Design beyond design: Design Thinking & Design Acting

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Abstract

In essence this paper seeks to answer the question: what are the essential elements of designing as a human activity that makes it possible to transfer these skills and attitudes beyond the world of design? The paper proposes to split the phenomenon of design into Design Thinking and its social dynamic counterpart into Design Acting. Design thinking is what designers do individually and in a collaborative setting of peer designers. The paper explores design thinking by reviewing literature aiming to discern some specific qualities that might be transferable outside the traditional field of design. We look at cases like Formula 1 designer Gorden Murray, architect Frank Gehry and industrial designer James Dyson in this perspective. The well-documented case of Edison and his invention of the telephone illustrate our discussion of design thinking. Design acting is described as the socio-interactive dimension of design, which places the designer in his social environment and promotes the design actor to an interventionist aiming to provoke change among the affected (non-design educated) stakeholders. The curriculum of the international master program Strategic Product Design at Delft University of Technology functions to illustrate the social corporate environment surrounding the designer and brings design to the fringes of the traditional scope of the designer's profession. This master program focuses on the fuzzy front end of design and on bridging the many gaps among the various non-designing disciplines involved. The paper shows that bridging gaps among stakeholders within product innovation processes is a process of change and interventions initiated and lead by a strategic design actor. A specific masters' graduation project illustrates the necessary integration of design thinking and design acting beyond the field of design.

Introduction

The popularity of design thinking these days need not be substantiated by a long list of references. The very fact that the Design Thinking Research Symposium No 8 is focusing on design thinking beyond the confines of the world of design is evidence enough. Design thinking has been there in practice long before educators and researchers started to explicitly mention it as a key asset of their educational program and as a subject of their research. The practice of design thinking has always been a practice of creating a new artifact, be it an axe, a plough, an armour, a shed, etc. People have been changing their tools and life environment by designing and creating since ages. Fact is that people can be good designers without having explicitly received any specific formal education. So, part of what design means in our lives is transferred to us genetically[1]. On the other hand, we don't want everyone to become designers of just new artefacts because we also want people to use their design sense in maintaining the existing artefacts. The flip side of creating and designing is sustaining or maintaining what is, sometimes also requires design thinking. If what we have is sufficient for our needs, should we engage ourselves in design processes?

[1] Creation of tools by apes and the existence of differences in the tools used by neighboring communities of apes have been recorded. These evidences show the innate nature of design that evolution has refined over time. (Nature, 2010)

But history has proven that all that is sufficient changes over time making artefacts obsolete and is subjected to serious questioning. What if …, We might want to …, etc. These questions aim to change the status quo and to create a 'better' status quo. The creation of the new state is sometimes an intentional process, sometimes a serendipitous process and sometimes an unintended process. Many breakthroughs come out of accidents!

This paper aims to shed light on what design could mean outside the confines of the traditionally accepted field of design. To do so we will split design into design thinking and design acting. Design thinking is what designers do while working by themselves and collaboratively with peer designers. This characterization of design thinking is well documented in literature. On the basis of this literature we will focus on the design problem and the design approach as potential elements that could be transferred outside the field of design. Design acting on the contrary is not well documented and covers design as a social process which can either take place among a setting of peer designers, the design team so to say, or in a multidisciplinary setting that includes large variety of stakeholders not educated in design or engineering. The latter activity forms our focus regarding design acting.

The reminder of the paper is structured as follows. First we will address design thinking by discussing the work of some remarkable designers from existing literature and discern some abilities that might be applicable outside the traditional world of design. As an illustration Edison's design approach is then presented as a case of exemplary design thinking. The literature related to design acting forms the second theoretical introduction. It is then followed by discussion of empirical material from final projects of students following a master of science in Strategic Product Design. We will end this paper by discussing our observations in the light of design outside design.

