

Inferno and exaltation

– How to design Creativity and support Interaction Designers



A Master's thesis in Interaction Design at Arts & Communication, Malmö University.

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Abstract

This Master's thesis is about how to enhance creativity and investigates the design process of interaction designers, in terms of the creative process, design support tools and especially through a concept presented in this thesis. The concept is called DSTZ (Design Support Tool Z) and suggests ways in how to support a designer in the creative design process.

An empirical study was carried out in the thesis that consisted of a survey conducted on 8 "Interaction Designers" investigating how Interaction Designers work and if they require or need any design support. A design survey was later conducted on 18 "Interaction Designers" of which 9 were professionals and 9 were students, to investigate the concept DSTZ and the creativity enhancing aspect.

The results from the empirical studies show that a design support tool is desired and DSTZ has features that are useful and can enhance creativity. The features consist of 8 palettes and 3 functions that are manifested in DSTZ. Further investigation is required in order to find data that support the statement that creativity can be enhanced through a design support tool

Keywords

Interaction design, creativity, design support tools, design process, creative, provocation

Foreword

On 1st of October 1999 I had dinner with a friend at Chandra Kumari in Berlin, at a restaurant which served specialities from South India and Sri Lanka. To my astonishment I tasted some dishes that I have never encountered before, especially the jackfruit dish. The dish looked like meat, not only in the appearance of the 'meatpieces' but also consistency. I was so surprised when I tasted it because I could not define nor produce any associations to anything I have ever eaten before. Unfortunately I did not like the taste or anything about it therefore I was just amazed. I am glad that I made a totally new perceptual experience and shocked my taste-sense.

What I would like to point out with this anecdote is that creativity in everyday life can occur through experiences unexpected and my notion of creativity is not only that creativity can happen or is possible by shaken concepts or new ways to perceive and view information, but also through an active approach to information and perception of actions, thoughts and reflection. Creativity is sometimes born out of no previous experience and knowledge. In these cases it strikes me that the act of creating is a particular way of perceiving and sensing a new connection between things uncategorized.

Why I engaged in the issue of creativity and interaction design in particular is because of my fascination about "creation" and the act of creating.

Finally I would like to thank all the participants who have taken their time and energy to be apart of this work. Thanks to the professional participants and their respective companies. Thanks to the interaction design students who have participated and provided me with interesting discussions. Thanks to my tutors, Jonas Löwgren & Jörn Nilsson, people at K3, Malmö University for support and help in everyday issues. The sun is shining :-)

CONTENTS

1	INTRODUCTION	1
1.1	PURPOSE	2
2	WHAT IS CREATIVITY?	3
2.1	GENERAL APPROACH TO CREATIVITY	3
2.2	PRAGMATICAL APPROACH	4
2.2.1	PROVOCATION	5
2.2.2	RANDOM INPUT	6
2.3	COGNITIVE APPROACH	7
2.3.1	THE GENEPORE MODEL	7
2.3.2	H-CREATIVITY AND P-CREATIVITY	8
2.3.3	DOMAIN, FIELD AND PERSON	8
2.4	ORDINARY PEOPLE AND GENIUSES	9
2.4.1	OTHER STUDIES	10
2.5	CRITIQUE	11
3	DESIGN ISSUES	13
3.1	ILL-DEFINED AND OPEN-ENDED DESIGN PROBLEMS	13
3.2	DESIGN IN HCI	14
3.3	RELATED TOOLS	16
3.3.1	COMMERCIAL TOOLS	17
3.4	WHAT IS INTERACTION DESIGN?	19
3.5	INTERACTION DESIGN OCCUPATION SURVEY	20
3.6	SURVEY DATA AND RESULTS	21
3.7	SURVEY CONCLUSIONS	25
3.8	DESIGNING INTERACTION DESIGN/ERS	25
4	DESIGN SUPPORT TOOL Z	27
4.1	METHOD OF THE STUDY	27
4.2	THE DSTZ CONCEPT	28
4.2.1	THE FUNCTIONS	30
4.2.2	A SCENARIO FOR DSTZ	31
4.3	EMPIRICAL STUDY	34
4.3.1	THE STRUCTURE OF THE STUDY	34
4.3.2	THE JUDGEMENT CRITERIA	35
4.4	RESULTS	36
4.4.1	THE JUDGEMENTS	37
4.4.2	SUMMARY OF RESULTS	43
4.5	IDEAL TOOLS DSTZ [INCONSISTENT FONT FOR NUMBERS]	44

5 CONCLUSIONS AND IMPLICATIONS	46
5.1 CRITIQUE	47
5.2 HOW TO DESIGN CREATIVITY AND SUPPORT INTERACTION DESIGNER	47
6 REFERENCES	49

APPENDIX I

INTERACTION DESIGN SURVEY	52
JOB EXAMPLES	53

APPENDIX II

DESIGN SURVEY DSTZ	57
SYSTEM SCRIPT	61
JUDGEMENT CRITERIA	63
SURVEY DATA DSTZ	69

1 Introduction

This thesis is an obligatory and essential part of the Interaction Design education at Malmö University. The parameters given for the thesis were to conduct research in a particular field of study in order to show an independent and relevant work in Interaction Design. I began with research on relevant theories, and aiming for a target group. Studies of use environments with an aim to require an understanding of the assumed users was the second issue which in my case was pretty easy to determine since I focus on fellow "interaction designers". Limiting the problem and defining a specific issue with focus of the use properties was a requirement for this work. Here I present a design concept and report the process of my work in the context of the thesis.

The thesis aims to discuss "interaction design", "creativity" and design support tools. By Interaction Design I refer to the field encapsulating the digital media/new media where focus is on the user perspective, use properties and revealing modes of action and communication through various digital forms/media's and human beings. Creativity I consider here in awfully general terms since I do not want to theorize or contribute in making or understanding new models of creativity, but rather consider what it is, how the discipline could provide substance in terms of Interaction Design and maybe in a long term view provide creativity with new aspects of how humans work and communicate via & with technology.

The Master's thesis objective began with a search on an area overlapping design, creativity and tools for creating and supporting design. I realized before I began my work that there is no good or sufficient tool to be used if one works as an Interaction designer. A tool that can be used in the everyday design work that also have a creative approach to supplement the designer in his/her tasks.

The questions I raised and asked myself were concerning the fact that creativity is so hard to measure and be evaluated. I wanted to create a tool that *would enhance and promote creativeness in the design process, thus making the interaction design issues dealt with easier to handle and overview.* Thereby was the idea of a design support tool put in action.

My work began with asking what creativity is and trying to establish and find some answers relevant for the thesis' context. The first phase in my work was to investigate creativity research, in order to decide how I would use and maintain the theoretical ground of creativity to stand upon. I chose the cognitive and pragmatism approach to focus on because of my interest and background in cognitive science. The second phase was to investigate tools, methods and design praxis and theory to find relevant and interesting insights concerning my main issue. Here I looked at the design area in general and Interaction Design in particular. In this part I conducted a "Interaction Design Survey" with 8 persons in order to find out how professionals view Interaction Design and what it means to work as an Interaction Designer but also to establish if there is a need for a design support tool. The third phase was to design a concept, which would support interaction design and enhance creativity. I introduce my concept of DSTZ and present my ideas for a design support tool as well as present the performed empirical investigation of DSTZ. The core of the concept is to give the interaction designer the possibilities to be creative through using the program application and implementing some functions that would challenge and help the designer in designing and being creative.

A study was conducted on 18 persons about DSTZ, these persons were divided into two groups, a student group and a professional group. Finally the report ends with conclusions and a discussion about design support tools and the framework for the thesis.

The whole thesis work was conducted over a period starting from September 1999 to April 2000. The DSTZ concept illustration is available on URL <http://www.kk.mah.se/students/id98zakh/thesis.htm>

1.1 Purpose

The purpose of my work is to investigate if a design support tool can enhance creativity in the design process, thus enabling interaction designers to create and work in a digital environment. The question is can creativity be designed or supported in the framework of interaction design and through an application. The thesis provides various aspects on these issues and questions.

2 What is Creativity?

“SA creativeness is “emitted,” or radiated, and hits all of life, regardless of problems, just as cheerful person “emits” cheerfulness without purpose or design or even consciousness. It is emitted like sunshine; it spreads all over the place, it makes some things grow (which are growable) and is wasted on rods and other ungrowable things.”¹

This chapter is about creativity, where creativity is defined and reviewed through specific research areas, in order to figure out what creativity means and may imply in this thesis.

What is creativity? An explanation you may find is that “creativity” means the “quality of being creative” or “the ability to create”².

What does creative mean one might ask? “Creative” means “marked by the ability or power to create” or “having the quality of something created rather than imitated”³.

This implies that creativity is a quality or an ability to create or to be creative.

In Longman Dictionary of Contemporary English⁴ one finds the following:

Create

- to make something to exist that did not exist before
- to invent something

Creative

producing or using new and effective ideas, results

- someone who is creative is very imaginative and good at making things

A definition found in creativity research is that creativity is “a set of activities that give arise to an outcome or product that is recognized to be innovative as judged by an external standard.”⁵

2.1 General approach to creativity

The general approaches to creativity are: mystical, psychoanalytic, pragmatic, psychometric, cognitive and social-personality⁶. I focus mainly on the pragmatic and the cognitive approaches further on in this chapter.

I have chosen to focus on the pragmatic and cognitive approach because of my background in Cognitive Science since it has provided me with an understanding and competence, which I have utilized throughout the whole thesis work. Thereby making it easier to work with the concepts based on the pragmatic and cognitive approach and a natural choice.

The mystical approach suggests divine intervention that acts upon individuals. The creative person is seen as an empty vessel, that a divine being would fill with inspiration, and the creative person shows these ideas to the world as otherworldly products.

¹ Maslow (1999) pp.160. SA stands for “self actualizing person” according to Maslow and the SA person/personality is defined to be characteristic of essential humanness, implying that being creative and to create is a highly valued feature in society and towards what a human being is about.

² Definiton found at WWWebster Dictionary <http://www.m-w.com/cgi-bin/dictionary>

³ Definiton found at WWWebster Dictionary <http://www.m-w.com/cgi-bin/dictionary>

⁴ Longman Dictionary of Contemporary English (1995)

⁵ Candy & Edmonds (1999) pp. 4.

⁶ Sternberg (1999)

"If we take seriously the dictionary definition of creation, "to bring into being or form out of nothing," creativity seems to be not only beyond any scientific understanding, but even impossible. It is hardly surprising, then, that some people have "explained" it in terms of divine inspiration, and many others in terms of some romantic intuition or insight."⁷

The pragmatic approach directs towards developing creativity as a primary goal, and understanding creativity as a secondary goal. de Bono and lateral thinking is an example of this which provides commercial success but do not present a theory in a strictly academic view. It is rather a practice. The psychologists find it hard to see these views as a serious endeavor for a psychological study, thus see it only in commercial interests.

The psychodynamic approach implies the theories of Freud, where creativity arises from the tension between conscious reality and unconscious drives.

The psychometric approach grasps a method exploring creativity in everyday subjects by the help of paper-and-pencil tasks. These experiments try to measure "fluency, flexibility, originality and elaboration" as a criteria for creativity.

The cognitive approach tries to seek to understand the mental representations and processes underlying creative thought. An example of this is the Geneplore model, which consists of two phases, a generative phase and an exploratory phase. In the generative phase an individual constructs mental representations referred to as preinventive structures. The structures have properties promoting creative discoveries. In the exploratory phase, these properties are used to come up with creative ideas. A number of mental processes (in terms on cognitive psychology) may enter into these phases of creative invention, including the processes of retrieval, association, synthesis, transformation, analogical transfer, and categorical reduction. Another method describes creativity as involving essential ordinary cognitive processes yielding extraordinary products.

The social-personality approach focuses on personality variables, motivational values and sociocultural environment as sources of creativity.

In general studies of creativity have been conducted focusing on the individual person such as case studies of outstanding individuals, problem solving abilities, lateral thinking skills. These studies have mainly concerned mental activities. Models of creativity such as insight, illumination and incubation⁸ presents the mental processes as primarily important compared to external tools, domain knowledge.

The process and the outcome of a creative act are necessary to be studied in order to perceive the whole context in which creativity takes place.

2.2 Pragmatical approach

The pragmatical approach to creativity advocated by de Bono argues about the need for serious creativity in all parts of society, not only business, but also in practical everyday life situations. The argument is supported with methods for how one can improve the creative skills through various lateral thinking tools and techniques.

⁷ Boden (1994) pp. 75.

⁸ Lawson (1997)

“Lateral thinking” obliges one to move “sideways”⁹ in order to obtain different perceptions, concepts and get out of order from a person’s normal or usual patterns of thinking. Lateral thinking is used in two senses, a specific and a general definition.

Specific: A set of systematic techniques used for changing concepts and perceptions and generating new ones.

General: Exploring multiple possibilities and approaches instead of pursuing a single approach.¹⁰

The pragmatical approach represented by de Bono does not supply us with a crosscut definition of creativity. The behaviors of self-organizing information systems are studied and seen as patterning systems, which use and make patterns. When the behavior is analyzed one gets a clear idea of the nature of creativity and one may learn how creativity works¹¹. “Lateral thinking” is a technique that can be used in the creative process but it is rather a method of techniques to obtain, categorize and perceive information, which expands our normal everyday way of obtaining and consciously processing information, especially to create new ideas.

2.2.1 Provocation

I will briefly describe two techniques, which I found useful: Provocation and Random Input. Provocation¹² is a technique for making experiments in the mind, for systematically being able to exceed the boundaries of reason and rationality. Provocation is a two-stage process, in which the first part is to set up the provocation; the second part is to use the provocation in order to move towards a useful new idea.

1. Choosing the creative focus means to choose an area, domain of interest.
2. Setting up the provocation, means to make a statement and use it as:

Provoking Operation Provocative Operation Provocation Operation¹³

Two methods are described for setting up provocations. The escape method¹⁴ and the stepping-stone-method can be used effectively to create provocations.

The escape method is suggested as the following:

Describe or say something that is taken for granted: Cars have four wheels.

Escape, cancel, negate, remove, deny from the granted: Cars do not have four wheels.

Movement, use the moment-to-moment technique to imagine: Cars have no wheels and are able to fly.

This technique is especially useful for investigating established methods, procedures and systems where one wants to make an improvement or change an idea, concept or a product.

The stepping-stone-method¹⁵ provides us with provocations that are mechanical and bold. There are four methods for achieving provocations, which are:

Reversal means the normal direction of an action is reversed, meaning that action is formed in the opposite direction to be a provocation: Cars have no engines

⁹ de Bono (1996) pp. 53.

¹⁰ de Bono (1996) pp. 54.

¹¹ de Bono(1996) pp. 4

¹² de Bono (1996) pp. 145-150

¹³ de Bono 8["(1996) pp. 164

¹⁴ de Bono (1996) pp. 166

¹⁵ de Bono (1996) pp.168

Exaggeration means the normal measurements (size, number, and weight) are exaggerated, either upwards or downwards: Cars have 5 engines.

Distortion means the normal relationship between involved things is distorted to form a provocation: Engines are placed outside of the car.

Wishful thinking means a fantasy that is not expected to happen. What if the car engine never broke down?

The stepping-stone-method is a useful procedure, which can be used without thinking of making the results useful. The exercise is to free up the mind and to find as many stepping-stones as possible around the creative focus.

Using the provocation means to use a mental operation called “movement”, which is an active mental operation and essential in creativity. It has to be learnt and practiced in order for a user to be skillful in using it. Movement means to be willing to move forward in a positive exploring way, instead of making judgements and deciding what is right or wrong. Movement is to be used in order to achieve practical, useful and valid ideas. There are five systematic techniques¹⁶ for getting movement from a provocation or a statement, which are:

Extract a principle - to extract a principle, concept or feature from the provocation.

Focus on the difference - to explore the difference between an existing idea and a provocation.

Moment to moment - to imagine the provocation realized, visualizing and fantasizing.

Positive aspects - to search and look for any positive aspect or benefits in the provocation.

Circumstances - in which circumstances will the provocation have a direct value?

Through these various techniques a person should be possible to use provocation as a method for extracting new ideas, concepts and products.

2.2.2 Random Input

The Random Input technique¹⁷ is called one of the simplest of all creative techniques and is used by people to create new ideas in various contexts.

Random inputs can be words or images. Here follow some examples of how to get random words (which are suppose to be nouns):

- Have a bag full of thousands of words written on small pieces of paper, cardboard etc. Close your eyes and draw a word.
- Open the dictionary or newspaper at a random page and choose a word.
- Use a computer program to give you a random word.
- Make up a list of 60 words. Look at your watch and take note of the seconds. Use this number to get the word.
- Choose pictures from advertisements and magazines cut them out and pick up a picture at random.

The word or picture found by any of the above mentioned methods should be used in the random input techniques. After the word or picture is identified, the next step is to list the attributions or associations with the word or picture. Then apply each of the items on your list and see how it applies to the problem at hand.

The random input technique requires an effort to look for unconnected inputs and use these in order to think in new ways. It is an easy to use systematic technique for using finding new associations and making new connections between ideas and thoughts.

¹⁶ de Bono (1996) pp. 151-162

¹⁷ de Bono (1996) pp. 177-183

2.3 Cognitive approach

The cognitive approach deals with creativity from the perspective of cognitive science, mainly based on experimental methods in cognitive science. The effort is on trying to identify under which conditions creative discovery might occur instead of predicting creative performance, since creativity is not predictable.

Creativity is conceived as a product of many types of mental processes. A difference is made in processes used in generation of cognitive structures and those used for exploring the creative implications of these structures¹⁸.

It is crucial to know the cognitive processes and structures behind an idea. This is done by relating properties of creative cognition to the final products, these properties are: originality, practicality, sensibility, productivity, flexibility, inclusiveness and insightfulness.

Creativity is surprising and unexpected. It is easier to predict when something will be creative than to predict exactly what form the creation will take.

Cognitive science is viewed as a good source of inspiration for supporting information retrieval and in creative thinking it is important to present objects from different perspectives and through different context representations.

2.3.1 The Geneptore model

The Geneptore Model is discussed as a model for creative cognition¹⁹ that considers generation and exploration as distinct through interactive processes. When forming new creative ideas, the model tells us to generate structures that are interesting and meaningful, in order to later on consider their implications in an exploratory phase.

