacobsen discussed his problems in drawing something satisfactory with Søren Hansen and he showed some of the chairs he brought from America. Jacobsen bought from him a chair designed by Eames in 1946, made of bent plywood with still legs, which were fixed under the seat through the attachment of shock proofing rubber.

In particular, Søren Hansen liked the innovative technique of bending the wood and putting the components together without gluing it, and he recommended Arne Jacobsen to use it. After this provocative exchange of opinions in different wood techniques, and discussing a previous chair designed by Søren Hansen with the Thonet´s technique, Jacobsen went back to his studio. This time, he took an active part in sketching and used some of the principles from Eames´s chair, creating a totally new chair. In an interview, when he was asked if he had difficulties of not incurring in plagiarism, he answered: "It certainly can be… when I have gotten an idea, I usually plow through a stack of books and journals on the subject to see if others have had the same idea so I do not end up plagiarizing. However, much plagiarizing is done unconsciously; certain trends in the period play a part. In 1939-1940, I worked on a luminary and found a solution. Then it turned out that the architect Vihelm Lauritzen had almost the same idea. In any case, the two lamps resembled one another to a suspicious degree… well, his was probably the loviest; at least it sells best" (Tau and Vindar, 2000).

Jacobsen was engaged into innovation: he was able to criticize his present status of things and to propose new solutions. The former design director of Fritz Hansen stated: ''it all started with the Ant in 1952. I'm convinced that it was inspiration from Eames that enabled Jacobsen to make the great leap in design; otherwise I can't explain how the differences in design from 1934 to 1952 are so significant. I think he was provoked by the success of Eames and thought, 'I can do that too, and even better,' and he did'' (Christiansen et al.2010)

In 1952 Arne Jacobsen started the production of the Ant, a little laminated 3 legs chair. The technology used for producing this chair was acquired by Thonet, and using plywood in a similar way, as Charles and Ray Eames did. Arne Jacobsen modeled the results for more than one year, since he recognized that it is very expensive to start the production of a serial chair. He worked a lot to achieve what he considered the right curves and the right cut.

The seat and the back were pressure of one piece of 10 thin layers of veneer, and after they are pressed and then attached in 3 (later in 4) slender metal legs, with rubber feet. The Ant was considered by Søren Hansen a wonderful example of industrial production at a very good level of quality.

Arne Jacobsen succeeded in finding a beautiful and vibrant solution at one problem, namely producing sit and back in one piece.

Arne Jacobsen challenged the design, since it was very difficult to work with a little thickness to create sufficient strengths in the transaction between the sit and the back; but in the Ant is possible to stabilize the transaction with a bend conjunction in the third plan; and this is the notch in the back.

Søren Hansen, in an interview in a newspaper, said that for making the back standing and not having weak bent, was unexpected a very little work, it was performed with only drawing board and not mathematical formula.. It was smaller than the ant produced nowadays and with three legs: *"if it has four legs, the one might not het a good grip, three legs will always stand"* (Arne Jacobsen in a newspaper interview). The legs were attached under the middle of the seat, where it was

positioned a little plate for the screws, the screws could have something to chew on, the legs run out until the vertices, where they supported the rubber and it acted as a calculated first suspended to drive by a junction in the middle of the seat.

The Ant was presented in the Danish museum of decorative art in 1952.The exhibition was curated by Arne Jacobsen, and the chair was positioned in a remarkable place. He was not concerned with all the business considerations in connection with the presentation, only with the visual impact, aspect he never compromised. When Søren Hansen asked to modify the ant to meet the request of the market (larger, more stable, less sense of fragility and four legs), he refused to change the design. Also Simony was asking to modify it, by producing a version with four legs, since the third on the front was hitting the legs of the tables. Jacobsen for years refused to design a model with four legs, since he believed the one of the four would always have problems in touching the floor, while three would always been stable and could be moved under the tables more easily. He was also sustaining, correctly, that the structure of the ant was not fragile at all, due to the multiple layers of veneers, proving the chair enough flexibility and an incredible robustness. Nevertheless, Søren Hansen wanted something to be commercialized also in the private market, not only for one factory. He was aware that the product was good, but it should be changed for meeting the customer requests. Arne Jacobsen was very inflexible, he was calling the ant "his little child", and he did not intent to modify anything of it. In order to overcome these struggles, in 1956 he designed a new chair, the Serie7, based on the same technique than the ant, but it looked less fragile. The shape was inspired from one of the first chairs designed in bended wood by Hansen.