Design thinking

Design thinking has been under investigation for as long as 50 years (Cross 1992). Most studies focus on industrial designers and architects although design as phenomenon has been discussed besides these two professions. Recently, design has become the hype for business actors and in business schools. They mix-match their curriculum with sprinkling of creativity and design issues. This raises a fundamental question; can you teach design thinking in a few courses? This effort cannot just be about teaching to be creative to solve well-defined problems. On the contrary, most design problems are ill defined and to address them is not mere problem solving. Of course, creativity is a condition sine qua non, but it is how the actor applies his/her creative potential makes all the difference. To what problem and in what context and with what aim and at what moment is the need for creativity action recognized, it is this contextualised application of creative thinking throughout the full length of the design process that could lead to a new design. This echoes the observation by Dune & Martin (2006) that designers treat problems differently than those trained in MBA. Authors like Boland & Collopy (2004), Gehry (2004), Weick (2004) and Buchanan (2004) point to the MBA-like educational programs as reason for the short comings of the present dominant thinking in business. According to these authors a different form of thinking is needed and they refer to design thinking which covers creativity, toleration of uncertainty and bring an 'And-And' decision style instead of 'Either-Or'. Either-Or-thinking polarizes the options in terms of one is good and one is bad and by that squeezes out all the solution space required for an approach aimed at realization of And-And.

It seems a matter of treating the initial situation or design problem. However, we agree with the observation by Dorst (2006) that the design problem is a problematic term in design science. According to him the design problem is too complicated to study since design problems are not knowable at any point during design, design problems evolve over time and the notions of the design problem tent to shift while designing (Dorst 2006). Cross (1992, p.8) for instance mentions that "designers habitually treat problems as though they are ill-defined" indicating that their normal behaviour is strongly related to ill-defined problems or challenging design tasks. This is similar to the suggestion by Dorst (2006) that ill-structuredness is not a condition of the initial problem per se but related to the applied solution methods, that is the capabilities of the problem solver. In our view, the designer must see a challenge in the problem and if not the designer creates one by playing with constraints and goals related or inherent to the problem. Further, co-evolution of simultaneous development of problem and solution (Dorst & Cross 2001) adds to this notion of seeking a design challenge by looking for problem-solution pairs simultaneously instead of defining the problem first and then look for solutions. This characterization also fits with Braha and Reich's description of co-evolving topological spaces of requirements and solutions (Braha and Reich, 2001).

To illustrate our thinking we will use an interesting example discussed in Hatchuel (2001). He compares two almost similar situations faced by two groups of students to entertain themselves on a Saturday night to illustrate the difference between problem solving and a design task. One group looks for a good Saturday night movie and the other group wants to organize a party. Clearly the first group only needs to solve the problem by selecting from the existing movies in town. This doesn't reflect a design process. It is a mere selection among existing alternatives that are of the same type and the same level of concreteness. The second group has a different task that according to Hatchuel is more like a design project that implicitly has room for unexpected and infinite expansions of solutions. There are variations possibilities regarding location, sort of party, drinks and food to offer, people to invite, etc. All these elements require different selections and needs to be integrated into a whole. While both groups want a joyful Saturday night, the first group has (implicitly) limited their solution space and have chosen to go for a good movie. The second group made a different choice of having a party that provides them an unrestricted problem and solution space. The constraints in terms of budget, time and capacity to organize, etc. make it a design project. The movie-situation could therefore be seen as a well-defined problem in comparison with the ill-defined situation of having a party. What we want to make clear here is that one of the elements that could bring design thinking outside the confines of its professional field is the designerly attitude of people (non-designers by education) to seek (consciously or sub-consciously) the 'design' challenge in situations that somehow are in need of resolution.

But what makes up a design challenge? A paper by Cross and Clayburn-Cross (1996) that reports of the design process of Formula One racing car designer Gordon Murray might be of help here. Murray frequently out-designed the competition by applying what seems to be a typical design approach. The authors mention that Murray's most important factor is to start by reconsidering the problem situation from scratch and by 'looking back at fundamental physical principles'. To us that seem like a good strategy since looking back at the fundamentals is a process that overrules or bypasses the assumptions and underpinnings in present and preceding designs. Looking at the designs of the cyclone vacuum cleaner and the new Airblade hand dryer by Dyson and the Strida foldable bike by Sanders (Roy 1993) it seems that consciously or

unconsciously this is what happened in arriving at a new principle. The conceptualizing that starts from the first physical principles (from scratch) leads to the creation of new integration patterns rather than the honing of existing ones (Cross & Clayburn-Cross 1996). It seems to us that this particular quality of looking for new forms of integration characterizes the (innovative) designer and could also characterize the non-designer acting as a designer within his/her own field.