The Geneptore model consists of a generative phase, followed by an exploratory phase. In the generative phase, one constructs mental representations called preinventive structures which have properties that promote creative discovery. As the exploratory phase follows, these properties are exploited in order to interpret the preinventive structures in a meaningful way. Finally the process leads to a creative product. A point to be made here is that the process is cyclic and therefore can be altered in any stage.

The conclusions from studies conducted implies that preinventive structures may result in creative insight when interpretive constraints are withheld whereas the structures are conceived. The structures achieved can be utilized during creative exploration²⁰. The general principles of creative cognition show that some creative skills are universal and that creative expertise is not restricted to a particular domain. Creative visualization studies show that people can mentally synthesize simple visual forms to make unexpected, creative discoveries²¹.

¹⁸ The generative processes include memory retrieval, association, mental synthesis, mental transformation, analogical transfer, and categorical reduction. The exploratory processes include attribute finding, conceptual interpretation, functional inference, contextual shifting, hypothesis testing and searching for limitations.

The cognitive structures of importance are preinventive structures which are internal representation that may be uninterpreted when constructed, which are used to represent novel visual patterns, object forms, mental blends, category exemplars, mental models and verbal combinations. Finke et. Al (1996)

¹⁹ Finke et. Al (1996)

²⁰ Finke et. Al (1996) pp. 189

²¹ Finke et. Al (1996) pp. 62

The cognitive approach suggests some practical methods following the theoretical framework. For a person to become more creative, they should practice generating preinventive structures and exploring novel interpretations of them. A suggestion is to imagine preinventive object forms and then consider various ways in which the forms could be seen as representing new types of inventions or possible new concepts; imagine putting together words or phrases in interesting combinations and then exploring some of their semantic or metaphorical implications; imagine creative exemplars to hypothetical categories and situations, and explore their implications.

2.3.2 H-creativity and P-creativity

“A merely novel idea is one that can be described and/or produced by the same set of generative rules as are other, familiar ideas. A genuinely original or radically creative idea is one that cannot. It follows that the ascription of creativity always involves tacit or explicit reference to some specific generative system.”²²

An intriguing and vastly different way of viewing creativity is by defining creativity into a psychological (P-creativity) and a historical (H-creativity) creativity²³.

A P-creative idea is an idea that has appeared for the first time in a person's mind, no matter how many times others have had the same idea. A H-creative idea is an idea that have appeared for the first time in a persons mind and it is the first time in all human history, meaning that no prior person have had this idea before. But all H-creative ideas are P-creative ideas as well.

The terms of H-creative and P-creative have generated ideas about how computers can be creative, where the computer is used as a tool and a partner in the creative process. Boden argues that computers can be creative somehow and that through this we can have models of how human mind and creativity functions. The discussions here have been mainly on a philosophical level. Creativity in explained in computational terms by computer theory and models. Computational psychology will be able to help us understand creativity in humans and learning how unusual the human mind is.

2.3.3 Domain, field and person

“Creativity results from the interaction of a system composed of three elements: a culture that contains symbolic rules, a person who brings novelty into the symbolic domain, and a field of experts who recognize and validate the innovation. All these are necessary for a creative idea, product or discovery to take place.”²⁴

An important question asked here is “where is creativity?” The answer is in the **domain**, which consists of a set of symbolic rules and procedures. It is in the **field**, where individuals act as gatekeepers to the domain, meaning that they are experts or rather ‘expertolders’ in a specific domain (subject area of knowledge, praxis etc.). In the

²² Boden (1994) pp. 78.

²³ Boden (1994)

²⁴ Csikszentmihalyi [Actually, his name isn't exactly that, check the books!] (1996) pp. 6

individual **person**, who shakes the boundaries, exceed them and provoke the field, the 'expertholder'.

Through this creativity is any act, idea or product that changes an existing domain, or transforms it, taking it into another direction. The creative person is someone whose actions and thoughts change a domain or establishes a new domain.

Csikszentmihalyi have conducted some studies on creative individuals and his conclusion from these studies are that creativity can be constructed, deconstructed and reconstructed several times over the course of history but also that "[...] creativity does not happen inside peoples heads, but in the interaction between a person's thought and a sociocultural context."²⁵

How is it possible to enhance creativity? Here are some methods mentioned briefly:

- Using mental energy appropriately, by freeing up creative energy and explore the world around us in its own terms.
- Cultivate curiosity and interest, the allocation of things for their own sake, by surprising oneself by something, by surprising other persons, by following an interest.
- Cultivating flow in life, by setting up specific goals each morning to look forward to during the day, making tedious things more enjoyable.
- Take share of your schedule, set up time and take control of it, take time to relax and reflect, find surroundings and space you like and feel comfortable in, find out what you like and dislike about life, and start doing more things that you like.
- Try to change personal traits, change perspectives of viewing the world, shift form openness to closure and try to evolve complexity.²⁶

Practical ways of being creative is by producing as many ideas as possible, to have as many different ideas as possible, try to produce unlikely ideas and try to realize some of these.

The important conclusion here is that creativity is decided or constructed in a social context through the domain, field experts and the individual, and not alone by a single genius individual. The process and the context are equally essential factors.

2.4 Ordinary people and geniuses

"[...] The creative thinking is the result of extraordinary thinking processes, processes that are somehow qualitatively different from the "ordinary" thinking that we all use for our daily activities."²⁷

An argument against the above quotation is provided by Weisberg who discuss how genius individuals were creative, by maintaining that "ordinary thinking processes" are in fact what creativity is all about and ordinary thinking was implied by genius individuals. Normal thinking processes constructs the basis for creativity and exploration, that is finding new innovative theories and creations in art, technology, music, etc, which are all based on previous work of a creative person. Inspiration and the form of ideas are already laid by others thus no one has by him/herself produced anything autonomously. New creativeness lies on the shoulders on giants meaning that "geniuses" does not exist. But on the other hand extraordinary creative persons exist and most of them work hard

²⁵ Csikszentmihalyi (1996) pp. 23

²⁶ Csikszentmihalyi (1996) chapter 14

²⁷ Weisberg (1993) pp. XII

in their domains for a very long time and produce lots of creations, where not only new production are essential but also revising the older ideas and compositions are equally interesting and evolving. To stimulate creativity in people, one needs to learn a thinking that is based on problem finding, problem solving as well as learning expert knowledge in a domain. An essential requirement is having adequate support and a stimulating environment, where a critical factor here motivation.

For a beginner motivation is the most important factor in order to maintain the interest. To be obviously motivated and dedicated to a work is something that is essential for creativity.

A ways to encourage creativity for beginners can be through the following ways:

- A mentor who guides and supports
- A stimulating environment and acknowledgement from colleagues
- A critical reviewing and reflecting attitude to ones owns designs and products²⁸
- A concluding depth in a field of domain or subject
- A possibility to surpass the old way of thinking and doing, knowledge and praxis. First to get an insight in the previous ways of thinking, product, and after that create new conclusions and new concepts and theories for ones own work.²⁹

The conclusion from this particular approach viewed through Weisberg is that creative thinking is ordinary meaning that people must not be taught how to be creative but rather be stimulated in their thinking processes and problem solving skills. What is need is a complete theory of thinking not a special theory to explain creative processes.

A simple way to increase people's performance is by providing an environment that encourages them to develop expertise and obtain detailed knowledge of the domain, but also by maximizing their motivation in order to maintain effective performance in any matter of interest.

2.4.1 Other studies

There are very differing views on creativity, studies have found differences between creative people in art and science, mainly concluding that in general creative people are more open to new experiences, less conscientious, are more self-confident, ambitious, dominant, hostile and impulsive. Although the individuals in art and individual in science do not have similar personality profiles. Artists tend to be more affective, emotionally unstable, less socialized and find it hard to accept group norms. Scientists are just more contentious.³⁰

An issue of creativity across cultures³¹ is shown in a study concluding that creativity is context dependent and that there is a difference between the western and eastern definition of creativity. The western definition of creativity is product-oriented and originality-based phenomenon, meanwhile the eastern definition is more concerned with expressing an inner truth in a new way or of self-growth.

Some studies³² show that the most important factors are desire, internal motivation, and commitment. Domain-specific knowledge or knowledge of specific creativity-enhancing

²⁸ My own associations goes to "the reflective practitioner" discussed by Schön (1987)

²⁹ Weisberg (1993)

³⁰ In "Influence of Personality on Artistic and Scientific Creativity" by Feist in Sternberg (1999), pp. 290.

³¹ In "Creativity across cultures" by Lubart in Sternberg (1999), chapter 17.

³² In "Enhancing Creativity" by Nickerson in Sternberg (1999), chapter 20.

techniques or heuristic are not enough. What is required is a sufficient motivation to obtain knowledge and discover heuristics.

An approach to the creative process is seeing the "the creative process is an organic, cycle movement going continuously through order and chaos, divergence and convergence, giving growth an evolution."³³ Where knowledge and form are in a constant change of evolution, conveying that it is important to trust and believe that the creative process is an organic, autonomous process which develops and grows freely.

Human memory constrains on interaction design, to consider that a person elaborates and assimilated knowledge, by providing mnemonic cues in the interface and flow of interaction, as well as restating the problem solving strategies used by a user required previously that might block the user in a present design situation, for instance by changing the ways the problem is presented or making it possible to redefine/reconceptualize/re-represent the tasks and problems by the software and working environment. LTM is inflicted by the fact that humans interacting with computers can and do use existing memories or memory structures to assign a meaning or interpretation to an object regardless of its intended purpose. Problem solving inflict that people do not do what designer want them to do, instead they intend to get actively involved and think and plan and solve problems.

2.5 Critique

Lateral thinking and de Bono³⁴ is criticise as being descriptive and pragmatic, presenting creativity with little theory. Lateral thinking has had commercial success because of its practical techniques for thinking creatively. The psychologists and cognitive scientist argue that these techniques and ideas are developed independently of contemporary cognitive science research, meaning or demanding that "thinking", or the cognitive processes involved in the creative process must be specified before the term "lateral thinking" can be used in a theoretical sense.

My own critic towards the research that have been conducted in creativity as a subject is that the researchers involved are too specialized in their own fields and not focusing to the whole picture and the context as such. The research should be conducted in an interdisciplinary manner with scientists who represent psychology, cognitive science, philosophy, artificial intelligent, and cooperating with people representing arts, such as artists, musicians, writers, designers etc. The research conducted should consider and cooperate with commercial interests, organizations and companies, in order to achieve results that can be used in a real context.

Creativity is a subject that cannot easily be studied nor measured, but it is not impossible to find information or conduct research about human thinking processes involved in creative issues, nor is it impossible to test methods and gain well-working techniques for aiding a person, or an organization that want to improve his or hers creative skills.

Therefore it is necessary to develop HCI models and cognitive models for understanding the creative process in the aspect of the design process, but also consider and investigate issues concerning software applications and design for digital media.

³³ Lerdal (1999)

³⁴ Finke et. Al (1996)

Creativity is described and characterized "as a progression towards some strongly-felt but ill-defined end-state in incremental constructions, each successive construction serving to clarify the end-state." This sentence makes a meaning after the following chapter, which deals about the design issues.

"A computer program is not a human being and creativity in a program will not be manifested in human terms."³⁵

Conclusions from this chapter are that the pragmatic and cognitive approach have been appropriate for further investigations and for working on the questions proposed. The theories revised here have proven to be helpful in the process of research and inspiration on the matters of how creativity works for humans and how creativity may work in the context of an application.

³⁵ Cohen (1999).

3 DESIGN ISSUES

"Design is rhetorical also in the sense that the designer, in constructing a design proposal, constructs a particular kind of argument, in which a final conclusion is developed and evaluated as it develops against both known goals and previously unsuspected implications."³⁶

This chapter deals with both theoretical and practical design issues, research and studies, which I find valuable in the context of the thesis.

Design is a convention viewpoint is seen as exploratory, opportunistic, abductive, reflective and risky. The designer has a medium, which is the sketch enabling ideas to be expressed and reflected, although they are not fully revised. The purpose of the sketch is to consider, revise, develop, and reject ideas of the designer. The ideas can be criticized, but also discovered, explored and allow the activity of design, which is precisely the function of the sketch. Sketches allow designers to work on different levels as well, from an abstract to a more concrete level. Sketches provide a playing ground for problems and solutions to meet on paper, by enabling exploration, showing limits and possibilities of both the problem and solution spaces.

When addressing the issue of developing interactive systems that support designer, what must be considered is the models of cognitive behavior so that the designs can be used by the intended users in ways which are cognitively comfortable³⁷.

Creative design has meant social research techniques based upon laboratory experiments, retrospective reports, and design protocols analysis³⁸. An alternative approach to study the creative process is by ethnomethodology and conversation analysis (CA), by which creativity in design is studied through observation focusing the data, recording and interpretation of designer at work in their natural circumstances. Creative episodes such as a problem-solving situation, dealing with conceptual design, are chosen and videotaped and transcribed.

3.1 Ill-defined and open-ended design problems

"[...] for we have seen design grow from a trade activity to a segmented profession to a field for technical research to what now should be recognized as a new liberal art of technological culture."³⁹

A major issue in design thinking is how to define the problems and the characteristics that designers have to face and find solutions to. Rittel identified "Wicked problems" in 1972⁴⁰, and they are presented here:

1. Wicked problems have no definitive formulation, but every formulation of a wicked problem corresponds to the formulation of a solution.
2. Wicked problems have no stopping rules.
3. Solutions to wicked problems cannot be true or false, only good or bad.
4. In solving wicked problems there is no exhaustive list of admissible operations.

³⁶ Design Studies (1999) pp. 28

³⁷ Cross in Design Studies, pp. 36-37

³⁸ Sosa (1999)

³⁹ Buchanan in Design Studies (1999), pp. 3.

⁴⁰ From the article "Wicked Problems in Design Thinking" Buchanan in Design Studies (1999) pp. 3-20.

5. For every wicked problem there is always more than one possible explanation, with explanations depending on the *Weltanschauung*⁴¹ of the designer.
6. Every wicked problem is a symptom of another, "higher level," problem.
7. No formulation and solution of a wicked problem has a definitive test.
8. Solving a wicked problem is a "one shot" operation, with no room for trial and error.
9. Every wicked problem is unique.
10. The wicked problem solver has no right to be wrong—they are fully responsible for their actions.

A designer in the traditionally meaning is suppose to deal with these wicked problems, and calculate a solution. But a conclusion by Buchanan is that the wicked problems are "only a description of the social reality of designing rather than the beginning of a well-grounded theory of design"⁴².

What is important in traditional design field is the argument of design thinking, that works in a concrete setting, using signs, things, actions and thoughts but most importantly extending these into the designer's sketches, various models and grabable things which shows an example of the designers argumentation.

The process of creative design is seen as an argumentation for the designers' mind. Design is seen as either an end product or a process⁴³, but design thinking is seen as a skill. Drawing is and has been a central activity in the design process, being a powerful tool of thought and communication.

3.2 Design in HCI

"For us design is a type of problem-solving in which the problem-solver views his/her problems or acts though there is some ill-definedness in the goals, initial conditions, or allowable transformations."⁴⁴

Design is seen as creating something new by the HCI-community, where design representation are intended to show unexisting artifacts or solutions⁴⁵. Design can be a collective activity where collaboration and working with other people is an important aspect of the design process, in comparison to the traditional design field where the designer is somehow viewed as an individual creator than a collaborative force. Bodker writes that representation play an essential role in design because designers need to externalize design proposals and present them to other designers, users; representations reflect the expectations and experiences, therefore they are containers of ideas, thus a focus towards a variety of representations that supports different purposes and perspectives in design activity is needed. Four different types of representations are mentioned:

1. *Formalized description methods* which are rigid, difficult in work-like situations, and want to represent the whole information-processing system
2. *Ad hoc representations* are 'here and now', and open to interpretations
3. *Prototypes* make it difficult to inspect choices and concerns
4. *Scenarios* provide understanding of the context in use, but depend on the participants preunderstanding of the context.

⁴¹ *Weltanschauung* identifies the intellectual perspective of the designer as an integral part of the design process. pp 14-15 in Buchanan.

⁴² Buchanan pp. 15

⁴³ Lawson (1997)

⁴⁴ Carroll & Thomas (1991) pp. 222

⁴⁵ Bodker (1998)

The software designers according to a study⁴⁶ use the following techniques for getting and fleshing out design ideas: taking user perspectives, generating task scenarios, interviewing and observing users, researching the problem, relying on domain experience, key users involved in the design team, other systems, literature, current research issues, discussion with others and brainstorming sessions, distraction, incubation, concentration, clear out mind, logical analysis, notes, charts, diagrams, building prototypes. It is suggested in this study that developers of tools to support design of interactive systems should focus on supporting informal activities, as well as assisting in cooperative team work, and supply prototyping tools that are easy and quick to create. The study shows that designers need and use tools in different ways and for different reasons, implying that an array of tools appropriate for various design contexts is a suitable solution to designers' problems. Designers rely on informal strategies such as observing users, other systems and brainstorming instead of formal design methodologies. Therefore it is concluded that tools should be built to aid idea development, which support informal techniques.

An ethnographical perspective on design states that design is a social process, where designers do not share the same internal representations of the design, meaning that design is a synthesis of the participants involved in the design process, thus being a social construction⁴⁷. The design knowledge could be found anywhere from scientific paradigms to mythic tales, where the design expertise depends very much on the context, as well as in the design process where it is important to consider and reflect upon the values of the participants, which will reflect in the quality of design.⁴⁸

The ideas of Bricolage as design I found intriguing and I will briefly mention it here. The concept of bricoleur differs from that of the artist, the designer and the scientist. The bricoleur works and makes with what is available, or exists and what is encountered, meaning that semi-defined elements are used, which are at the same time abstract and concrete. These elements are operators, which form a meaning from the bricoleurs experience, knowledge and skills, and the important aspect here is that the meaning can be modified and be used for any operation of a certain type.

The bricoleur works with signs, uses signs to reorganize, staying within the constraints, interrogates and is in a mutual dialogue in the design process.

Bricolage creates structures, in the forms of its artifacts, by means of contingent events. Bricolage is the creation of structure out of events. Good design being an artifact that corresponds to its context.