The serie7 became the most sold chair of the world. The chair had four legs and a more solid figure, since its organic form is plainer than the Ant. It was exhibited in 1957 for the first time in H55 (Helsingborg exhibition), which he personally curated. Arne Jacobsen had a great career as an architect, and from the launch of the ant, he started to place his furniture in the buildings he constructed, like theatres, halls, municipalities. Danes got accustomed to see the chair and perceive it as good quality, affordable design for all the families. This is evident from the advertising material proposed by Fritz Hansen at that time.

In an interview, an old designer, who worked in Fritz Hansen in that period, stated that when it was first produced at Fritz Hansen's, no one had ever dreamed that it would become a best seller. At the factory one could see that this was something special, one believed in it- and it was a success from the very start, even though it is rumored otherwise. Instantly it was exhibited worldwide, and was given a separate room at the annual exhibition of Danish design. This chair was new, simple and expressive (Christiansen et al, 2010). It was small and modest and at the same time it expressed so much. As the journal ''Design Corner'' stated in 1961, ''the name Arne Jacobsen has been synonymous with ultra-modern design since 1952",, year of the launch of the ant.

The Egg case (1958-59).

In 1944, the Dow Chemical Company patented expanded polystyrene in the United

States under the brand name Styrofoam. Søren Hansen acquired the license in 1958 for using Styrophor, which was patented by BASF in 1950. Arne Jacobsen was aware of the possibility to use this new material, and he was experimenting with it, after the launch of the 3107. He modeled some prototypes, but Søren Hansen refused to start the product development process unless he had a consistent commission.

When Arne Jacobsen wan the competition for building the Radisson Hotel, in Copenhagen, he saw this as a good possibility for experimenting with the Styrophor, and he involved Søren Hansen. Furthermore, Jacobsen and his design studio exploited the situation fully and tried to involve more allies into his network by presenting the contract-givers with the suggestion that he should design as much of the interior as possible, including lamps, fittings, kitchen- ware, and furniture. As he was subsequently given that contract before presenting the exterior design, Fritz Hansen became more inclined to continue product development of the Egg. The optimism is also shown in the furniture producer's willingness to assume risks and put new furniture into production. According to the design director, ''back then, in the 1950s and 1960s, we had producers who were willing to assume risk; there were new materials, a new social system, an up-swing after the war, and lots of opportunities. Designers were politically engaged and wanted to make furniture that the new, young families could enjoy. But it was also a time of brilliant journalists who were able to communicate and spread the news of these new types of furniture; Politiken [a main DK newspaper], played a major role, but so did exhibitions and department stores'' (Christiansen et al, 2010) Jacobsen began the innovation process by drawing rough sketches; these representations were transformed into full-scale molded plaster models of the Egg. The cabinetmakers in Fritz Hansen revealed in an interview that they were pretty frustrated. Arne Jacobsen was as precise and methodic in architectural sketches, as imprecise and vague in designing furniture, and they needed to interpret a couple of lines and make a plastic model. He used to pick up the prototype in the weekend and continue to model it in his summerhouse, and returning the next Monday. In the ´50s, Jacobsen was still running his office with a fairly small staff, so every one was aware of what the others were working on. In the office, at that time, employees did not work according to any specific system of rules or organizational principles. Each project was started in an exploratory way. Also the Egg project happened in the same way. Jacobsen handed few sketches to the person working on that, and the idea was constructed with time: the employee developed the idea with few lines, then Jacobsen corrected with a thick pencil, returned to the employee who worked on that, gave to Jacobsen who corrected it and so on. Both Jacobsen and the employees felt very unsecure about how it could develop, but line after line, the project was progressing, sectioning few ideas. Henning Lassen in an interview declared that Jacobsen was sometimes intentionally creating a state of fertile chaos, making the people in the studio and Søren Hansen participative in producing ideas and suggestions. Jacobsen aim was to co- create proposals, selecting good points from the different sketches and than putting them together.