Such a reframing of the initial situation is what designers often do to get a better starting point. Instead of accepting the constraints inherent to the initial problem definition another viewpoint is created by considering for instance the total system. A (total) systems approach could lead to circumventing the dead alley introduced by the initial framing. Systemic design zooms out of the present layer of concreteness that contains the constraints to a level that takes the whole system as a unit for design. Cross & Clayburn-Cross (1996) provide an interesting example of such a systemic approach and report on Murray's innovative idea of using refuelling pits stops during a race with the ultimate aim of reducing the weight of the car *during the race* in stead of reducing the weight by redesigning car's construction. Like him all other teams did focus on the construction but found themselves somewhat in a dead alley. By reconsidering this problem in the light of the total system of one race he realised that one way of making cars lighter during the race was to carry less fuel around. Making racing cars more fuel-efficient was not a real option at that point. So he realised that cars that only contain half the amount of fuel are lighter, have better acceleration and deceleration, smaller fuel tanks, less wear on tyres and provide a more constant handling during the race. Having less tyre wear and a planned pit stop made it possible for them to race on softer rubber compounds which improved the cornering speeds. However, pit stops until then were only used for emergencies of tyre punctures or light damages. Lifting the initial design situation to an abstracted level of considering the total race as a system implied that redesign efforts would be needed on the various elements within this newly defined system. Murray needed to develop a fast fuelling system, a new wheel-nut gun, rapid tyre change procedures and a tyre heater. The latter was needed to prevent the sub-optimal grip of cold tyres during the first two rounds after a tyre change. Making a tyre change part of every race implied that all unnecessary lost seconds before, during and after the pit stop must be squeezed out of the system, hence the tyre heater that didn't exist before had to be created. All in all, the system approach here meant that the various elements were redesigned and integrated differently into a new and innovative system which made it possible for Nelson Piquet to win the F1 championship in 1983 (Cross & Clayburn-Cross 1996).

Interesting to note that considering the system level as starting point for design is already outside the scope of the actual design field and the consequences thereof are that much more need to be designed than just the car, like designing pit stop procedures for rapid refuelling and tyre change. There are no reasons to believe that the design approach of pit stop procedures worked any different than the design of a better-suited wheel-nut gun. On the contrary, in 1982 the new pit stop was already tested in the season. But also 'prototype' runs that were taped by a specially hired film crew that on play back informed the redesign of some procedures and are quiet similar to design thinking in the traditional field.

Another element that is frequently mentioned in the Cross & Clayburn-Cross paper is the carry-through of the initial idea until the very last detail. Designers envision the future new situation as an integrated whole which enables them to concretise the new situation. In the case of Formula One, there is no time to continue a process of

reframing because of the time pressure exerted by the approaching next race or next season. Murray needed to carry on as fast as possible and develop and produce the new solution until the very last detail and until all 'bullshit' is out as he called it. Such a solution-focused strategy is similar to what Roy mentioned on Dyson and Sanders. Getting real and integrated as soon as possible and as close to reality as possible by numerous drawings, mockups, models, prototyping, etc. Such a strategic approach is best illustrated by "parallel working, keeping design activity going at many levels simultaneously" (Cross & Clayburn-Cross 1996, p.107). It seems to us that parallel working and at many levels favours the search for the new integration of elements.

Awareness of the vocabulary in use and the emergence of new/additional elements of the vocabulary in the project form a final element of design thinking. A paper by Boland et al. (2008) discusses the design practice of Frank Gehry and mentions that anyone involved in designing must be conscious of the project language and the characteristics and logics of his/her own language and vocabulary. Designers need to be open to the tension and constraints their vocabulary imposes "on the desire to create new and more powerful designs" (p. 14). Breaking out of such a circle requires awareness, reflection and possibly additional vocabulary, like the tyre heater in Murray's case.