The designer on the other hand must be creative: he/she must give novel solutions to problems, thus refine the purpose of the artifact and handle the model in ways, which are not permitted by the artifact. This points to Schöns reflective conversation with the situation at hand, where design is a discussion conducted with the materials in the medium with which the designer works, it is a hermeneutic process, a process of iterative understanding.

Design as bricolage has four intertwined strands:

1. Design is a form of art
2. Design is a form of science

⁴⁶ Rosson & Maas & Kellogg (1988)

⁴⁷ Bucciarelli (1988) pp. 167

⁴⁸ Bucciarelli (1988) pp. 168

3. Design is extensive
4. Design arises from the interplay of structure and event

Creativity is this handling of the unpredictable (good design). Design is an affective process.

Bricolage shows a different aspect of the designer as a creator of artifacts and products, thus providing the HCI-field with inspiration on what a "designer" could be or should intend to be.

The Genex for generating excellence is an attempt by Schneiderman⁴⁹ to built a support tool built on Csikszentmihalyi, which proposes four phases:

1. *Collect*: learn from previous works stored in digital libraries & WWW
2. *Relate*: consult with peers and mentors at early, middle and late stages
3. *Create*: explore, compose, evaluate possible solutions
4. *Donate*: disseminate the results and contribute to the digital libraries

These phases are the outcome of the aim to support creativity. The eight activities proposed for this matter are: searching and browsing digital libraries, consulting with peers and mentors, visaulizing data and processes, thinking by free association, exploring solutions-what if tools, composing artifacts and performances, reviewing and replaying session histories, and disseminating results. These activities form a research agenda in HCI and User Interface Design.

3.3 Related Tools

In the HCI-field there are several categories of tools ranging from hypertext systems, example databases, automatic design systems, to evaluating and commenting systems. Here I will present a couple of commenting and critiquing tools but also a couple of commercial tools.

A commenting & critiquing system or tool is a knowledge-based system that comments a users solutions to a specific problem and provides the user with comments or critique. The system gives comments, critique and alternatives but the user decided ultimately to how react or utilize the feedback. These systems are in general used for reasoning and problem solving tasks in order to simplify knowledge organization, for providing non-intrusive advice and guidelines in order to simplify the interaction process between the user and the system, and for providing arguments and explanation in order to make the critique understandable and useful.

The arguments for using a commenting tool are their usefulness in situations where the task and the problems are difficult to specify. The main idea is to provide design information that is relevant for a specific task through which the commenting tool supports the actions the users conducts. These tools affords learning on demand, which occurs when the user interacts with the system and thus knowledge is actively used and learning occurs⁵⁰, which supports and refers to situated cognition where learning is dependent on the situation.

The behavior of a commenting system specifies the interaction between user and the task that is to be performed. Factors that play an essential role in the success of a commenting system are the active/passive mode in which the system operates, where an active system gives autonomous feedback on a certain action, while a passive system requires the user

⁴⁹ Schneiderman (1999).

⁵⁰ Ericsson (1999)

to ask for feedback. Timing is a factor that derives in when to present a feedback, before, during or after an action is taken and reacted upon by the system, rather when a problem is detected by the system.

Knowledge, process, presentation form, adaptability are essential factors as well.

The process characteristics are mode (active & passive), timing (early, immediate, delayed), process (incremental, batch, design-time, run-time), evaluation algorithm (analytical, differential, consistency), adaptability (adaptable), knowledge (positive & negative, shallow & deep).

The presentation characteristics are modality (text, image, sound, animation etc), mood (imperative & declarative), specificity (general & specific), argumentation and interactivity.

The Framer system⁵¹ is a design support system for window-based user interfaces. The system is used for cooperative problem-solving and domain-oriented design tasks. It provides mandatory and optional feedback which can be rejected by the user, but also automatically provides a default solution for a problem, and all the feedback received by the user can be further requested. The system implies an active mode of interaction with the user.

VDDE-critics⁵² is a voice-dialogue interface support system that implies multiple behaviors and pluralistic critiquing. The user can set the systems active-passive mode and behavior. It supports an analytical process based on rule sets, but also a consistency evaluation that allows a comparison of two manually produced design solutions and point out the differences.

According to a study conducted by Ericsson et al.⁵³, a commenting tool is perceived as useful in supporting User-Interface design but also disturbing thus implying that the comment interrupts the flow of design but is justified by the value and usefulness of the comment.

Research on critiquing systems⁵⁴ have shown that users are supported in their problem solving and learning activities, where aids the user in solving real-world problems but also learn in the action, where the user is empowered through the critique. In my case the critique is manifested similarly through the functions especially the provocation function that provokes and challenges the designer in order get an edge of thinking (see the 4.2.1).

Critiquing systems⁵⁵ are proposed to influence the designers' cognitive processes positively by pointing out and issues and problems when the designer is at work. The system supports design by allowing the designer to propose solutions while the system help the designer to reflect and assess features in the solutions.

3.3.1 Commercial tools

Axon Idea Processor⁵⁶ is a commercial application that can be used as a writing tool for essays, thesis and manuals, a diagramming tool for concept and mind mapping, a design

⁵¹ By Lemke & Fischer (1990) in Ericsson (1999).

⁵² By Harstad et al. (1993) in Ericsson (1999).

⁵³ Ericsson, Bauren, Löwgren, Waern (1998), In CHI '98.

⁵⁴ Fischer et. Al (1990).

⁵⁵ Sumner, Bonnardel, Kallak (1997).

⁵⁶ See <http://www.axonweb.com>

tool for strategic plans, systems, procedures and products, a modeling tool for learning and explaining complex issues.

The main features are objects for idea processing, links and labels which connects objects, actions that are associated with each object, multi-level workspace, a analyzer that analyzes texts, a generator that combine ideas to form new ideas and expands concepts into details, a questioning tool that contains a list of generic questions, a diagramming tool with drawing entities, and hypertext & rich text that are connected to an object. Other features are icon library and a smart icons with special functions, drag-and-drop from other windows program, and computing expressions.

The benefits of the application are considered to be to work with ideas and concepts, emphasising on the overview, analyzing complex problems. In the application it is stated that it "improves memory and recall, stimulates creativity and discovery, facilitate knowledge capture and transfer, effectively amplify mental potential, focus attention and minimize distractions, reduces mental fatigue and writers' block and enable to see relationships from different perspectives".

It generate ideas through replacing words as verb and nouns randomly from a list of alternatives.

MindManager⁵⁷, the ultimate organisation tool is a tool that creates mind maps, but it has features that turns maps into conventional reports and HTML documents, and enables group work in real time. The application can design websites, and be used as a communication center and allows anyone to produce huge quality graphical output. Mind maps can be used for "concept creation: brainstorming, outlining speeches, presentations, demonstrating relationships, decision making, sales strategies and strategic planning; documents: reports summaries, technical documentation and training notes; organisation: daily planning, check lists, staff planning, organizational overview; information management: structuring existing material and generating reports in order to improve readability and understanding; corporate web sites: publish documents on web sites.

The Brain⁵⁸ is an application that lets the user use the computer as the mind is used intuitively, where associations are the inspiration of how to work and organize, integrate information from the Internet and other applications. The application has elements called "thought" that represent anything from a concept, project, person, subject, document, web page, spreadsheet, file, shortcut, game, where the user has to decide the representation, name-tag, its relation and what it contains. The modes are active and passive thought. The thoughts are divided into parent, child and jump thought . Gates link thought through a circle.

These three commercial tools are an example of existing application that support a person in various tasks, and they are mentioned here in order to show the variety of tools that may associate to a design tool or show how creating, organising, and making use of information but also representation of information and knowledge can be conducted with the assistance of an application.

This brief overview of commercial and critiquing tools show that in the context of design support tools the existence of a design support tools such as I try to examine and propose in this thesis work are lacking. I was assured through the above that concepts concerning design tools needs to be realized and developed both in theory and practice.

⁵⁷ See <http://www.mindmanager.com>

⁵⁸ See <http://www.thebrain.com>

3.4 What is Interaction Design?

"Interaction design focus on the design of interactive use experiences, and the shaping of use properties in interactive digital systems."⁵⁹

An approach to define the field of Interaction design is through the contemporary literature such as given by Jonas Löwgren⁶⁰. "Interaction design is designing the way people interact with objects and systems, especially with computer software"⁶¹. A similar approach can be made by reading job advertisements announced by companies and they all show a categorization of what an interaction designer is suppose to work with and what tools or qualities are required from the designer. The typical work assignments are the following⁶²:

- work in a design team, requirements analysis,
- design and prototyping of early concepts, design visual interface components such as screen layouts, icons and other graphic elements,
- conceptualize and design innovative user interfaces, specification of the user interface and design testing, build user interface simulations and prototypes,
- create storyboards and develop multimedia presentations to communicate key concepts

The academical qualifications required are ranged from degrees in Interaction Design, Human-Computer Interaction, and Graphical Design to Programming skills. The tools one should have an expertise in or at least some experience with Director, Flash, PhotoShop, Illustrator, Quark, HTML, dHTML, Visual Basic, JavaScript to Perl and C++.

"We need a new class of professional interaction designers who design the way software behaves. Today, programmers consciously design the "code" inside programs but only inadvertently design the interaction with humans. They design what it does but not how it *behaves, communicates or informs*. Conversely, interaction designs focus directly on the way users see and interact with software-based products."⁶³

This description of interaction designer is the best so far, describing that interaction design is a process that contains conceptual aspects, behavioral aspects of the users and deal with the interface of a software-based artifact. What is further stated is that according to goal-directed design, the aim is to design interactive products completely before any programming begins, and the design aspects should be carried out by trained interaction designers⁶⁴. Good interaction design is creating interaction that let users achieve their practical goals without violating their personal goals⁶⁵.

What interaction designer need to do is to write, sketch, and present their solutions as if they were blueprints to be followed and implemented. Interaction designers are compared with architects who deliver a set of blueprints that describe in detail how the product is to be built⁶⁶.

⁵⁹ A quotation from Jonas Löwgren, translated by Zayera Khan.

⁶⁰ Löwgren (1998)

⁶¹ Winograd (1998) pp. 39

⁶² See Appendix I Job examples

⁶³ Cooper (1999) pp.16

⁶⁴ Cooper (1999) pp.120

⁶⁵ Cooper (1999) pp. 150

⁶⁶ Cooper (1999) pp. 228-234

The field of interaction design is a discipline that attracts individuals from diverse backgrounds, both concerning education and training praxis, as well as personal interests in how to deal with and design digital artifacts.

What makes a good Interaction Designer? Is it the knowledge encompassing technology, media and humans or is it the ability to communicate design for a certain purpose? How will it be possible to differentiate a good designer from a bad one? Is it from the results manifested in the products designed or is it the actual process from a goal formulation to several intriguing creative design suggestion which fit for a specific target group. It seems likely that more and more individuals are interested of design from various aspects, although they may yet not have a training in being an Interaction Designer – so is Interaction Design a discipline like other design discipline that requires training and praxis? I propose that Interaction Design is in fact a discipline that will benefit from an ongoing discussion and dialogue towards development of field expertise, methods, sharing mutual dilemmas and creating a framework for communication and tools to work in a stimulating research field. This proposal is a desire that should not only be held within an academic setting but more importantly across the vast forms of commercial and product-orientated companies. I can only see benefits from an ongoing debate where Interaction designers can ventilate ideas, thought and discuss subjects with fellow professional and academics that may be a threshold to discuss with colleagues in the company.

In order to investigate some of the questions I conducted the following survey for finding facts about Interaction Designers in Sweden.

3.5 Interaction Design Occupation Survey

The survey⁶⁷ was designed in order to receive input from interaction designer working in various fields concerning what and how an interaction designer works, the diversity, the difficulties of the occupation but most importantly to state if there is an actual need for a design support tool.

The survey had three sections where the first part had questions related to the occupation as an "interaction designer" or equivalent. The second part had questions concerning creativity and the third part had questions about the design process investigating elements or features that might be desired in a design support tool.

The survey was conducted by first speaking to the participants on phone, explaining the aim of the survey and further on giving an introduction to the survey and my thesis work. The survey was sent to the participants via email and returned to me by the participants within a couple of weeks.

The survey was used in order to tie together ideas and focus of the thesis into the implementation of the design concept.

⁶⁷ See Appendix I Interaction Design Survey

3.6 Survey data and results

The participants were five men and two women who are employed by various companies, ranging from consultant, media, telecommunications, to software companies. They have the following occupations: external designer, usability consultant, usability architect, creative director, interaction designer, usability expert, and project manager.

According to the participants an interaction designer should or could be the following:

- An interaction designer is a person who is a good communicator, who communicates with customers and consumers, but also groups such as software-engineers, graphic-artists and project manager. This person should also have good knowledge of how to develop different type of interfaces, HCI and working life, to work within the limitations given and to be able to find a suiting solution, to be able to describe and motivate solutions, know system development and focus on usability and find it fun to develop systems.
- Someone who guards the users interests and perspective.
- Someone who can design good interface, functions and structures.
- Someone who knows what good interaction is and has an ability to see new solutions, a creative person who foresee the use for the consumer.
- Someone who has understanding of how humans and computers work/function together and can construct interfaces with this knowledge.
- Someone who is a practical person with expert knowledge in interaction design and design processes, who likes smart, beautiful and effective solutions, and have a feeling for color & form, but is also susceptible to tests and evaluations.
- Someone who has good knowledge of HCI, interaction, CSCW and an understanding of humans.

The results of the questions on creativity are shown by the following:

- Creativity is an ability to think unconventionally, overcome technical barriers and constraints and find better solutions, to learn through how others tackle, solve problems and through discussion.
- Creativity is an artistic creating process and the creative process means to take part of others experience, insights and ideas. Creativity needs time and necessary input, one needs to be relaxed and not be afraid to play.
- Creativity is to think solutions and concepts that are new and to be free in mind and thought.
- Creativity is an ability to associate freely about something and imagine in various ways; creativity is connected with imagination.

What is a Creative Interaction Designer? Here are some answers:

- A creative Interaction designer can work with the provided resources and design the best possible solution.
- Someone who can think in new ways and provide suggestions of how interaction can be conducted and supported.
- Someone who sees the solution in hard situations, find new perspectives and uses the knowledge in the right way, and not is locked/hindered by theories.
- Someone who communicates and has an ability to put oneself into others work situation, social being, having a social competence, skills and a sense of aesthetics and form.
- Someone who does not care about prestige, and can work with others as well as reason for solutions and suggestions.

Tools and program applications used by the participants beside the most common and natural method which is paper and pen, are brainstorming, whiteboards, sketches, storyboards and prototyping through various methods. The applications utilized are

Word & Office, Mindmanager, Dreamweaver, Homesite, ADIT⁶⁸, Freehand, Paintshop and the Delta-method⁶⁹, Html, PhotoShop, PowerPoint, Illustrator, Flash, Studio pro and Copyeditors.

A suggestion was proposed for an ideal tool for Interaction Designers and the following questions were asked:

1. Should it support design such as in graphics?
3 Yes and 1 No. A participant wished the drawings to look like pen sketches and not finished ones.
2. Should it support documentation and reports?
3 Yes
3. Should it support group communication, ease understanding between team members?
3 Yes. A suggestion for a community tool was given here.
4. Should it support simple multimedia presentations?
3 Yes and 1 No.
5. Should it support brainstorming methods and ideas?
3 Yes and 1 maybe.
6. Should it support sketching?
3 Yes. A response was that might be difficult to beat paper and pen, but it would be great to handle versions of the sketches.
7. Should it be open for using by certain people or only be used by a single user at a time?
Yes. A suggestion was to have been given a choice to choose depending on context.
8. Should it support designing of information structures?
3 Yes.
9. Should it support Internet services, creating websites and application?
3 Yes.
10. Should it support design of applications through usage of standard icons, buttons, and common functions?
2 Yes and 2 No. A suggestion was to have a possibility to connect and use companies own standards.
11. Should it provoke and criticize your suggestions?
4 Yes. A suggestion was that it would be great, and a good idea would be if the tool performed cognitive check-ups for disposition, color etc, and could warn for too deep hierarchies and unfamiliar words for the users.
12. Should it provide alternatives and solutions to you from specified data and information provided by yourself?
3 Yes.

Only 4 participants returned direct answers to these questions meanwhile from the remaining a person replied that "everything is ok" and the two others were rather skeptical and argued "No" since they believe that it is not possible nor wished to combine a tool that fulfills all purposes and needs within a design process. One of the participants argued that the customers' demands and requests are too complex to be handled by a single tool, nor is it possible to create a complex toll that can handle the entire design phase. This person rather desired learning methods and applications to visualize and test ideas. The second participant argued that it is not possible to combine all tools and keep the use of it easy and compatible with various formats.

The positive comments received were that the tool should help in "how to present ideas" so that made-up storyboards can be easily understood and explained to others. According to the majority of the participants the tools should support design processes, documentation, presentation of reports and prototypes, sketching, information structures. The tools should support positive and negative aspects in order to shown the consequences to be able to make an objective choice between two differing design solutions.

⁶⁸ Cell Networks ["Network's"] own method, <http://www.cellnetwork.se/>

⁶⁹ Delta method is a software developing method.

A participant wants a "Director light" version to make multimedia presentation, this program should also have the functionality of the Brain⁷⁰ program to make mind maps. Another participant suggested that a design support tool should formalize the design process and make it visible, in order to give control over the design decisions made and know the 'whys'. A participant desired that the tool should make documentation in a chronological order for user tests, prototypes, and sketches so that it is easy to follow the process.

When it comes to the issues about the work process, what and how Interaction Designers work or utilize in their work situation, I hereby summarize the answers received from the survey concerning the use context, but also a summarization of the other questions:

A1 works by creating design from a user perspective with sketches paper prototypes where information, motivation and design decisions are essential. A1 conducts expert evaluations and usability tests. The work process is mainly non-electronic and solution-oriented. A1 desires a design support tool and welcomes all suggestions. A1 present and communicate ideas and concepts through design meetings, where sketches are explained as well as design documentation in which interaction and interfaces are described. A1 works with paper & pen initially for sketching on solutions and afterwards works on applications. Example of a design problem is the following: in a situation where a choice has to be made especially working with web-applications and where one has to choose between two, then one has to think of all the negative and positive consequences for the alternatives and make an objective choice, if the situation is really difficult then a design meeting is called upon and the ID gets help in making a decision. A1 states that help is often needed in order not to get into the same conventional design solutions, and that they (at A1's workplace) have been talking about a random-generator that creates GUIs, where the designs are useless but they may help in conveying new ideas. An important part of the job is to document how and why a design is developed and motivate to the customers why a specific design solution is better than another, and therefore it is important to write and document thoughts and background information which can be easily forgotten otherwise.