In Fritz Hansen, the whole team worked in a chaotic, but still ordered process, applying a "wirthwind model": Søren Hansen was supervising and giving

suggestions, Arne Jacobsen directing the design, the design team modeling trying to interpret the directions, and the material and sewing team bringing suggestions on the feasibility of covering the shape with leather. It was a continue back and forth process, and even if the team was constituted by strong personalities (such as Jacobsen and Hansen), this dyadic leadership team was successful, and acted well in interessing other actors and making the innovation happening.

The launch moment of the Egg happened when it was displayed in January 1959 in Fritz Hansen's showroom. The first public appearance of the Egg was in November 1958 at the Formes Scandinaves exhibition at Muse´e des Arts Decoratifs in Paris, where the Egg and the Swan were presented as part of the interior for the SAS Royal Hotel. In a 1958 article in the Danish newspaper, Politiken, a headline referring to the Formes Scandinaves exhibition reads: ''The French press is astonished by Danish Design.'' Other furniture fairs, which all helped to draw attention to the new creation, followed the exhibition in Paris.

In the 1950s and 1960s, the architects association organized yearly the Copenhagen furniture exhibition, Den Permanente, where designers showed their work. This furniture exhibition was considered an important place where to exhibit, due to also the international recognition that Danish design has acquired. According to the graphic designer from Fritz Hansen, the managing director of the exhibition centre was associated with the Egg network early and easily: ''Søren Hansen was an extremely outspoken person. He was chairman of 'Den Permanente' and chairman for Danish Hand- crafts. He had access to all the right channels and knew how to exploit them so that the Egg appeared at the right places at the right time. He was part of a very strong network. Today I would call him a lobbyist. Søren Hansen was also the man to open the door to the American market. There is no doubt that he played a key role in the initial success of the Egg.''

The Egg was frequently satirized in the Danish newspapers. For example, it was represented as uncomfortable for the Flinston family, or not well received by the American President after he sat in the SAS hotel, mocked by British professors when they decided to assign Arne Jacobsen the construction of Saint Catherine´s College, in Oxford. Despite the critiques, the public was welcoming the Egg. As the professor in design explained: ''The Egg represents the organic paradigm, a feminine esthetic, a product that appeals to the home of the welfare society. As such it is a radical break from functionalism, with its standards for mass production and rationality that had dominated the years since the war.'' It was a period with new optimism and more risk taking and a growing welfare society. He continued: ''We were headed into the 1960s, a time when many things happened in Denmark; there was an economic upturn, and the mentality was changing. People were ready to embrace new things'' (Christiansen et al, 2010)

The Ice chair case (2002-2003).

The Ice chair, which is ascribed to designer Kasper Salto, marks a milestone in the history of Fritz Hansen: Ice is the first chair marketed from Fritz Hansen that is equally suited for both indoor and outdoor use. The chair with its rib-like back

incorporates the virtues of classic chairs of the past while the choice of materials points to the future. The base is natural anodized aluminum and the seat and backrest are made of ASA-plastic, a both sturdy and sustainable choice. The result is a lightweight, highly comfortable and hardwearing chair.

Kasper Salto worked on development of the Ice Chair from august 1997 to October 2002, and so did others also. At the beginning, most of the time was occupied by meetings with the design management team in Fritz Hansen (mainly the design manager and the CEO), in order to better define the design brief. In Fritz Hansen, the brief for that project was a s a document developed to specify which were the business needs for the design and for the designers, focusing on the product description and development, not on the aesthetic. The Fritz Hansen team was seeking for a stackable and durable chair that could be used both indoor and outdoor. During an interview, the design manager explained that the brief was voluntarily of few lines, in order to use it as a mediator during the meetings. In his experience, navigated designers preferred few lines to discuss with the company their ideas, while inexperienced designers wanted to have a clear detailed description of what they were intended to do. The design brief was written by the design manger from FH along with the people working in the marketing department and fashion scouts.

The company Fritz Hansen in that period relied heavily on the marketing department, which was investigating what needs customers, could have, and they employed fashion scouts to discover the latest trends around the world. The design manager listened carefully to them and wrote the brief. The brief was then discussed, modified, and approved by the management team. In this case, it was the outcome of negotiations and successful relationships between multiple actors, including designers, design manager, CEO, computers, tables, contracts, and so on, fashion scouts and marketing department. It becomes a tool for the management of design processes and products. For the different actors, the brief had different goals; it was mobilized for different purposes. For example, for the design manager, it was an explanation of the needs for creating new product. For the CEO, it was a management technology tool, able to abbreviate the distance between the designers and the management. For the designer, the design brief was considered a departure point with an explanation of his future job.