Although, Cross & Clayburn-Cross, Roy and Boland et al. focus their work on extremely innovative designers and compare this with other studies on innovative designers. They merely draw out the extreme approaches and attitudes of a designer. Their chracterization of designers will help us to define some of the elements that are similarly valid for designerly actors outside the area of product design.

Based on these observations in literature we found some characteristics of design thinking that are likely to be applicable outside the field of product design. First, it seems that design thinking related to how the initial (problem) situation is handled is more suitable for application outside the design field than the actual design process. Treating problems or initial situations as ill-defined in search of a suitable design challenge that provides opportunities for new integrations, even if the problem seems well defined at the beginning! Designers have the ability to work on the solution without having defined the problem properly. Considering the situation at either more abstracted and comprehensive levels (system) or more fundamental levels (principles) is another strategy that opens new pathways for the designer to challenge older assumptions and possibly circumvent them. We believe that these different forms of 'situation handling' are very much transferable to non-classic design fields. Second, apart from the tactics in design, there seems to be a strategic approach that aims at working at different levels of abstraction. The detailing of one particular design element runs in parallel to conceptualizing of another element. One part of the design is detailed out while another part stays at the conceptual level until later and until integration is possible. This brings us to the third characteristic of design thinking: (des-)integration. We believe that designers have a very fine tuned feeling fpr decomposing any situation into an opportunity to re-integrate differently. Integrating elements that as whole make up the (innovative) design goal are what designers look for and make them going.

All in all, designers manoeuvre themselves in a position regarding the design situation that opens for them the possibility for creating a design challenge that bears opportunities for searching new integration and possibly additional vocabulary. The next section considers the work and thinking done by Edison to illustrate this manoeuvring and way of acting outside the traditional field of design.

Design thinking by Edison

Edison is the quintessential designer and inventor who was good at the practice of design thinking. While everybody knows about a number of Edison's inventions, his invention of the telephone is not as well known as the primary credit went to Alexander Graham Bell. The history of the invention of the telephone shows that there were many contenders including Edison. The notion of telephony was in the minds of many inventors after the invention and use of telegraphy. Most early expansion of the telegraph was to be able to send multiple messages simultaneously; multiplexing the messages. Edison was very active in this area of telegraphy and has sold duplex telegraphy to Western Union. Initially, Edison did not participate in the telephony research and development. Western Union had rejected Bell's offer of telephony and was looking for an alternate avenue. Edison was brought into telephony by Western Union, who felt they lost out to Gould in letting Edison's work on quadraplex telegraphy go to them. At this point the work on telephony was restricted to using discrete telegraphic signals with some variation in tonality to transmit voice. This approach to extending the current telegraphy into telephony was not something that appealed to Edison. His goal was to be able to faithfully reproduce human voice and pursue the detailed investigation of the relationship between electricity and sound. This meant his search for the solution had to go beyond simple extension of telegraphy. In this context, he sought to use research unconnected to telephony coming more from the Helmholtz experiment on synthesizing different vowel sound by combining sounds of different tonal sounds electronically. He also used the work of Reis on intermittent sound generation to understand human hearing and modified it to generate continuous sounds by using a variable resistance transmitter to get soft and loud sounds. Further, Edison wanted to improve on the magneto based single receiver and transmitter apparatus for the phone to a technology for both the receiver and transmitter whose performance was better than that of Bell's magneto based receiver-transmitter. He spent time building this apparatus using carbon particles and a diaphragm and adding battery power to prevent the decay of current over long distances. He had to modify the diaphragm made of mica to other materials. In developing this receiver, Edison pursued several avenues simultaneously both as betting for one of them to succeed but also to generate knowledge that he could use later. At the same time he pursued avenues similar to that of his competitors and patented them to block them from achieving their ends. In realizing the telephone Edison used complex variety of experiments including use of number of materials such as plumbago, mica, oil and other materials. "The work Edison did was, as usual, infinite variety of methods as well as the power to seize on one needed element for practical success" (Dyer and Martin 2007, p. 87).

If one were to look at Edison's work on the electric bulb, it is not just the bulb he worked but on the entire electricity system to go with it – his genius was not different from Gordon Murray in that he was always able to work on the part and the whole simultaneously.