A2 works mainly with project managing and graphical task, and would like to work more with conceptual development and lesser graphical-oriented tasks. A2 makes oral presentations and shows sketches created by various applications. The work process is structural and goal-oriented using a method. A2 does not believe in a tool being able to enhance creativity but can see a point in testing and illustrating ideas. A2 works in group and individually, with external customers and with colleagues as a discussion partner, the work process is categorized by good ideas and a healthy memory in order to remember.

A3 works mainly with usability issues, produces GUI and speech Interfaces. A3 would like to work as early as possible with users in a design project. A3 presents through prototypes, sketches, reports and find it difficult to communicate essential information to colleagues because of lacking structure and formal ways to presenting and discussing results. The work process is vague but involves user analysis, conceptual design, prototyping and iteration in the usability cycle. A3 would like to have a design support tool that formalizes and makes visible each design step in the design process, since its

⁷⁰ This application helps a person organize, visualize and share knowledge. For further information visit <http://www.thebrain.com/>

easy to forget the whys and essential decisions in the creative process. A3 had the suggestion of documenting analysis, sketches, prototypes chronologically making it easy to match certain demands to specific design solutions in a prototype, and finds it essential to "document creativity".

A3 works mostly individually, and communicates through prototypes, sketches and written reports from ideas to a concept solution. The problem can sometimes be to communicate important information to team members. The work process is vague and involves user analysis, conceptual design, prototyping, iterations on the design process. A3 thinks that it is important that products that are to be used in the same context have similar modes of interaction and a synonymous frame of conceptions which is currently lacking or becomes a problem in the work A3 conducts. A3 proposes that a tool can help in having control over the design decisions and know where and why a decision is carried out. B3 thinks that when creativity is in the flow, it is easy to forget why a certain decision was taken, so why not have a tool through which the demands in a specification can be directly connected to an interactive prototype or solution.

A4 works with interactive drama, design and sales. A4 would like more time for conceptual and exploring various components through a humanistic perspective. A4 works in a group with Art directors, Graphical designers, Cognitive scientists, HTML-programmers and utilize brainstorming, sketching for creating ideas and concept. By having all the various competence the design process is enriched and presents differing views in the idea process where one gets a better end-product. The work process is characterized with chaos, wild ideas, restructuring, presentation, re-sketching, iteration in the design process and a final concept that is accepted by the customer. An example of a problem consists in the graphical versus technical solution, where a conceptual idea can be dependent on either the graphical or the technical aspects that are possible to implementation.

A5 works and functions as a link between consumer and developers, dealing with creative solutions in products and would like to work more with pure interaction design issues. A5 presents in paper and the work process is dependent on good ideas, and a long memory. A5 doesn't believe in a tool being able to do all because the demands of the customers are more complex than one can imagine and therefore it would be impossible for a tool to support these and be flexible enough. A5 works both in group and individually, where the group work gives a flow of ideas, and the individual part means to make structure and refine the ideas, so the whole the process is parallel. A problem example is a completed design solution has to be altered because of a new demand when the creative process is over and only implementation is left. Then it is good to have someone to discuss a compromise and issues that can be presented to the customer.

A6 works with usability investigations and represents the user perspective. A6 presents through sketches, paper prototypes and reports. A6 thinks that a design support tool is needed and suggests that a main function should be visualization of complex structures. A6 works in both group, individually as well as internal and external. In group A6 work with a project where A6 is the only person with such a competence. In the individual work A6 gives lectures for both external and internal work. The work process is very flexible and varied for A6.

A7 works with usability studies, interviews, and interaction design issues. A7 is working on an application using "Unified Modeling Language" as an Interface Designer, alternating between designing and analyzing the activity of the process. A7 makes

sketches and prototypes that are tested on users. A7 gave no answers to certain questions, because A7 was initially interviewed on the telephone and later concluded with some written answers concerning the design support tool.

3.7 Survey conclusions

The survey data and results suggest that a design support tool is desired in order to support the design process in which both the design decisions are documented and motivated but also the structure of organizing and making sense of information is conceived. A documentation feature is wished for in order to make it easier to remember, support memory and share information with colleagues. Sketching is an essential feature is an essential feature for creating artifacts therefore it should be supported as well as the art of making prototypes and illustrating that makes the designers ideas and concepts understandable and graspable. Features that make it easier to make a choice and compare differing variables, and overview apparent or unpredicted consequence would be useful and remind the designer of factors that otherwise would be overlooked.

The work context in which the participants work in shows that the designer work both individually and in team work involving several other professionals. This requires for the designer to be able to communicate and present their ideas and concepts. The designer has to think of aspects concerning the users as well as usability issues in order to perform and test their design solutions.

When it comes to the creativity issues the designers would definitely use an application that has features that somehow supports and enhances creativity, although the whereabouts can be discussed. Therefore the interaction design occupation survey has emphasized the need for a design support tool and through these findings I was reinsured and continued with my work concerning design support tools.

3.8 Designing Interaction Designers

This chapter discusses briefly design and interaction design, what I want to conclude and discuss here is what has design to give Interaction Design? The theory of design from disciplines such as architecture, industrial design, graphical design provides with perspectives and shows an evolution of shifting concepts. Inspiration can be found and related to similar problems and issues of the act of designing. Through the major difference is the fact that design in these fields is based very much on a real hand-on-material gut feeling which is a sense developed in viewing, understanding and creating artifacts through prototypes in paper, clay, plastic, wood, metal, etc. In Interaction Design we do lack this perspective which responds in differing constrains on the Interaction Designer. I lack a metaphor such as sketching in Interaction Design, as well as I lack a tool and a method of representations of abstract knowledge, experience into concrete manageable and applicable framework of development in the field.

A major issue is the fact that the media/medium employed have differing affordances! The digital media puts its own constrains yet provides a freedom which is limited mostly by the human mind and prejudices about how design should be and how it should be conducted/produced. Yet in Interaction Design the emphasis on the end-users & consumers of a product is more democratical and emposing than in any other design field. Where else do a designer need to have a user in mind in every aspect? Interaction Designer have to be humble and always open to all a potential user demands, having an

ability to put him/herself in the users shoes and perceive the world through the users, yet then in the process distancing from this to be able to be more product-oriented and design from the broader knowledge of what, why and how! *Give the people something that they cannot even imagine.* Therefore we are responsible of challenging and predicting what is desired, what will function and work satisfactorily, what will provoke and disgust and from the manufacturers point of view-what will sell!

As for Art, the aesthetics of Interaction Design has its predecessors naturally in Art & Design, where the experimental choice of displaying reality perceived and conformed by the artist. Interaction Designers with a bend in art have a differing input into what they design since I believe that in order to follow a discipline and yet revolt against it one has to be courageous enough to make own definitions through high awareness of the made/constructed definitions & decisions. Artist have a goal which is concerned and focuses on the free expression⁷¹, this perspective is differing from the designer who mainly are product-oriented.

Seeing Science in Interaction Design one can easily conclude that the traditional aspects of method, investigation and research are somewhat unfulfilling. How to study and methodically investigate a field that is evolving? Is it through perceived performance (satisfaction, feedback, frustration, excitement, and usefulness) by its users? Is it through the products commercial success or malsuccess? I presume that these issues hopefully will be discussed and reach a consensus but right now we have to start formulating the questions and designate towards a platform for development in the field of Interaction Design and Interaction Designers, the practitioners that come in all varieties and shapes!

"Interaction design is more of an art than a science"⁷² is a sentence that I disagree with since I believe that Interaction Design has to be more than Art & Science, meaning that a combination of both to create a new ground to stand upon, independently of traditional concepts and knowledge representations as well as praxis related to form and aesthetics. Why not break free of conventions and form new bold ways to perceive, model and create artifacts, services and products for the technology driven-human!

⁷¹ Quotation from Chris Hales in a private talk. Hales is a "in-residence artist at K3, Malmö University"

⁷² Winograd (1998) pp. 56 by Cramton Smith & Tabor.

4 Design Support Tool Z

This chapter presents the design support tool Z concept, the empirical study and the results. In the end of this chapter I present a suggestion for an ideal "DSTZ" and discuss the necessary elements for providing and maintaining a reasonable design support tool.

Design Support Tool Z (DSTZ) is my concept and a suggestion of an application which can enhance creativity and support a designer through the design process. The theories of creativity, which are mentioned in the beginning, inspired and laid a foundation of how to enhance creativity. Provocation and Random Input are techniques I was inspired by and investigated further by using them as a part of the concept, for the purpose of if they can stimulate creativity in a design support tool setting.

The concept of DSTZ is a tool that can enhance and promote creativity by engaging and stimulating ordinary thinking processes. By means of supporting and providing the designers with such a tool will make it easier to communicate, carry out a dialogue in the design process for creating, to overview and easily document necessary thoughts and ideas, and importantly to know when and why essential design decisions were carried out, and how a final solution is chosen.

4.1 Method of the Study

The method for the study performed is based on previous chapters mainly concerning creativity and interaction design issues. The Interaction Design Survey provided several interesting aspects and questions, which I try to investigate and implement in the concept, but also new notions and perspectives that I received and was inspired by through the survey, which concerned the issues of support for finding new solution and concept, documentation, sketching, presentation, structuring information, creativity and user contexts and properties, as well as various techniques and methods for usability.

My aim have been to investigate and discuss if it is possible for an application to enhance creativity, or enabling a designer be creative. My purpose have been to provide a tool that can support the designer in the design process as well as in the creative process. The application should be the "designers tool" as the carpenter use the hammer and the chisel.

DSTZ is not suppose to be creative in itself or display any feature that are autonomously creative but rather enhance creativity through various functions, palettes and give the designer a choice to develop and experiment with ideas and solutions. DSTZ is not suppose to measure creativity through the application either but creativity can be measured when evaluated by experts who examine the design solutions based upon specific criteria. This concerning the domain, expert and person notion mentioned in the creativity chapter.

The method by which the study is performed can be divided in 2 parts. The first part began with creating and embodying three functions/strategies that investigates how the design process can be supported and stimulated in the context of DSTZ. A system script was written for the functions in order to establish the behavior of the system [DSTZ], meaning when and how to respond to actions and the feedback of the user that occurs when using DSTZ.

The second part contains the expert's criteria⁷³ for judging the results of the design survey, implying which aspects are important for an interaction designer to think of and present when solving a design task, but here more specifically concerning the question I have raised and want to investigate through the design task that was given to the participants, which is creativity and the design support tool DSTZ.

The idea of DSTZ began with the notion of how to handle creativity in the context of interaction design, in particular how to enhance and stimulate creativity in the design process. The aim of the concept is to provide and give the interaction designer not only possibilities but also a useful tool to be creative with. I focus on specific parts of this application, such as essential functions like: Provocation (P), RandomChaos (RC), Elaboration/Exploration (E2).

These function are to be used on the designers ideas and suggestions in order to provide the designer with further alternatives to invoke and evolve the design process in which the designer is restricted in, voluntarily or involuntarily.

4.2 The DSTZ concept

A theoretical issue I had to decide and deal with was the fact that in the field of interaction design we do not have our "signs, actions and sketches" which are clearly identified in other field, especially in design (such as architecture and industrial design). The designers in these fields have externalized their thinking in forms of drawings and sketches – what/where/how is there an equivalent and corresponding form for us? How do we make and work with conceptual ideas in a framework of creating and evolving a field which overlaps design, technology and art with the focus on humans that is more essential and critical than in any other design field?

We need to take advantage of affordance and design artifacts that are adapted to human needs. We need to build in information and data, maybe sensory data into artifacts that would make it easier to use through ubiquitous computing.

We need to design such tools ourselves, considering not only making the design process easier with emphasis on work strategies and support but also relating to the mechanics and technological limitations set by the tools.

One aspect of my concept is a focus on the individual designer, working with any problem, in any context. The specification here lies on the creative process and how to enhance creativity, by using the application with all its functions and palettes.

The second aspect is to focus on a general design process where the designer is working in collaboration with either other designers, or any other skilled professions or identified/assumed users. Here the focus is how the program enhances and supports both the collaboration and the creative process in between, meaning that it should not limit but rather open ideas, makes paths for easy communication and evaluation of ideas and solutions⁷⁴.

The DSTZ concept should be easy to use, easy to modify, provide overview, show progress in the design process and be a dialogue partner through the functions.

The application contain these palettes:

⁷³ See Appendix II Judgement Criterias.

⁷⁴ I got inspiration from a workshop held at Art & Communication, Malmö University in October 1999, which was about "Augmented Shared Worktables" and where my group developed a concept called C6.

- Tool palette A with a set of unfinished looking components for prototypes, such as interface elements (buttons, icon, menus, toolbars, dialog boxes, pointers, styles for text) with an exaggerate simplicity.
- Tool palette B with elements for drawing and sketching with for instance a drawing board ⁷⁵ with input/output device.
- Tool palette C with plug-in elements for audio-input/output, images, animations and 3D (these can be extra features or plug-ins adapted to programs such as Adobe PhotoShop, Illustrator, Soundedit-software, 3D-applications such as Rhinoceros).
- Guidelines palette providing High level advice, such as relevant design rules and very Low-level guidelines in order to evaluate tasks. It has an evaluation mechanism that contains methods showing usability issues, techniques with which the designer can simulate and create test/evaluation situations, and set criteria and see if a specific variable can be work for a defined design solution and users, as well as get information about how to perform and use a usability method.
- Gallery/maps palette automatically saves design alternatives, display the progress of a design solution, with or without interference of a function (see below 4.2.1), so that a stepwise reconstruction is possible. The palette has a feature that shows and enables conceptual maps where the design representations are encouraged to be made or revised, and through this the maps are re-mapped, can be altered and make it possible to modify the actual representation.
- Inspirational database palette, is a database that contains design examples from various genres of design fields, such as architecture, furniture, media, design movements, but also information on specific products, individual designers, companies/manufacturers and periods. The information should be automatically updated via WWW and provide links to web sites as well.
- Documentation palette containing files of information and reports, both self-made and chosen reports by the designer which are relevant for the project. This palette also enforces the users to document the design process, to update, and gives the designer a choice to write and argument, motivate designer decisions as well as illustrate the chain of thoughts. The designer can choose to be reminded to document and set a time (timer-function/automatic-reminding functions).
- User X palette is a palette with two different features, one feature enables to make user profiles by details such as: name, age, interest, occupation, income, habits, living status, and technology features. Through this the "most common user" profile or making three differing profiles of the potential users would help the designer in understanding and targeting a specific presumed or identified user. The second feature displays the user environments dealing with context dependent features, such as home, work place, public place, or any specific space/places. Through this feature the designer can create scenarios and storyboards that relates a design solution to a practical context or in order to present and illustrate the solutions to team members or external people.
- Empty palette is actually the designers own palette where the contents can be chosen and defined, as well as making it possible to create, add, saving new features within a project work.
- Function palette that has the following functions: Provocation, RandomChaos, and Elaboration/Exploration (see 4.2.1 for further details).

These palettes are conceptualized because the cognitive processes involved demands attention and reminding of certain facts and issues.

These palettes work as reminding/demanding features, directly changing and altering the design in which the designer is involved by saying "Hey, its time for the user perspective to drop in!" or "Think about how this design will effect user Anna!". Meaning than the design solutions conceptualized by the designer are directly emphasized and the designers cognitive processes are supported by features that demand attention, work as reminders or cognitive clues to facts that other wise might have been forgotten.

Each time an old project is opened, the application set the default settings automatically for the project, which means that it updates the whole application to the current project.

⁷⁵ Drawingboard with different pens, and flat screen on the wall as a differing working context should be used with the program. Wacom INTUOS Interlligent Graphic Tablet System A5 with pen, presseure sensitivity, and airburshes, mouse, lens cursor, various pens is a pointer in that direction. See www.wacom.de

4.2.1 The functions

The concept DSTZ contains three functions, which I have tested in the design survey. I will describe these functions and what they imply in the concept and in the study.

Provocation

This function is based and inspired by de Bono's method of Provocation, which I have explained in the beginning (see 2.2.1). The function in the concept is meant to provoke and directly manipulate the designers design solutions by the following strategies:

- Situation specific, which means to manipulate and change an interface element by removing, adding an interface element, suggesting and changing proportions, providing and generating provoking design solutions. These sub-functions (which works in the same way for the other functions as well) are triggered when a specific action or lack of action is carried out by the designer.
- Randomly, which means to give suggestions to utilize the User palette, changing either of these factors: users/context/situation. These sub-functions are triggered randomly by the application, when the designer is working on a design solution.
- At no activity, which provide cues, suggestions and question in both a positive & negative sense. These sub-functions are triggered when there is no activity by the designer, precisely meaning that the designer can set a minimum time for this (10 minutes of no activity).

RandomChaos

To "put oneself deliberately in a difficult, unpleasant and chaotic situation" this will result in an effort to make structure out of the chaos and regain balance, through this creativity is born. Through this I thought of the idea of having a function that make chaos. The RandomChaos function is meant to evoke randomness and chaos in the design solutions, by the following strategies:

- Situation specific, to define various features in a list, choosing and using specific ones and comparing with each other. A feature here is to provide the designer with generated solutions through chaos/at random by the application.
- Randomly, which questions the purpose of the design and asks questions about the functions, design elements, aesthetics, and user environment, in order to change perspective.
- At no activity, which show pictures for making associations, and throws words for making associations, as well as presenting word games to the designer.

Elaboration/Exploration

The main idea of this function is to elaborate and compare design solutions in order to find solutions that otherwise would not be found.

- Situation specific, which starts with asking the designer to make 2 differing designs, then freeze the design solution in order to explore & elaborate the two solutions and finally comparing these two with each other and describe and motivate the differences between them.
- Randomly, which asks the question "what if everything went wrong?" and order to reprioritize and make new solutions.
- At no activity, which explore the problem area and find new/more problems and create solutions out of details in products and ideas.