After being approved, the words in the brief did not change, but it became a sort of narrative about the firm's ambition to create value for its customers by launching a revolutionary chair. Salto used to refer to the design breief when he had to present new drawings, when he translated it into figures, texts and illustrations: a written development and translation of the designers' ideas and knowledge of different source and resources.

The design manager and the CEO in Fritz Hansen knew there can't bee too long time spam in the development process because it costs a lot of money, but the managerial team let Kasper Salto free to work at his own speed, at least at the beginning. In the brief, it was explained that the Ice Chair was meant to be a core product for the firm, a breakthrough innovation for the Danish market, revolutionising the concept of the chair: both indoor and outdoor.

The design manager contacted Salto after having seen a chair he made exhibited in the Kunst Industrieet Museet (museum of industrial art) in Copenhagen. Even if the design style of that chair was not aligned with Fritz Hansen design, he decided to involve Salto anyway.

The CEO and the design manager contacted 5 designers and they started a competition based on the brief they proposed. The designers were unaware that there was a competition.

The brief produced by the top management described the characteristics of the chair: a multiple use chair that could go in and out of the houses and also at the same time be light lightweight, strong and comfortable. At the individual meeting with the designers, the CEO and the managers were discussing the brief . The brief for the new chair was inspired by a café chair that went out of production some years before in Fritz Hansen. It was a simple outdoor chair, but very heavy to move, so it could not blow with the wind. It was galvanised to not get rust. It was very heavy durable and stackable chair but not very sophisticated, and not comfortable. Material and production wise, it was not technological advanced. Fritz Hansen management was asking for a highly ultra modern chair, lightweight, strong, comfortable and stackable, that could both being inside in café, canteen, and also indoor, as meeting chair to be used at the high managerial levels. It should be elegant and sophisticated enough to be used as meeting chair, not as office chair for the managers.

The vision of the top management team in FH was clear: making a product that could be displaced and travel everywhere, in all the environments of the houses, in different buildings, and also outside. For Salto, it was a very ambitious project, and very hard to solve. The risk was high, since the chair could be interpreted as a chair that was suitable for anything and nothing, and being not commercialised for the lack of an interessement of the customers. Moreover, Salto at the beginning had difficulties to conceive a balanced chair in that sense: an outdoor chair should be durable, resisting enough for the rough Scandinavian environment; an indoor chair should be soft, smooth and warm, it shouldn't be too heavy, nor too cold.

Salto worked in the prototype alone in his studio, showing it to the team in Fritz Hansen when he though to have advanced in the modelling. He was enthusiastic in working with the plastic, a new material for him, too expensive to experiment without a commission. According to Kasper Salto, the chair is an excellent chair, very high tech, maybe a bit expensive to be very commercial chair. The chair became so much high tech that it has scared some of the targeted market. It is very precise chair, not cosy, or warm. The plastic chair was made of plastic and aluminium, materials that are supposed to last for long time,

Both for Salto and Fritz Hansen, this was a radical innovation process, since the actors involved enrolled in the network plastic and aluminium, materials that were not used neither by Salto or the manufacturer company. Moreover, the aesthetic of this chair was clearly departing from the tradition of Fritz Hansen. Even if there had been a prior experiment with outdoor chair, but the company did not consider it enough successful to build on that case.

During the prototype moment, Salto was unaware that he was in the middle of a competition. He discovered this in November ’99, four weeks before the deadline for submitting the prototype to Fritz Hansen. Salto in that moment felt part in a bigger network, and it was becoming more fragile, and unstable, since there were other designers ready to put him out of the network. He decided to work night and day to prepare a prototype, until it was considered satisfactory, hoping that his design was considered stronger than the competitors

From a technical point of view, the frame, arms, seat, the back and the injunctions are moulded in high pressure. Fritz Hansen´s team allowed Kasper Salto to do a lot of testing, moulding a wide range of plastic, from very cheap to very expensive. For three years Salto worked only on this project, and this process is very unusual for a designer since it is consuetude to have more than one project.