The fundamental approach of Edison was to change the problem that was being solved by looking at problem-solution pairs that kept changing the problem at different levels of detail. Edison continuously challenged himself in the design of the telephone at all levels during his design process. Edison's designerly thinking was systematic but one that needed re-questioning at every stage of the problem. Edison was an exemplar of design thinking who continuously changed the problem being solved as he went about his inventions. He always created challenges for himself in designing things he invented while others looked at problems incrementally. Edison

was also a clever strategist who continued work on intermittent telephony and kept patenting new ideas to keep his competitors off his track. In inventing the telephone, Edison kept expanding the vocabulary and language required to describe the invention to include those that were not part of the previous efforts. This included the notions such as continuous instead of intermittent sound propagation, variable-resistance transmitter and others. As in any design context, the necessity to bring additional terms continuously refines the artefact being designed and is an integral part of the design thinking process. The design concept often requires new terms to be brought together in its realization. The history of his work on telephone as directed evolution of ideas (Carlson 2000) is an excellent example of documentation of Edison's way of thinking that exemplifies the nature of design thinking discussed so far.

Design Acting

So far we have concentrated on design thinking. In this section we will briefly address the socio-interactive counterpart of design acting. Designers don't work isolated from their environment but are engaged in a social system made up by many other disciplinary and functional actors or at least need to create such a social system if they are entrepreneurs and starting a business like Dyson and Sanders. With design acting we don't mean individually performed design activities like sketching, CAD-drawing, model making, etc. but these activities and other activities related to the design process in a social setting of non-designers. It is here that the design literature is not very well developed, but as Hatchuel remarks this perspective is inextricably bound up with design: "we should not forget that understanding and designing the social interactions of a design process is an essential part of the design process itself" (Hatchuel, 2001, p. 267).

Junginger (2008) argues that product development is about creating change and must be seen as vehicle for organizational change. She points to product development as means to bring and implement change to the organisation and even suggests that product development is to be seen as an inquiry into the organization and to transform it into a different unified whole. She mentions that human-centred product development could be suitable strategy for bringing change to organisations. How such an inquiry should take place is not really detailed out. Here we will set out a path that could serve as basis for describing in more detail the change dimension of product development.

Stepping away from the difficulties surrounding the design problem, Dorst (2006) looks at the underlying phenomenon which brings us close to the socio-interactive dimension of design. He proposes to describe the design problem and design process as multiple discourses that initiate conflicting and paradoxical situations in need of resolution. Discourses, according to Dorst (and he based his definition on Foucault (1969)), span "the *complete* breadth of human thinking" (p.15, italics in original) and human activity within a certain domain. This resembles the notion of disciplinary object worlds (Buciarelli 1988) and disciplinary thought worlds (Dougherty 1992). Thus for discourses to become paradoxical more than one domain must be involved, that is, it requires more than one actor representing another domain. Dorst certainly proposes an interesting viewpoint, but we see his description of design as "the resolution of paradoxes between discourses in a design situation" (Dorst 2006, p.17) as the socio-interactive flip side of the rational-analytic dimension of describing design that was recently described as the growing content knowledge related to the artefact under development (Smulders 2010).