The motivation for making the functions automatic, specially the provocation function is because the DSTZ concept in my opinion would be a more challenging and thus a better design support tool. Studies⁷⁶ have shown that an automatic operation triggers the

⁷⁶ References are from Fischer et. Al, Finke et. Al, Löwgren, Ericsson, Amabile, Arnheim, Cross et. Al, Csikszentmihalyi, de Bono and Schön.

designer and promotes new ideas, where the effect of this in my case is to enhance creativity. Designers need to be reminded, motivated, provoked and even provided a 'break-down' in order to reflect and create new concepts, work on their own going ideas with a new approach and have a better work flow instead of getting stuck and working in old patterns and their ordinary paths. The designer has to be diverted from old pattern of thought and ideas, and thought the functions described above I aim to disturb and provoke the designer in order to manifest new solutions and brave new ideas.

4.2.2 A scenario for DSTZ

A scenario illustrating the DSTZ concept and the provocation and the elaboration/exploration function is described here, in order to provide an insight in my work.

Scenario for the design task

The task is to design a new communication device for any environment, and the typical users are defined to be a family consisting of two adults, Laura 40 years & Paul 45 years, three children Michael 4 years, Saul 7 years and Joan 12 years old. Laura and Paul work full-time and the kids go to kindergarten and school. They live in a house and have a need of at least four communication devices, the adults need one each, the kids have one that they share and there is also spare/guest device.

The technical restraints are voice, text and small images which are created and sent, but the device is not a data saving device, therefore the device automatically deletes old messages that are "read" after three days.

The designers' task is to design a conceptual design and suggest an interaction design of how the communication device would work.

Creating a design solution according to the Provocation function

The Interaction designer (ID) opens the DSTZ application and utilizes the User X palette in order to make the user profiles from the given specifications. ID opens the documentation palette and re-writes the criteria and own ideas about what is essential and worthy to think of. ID starts drawing on the work-table and makes some quick sketches on a possible design and defines features that are essential such as: communication possible at any time, essential for tracking family members, quick and easy to write/send messages, easy to find numbers to dial. When the ID have worked for 30 minutes the DSTZ says "*Think of a three specific environments in which the design situation can be used*". The ID opens the User X palette and creates three scenarios/situations for the user, which are: Laura is caught up at work and is late for picking up the kids from school, Saul is at a friends place and needs to inform his parents about where he is, Joan is talking to her friends and therefore the voice-functionality is not available. Through this ID begins to think of how these problems can be solved by the communication device and keeps on working another 45 minutes. By that time ID has made a couple of GUIs and DSTZ says "*Change the proportions*" and ID does that and after another 15 minutes DSTZ displays four generated GUIs to ID, which are examined and reflected by ID. ID asks DSTZ to show in detail one of the solutions and continues to work on it. After another 20 minutes ID has altered the solution enough that DSTZ interferes directly and adds some elements in the GUIs. ID reacts a little puzzling to this and takes a break.

After 30 minutes ID continues with the conceptual design but in a certain moment the ID is blocked, DSTZ notice this since the "at no activity event" is set to react after 10 minutes of non-activity. DSTZ shows ID some inspirational pictures and web sites on

similar product, and asks the ID to "*Compare these products with your solution*". ID does that and finds out facts that were overseen, which are now documented in the Documentation palette before ID continues to work on the design solution. Finally after a while ID has come up with a solution that is satisfactory and prints it out for showing it to team members and discuss them the next day.

Creating a design solution according to the Elaboration/exploraion function

Another ID opens DSTZ application and gets an initial command from DSTZ saying "*Create two opposing design solutions, concerning the GUI and the physical appearance*". ID creates two opposing and very different design solutions such from scratch and after 35 minutes the ID is interrupted again where the DSTZ says "*Compare these two and motivate the differences between them*". ID now opens the documentation palette and starts to write while examining and comparing the two differing design solutions. When this is done ID suddenly realizes aspects that are necessary and essential for the target group. ID wants to investigate this further on and opens Guideline palette in order find relevant methods or design rules that should be considered. ID finds a couple of methods that are appropriate and wants to make a simulation. ID now specifies the users, by creating profiles and context in the User X palette and then creates a setting for simulation. The design solution is tested and the results show what works and what is critical in the design solution. DSTZ suggests that the designer completes the design and try to make real user tests with a couple of users in the near future. So ID continues, finished the first design solution and make print outs and prototypes that are later tested on the targeted users.

The designer is the described scenarios is working on the design task with the worktable where the input devices consist of keyboard, mouse, drawing board, and the output device are printers. The designer utilize the DSTZ concept through the palettes and the functions in the design process whenever desired, thus promoting creativity and seeking for an innovative design solution. The design process and the solution should be communicated and shared with other persons such as colleagues, employers and consumers. The restraints are visible and could be either impeding or nourishing.

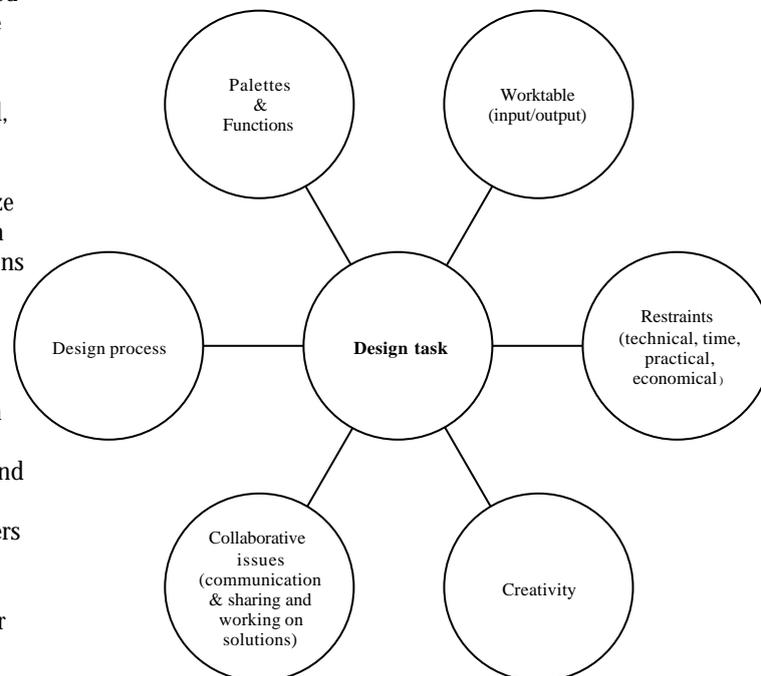


Figure 1. Conceptual view of factors involved in the scenario.

The DSTZ concept can be illustrated by showing the concepts and the essential parts as following, where the first picture shows an initial phase with the palettes, and the second picture shows an different mode where the designer is working on a previous design.

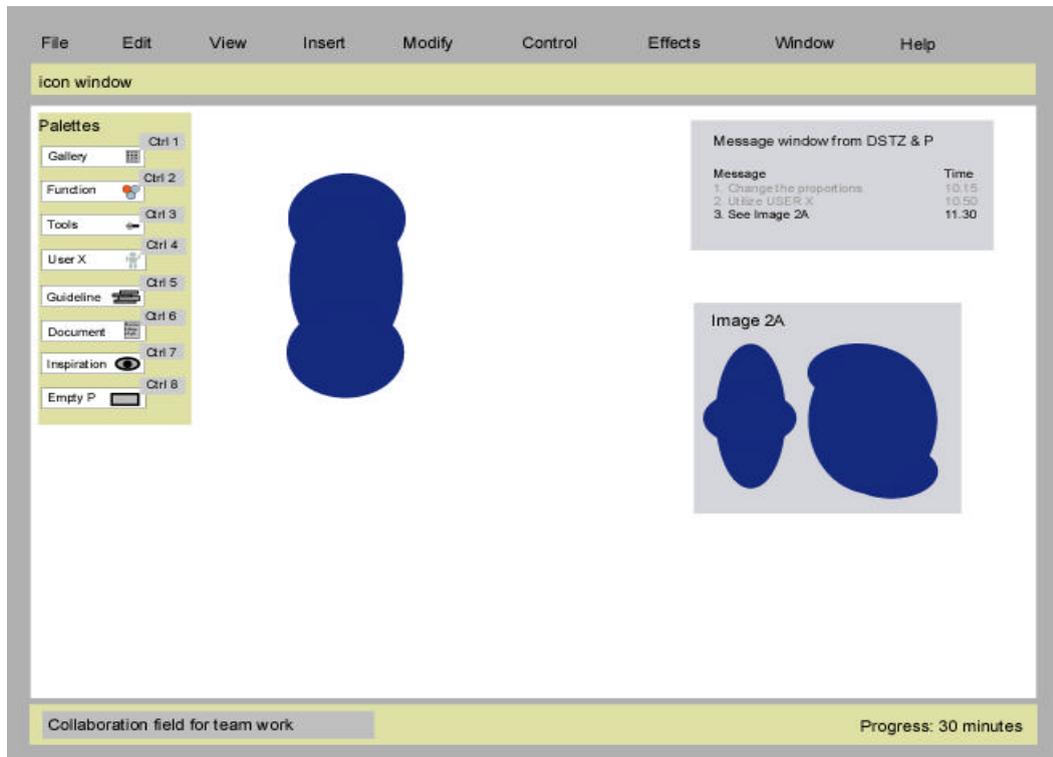


Figure 2. Illustration of DSTZ, showing the message window, and alternative solutions presented in "Image 2A". The Palettes are displayed with the short-cut commands, illustrating an inactive mode.

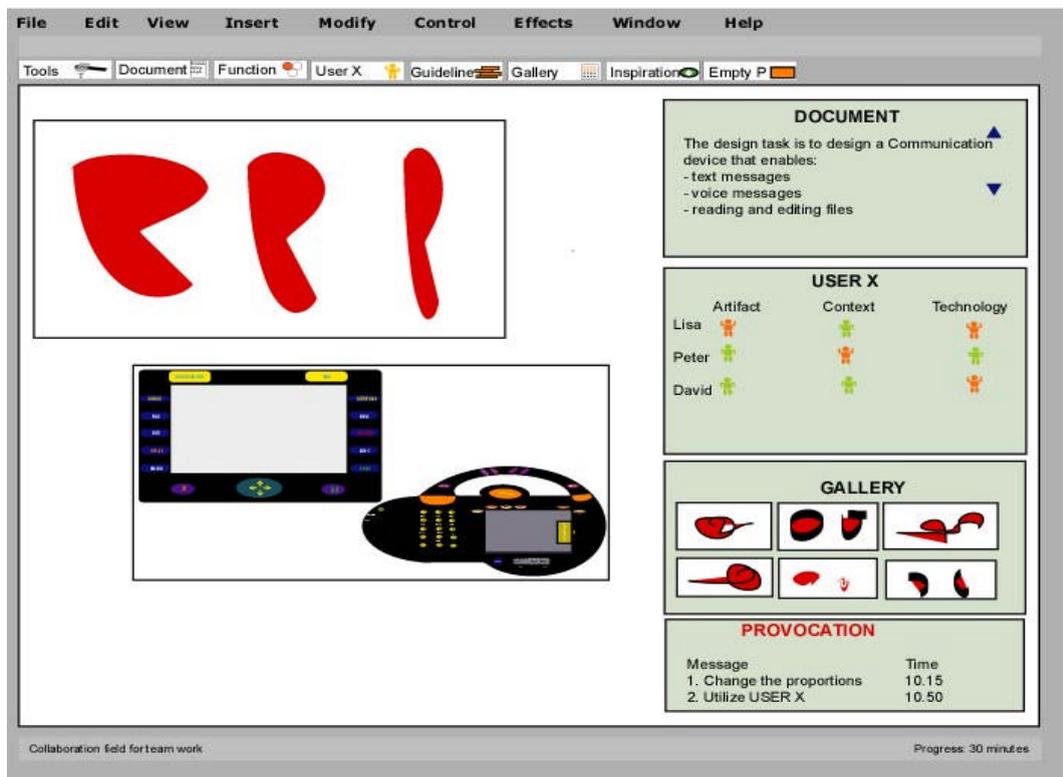


Figure 3. Illustration of DSTZ, showing the document, user x, and gallery palettes. Where the palettes are in the active mode indicating that the designer is actively using DSTZ in the design-process.

4.3 Empirical study

The empirical study was designed by the inspiration of the research in Creativity and Design, thus complementing it with the Interaction Design survey. The study began first of all with defining the functions, which had to prove or shown if creativity is possible to enhance by the functions and in the framework of DSTZ.

The participants were divided into two groups, one group of professionals, who work with interaction design, usability or similar tasks. The professionals were chosen in order to achieve a broad category of work situations and represents the vast field of Interaction Designer. The 9 participants are working at five various and major companies in Sweden. The other group were students studying Interaction Design⁷⁷ at Art & Communication, Malmö University.

The participants were sought and emailed a request of participation. They were informed via email/phone the purpose and a meeting was later on booked. All the user tests were performed during two weeks.

The participants were further on divided into subgroup to be tested for the functions, as following:

<i>Provocation</i>	<i>RandomChaos</i>	<i>Elaboration/exploratio</i> <i>n</i>	<i>Reference group</i> ⁷⁸	<i>Mixture</i> ⁷⁹
2 persons from each category	2 persons from each category	2 persons from each category	2 persons from each category	1 person from each category
Total (18): 4	4	4	4	2

4.3.1 The structure of the study

The study consisted of five papers where the first page was a description of the task to be performed giving the information that this experiment was suppose to simulate the concept DSTZ, which was also described on this paper. The remaining four papers were four examples of the following palettes, which I have later renamed and revised, both in the previous section and in the illustration⁸⁰:

- User palette with scenarios (later called User X)
- Use environment palette with scenarios (later called User X)
- Usability palette with methods and simulated tests to check the design solutions (later called Guideline)
- Designers own palette, with the designer own examples of necessary features (later called Empty P)

The participants were received the instruction to comment and think-aloud and not speak directly to Zayera (who conducted the experiments). The tools at hand were white sketch pad, 8 color markers, 6 color pencils, post-it notes to write and ask questions and request to the system "DSTZ".

⁷⁷ Except one student who studies "Material and virtual design" a three year Bachelors program. The remaining students are all ID students in the first or second year.

⁷⁸ The Reference group was only subjected to the DSTZ without any interference of the functions, but if a person wanted to utilize any other part of DSTZ (the palettes), then that was allowed.

⁷⁹ The Mixture group consisted only of two persons who were subjected to a combination of two differing strategies or functions.

⁸⁰ See Appendix II Design Survey DSTZ

The design task was to "Design a new version of an email system (ES) that works on palm pilots". A short description of the project was provided as well as main system functions and basic function criteria were established. The target group for this product were youths and students in the age of 15-25 years. Their main objective with the product is to communicate with friends, family, education- and job-related context. The following was required of the participants:

"The design task is to design an interface and functions for the ES. Work from the target group and the scenario described with the help of DSTZ. The focus and assessment of the design is on the quality, creativity and realizability."

The participants were given maximum 2 hours to produce a suggestion for the interface, the concept and functions.

The concept tool was described as such:

"DSTZ is a 'universal plug-in' which can be used without any constraints for example with Director, PhotoShop, Illustrator, Rhinoceros, Dreamweaver, Office, etc. The tool is used to support the design process and enhance creativity. The system will actively interfere in the design process by applying a certain strategy. These interferences will be suggestions and direct interferences in the design solutions."

After the performed test the participants were handed out a questionnaire⁸¹ which contained questions about the perceived test situation, background information about the participants, their views and ideas on creativity & design support tools.

4.3.2 The judgement criteria

The second part of the empirical study was to make and decide the criteria⁸² in order for the judges to be able to judge the design solutions. Since I was an active part of the empirical study and played the role of the system "DSTZ" I thought it better for external judges to objectively judge the solutions. The reasons for doing so are several, a major reason is the domain expert role, and another reason is to achieve objective unbiased judgments without the judge knowing who they are judging. Guarantee is thus provided towards the participants to be part of the empirical study anonymously.

Three judges were chosen to examine the design solutions, the essential thing to judge was the main concept and the final design solution.

The procedure was carried out as the following, I sat with each judge, filled in with necessary information and presented/showed the papers to the judges. Each participant's solution was judged by two judges. Each judge commented 12 solutions in a single session, which took approximately two hours per session.

In the diagrams further on I have written judge A & B, which means and shows the different judgements each design solution have received from the three judges.

The judgement criteria were defined by four questions:

- How creative is the design solution?
- How novel is the design solution?
- How useful is the design solution?
- How relevant is the design solution?

Creativity in these criteria stands for an ability to create a solution that differs from traditional solutions or design of the artifact. Creativity means an aspect of attractiveness and fun for the target group.

⁸¹ See Appendix II Design Survey DSTZ

⁸² See Appendix Criteria.

Novelty is seen in the range of associations of the design solution to other product for example palmPilots in general. This criteria is viewed in both a negative and a positive aspect, implying that the product should be similar enough to be easy for the user to adapt to and utilize, the negative aspect being that it would be boring if it is too familiar and traditional.

The usability aspect deals with how useful the design solution is, how easy to handle but also the cognitive and ergonomical aspects that affect the physical design, software design and modes of interacting.

The relevancy of the design solution considers aspects of the basic system functions and the demands of the task, and the target group. An essential aspect is how realizable is the solution concerning economical, technical and manufacturing perspectives, as well as how easy to understand and to sell the product.

The criteria were formulated as 14 statements⁸³ and judged by a number 1 (bad) to 5(good).

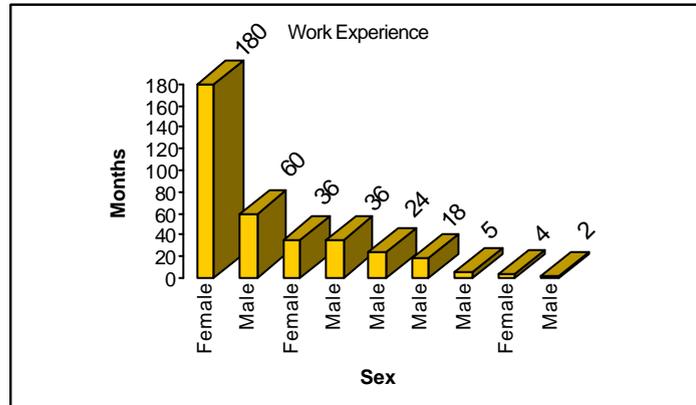
4.4 Results

The results of the empirical study are shown in this part section by section.