The final prototype was produced, Kasper Salto wan the competition with his chair. Jacob Holm, the FH CEO, asked that the design should be scaled 4- 5 % compared to the first prototype. After the launch, the marketing director of Fritz Hansen organized a campaign, with the launch at the at the fair in Cologne in Germany, booking 300 square meters, and putting only 150 ice chairs and cubes of ice everywhere. For the first time in a launch campaign, the concept of the launch event was altered: no fine food or wine was served, the main actors were the chairs and the designer Salto, promoting and describing the chair.

PRELIMINARY ANALYSIS

	Serie7 (1955)	Egg (1958)	Ice (2002)
Non human actors involved in the network	Improved econimics,bended wood technique, thonet, Plywood, the ant chair, N. American designs, Eames, Novo Nordisk, 10 layers of veneer rubber feet screws feminine forms, production facilities, patents	Improved econmics, Styrophor, womb chair, Eames, N. American designs Plaster models Sketches, Organic forms, production facilities, patents	Plastic, café chair, Italian furniture, masculine and high tech forms Prototype Competition Company strategies, Marketing strategies The design breif
Humans actors involved in the network	CEO (Søren Hansen) Customers not satisfied by the Ant and the 3 legs, Arne Jacobsen,	CEO, Søren Hansen, cabinet makers in FH, Arne Jacobsen	Bjorn Stærk (design Manager), Jacob Holm (CEO), Kasper Salto,
Actors mobilized and enrolled into the network for the launch campaign	Exebition: Helsingborg 1955, Politiken (newspaper) Den Permanente (Exehibition) Construction of buildings where he could place the chair (theatres, universities, oxford university) Design corner	SAS hotel Politiken (newspaper) Den Permanente (Exehibition) American President Design corner Formes Scandinaves Danish Modernism	Cologne Fair, Presentations of the chair in Fritz Hansen showroom around the world

Table 3: Preliminary analysis: the actors, the processes and interessement in the concept- and launch phases for the 3 chairs. The year indicated refers to the year in which the chair has been launched.

Relationships. The theoretical framework used in this paper focuses on relationships: relationships between the human and non-human actors, their actions to enroll and interress in the network other actors, the efforts to make it stable. Interressement is the process of successfully getting others to support, interact, and devote their energy and resources toward something. In the literature, innovation processes and new product development can be seen as a mish- mash of decisions that cannot wait, in an environment of complex changing markets and customer tastes, in which actions cannot be planned or predicted in any mechanical way (hence the term nonlinear). The products face many different trials (tests) and accusations, and in these there are

claims for an innovation (i.e., a certain product) that it is better than prior solutions. The chairs analyzed in this article were considered very innovative and a radical innovation for the company when they were developed.

Design is constantly in search of allies and the designer is the actor, who is acting in order to capture the allies´attention, displace goals and enroll other actors in the network, make constant reinterpretations explanation after explanation, and reinterpretation of the meaning of the design. This lead to affirming that there is not an essence of design, but the interessement actors are communicating the result of the network construction.

The characteristics is not only a reflection of the technical features of the product, but also the result of numerous agencies constructions (museums, exhibitions, review, sale numbers, architects and so on), and that the fact that a product has been able to be displaced across time and space is the result of a intricate variety of actors and situations springing from their relations.

Endless number of actors needed. From the above table, it is noticeable that a wide network of actors has been enrolled to make the chairs accepted and popular before and during the launch.
"To enroll others so that they participate in the construction of the fact; to control their behavior in order to make their actions predictable" (Latour, 1987, pg. 108)

Many human and non-human actors become designers in the process. The product, the design, was influenced and formed during the processes. The meetings became moments in which the actors were renegotiating the features of the chair, their identities. In all the cases, the actors involved were working together to transform the prototype in a product, and in case of actors working in antiprograms (Latour, 1991), the designer was successful in being an interessement actor, enrolling the actors that initially refused to be enrolled (for example, the moldering people in the case of Jacobsen, or the plastic in case of Salto, who successfully learned to mold.).