The involvement of multiple stakeholders in design is what makes up the conflicts in discourses and represents what we mean by design acting. What did the examples discussed earlier mention in relation to design acting. The Cross & Clayburn-Cross paper (1993) mentions that Murray frequently uses sketches and drawings for communication and to involve other team members in the design process. He even wanted a full size drawing on the wall to get the discussion going on the detailed level he wanted to address. Not surprisingly that Murray only hired engineers that were also 'designers'. Meaning, he wanted engineers with a particular design mind-set that were also able to act critical on his ideas and 'to bounce ideas off', hence "the resolution of paradoxes between discourses in a design situation" (Dorst 2006).
In addition to the use of sketches and their likes designers also use physical models, mockups and prototypes for communication and discussion purposes, like the clay models in car design. All these representations of the artefact underdevelopment are to be considered as boundary objects as introduced in bio-history by Star & Giesemer ((1989), suggested for design by Bucciarelli (2002) and empirically described in design by Carlile (2002), Subrahmanian et al. (2003) and Smulders (2006). Based on the recent literature we see an increasing interest among academics in boundary objects as tools that enable boundary spanning social interactions in multidisciplinary settings. Boundary objects form a common representation that can be interpreted by the different stakeholders along their particular line of reasoning and knowledge. In the discussion the paradoxes become apparent and need to be resolved.
Designers need to bring their message to other parties not only as transfer to the next in line downstream the innovation process, but also to synchronize during their design process with these downstream stakeholders in order to integrate downstream constraints and requirements in their design (Smulders 2007). Design acting in this sense is dominated by interaction with other stakeholders that brings it automatically beyond the confines of the traditional field of design. But, design acting seen from this perspective is not a one-side process but a two-sided process whereby both parties attempt to introduce the other to the understanding that belongs to their own discourse or thought world (Smulders 2006). Depending on the reason of boundary spanning conversations all actors acting in a design mode need to 'design' forms of intervention and it's accompanying boundary tools, which is in line with what Hatchuel mentions: "the social interaction becomes both a resource and a designable area" (Hatchuel 2001, p.267).
In the next sections we will discuss the masters program in Strategic Product Design and a final project to illustrate the above socio-interactive perspective at the borders of the traditional field of design.

Mastering Strategic Design
Since 1969 the faculty of Industrial Design Engineering (IDE) at Delft University of Technology offers a multidisciplinary design program on bachelor and master levels (over 4000 MSc graduates). The philosophy underpinning the multidisciplinary program from its conception is that one can not design a successful product without taking into consideration issues related to form giving, ergonomics, consumer needs and production technology. "Creating products that people love to use" is the IDE-slogan that captures these disciplinary perspectives. In 2003, the faculty introduced three international master of science programs: Integrated Product Development (IPD), Design for Interaction (DfI) and Strategic Product Design (SPD). Here we will focus on the master of Strategic product Design (SPD) as the one that brings the students to the boundaries of the traditional field of design and therefore fits the focus

of this 8th Design Thinking Research Symposium. SPD teaches students to become masters of the strategic steps surrounding the field of product design.
The program was developed because we recognized the need for professionals that are able to blend issues related to design, technology, brands, consumers and markets during the strategic stage of innovation, often referred to as the 'fuzzy front end'. Therefore the SPD-program focuses on branding issues, portfolio considerations, economic rationales and competitor evaluations because these play a major role on the strategic level of product design. Companies that take product design seriously need professionals that play a key role in filling the product innovation funnel on one side and in devising commercialization strategies at the end of the funnel. This need is in line with the reasoning of Roger Martin, dean of the business school a Toronto and a pioneer in bringing design thinking to business education & practice. He mentions that design thinking could bridge the gap between the analytical and decision-making style of thinking by MBA-ers with the intuitive and creative thinking of designers. He doesn't realise that this interpretation of design thinking in fact is design acting. Of course, thinking precedes acting, but as we argued earlier, the thinking required for socio-interactive bridging of gaps between groups of actors is about designing the interventions and the social processes, hence it is design acting as presented here. We also realised that 'pur sang' product developers and engineers miss the necessary competencies (knowledge & skills) to operate on this abstracted strategic level. The need identified in the market raises the question posed earlier, will an MBA-type with rudimentary design skills be able to do the job or do you need a designer with basic MBA-knowledge. Delft chose for the latter because a design attitude (thinking and acting) cannot be inculcated to students in just a few courses within one/two-year MBA program. We therefore developed a two-year international master program (SPD) that only allows students with a bachelor in product design because we are convinced such a base is essential to start from. We believe that somebody with an MBA-background will for instance not be able to translate the intrinsic values as experienced by the users of a brand into new product concepts and a new product portfolio. This definitely requires a designerly approach.
On a more abstracted level the SPD-program aims at teaching students how to bridge the many gaps that surround and inform the product development process. There are gaps between the user and the design brief, between company's abstract strategy and its more concrete but still strategic product development portfolio, between market needs and product portfolio, between investments and return by new products on the market, between marketing & sales and the potential buyer of the new product, etc. All these gaps need somehow to be addressed by somebody who is literate in product development and literate in the fields (and associated disciplines) mentioned as well as having transforming and translating proficiencies. Addressing such a gap is not just a few moments of interaction, but these are processes of transformation and translation (Carlile 2004; Smulders 2006). Actors responsible to bridge these gaps need to apply design thinking and design acting. The design thinking is necessary on two levels: First, actors need to be able to visualize new product concepts for the purpose of using them as boundary objects in conversations with the various stakeholders. Not just presenting a sexy rendering of a new product, but incorporating this picture into the context of the future company and future competitive market situation. These presentations must be considered interventions that aim to change a certain status quo and bring that into a new situation (Cummings & Worley 1997) and not just a series of nice slides in power point presentation. It is a process of social interactions that have a certain aim in terms of bringing the message across and