The students and the professionals had the same amount of time ranging from 1 hour for the reference group to 2 hours for those who were exposed to the provocation function. The students group handed in 5-18 papers and the professionals handed in 8-18 papers.

The professional group had all an education level of a master's degree or engineer's degree. They have working tasks ranging from Interaction designer for some participant to more usability-oriented tasks.

The work experience varied for the professionals from 2 months (the shortest time) to a participant who has worked for 15 years.



The participants find the empirical study fun to do but some found it hard and challenging and stressful. Fortunately they all found it meaningful. Only two persons found the time frame to work within enough, the rest found the time not enough.

The participants use the following tools and applications in their work: NetDynamics, HTML, PhotoShop (very common), Dreamweaver, InDesign, VisualBasic, MindManager, Powerpoint, HomeSite, Word, and complemented with various usability techniques, methods but also paper and pen of course. This suggests and imposes to the answers achieved from the Interaction Design survey concerning what tools and applications Interaction Designer utilize in their work.

⁸³ See Appendix Criteria.

According to the professionals an Interaction designer is someone who has a combination of design-knowledge and HCI, have an understanding and feeling for all the involved partner in creating a product, is creative within the restraints, focus on usability and users, inhabits a feeling for the user, creativity and knowledge.

Someone who has a feeling and knowledge of humans' needs of support and inspiration, but also can be creative at demand. Someone who is trying to create useful solutions, has knowledge and experience of design, possess an ability to evaluate design comparing to an architect and industrial designers.

The answer to the question if the participants are satisfied with their own work and felt that they were creative while performing the design task were: either no or careful answers that they could have been more creative if not stressed by time. Two of the participants answered that they did not feel creative in general, the remaining responses were from relatively creative to pretty much.

The answers to how did the participants perceive the systems input were: from "very good" to "could be more active" to "a bit magical". So the overall response were positive.

In the student group all of the students except one found the design survey fun, meaningful and found the time enough for doing the design task.

DSTZ is said to be interesting if intelligent (if the actual application could be as intelligent as the simulation) , but it is also perceived as being too static.

The students respond that they are a little creative sometimes, not giving any firm answers but rather cautious answers.

The systems input were commented to "be a bit boring", "better than assumed" and a person commented that "a robot cannot substitute the dialog with people" referring to the DSTZ as a autonomous application trying to take the role of an dialogue partner in the design process.

4.4.1 The judgements

In the Appendix II⁸⁴ all the data is presented and here I will provide a short summarization of the data and present the results.

The judges have judged the design solution and concept, where the judges have thought that the solutions lacks an aspect or does not fulfill the question criterias they have given "0" remarks. Therefore some of the scores are misleading since the average scores presented in the table are affected by the amount of "0"s received.

The professionals I have called "worker" or shorted "W" and the students "S". Following I will describe some facts about the input and output during the tests.

The professionals

W1 got the scores 3.6 & 3.6, the session took 2 hours and resulted in 11 papers. W1 asked the system 13 questions mainly about technical concerns. The system gave 4 input, which were the following:

- Make 2 different designs and mind movement, dirt and waste
- Make the design challenging and striking
- System input-showed alternative solutions

⁸⁴ See Appendix II Judgement Criteria

- Skip the keyboard and skip the pen

W1 actively used the palettes, the user palette for assumptions about the users and in which context the product would be suited. Use environment and designers own palette was used for details and essential information, and for reminding practical and technical data concerning the design task.

W2 got the scores 3.4 & 3.1, the session took 2 hours and resulted in 7 papers. W2 asked 6 questions concerning technical matters and about the example figures Kalle & Lisa⁸⁵. The system gave 4 input, which were:

- Make 2 different designs
- System input-showed alternative solutions
- Think of the movement aspect
- Use other users such as Lisa

W2 used the user palette and designer palette with functions that should be part of the solution.

Both W1 & W2 were tested by the provocation function from the system.

W3 got the scores 2.2 with 4 unscorable questions & 0.6 with 9 unscorable questions. The session took 1 h 45 minutes and resulted in 16 papers. The system was asked 4 questions about suggestions on relevant designs and prototypes, and previous sketches. The system gave 4 input, which were:

- Choose two differing contexts
- Create solutions from details
- Look at the user environment palette and utilize the context aspect
- Design suggestions and flexibility

User palette was found useful and reminded W3 of things that W3 had not thought of.

W4 got the scores 3.1 & 2.5, the session took 2 hours and W4 is one of the few participants who owns a PDA, and the output was 18 papers. W4 started working from the User palette and used Kalle as an example. The system was asked 4 questions about conceptual design and practical examples concerning the structure. The system gave 6 input, which were:

- Easy to move/moveable
- Finger size, dirt and waste
- Alternative to a pen
- Challenging and striking
- Make 2 different designs, both the physical and interaction aspect

W4 thought communication was the most central part, and got stuck in the information structure and thought a lot of in terms of internet-solutions. W4 commented a desire to browse for inspiration and to gather information about PDA's and other similar products. W4 wants a dialogue resembling that conducted with a real human being, which the system cannot provide but the positive comment given was that the system initiates thoughts. W4 utilized the designers palette for defining and reminding things/features.

⁸⁵ See Appendix II Design Survey DSTZ

Both W3 & W4 were tested by the elaboration/exploration function from the system.

W5 got the scores 2.8 with 3 unscorable questions & 3.4. The session took 2 hours and resulted in 13 papers. W5 have never have used a palmpilot and asked only 1 question about the design. The system gave 5 inputs:

- Create a challenging and striking design
- Create a physical design
- Make it esthetical and mind movement and dirt
- Define the functions and differ
- Showed the copies (inspiring pictures⁸⁶)

W5 divided the target group into a student group for responsibility & bills and a high-school group for social relations and used the user palette, designers own palette actively, but thought that the user environment palette was some how strange and did not really utilize it.

W6 got the scores 3.3 & 4.2, the session took around 1,5 hours and resulted in 17 papers. One question was asked about the concept phase. The system gave 5 input, which were:

- Alternative ways to interact without the pen
- Movement, dirt and waste
- Challenging and striking
- Use the user palette and see what Kalle can need
- Showed the copies (inspiring pictures)

W6 lacks support to motivate design decisions, for providing a short and precise motivation which in stored with the design solutions in the system. W6 gave the suggestion that one should be forced to motivate and write down design decisions in the system and then one can get a print of these.

Both W5 & W6 were subjected to the RandomChaos function by the system.

W7 got the scores 3 & 2.5 with 3 unscorable questions. The session took a little more than 1 hour and resulted in 8 papers. The only question asked was if the product can send attachments such as files and if it is possible to call.

W8 got the scores 3.4 & 3.6. The session 1,5 hour and resulted in 14 papers and W8 have never used a palmpilot. W8 renamed and redefined designers own palette to "combination palette" which was a combination of the user palette and the user environment palette. W8 made a comment about "my baby syndrome", which means that it is hard to get ride of the first design solution thought of, pointing out that discussion is important to catch ideas and get a feedback from others on ones ideas and suggestions.

Both W7 & W8 belonged to the reference group, meaning that the system gave them very little input or no input at all.

W9 got the scores 2.6 & 3.6, and was subjected to a mixture of functions (e2 – to nothing). The session took 2 hours and resulted in 7 papers. A question was asked about

⁸⁶ The system showed the participants 3 photocopies with buttons, product and short descriptions and a cartoon. The same copies were shown to all subject to the elaboratio/exploration function.

the concept and the only input the system gave was that of making two differing physical and interaction design solutions in the beginning of the session.

W9 wanted a scrab-book besides to write notes outside the system, and made a suggestion for a notebook for writing and using within the system.

W9 actively utilized the user, user environment and designers palette and made two other scenarios in the user palette, the characters were named Pelle age 20 and Olle age 25.

They were further used in the user environment palette with Kalle, Lisa, to see how they would act and function in various environments. The designers palette was given scenarios for user cases and differing situations stating desirable function for the concept, parts of the system, UI, and categorizing the two differing solutions.

The students

Students S1 got the scores 3 with 1 unscorable question & 4.4, the session took almost 2 hours and resulted in 7 papers. S1 asked questions related to technique and a response to the input from the system.

The system gave 8 inputs, which were:

- Add voice management
- Think of the user context
- New demands, new users – handicaps
- Physical proportions
- Fingers size
- Direct manipulation in the UI
- Inserts microphone in a sketch
- Insert a button

S1 protested and did not follow the systems requests and acted on own impulses.

S2 got the scores 2.4 with 5 unscorable questions & 2.3 with 5 unscorable questions because of lacking and uncomplete design solution. The session took less than 2 hours and resulted in 14 papers and 4 overheads. The questions asked were related to the inputs. The system gave 7 inputs, which were:

- Movement/carriable
- User context Lisa
- Skip priority
- New modes of interaction with the product
- Call and answer mail simultaneously?
- Skip the balls

Both S1 & S2 were subjected to the provocation function by the system.

S3 got the scores 2.1 with 2 unscorable questions & 2.3 with 2 unscorable questions. The session took 1,5 hours and resulted in 4 papers and 3 overheads. Five questions were asked about technical aspects, user examples and suggestions. The systems input were:

- Apply the User context
- Create 2 radically different design solutions
- Finger size – uses pen
- Make the display bigger
- Get ride of the pen (response no!)

The user palette was used to make a scenario for the product based from a user. S3 suggested that the scenario with actions in the form of templates would be great to provoke the designer own design and receive suggestions from the system.

S4 got 2.1 with 5 unscorable questions & 4.6. The session took 1,5 hours and resulted in 10 papers. The questions asked were about the depth of the structure and how specific are the scenarios/usage. The system gave 4 inputs:

- Create 2 different design solutions
- GUI should bear dirt, waste
- Utilize of the user context
- Consolidate the two differing designs and chose one

Both S3 & S4 were subjected to the elaboration/exploration function by the system.

S5 got the scores 2.5 with 3 unscorable questions & 2.7. The session took 2 hours and resulted in 4 papers. S5 asked questions about suggestions on buttons, placement, and examples of integrated functions, suggestions and inspiring thought about interesting design and how to use the user context.

The input given by the system were:

- Define the functions and make a design suggestion
- What is important with these functions and compare
- Make the design challenging and striking
- Change the proportion, can the keyboard be skipped?
- User palette reminds of moveability desired by the users
- Skip the physical design for the moment
- Showed the copies for inspiration (pictures)

S5 utilized the system very actively and demands suggestions and inspiration. S5 wants a reference library with inspirational material, and finds the system as a nice designer-partner and through this escapes loneliness.

S6 got the scores 2.9 with 1 unscorable & 3.6, the session took 1,5 hours and resulted in 9 papers. A paper mock-up was created illustrating the design solution. Four questions were asked to the system about technical stuff, software-programs and illustrations. The system gave 3 input, which were:

- Create 3 different design solutions
- Design the physical design
- Make it challenging and striking

Both S5 & S6 were subjected to the RandomChaos function by the system.

S7 got the scores 2.2 with 4 unscorable & 3.1. The session took 1 hour and resulted in 6 papers. The only question asked was if the product was a hand-computer with a telephone.

S8 got the scores 3.6 & 3.4 with 1 unscorable. The session took 1 hour and resulted in 7 papers. The question asked was about a technical aspect and the only input received was to draw/design a UI.

Both S7 & S8 belonged to the reference-group in the survey.

S9 got the scores 2.9 with 1 unscorable & 4.8. S9 was subjected to mixture of functions (provocation – to nothing). The session took 1,5 hours and 4 papers were produced as well as a paper mock-up. A question was asked about a technical aspect. The input given were to think about the finger size and make the design challenging.

The judgements received from the judges are shown in the following table:

	P	A	P	B	E2	E2	RC	A	RC	B	Reference	Reference	Mixture	Mixture
			A		B						A	B	A	B
Student1	3	4.4	2.2	2.3	2.5	2.7	2.2	3.1	2.9	4.8				
Student2	2.4	2.3	2.1	4.6	2.9	3.6	3.6	3.4						
Worker3	3.6	3.6	2.2	0.6	2.8	3.4	3	2.5	2.6	3.6				
Worker4	3.4	3.1	3.1	2.5	3.3	4.1	3.4	3.6						

Table 1. The scores form the judges

Two judges rated in a similar way and the third judge rated a bit differently resulting on higher remarks and thus providing a larger difference between the ratings received on specific design solution.

The diagrams below show the functions and the judgements the participants received.

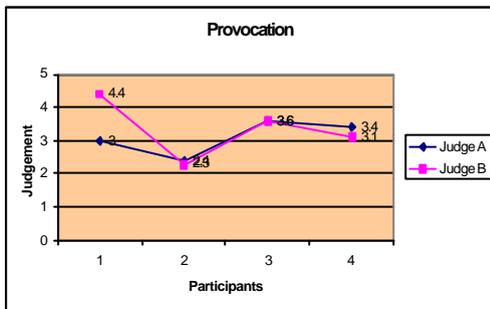


Diagram A. Provocation

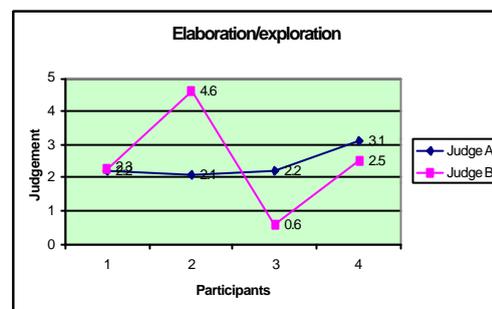


Diagram B. Elaboration/Exploration

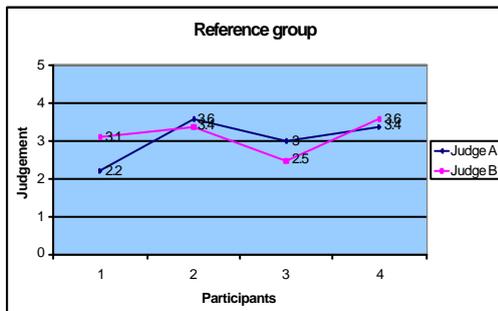


Diagram C. Reference group

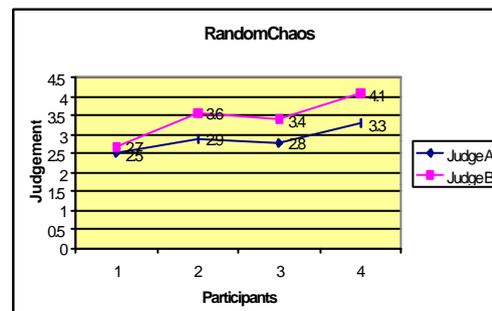


Diagram D. RandomChaos

The judgements show that at times the judges agree and have given the same remarks but at other occasions the judges have given the opposite remarks (for instance 0 & 5). The question that received the overall highest remarks⁸⁷ in the professionals group was regarding the technical and realizable aspect. Meanwhile in the students group the question that received the highest total remarks was regarding the attractiveness to the target group.

The lowest remarks in the professionals group was the question about the esthetical appeal for the target group and for the student group it was functionality aspects.

⁸⁷ See Appendix Survey Data DSTZ

The positive comments on DSTZ are that good support is provided if one is working alone, and the designer can achieve a solution quickly, and one is forced to think and get through "dead points". The participants suggest that support is needed to overview thoughts, solutions and decisions, as well as a support for the work process, and to be reminded of necessary knowledge and facts.

The negative comments on DSTZ are that it is perceived "too ruling", that the system needs to know when to disturb and when not to, so that one is not disturbed in a good work flow and be interrupted from achieving great ideas. A similar critic is that the system needs to know what is the right kind of input and provide it when needed.

4.4.2 Summary of results

The results from the empirical study in fact show that the research that I have conducted and the approach I have decided to focus on, the cognitive and pragmatic approach have been fruitful since I have been able to use and confide in the research and studies that I mentioned in the previous chapters. Initially I found the ideas of provoking and creating functions in the creativity research that I later on implied in my concept. In the design research I found interesting studies and questions which I wished to investigate thus also a confirmation of design tools that aim to support and provide the designer with useful critique, comments, suggestions and information.

The motivation behind the automated process/event in DSTZ was confound⁸⁸ in studies where the designer is assisted and helped by a "design tool" through an intruding mechanism that caused a disturbance in the designers work process although promoted the overall performance.

The participant in the empirical study found DSTZ concept very interesting and all the participants suggested at least one feature that they would like to integrate in the DSTZ concept, for instance: a reference library, inspirational material, a nice dialogue partner, patterns for creating scenarios [utilizing USER X], templates for action, provoking own design (this participant was ironically subjected to the Elaboration/exploration function), a GUI suggestion for example buttons and other elements, a decision support mechanism that forced the designer to write down and document design decisions, a documentation after each 'use session', a notebook and workspace outside DSTZ, a feature that provides demands from the other team members and groups of professionals.

The judgements show that the judges rated the design solutions very specifically to each criterion, meaning that some criterion got very high marks while the other got low, so the average "3" mark was not overwhelming in the judgements. This implies that the designers show factors in the design solutions that are creative and innovative, thus the judges have viewed the design solutions in their own expertise which cannot be generalized in between the judges, since all three judges have three different background and represent three various perspectives.

All the participants in the empirical study agreed to the fact that a design support tool is needed and desired, and half of them find that they could be creative by using DSTZ. DSTZ was perceived to be good for structuring thought and the thinking process, solutions and decisions, as well as more support and disturbance is required as well (by another participant who was subjected to E2 function). A participant would like to utilize a design support tool when colleagues do not have time or when the time is a critical

⁸⁸ See Fischer et. Al, and Ericsson.

factor. Another participant said that DSTZ could remind of what the designer already knows, meaning knowledge and methods, which otherwise is easily forgotten and unutilized.

The best comments received on DSTZ was when the participants have perceived and wished for a 'dialogue partner'.