It is evident that the designer, in order to be an interessment actor, should be able to create a wrap of links that relate the design object to all the other actors in the network which have an interest in the object and attach to it. Following the quote of Hennion: [...] recognize that creation is far more widely distributed, as it takes place in all of the interstices between the multiple intermediaries involved in producing and appreciating art".(Hennion & Grenier 2000, p. 351)

The **de**signer and his ideas and concepts are transformed during the process.
Actors were also constantly looking for allies to support their network and product definition. Some allies emerged spontaneously (like journalist writing good reviews in an important magazine) or needed to be mobilized (like design and architecture exhibitions). Other important allies are also the public buildings where the chairs were displaced. Arne Jacobsen always put his furniture in the buildings he constructed. He

used to say that there was not good furniture in the market, so he had to design and place his own chairs. This increased the exposition to the public, and especially in Denmark, the serie7 has become a chair that every family knew and then bought it. The architects are also responsible for suggesting which chairs to place in public buildings, and they have been important allies for the circulation of the chairs. The choice of the material, the organic forms in case of Arne Jacobsen, or masculine and strong forms of Salto, the innovative traits, and the strength of the structure to make the products long lasting, were choices done to strew strategic allies. Moreover, the chairs were developed and launched in a moment in which the socio- economic environment were very positive, so the customers were willing to buy, increasing the adaption of the chairs. During this process, in their search for allies the design is transformed, and the designer is shown to be a mobile - a human actor that is no stronger than the network he can mobilize.

The success of the design is co-constructed, and the designer becomes an interessment mobilizer. The individual qualities of insight, intuition, vision, creativity, are reinterpreted and assembled in the language of the design, not being anymore the properties of an individual, but collective virtues, in which governing and managing has a fundamental role (Akrich et all, 2002, pg190).

Non human actors played an important role in all the three cases, as design concepts, as materials, as patents and productions facilities all became important for the stable network to emerge.

Involve anti-programs. The designer her-/himself becomes an actor among others involved in the interessement process. The persons working in Fritz Hansen, if they arouse some doubt or concern for the processes or the materials, they would be involved even more in the development process to strengthen the network and to represent the potential problems related to the choice of the material that might break the newtwork. Representivity is not brought into question (Callon, 2005), but the management in several instances, acted to protect the original design brief from anti-programs that might threaten the concept.

The meaning is produced not given. The chairs had not intrinsic properties, the semiotic meaning of design is not a priori determined, but constructed in the network by engaging a multitude of the complex micro-processes that happen in the design creation, development, launch, and post launch moment.

The boundaries, working orders and makers of the design are all fluid, they are vague and moving rather that being clear and fixed (De Laet, Mol, 2000). This allows to multiple human and non-human actors to interact and in the processes not only to produce the final proposed design, but also mutating the design and the role of the actors mutates through the translation processes. For example, Arne Jacobsen was stimulated by the chairs bought in USA and displaced by Hansen, he shifted from a neoclassical Danish design to a more radical design; he was stimulated by the critics

of the public and by the suggestions of Hansen (CEO) for producing the serie7 as a more attractable chair to align with more customers.

The analysis of the three chairs demonstrates how multiple human and non-human actors interact and in the processes not only produce the final proposed design, but how the design and the role of the actors mutates through these translation processes. The final design is a bricolage, where the traditional role of the designer becomes to be one among many human and non-human actors in a network that at one point in time is declared to be "the design". The designer is during the process her/himself re-designed through the need for being able to adapt to other actors in the network.

The success of the chairs has been decreed by the capability of the designer to interest, mobilize and enroll allies in the network, but also to move across the fluid boundaries to make the network bigger and more stable.

CONCLUSIONS AND IMPLICATIONS

This paper demonstrates that the outcome as a design object is not only the result of a genius and a design brief, or technical factors, but the outcome of a socio-technical network that makes human and non-human actors connect and act as a collective. The final, stable - but fragile - solution is a outcome of alliances and relations between these actors. The design and the new product development it is the result of network construction.

The management of design and design and processes becomes in this perspective a matter of not hiring the best or most modern and futuristic designer, but the ability to assemble and construct the most stable network, but also being able to manage the struggles and anti-programs that might emerge during the design processes.

It would be interesting to study the role of mediators, in the cases we analyzed, are fairs, architects and designers. Mediators are constitutive for forming the objects and they are actively involved: “Mediators are not passive [...], but active producers” (1997, p. 416). The design is not simply produced by a vision of the designer, but multiple actors contribute in the creation and development, and it is materialized thanks to the interaction of various human and non human actors. Which is their role in the design environment is still unknown.

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