convincing the stakeholders that they need to buy into the new ideas. Or convince the board to initiate a decision-making process aimed at assigning budget for starting development project. This is the second level where design thinking is needed: the development of small and large interventions required to initiate change. Simon (1996, p.111) sees such interventions as design: "Everybody designs who devises courses of action aimed at changing existing situations into preferred ones."
The strategic design actor needs to treat the development of the interventions with delicate care since interventions are like spoken language: there is no second chance! However, the literature on this practical level of acting is still in its infancy. On the other hand design acting could benefit from literature on more abstracted levels like organizational routines (Pentland & Feldman 2008) and literature on change and interventions like the five colour theory of interventions by De Caluwé & Vermaak (2003). Like we contended boundary objects are supportive in bringing the message across. Boundary objects that strategic design actors might use are projectas (Buijs 2009), personas, scenarios, sketches, story-boards, mock-ups, models, launching customers, etc. But also boundary-spanning processes between users and marketers facilitated by the design actor, like context mapping, creative facilitation, focus groups, etc.

Design acting in practice
A recent Master's final project of a SPD-student illustrates these design activities as an integrated whole of design thinking and design acting. The project was for an international software company (here named SoftCy) with a yearly turnover of 200 milj € that delivers accounting software to SME's. Most of their products are software driven instead of user centred. Programming software and selling it to the intended class of users has worked fine and successful over the last 25 years. The software products were not very complicated at the beginning and worked fine on stand-alone computers or in small networks. However, over the years the complexity of the software increased in parallel to the growing tasks of computers as mainstream workstations. Because the users didn't change too much in this time frame there was simply no trigger in that particular competitive arena to transform existing NPD to a more designerly form of NPD. But now a new generation of users (Generation Y) replaces older generations and different users might need different kind of software products and services. Thus SoftCy realised that they needed to redesign their NPD-process in order to comply with the new generation of users. The graduation assignment focused on developing and implementing an user centred design (UCD) approach within the existing NPD. The idea behind this was, that in the future users keep on changing and SoftCy will need to bring products to the market that continuously fulfil those changing needs of users. Reformulation of her assignment: What UCD-approaches are suitable for the NPD-process of SoftCy in order to make it more user centred? The student realised that her assignment pointed to a 'Russian doll' situation, meaning that for redesigning the existing NPD-process she also needed to apply a user centred approach by involving the future users of the adjusted NPD-process! This implied that the social setting of the existing NPD-process became part of her development activities. It is here that design acting comes in: developing the social interactions of the adjusted NPD-process itself (Hatchuel, 2001). She knew that an abstracted development process without involvement of the future users, i.e. SoftCy's NPD-actors, was not going to work because that would cause implementation problems after she was finished. One cannot develop an adjusted (NPD-) practice for other people. This needs to be done in a collaborative setting