4.5 Ideal tools DSTZ [Inconsistent font for numbers]

A suggestion for an ideal design support tool would be an application that could be creative in it self by evolving and using a AI-algorithm (genetical algorithms), providing that it has the ability to learn and creates its own rules and judgements.

My ideal DSTZ tool would show an immediate feedback to one's actions. Trying to make the experience enjoyable as well as challenging. Being focus on what is being done right now, and emphasizing on the state of acting. The user should only be aware of what is relevant in a specific stage of the design process yet being able to get an overview whenever needed by the application.

My criteria for success in the ideal DSTZ would be that designing is autotelic and an enjoyment for its own sake.

In DSTZ the designer can make own categories of users and personas⁸⁹ with (name, interests, job, what uses, technology) representing user in a majority. A distinction can be made from average user personas to unique/extreme user personas for each project, which directs the goals for function and design for a project – primary persona. These personas have a picture in the picture gallery in the user palette.

It should be easy to create and manipulate "Daily use scenarios". A feature in the application would be a vocabulary, where the designer can define words/terms/functions which are used in the project work, aiding the project with an editable "word" dictionary/library for each project.

DSTZ should enable the designer to develop a precise description of the presumed users and what he/she wishes to accomplish with the designed artifact/product/service.

An essential demand on DSTZ is that it should aim to provide and design for instance UI that match the users cognitive models.

Any incoherence between DSTZ and the plug-in tools or other applications that could be utilized should be minimal in order to provide a frictionless work setting.

The ideal DSTZ would provide an overview for the whole design project, set and enable the designer to manipulate and change the design criteria throughout the project work, stimulate various modes of interaction and focus on the users needs and purpose as well as distancing from these. A documentation of creativity and the design process is provided, in order to make it easier for the designer to study and help him/herself through previous "saved" design tasks.

An essential feature would be to remind and enforce the designer to motivate and document the design decisions, or motivation for a specific design solution.

The ideal DSTZ would support collaborative design and somehow providing ways to communicate, collaborate and work on differing aspects of a design solution from

⁸⁹ "A scenario is a concise description of a persona using a software-based product to achieve a goal." (s.179). Personas are hypothetical archetypes of actual users, which are defined by their goals. in Cooper (1999).

selective perspectives. In this view the communicative and documentation aspects are probably the more essential ones, including awareness of the other project members.

The DSTZ should ideally have a conceptual model of dealing with physical affordances⁹⁰, and an awareness of this, which can be utilized in comparing the design of real world artifacts with digital artifacts. A simple question asked would be "Does the user perceive that clicking on a object is a meaningful, useful action, with an known outcome?". The answer could be compared to a real artifact and thus providing a conceptual models and showing the differences of medias and perspectives.

The critical factor of timing, knowing when an action is appropriate or should be triggered for achieving optimal effect is something that needs a thorough investigation. A proposal could be that the system map out and creates automatically a profile of the designer where the design patterns and working phases and noted, thus adapting and easily predicting what phase would come next or what the more presumable action would be committed by the designer. An outcome of this feature could be that the designer is reminded of old solutions and eventually the designer starts to remake his/her own design patterns.

An amusing feature in DSTZ would be if the functions were given a character that played the function and interacted with the designer, for instance the Provocation function would be "a little amusing weasel that agitates, irritates and provokes" or any animated or human character that functions like a dialogue partner with the designer.

An additional feature in the USER X palette would be to provide a simulation of possible collaborators or team members, where software engineers, technical engineers, artists, marketing people etc, would point out their views and what questions and factors are critical for them. The team members in an actual design process could through this feature send their questions or update the palette with their concerns and perspectives, which would be available for all involved in the work process.

⁹⁰ Norman (1999).

5 Conclusions and Implications

This thesis has investigated creativity and if it is possible to enhance creativity in the design process, using a design support tool. My concept DSTZ was proposed and tested in an empirical study. The objective of the empirical study was simply to test the concept and test three functions (Provocation, RandomChaos and Elaboration/Exploration) in order to see a connection or achieve any confirmation if creativity can be enhanced in the framework of the concept DSTZ.

Who is the user of DSTZ? My aim have been mainly Interaction designers and other kind of designer. What are their needs? This was investigated in the Interaction Design Survey before the empirical study, which provided a direction of what issues and problems are interesting to further investigate through the concept.

What conclusions can be made from this thesis work? Can creativity be enhanced by the concept suggested in the thesis and through the application DSTZ? An optimist would answer “Yes!” and a pessimist would answer “Maybe some kind of support-but creative? No!”.

The important outcome of the empirical study is showing the fact that Interaction Designers do desire and need a Design Support Tool, since a framework for investigating and working with digital systems, products, artifacts and services is not defined and currently lacking. The empirical study did not provide any clear results show the complexity of the interaction design field as well as the nature of the design process.

What has been proven useful and important for this work has been the research in creativity where ideas about ordinary thinking processes are essential, as well as the inspiration and associations enlighten through lateral thinking methods and techniques. The overall reaction and results from both the Interaction design survey and the empirical study prove and support that a design support tool is needed and the concept that I have proposed have features that are useful as well as challenging for the designer.

What exactly formed the DSTZ concept? The initial ideas are my own curiosity and the fact that I wanted to investigate creativity and design support tools. The research conducted in creativity and design issues provided me with several rewarding questions and proposals of what to examine and in which direction the framework of the thesis should proceed. After the Interaction Design Occupation survey (IDO) I found confirmation on the ideas I had of what could kind of support is needed. The survey itself is an example of the fact that issues I estimated were important and critical proved to be essential later on. I continued to develop the DSTZ concept and eventually I had an substance that I wanted to perform and test. Due to lack of time I was unable to actually realize a prototype for the DSTZ concept that the empirical study could have been performed on. Therefore the empirical study was performed on paper, face-to-face and was more of a simulation of the system and DSTZ-concept. Never the less in this study I proposed the DSTZ⁹¹ concept with three functions and four palettes, where the emphasis was on the function that dealt with the matter of enhancing and promoting creativity. The palettes were performed after my own conception of what I thought was needed in the design process for an Interaction Designer, as well as some grounding through the IDO survey. The empirical study showed that the functions were perceived

⁹¹ See Appendix II, DSTZ.

positively and the palettes were utilized by the half of the students (4) and all of the professionals (9), and by this acknowledging their importance and usefulness.

The evidences provided in the studies and this thesis prove the fact that a DSTZ is desired and Interaction designers do need and yearn for a design support tool. How and what exactly the design support tool should act, react, and contain are questions that need further investigations. Through my work I have shown an example of a design support tool, DSTZ that has features which are helpful and supportive.

The participants in the studies have agreed to the fact that they require a design support tool in their work and that DSTZ has helped them in creative solutions, thus giving a direction pointing towards that the functions I have investigated through DSTZ actually enhance creativity. The judges judgements point to the fact that the design solutions contain excellent elements of creativity and good interaction design. Although the critical factors must be taken into consideration I am assured that an actual application of DSTZ would further underline that DSTZ and the three function proposed can promote and enhance creativity, but also provide a reasonable and good support for an Interaction Designer in the design process.

5.1 Critique

A lot of critique can be directed towards this thesis, the concept and DSTZ. There are always alternative ways to study and investigate creativity, as well as methods of testing design support tools. Some alternative ideas I had were the following:

1. The participants should have tested all three functions and then evaluate which one is better than the other, or more suitable, and thus found more about which function works.
2. A ready prototype with the whole concept, where how it is used, which palettes are utilized and which are functions are liked would be investigated.
3. The participant could have worked on a half-ready design solution and use DSTZ to make a better re-design, thus investigating difference between re-design and new-design.

If the empirical study was conducted on an actual prototype instead of a paper-simulated test, the results would have different and probably more precise. It has been difficult to make any statistically valid conclusions from the current study, because the individual differences were too invoking, and it has been hard to isolate single factors, referring to either creativity or the design process in its essence. I now have better ideas of how to conduct and perform a study regarding the questions dealt by in this thesis.

5.2 How to design Creativity and support Interaction Designer

As the title says "how to design creativity and support Interaction Designers", I have shown in this thesis the perspectives of creativity as well as discussed how creativity can be utilized or rather should be exploited through an application. How can creativity be designed? A simple answer is that it cannot be *designed* but creativity can be stimulated and directed into a path that makes it possible to be enhanced even in a digital computer setting through an application. I firmly believe that this is possible although my empirical study has not provided me with any clearly supporting results. Creativity cannot be designed in the sense that one aims to make creative artifacts, products and services. Creativity can be utilized in the knowledge relevant for how a design process works, supporting the cognitive factors essential for an optimal work and creative flow.

How to support Interaction Designers? My works suggests through the Interaction Design survey, the empirical study and my own ideas manifested in the concept several fruitful assets. These ideas and suggestions provided a way of representation through the concept and a prototype that I have made in order to illustrate the main concept. A summarization of these will be given here:

1. The representation problem – means that the designer deals with real artifacts in the represented world. Yet a Interaction Designer deals mostly with digital artifacts, products lacking a representation, the designer has to in this case create and decide a relevant representation, in order to grasp, understand and make knowledge of the undesigned, uncompleted thing. The representations concern also information structure, visualization aspects and transferring abstract knowledge and skills to physical or digital things. In my concept the designer is obliged to make his/her own representations, and emphasis on the differences between the medias utilized in the design process.
2. The technical problem – means the concept is finite within the computer technology and confined into an application, automatically transferring the possibilities but mainly the negative stress provided when handling an application, short laps of involuntary timewaste, concentration problems and ergonomical perspectives. Ideally the concept would have a free platform to work upon, which is strong enough to give the designer immense opportunities to create by utilizing various applications but also creating in a new way/sense fitting the digital perspective.
3. The human dialogue problem – this problem refers to the fact that we prefer to discuss and argue about our ideas, we need and demand response for others and in this process develop and learn new information and knowledge. This dialogue is very hard to provide within the framework of my concept. A possibility would be to implement an agent which is highly intelligent (by genetic algorithms) both in terms of computation but also concerning human qualities. A challenge here would be to make this agent "creative" in order to compare the differences between humans and artificial intelligence agents in the purpose of supporting and evolving in the design process.
4. The hands-on-lacking problem – this is a desire from designer or persons creating that one feels an urge to create and work with the hands on material. This can be viewed as compensation to the features an application can never support or supply. An idea could be that a designer models and works with his/her hands and this model can be "scanned" and transferred in a digital for to the application, with which the designer can continue to work, manipulate and design. In the reverse sense the re-modeled model should be reprinted or re-created in a physical form by the application, for instance with a simple, cost-effective 3D-modelling and rapid prototypes program⁹².

⁹² An example is Stratasys 1600 which creates 3D-modells.

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Interaction Design Survey

This survey was sent to a group of participants via email and returned to me after a couple of weeks.

Occupation

1. What is your work title?
2. What education do you have?
3. What kind of work tasks do you do?
4. Describe a project you are working on and what your role is in this project?
5. How do you want to change your work assignments/tasks?
6. What would you like to work with that you are not working with today?
7. What is characteristic of a "interaction designer" for you?
8. What is characteristic of a "interaction designer" for your company?
9. Is there a need in the future for "interaction designers" in companies/other employers?

Creativity

1. DO you think of yourself as creative? Why/or why not?
2. How do you define creativity, concerning yourself?
3. Do you have any ideas of how to enhance the creative process?
4. What do you expect of a "creative interaction designer"?
5. How is creativity shown in work context, either individually or in-group?

Work and tools

How do you work? In group or individually? In the company or at other companies? (Describe with examples)

1. Which tools do you use? (Program applications, techniques and methods)
2. How do you show your ideas, concepts and solutions?
3. What is characteristic of your working process?
4. Do you feel a need for a tool or application to help and assist you in your working process?
5. What should this tools be able to do or conduct, meaning what functions should it have?
6. Give an example where someone or you get stuck in a design problem. Describe how it was solved.
7. Can you imagine a tool to enhance creativity in the design process?
8. If you were to design a "fantastical, ideal" tool or application for "interaction designers", how would it be or what is possible to do with it?"
 - Should it support design such as in graphics?
 - Should it support documentation and reports?
 - Should it support group communication, ease understanding between team members?
 - Should it support simple multimedia presentations?
 - Should it support brainstorming methods and ideas?
 - Should it support sketching?
 - Should it be open for using by certain people or only be used by a single user at a time?
 - Should it support designing of information-structures?
 - Should it support Internet services, creating websites and application?
 - Should it support design of applications through usage of standard icons, buttons, and common functions?
 - Should it provoke and criticise your suggestions?
 - Should it provide alternatives and solutions to you from specified data and information provided by yourself?

Do you have any further ideas or suggestions?

Thanks for your co-operation.

Job examples

Cooper Interaction Design

Members of our design staff are unanimous in their distaste for software-enabled products that insult, intimidate, annoy, or lose users—regardless of the functional power or financial success of the product. Our design staff shares a passionate drive to improve this situation. We believe there is no reason that software-enabled products cannot be easy and fun to use while at the same time fulfilling the goals of people who use them. Putting your passion together with our proven design methods can create an irresistible force. We are looking for a world-class designer with a fire in the belly. Putting together a cool interface is one thing—and our designers know how to do that—but coming up with the right conceptual design in the first place is another thing all together. That's what we specialize in.

To be a designer with us, you must understand the product creation process, particularly how it pertains to software development. Just as important, you must be able to understand complex systems and why people interact with them. The CID design environment is highly creative and collaborative, so you must also possess rich communication skills. Beyond verbal dexterity, you have to love the whiteboard, use computer graphics tools to get your point across, and be able to write with skill and grace.

What does it take to be an Interaction Designer?

Empathy and improvisation

As an Interaction Designer, there is no end to the ideas you can come up with. You can fully imagine the experience of users of the product you design, and to put yourself in their shoes. You have an aggressive and questing intellect and you can defend your position with poise. You love collaborating with others to get at the right answer; you know the right answer when you see it—whether you came up with it or your teammate did—and you are able to improve upon it. You enjoy articulating complex design ideas to ensure effective meetings with staff and clients. You can work hard and work smart. You are self-motivated and enjoy being the master of your own process. Your personality inspires others to excel.

Superb communication skills

Much of the success of our designs depends on our ability to communicate the work to our clients. Consequently, you must have visual design skills sufficient to fluently express your ideas with sketches and the ability to work closely with computer graphics tools as the need arises. But since CID has talented Visual Designers on staff, advanced graphic arts skills are not a requirement for Interaction Designs. You must also have the language skills—verbal and written—necessary to convey your designs and why they are right. On the one hand, you must be able to draw out essential information from users and engineers; on the other hand, you must be able to present your design before a room of curious developers and anxious marketing people. Design Communicators on our staff are the people primarily responsible for capturing the essence of our creations; you must work closely with them, assuring that they have all the information they need to communicate the team's designs. You must be able to create drafts of your ideas, and to be able to edit the written work of Design Communicators.

A desire to design all the time

Designers design. We have no openings for human factors specialists, ergonomics engineers, programmers, graphic artists, or model fabricators.

We're looking exclusively for permanent staff to work full-time at our Palo Alto office. We are building our company to last, so we are looking for people who will last.

<http://www.cooperinteraction.com/jobs.html>

User interface designer -adobe

Responsibilities

Will be responsible for providing interface designs, prototypes, icons, drawings, artwork, specifications and mock-ups on a by project basis for various projects in development. Will work with Product Marketing Managers, Engineers, Quality Assurance and Technical Support personnel on projects to provide teams with designs that fulfill the needs of the customer and works consistently across other Adobe applications.

Qualifications

Requires a BSCS or equivalent and 2-3+ years interface design experience developing professional software or concentration/study in human and computer interaction. Must be knowledgeable about

Adobe's line of graphics products (Photoshop, Illustrator, PageMaker, Premiere and others). Knowledge regarding both Macintosh and Windows interface issues is preferred.

<http://www.adobe.com/aboutadobe/careeropp/jobs/99-0004965.html>

Yahoo

Interaction Designer (Location - Santa Clara, CA)

Yahoo! Inc. is looking for an interaction designer to join the Gooley Design team. You will be responsible for the interaction design for various Yahoo web services and software which include identifying requirements, developing the user interaction model, proposing designs, creating prototypes, and writing specifications. You will provide direction to, and work closely with producers, engineers, visual designers, and usability engineers to develop and improve website and software usability and functionality. Education and experience: BS or BA in Human Factors, HCI, industrial design, or related area (or equivalent experience). The ideal candidate must communicate clearly and effectively, have strong analytical and oral communication skills; excellent interpersonal and leadership skills; able to collaborate actively with others in a cross-functional team. Organizational skills and the ability to act independently and able to switch rapidly between different projects in a fast-paced and exciting environment is a must. In this position you will develop new approaches to complex design problems and meet aggressive deadlines. Has an eye for detail and can put ideas into a tangible form. Additional qualifications: Master's degree or 2 years

<http://join.yahoo.com/open2.html#web>

Interface and Visual Designer

Job Description:

Work with multi-disciplinary team of computer scientists, human-factors psychologists, engineers and graphic designers to develop public access systems. Responsibilities will include processing raw scanned images for system, and analyzing process and results to set requirements for software tool development. Further responsibilities include: contribute to visual design and usability of interface. Develop concepts for system in dHTML.

Skills:

The best, qualified candidate will possess the following qualifications:

Strong graphic design and interface design skills with portfolio/samples to demonstrate experience.
Ability to articulate concepts Strong organizational and analytic skills Demonstrated ability to excel while working on team Experience with dHTML, scripting, Photoshop, similar programs

Educational level:

Ph.D (preferred) or Master's degree in interactive design or equivalent field.

Experience in interface design or instructional design within a product development organization or large website. Experience with shipping products and with web page and web site design. HTML, Java, Perl, UNIX as well as Interaction design for web sites and/or web applications is a plus.

Interested? E-mail your resume to jobs-gui@yahoo-inc.com and note job code WEBGUI.

<http://join.yahoo.com/open2.html#web>

Maya design group

Graphic/Interaction Designer

Seeking a versatile, entry/mid-level designer to collaborate with software engineers and human scientists. The ideal candidate will be primarily interested in user-centered, human-computer interaction design -- equally comfortable designing GUIs for PCs, web, and a powerful new environment for exploring, analyzing, and visualizing information.