(Smulders, 2006 & 2010). And this is not all. For the same reason she also needed to involve SoftCy's board of directors in her development activities. The board at SoftCy forms in fact the internal client of NPD, so they are part of the present NPD-routines and will also be part of the adjusted NPD-routines, which will require different forms of social interaction between NPD and the board. Similar was true for NPD-management and project leaders. The approach that she took was to use an existing product in need of a redesign as a carrier for her design acting activities. She planed to involve the three groups of internal actors (NPD, project leaders & board) in her process as well as the external future users of the redesigned product. She first developed a fledgling vision herself on a particular user group by desk research and interviews with customers and other representatives of that generation. She brought that first idea in an interactive session to the middle management of the company and requested for involvement of various disciplinary NPD-actors for one of her next steps. Without going into details it is clear that she had to design this interactive session as an intervention aimed at provoking a decision. The request was granted and she developed series of sessions with representatives from marketing, service and product development as well as present and potential customers. These sessions were based on interventionist tools like context mapping and working with personas (Sleeswijk Visser et al. 2005). A much sharper description of the target group came out of these workshops and informed an impressive list of recommendations regarding potential improvements for the product that she had chosen as carrier for trying out the UCD-approach. At the same time these sessions formed the base for further implementing the UCD-approach within the existing NPD-process. Finally she presented her findings to the board of directors, convinced them to implement her strategy (and was hired …).
In short, what she did was designing and enacting a first version of UCD-process with all future users within SoftCy to set the base for further embedding and routinizing the UCD-approach in NPD. This example particularly tells us that design acting is insoluble embedded in a design process that crosses the borders of design itself. Furthermore this example illustrates that a designerly attitude very well fits in an environment that has never been worked in such a way. It also illustrates that design acting in terms of the socio-interactive dimension of design definitely is applicable outside the direct domain of design. Finally it shows that design acting still requires design thinking to devise a suitable course of interventions and by that promotes the designer to an interventionist aiming to bridge the various gaps surrounding the actual design process.

Discussion

We have seen in this paper that design could be divided in design thinking and design acting. The first is to be seen as the learning and exploration process of the designer and relates more to the content related knowledge that is cumulative during development. The second brings the less articulated perspective of the socio-interactive environment surrounding any design process into the picture. Both perspectives were elaborated upon and essential elements as found in literature were discerned.
We found particularly interesting that the design problem, or better the design situation, needed to get its challenging value from the (first) steps by the 'designer'. Framing the situation in such a way that it opens up to new possibilities for integration might be a promising characteristic to apply outside the field of design. Designers start looking for solution, or opportunities for betterment, even without

having a clear definition of the design problem. Edison showed us that all of design are challenges to what is and what is known to what is not yet known through a variety of methods and experimentation in search of means to integrate what is known and what is discovered in uncovering the unknown. Further research on history of exemplar designs and engineers aimed at capturing strategies that describe how designers treat initial situations will illuminate our understanding of design thinking.

Design acting brings us into a completely different field of literature on change & interventions as possibly also the field of knowledge management that increasingly treats knowledge as being both a thing and a flow (Snowden 2002). The development of the content (≈ product) being more related to knowledge as a thing and the social-interactive site of knowledge creation being more related to knowledge as a flow.

Designers are interacting with a large variety of actors not educated or trained as such and are introducing change. In order to make the design thinking attitude contagious design actors need to become change masters. They will need a deep understanding of the neighbouring discourses within the system affected by (their) development activities and be proficient in designing change programs and associated interventions among those that don't posses any of the mentioned design qualities. Design beyond design is creating a secure social context that enables fledgling new organisational routines to surface. Such requires a similar confidence in design acting as designers expose in design thinking: being comfortable in situations of extreme uncertainty. It would be their responsibility to bring the group together to create a joint thinking of the product or service (the common cause) that emerges through these social-interactions and explorations. Further research is needed to discern and describe low level intervention tools, techniques as well as the roles of the supportive boundary objects.

Edison's drive to make things that are commercially viable – a business goal – was integral to both his design thinking and design acting. While design thinking that characterized Gordon Murray and Edison were emphasized, their design acting capabilities were no less important in making a success of their endeavour. Murray, Gehry and Edison are/were certainly people that were able to master both dimensions of design, design thinking and design acting and thereby were able to master the change that they themselves provoked. If we are to bring design beyond the confines of its traditional field then we must carefully train those involved in both dimensions to provide them with the ability to create and implement the change that serves society.

A world full of design thinkers and design actors is not what we envision. Convergent thinkers that treat situations as either/or and base their decisions on what seems the best solution at that moment in time are necessary to maintain certain present qualities. A meta-design approach to the world's situation that calls dramatically for sustainability is having people with both qualities, the 'either/or' and the 'and/and' in a well balanced collaborative mix.

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