Desired qualifications include:

Graphic Design or related degree; Sophisticated aesthetic standards and outstanding creative talent
Expert knowledge of visual design software (Photoshop, Illustrator, Quark)
Programming or prototyping skills (Director, HTML, Visual Basic)

Interface Designer/Developer

Seeking a versatile, entry/mid-level designer with a passion for keeping up with the latest and greatest

technology innovations -- especially for web-related projects. The ideal candidate will be primarily interested in user-centered, human-computer interaction design. Desired qualifications include: Design or related degree; Sophisticated aesthetic standards; Working knowledge of database administration, Expert operation of visual design/image manipulation software tools and strong programming/prototyping skills ranging from HTML and JavaScript to Perl and C++.

Information Designer

MAYA Viz, an exciting new spin-off of MAYA Design Group, develops customized information-visualization applications for organizations that must manage and analyze huge amounts of diverse information. We're seeking a versatile designer with graphic expertise, HCI experience and a passion for information design to collaborate with human scientists and software engineers. The ideal candidate would resonate with the words of Edward Tufte: "To envision information... is to work at the intersection of image, word, number, art. The instruments are those of writing and typography, of managing large data sets and statistical analysis, of line and layout and color. And the standards of quality are those derived from visual principles that tell us how to put the right mark in the right place." Desired qualifications include: A degree in design or related; Sophisticated aesthetic standards and outstanding creative talent; Expert knowledge of visual design software tools; Advanced programming/prototyping skills.

<http://www.maya.com/jobOpen.html>

Symbian

Interaction Designer Manger

Salary Range 35-50K

Location: Central London

Broad Content of the role

To lead a design team to create the next generation smart phone interfaces.

Key Tasks

Requirements analysis, design and prototyping of early concepts, specification of the user interface and usability testing.

Qualifications and Education

Educated to degree level, in HCI or design course a strong plus. Technical background also very helpful.

Essential Experience:

Professional experience designing and shipping user interfaces. A history of working with programmers both in communicating design ideas, assessing their technical impact and seeing the design through the implementation and beyond.

Desired Experience:

Working on small screen devices or consumer devices.

Essential Skills:

An analytical, logical mind, with the ability to think from other people's point of view.

An ability to stand back from the detail and see the big picture. A teamwork attitude is essential; all of our software specifications involve the work of many people.

Desired Skills:

Prototyping skills, negotiating skills

http://www2.symbian.com/soft_vac.nsf/WebPub?OpenView&Start=1&Count=1000&Expand=1.1#1.1

<http://www.symbian.com>

T. J. Watson Research Center - Yorktown Heights NY
Interface and Visual Designer JOB ID# is 100317

About the position: Interface and Visual Designer

Job Description: Work with multi-disciplinary team of computer scientists, human-factors psychologists, engineers and graphic designers to develop public access systems.

Responsibilities will include processing raw scanned images for system, and analyzing process and results to set requirements for software tool development. Further responsibilities include: contribute to visual design and usability of interface. Develop concepts for system in dHTML.

Skills: The best, qualified candidate will possess the following qualifications:

Strong graphic design and interface design skills with portfolio/samples to demonstrate experience.

Ability to articulate concepts

Strong organizational and analytic skills

Demonstrated ability to excel while working on team

Experience with dHTML, scripting, Photoshop, similar programs

Educational level: Ph.D (preferred) or Master's degree in interactive design or equivalent field.

To apply for this position and any others, return to the IBM Research listings and application page and CHECK OFF this job by clicking in the box to the left of the description. If you are applying by E-Mail or Regular Mail you need to know that the ID# for this job is 100317

IBM is committed to creating a diversified environment, and proud to be an equal opportunity employer.

<http://domino.watson.ibm.com/hr/research/>

Razorfish

Designer, San Francisco

Designers are responsible for providing creative assistance and support to the design team as required throughout the various stages of the design process.

Responsibilities: Designers work under the guidance of the Design Director and are responsible for creation of concepts, refinements of design direction, and final refinement toward production, some graphics production, and creation of presentation materials.

Qualifications: A designer is a college graduate with a design degree (B.A. Design; formal training in typography, identity design, interactive design, and information design) who has more than a year and a half project experience. Web design experience along with a good understanding of HTML, the capabilities of Web browsers across multiple platforms, and the constraints involved in designing for online media are required.

Compensation commensurate with experience, includes stock options. Please fax resumes to (415) 865.1475 or email to: hr-sf@razorfish.com

Information Designer, San Francisco

Razorfish has an immediate opening for an information designer in our San Francisco office. As a member of our information design department you would work with our strategy, design, and technology teams to:

Responsibilities: Develop the information architecture for Web-based applications Prototype site schematics for presentation to clients Perform usability testing of proposed designs.

Qualifications:

Degree in a related field, such as technical communications, human-computer interaction, or graphic design Excellent oral and written communications skills Excellent presentation and client relations skills Experience designing website and application interfaces Experience designing and conducting usability tests

Compensation commensurate with experience, includes stock options. Please forward resume, cover letter, and sample URLs to hr-sf@razorfish.com or fax to (415) 865.1475.

www.razorfish.com

Design Survey DSTZ

The instructions given to the participants were to read the documents, and use the following to perform the task: Sketchpad (white paper) and 8 colour pens/markers (tombo abt) and 6 colour pencils (rexel cumberland derwent studio). Post-it notes to write and ask questions to the System "DSTZ"

They received a paper, which described the design, survey and the task to be carried out, here follows a translation of these papers.

Design task: Design a new version of an emailsystem (ES) that functions regardless of platform and operative system. At this moment the ES will be tested on

1. Computers
2. Palmpilots with a mobile telephone functionality

Description of the project

For this task the design is concentrated on 2, where the technical aspects are not at any hindrance but the product should be able to be realised and follow the framework of the project. The project has been conducted for 2 months and the product will be shipped within 4 months. The designer in the team is ill and therefore YOU have to continue with this work. The design team consists of hardware-group, software-group, designers and other skilled profession is brought in at demand.

The main system function are

- Be able to send short messages, very quickly, maximum 150 signs (SMS).
- Be able to send regular emails with no text limitation but these message have to queue and will approach the receiver within some hours.
- Be able to send voice messages, maximum length 3 minutes.
- BE able to transmit files and text documents
- Have Internet connection, chatchannels, URLs and subscribes services.

The basic functions are

To read and send messages

To open and transmit files

To record and edit sound messages

The targetgroup

The targetgroup are youths and students in the age of 15-25 years.

They say ES mainly in order to communicate with friends, family, education- and job-related occupations, such as summer job or extra-jobs.

Objective

The design task is to design an interface and functions for the ES. Work from the target group and the scenario described with the help of DSTZ. The focus and assessment of the design is on the quality, creativity and realizability.

Today's experiment means the following:

You have a maximum time of 2 hours to produce a suggestion for the interface, the concept and functions, as far as you can or have the energy to do.

DSTZ

DSTZ is a "universal plug-in" which can be used without any constraints for example with Director, PhotoShop, Illustrator, Rhinoceros, Dreamweaver, Office, etc. The tools is used to support the design process and enhance creativity. The system will actively interfere in the design process by apply a certain strategy. These interferences will be suggestions and active interferences in the design solutions.

You have the following at hand in the design task:

- Paper and pen
- 4 palettes which are
- User palette with scenarios
- Use environment palette with scenarios

- Usability palette with methods and simulated tests to check the design solutions
- Designers own palette, with the designer own examples of other things

Please observe that you should not talk directly with the system (Zayera), but speak aloud and comment what you are doing and designing. Describe as detailed as possible on papers your ideas, concept, design and formation.

User palette with scenarios

This palette contains information and an example scenarios with Kalle, who do certain duties and task with his friends, his family, at school and his extra-job.

Use environment palette with scenarios

This palette tells the designer to identify in which environment the product is going to be used, to make a priority list of the most wanted/desired environments and modes of usage. Kalle is given as an example showing usage of ES at home, study, job, public place, at bus/train/boat/aeroplane.

Usability methods & simulation

Usability palette with methods and simulated tests to check the design solutions

This palette contains several methods for conducting usability tests for supporting the design.

A list of fitting methods is available as soon as the designer defines the concept through key concepts, users and environment.

This palette contains information about how to carry out an investigation but also if the design is detailed the system can simulate some simple tests. The tests are to show which method is probable to use and achieve success for a specific design solution.

Example methods

Cognitive Walkthrough.

Constructive Interaction.

Contextual Inquiry.

Diary Keeping.

Focus Groups.

Future Workshop.

Heuristic Evaluation.

Observation and Invention.

Parallel Design.

Performance Measurement.

Pluralistic Usability Walkthrough.

Retrospective Testing.

Task Analysis.

Thinking Aloud.

Heuristic Evaluation

A heuristic evaluation consists of a structured analysis of the usability of an interface with respect to a number of usability heuristics. The evaluators inspect the interface, comparing it to the heuristics one by one, taking notes whenever a rule is violated. One heuristic could be for example "The interface should be consistent and follow applicable standards and conventions". There exists a large number of usability heuristics, see Further reading.

This evaluation is preferably done with three or more evaluators since it is very difficult for one evaluator to find all usability problems in an interface, see (Nielsen 1994) for a more detailed discussion about the number of evaluators.

Classification

- Evaluation
- Without the user
- Diagnostic and Certifying

Results

A heuristic evaluation produces a list of potential usability problems. These problems are based on the particular heuristics that have been used and every item on the list is referenced by one or more of these heuristics. In addition, every item also has a severity estimate.

How to Perform a Heuristic Evaluation

1. First a group of evaluators has to be established. The members of this group could be with or without experience from HCI-work or heuristic evaluation. The more experience each evaluator has, the fewer is needed.
2. Let every evaluator inspect the part of the interface that is to be evaluated, comparing it with one heuristic at a time. Every violation of the heuristics is noted together with some severity estimation. Every note has to be followed by a reference to one or more of the heuristics, it's not sufficient just to say that a particular detail in the interface is not good enough.
3. All the lists from the evaluators are summarised in one list. All items on this list have a severity estimate.

Benefits and Limitations

It is not possible to identify and correctly evaluate all usability problems in a heuristic evaluation. Primarily because the evaluators and the end-users often have different domain knowledge. This may lead to certain usability problems getting the wrong priority. A problem that is imperative to the users just seems like a minor problem to the evaluators or vice versa.

Further reading

Nielsen, J. "Heuristic Evaluation", at <http://www.useit.com/papers/heuristic/>
Nielsen, J. (1993) "Usability Engineering" pp. 115-163, Academic Press Inc., ISBN 0-12-518405-0

Designers own palette

Designers own palette, with the designer own examples of other things, ideas and concepts. In this palette the designer can create anything needed to be used in the design process for a certain situation.

After the design survey the participants were handed the following questions to be answered in a questionnaire:

1. What is your educational background?
2. What are your work tasks?
3. How long have you been working?
4. What would you like to work with that you are not doing today?
5. Has the design task been fun?
6. Has the design task been meaningful?
7. Has the time been enough for the task?
8. Have you understood the task?
9. Can you see any concrete use of this task in your own work?
10. Can you imagine using "DSTZ" in your work?
11. Which are the positive and negative aspects of this?
12. DO you think that DSTZ can help you create creative solutions?
13. How do you judge your own efforts?
14. How do you judge the "systems" efforts?
15. Do you think you were creative when solving the task?
16. Are you creative in general? Why/why not?
17. What does an "interaction designer" characterise for you?
18. Is there a need for "interaction designer" in companies?
19. What tools do you use? (software, techniques and methods)
20. How do you inform your ideas, concept and solutions?
21. What is characteristic of your work process?
22. Do you feel any need of a tool that supports you in your work process?

System Script

These system scripts were written only to provide guidelines for the system, since most of the experiment was based on improvisation, "in-action" during the test but also following the main features of the system scripts.

Three rules implies for the systems decision-basing rules:

1. Situation triggered scripts (if A happened then B)
2. Randomly triggered scripts (disturbing the user by using time * action providing a specific reaction from the system)
3. Activity triggers, logging activities per minute, if
>10 nothing happens
< 10 specific actions start to happen

These standart actions/respons are triggered at 2 & 3:

- Redefine and create icons/symbols
- Make the display smaller/larger
- Make the product moveable, useable in movement
- Make the design more aesthetical
- Enlarge or minimise the size 50%
- Make the design challenging and hot
- Let the user decide or make it flexible for the user
- Increase/decrease readability
- Increase/decrease audibility
- Make the product foldable
- Get ride of pen/key board/buttons/touch-screen
- What happens if the product gets water/sun/moisture/greasiness
- Make the product durable to fat/filth and waste
- Think of the size of the fingers
- Increase the length/breadth/weight with 20-50%

Scripts for Provocation, RandomChaos, Elaboration/exploration

Provocation

Situation specific

- Change an interface element by removing, adding an interface element
- Changing proportions
- Generating provoking design solutions

At no activity

- Provide cues, suggestions and question both positive & negative

Random

- Give suggestions to use User palette
- Change the users/context/situation

RandomChaos

Situation specific

Define various features in a list

- Use some of these and get ride of the others
- Compare with each other

- Generate solutions through chaos/at random

At no activity

- Show pictures for making associations
- Make associations with random words
- Word games

Random

- Question the purpose of the design
- Change the starting point for the functions/aesthetics/user environment

Elaboration/exploration

Situation specific

Make 2 various designs

- Freeze the design solution
- Explore & elaborate 1/2
- Compare 1 & 2
- Describe and motivate the differences

At no activity

- Explore the problem area and find new/more problems
- Create solutions out of details in products and ideas

Random

- What if everything went wrong?
- Reprioritise and make new solutions

Judgement Criteria

Criteria's for judging the design task

The jury consisted of three tutors who evaluated the design task by looking at all the papers and getting some information from me about the design performances and relevant information to explain the designs. A paper was handed to the judges to read and have an idea of what to judge and understand the question to be judged and remarked.

How creative is the design task?

Creativity means in this specific design task an ability to create a solution that differs from traditional solutions or design of the artefact. In this aspect I further establish that the product should be fun and attractive for the target group (15-25 years). From one aspect creativity is seen as creating in consideration of attractiveness and fun. "Good creativity" means in this case that the product is judged not only in the aspect of being creative but also attractive and fun to use.

The second aspect is an ability to find a new way to perceive a problem, concluding in a differing perspective that helps the designer to create a solution, which reflects this perspective.

How novel is the design solution?

How new is the design task? Can one associate it to other product or the same category of products, for example palmpilots in general?

How useful is the design solution?

The usability aspect treats questions of how useful a product is, how easy to handle and use, and adjusted it is to its target group. It also deals with cognitive and ergonomical aspects that affect the physical design, software and modes of interacting.

How relevant is the design solution?

Does the design solution fulfil the demands of the task? Does it take any consideration towards the basic function and system requirements? Does it take any consideration of the target group?

How realisable is the design solution?

How realisable is the design solution concerning aspects such as economical, technical and manufacturing?

How easy to understand and have an insight in the design solution? How easy is it to sell the design solution?

The design solution (DSL) should be judged through the following scale: 1 = bad, 5 = good

1. DSL is attractive for the target group
2. DSL is predictable for the target group
3. DSL is technically and in views of production realisable
4. DSL is easy to understand and get an insight into (for the judges)
5. DSL reflects a new way to communicate through PDA's
6. DSL gives associations to similar product on the market
7. DSL fulfils the design tasks demands
8. DSL shows a creative way to interact with the product
9. DSL has an physical interesting design
10. DSL is easy to use and adapted to the target group
11. DSL is fun/amusing to use for the target group
12. DSL is aesthetically appealing for the target group
13. DSL is functional to use
14. DSL is a novelty concerning the PDA's physical form and interaction

Survey Data

This Appendix contains survey data that the judges gave the design solutions concerning the DSTZ. Here follows an example showing the worst and best scores (given by me). The appendix further shows first the nine professionals scoring, followed by the nine students scoring. "0" is given by the judges where the design solution has provided little or lacking substance in order to judge and comment that criteria/question.

	Worst	Best
1. DSL is attractive for the target group	1	5
2. DSL is predictable for the target group	1	5
3. DSL is technically and in views of production realisable	1	5
4. DSL is easy to understand and get an insight into (for the judges)	1	5
5. DSL reflects a new way to communicate through PDA's	1	5
6. DSL gives associations to similar product on the market	1	5
7. DSL fulfils the design tasks demands	1	5
8. DSL shows a creative way to interact with the product	1	5
9. DSL has an physical interesting design	1	5
10. DSL is easy to use and adapted to the target group	1	5
11. DSL is fun/amusing to use for the target group	1	5
12. DSL is aesthetically appealing for the target group	1	5
13. DSL is functional to use	1	5
14. DSL is a novelty concerning the PDA's physical form and interaction	1	5
Total	14	70

In the table "Q" stands for the questions/statements above. "W" stands for the professionals' and "S" stands for the students. The functions that the participants were subjected to are writtens as P, RC, E2, Ref and Mixture.

W1 & P	A	B	C
Q1	4	5	
Q2	5	4	
Q3	3	2	
Q4	4	4	
Q5	1	5	
Q6	2	3	
Q7	4	3	
Q8	4	2	
Q9	5	4	
Q10	5	4	
Q11	4	4	
Q12	4	4	
Q13	2	3	
Q14	4	4	
Total	51	51	
Average	3.64	3.64	

W2 & P	A	B	C
Q1		4	3
Q2		2	3
Q3		4	5
Q4		4	1
Q5		4	3
Q6		4	4
Q7		4	3
Q8		4	1
Q9		3	4
Q10		4	4
Q11		2	3
Q12		2	3
Q13		4	2
Q14		3	4
Total		48	43
Average		3.43	3.07

	E2	
W3	A	B
Q1	4	0
Q2	0	0
Q3	5	4
Q4	1	0
Q5	4	0
Q6	5	1
Q7	5	0
Q8	0	1
Q9	1	0
Q10	0	2
Q11	4	0
Q12	0	1
Q13	1	0
Q14	1	0
Total	31	9
Average	2.21	0.64

	E2	
W4	A	C
Q1	4	3
Q2	2	1
Q3	2	1
Q4	2	1
Q5	4	3
Q6	1	4
Q7	1	2
Q8	5	4
Q9	4	2
Q10	4	4
Q11	4	2
Q12	4	2
Q13	1	4
Q14	5	2
Total	43	35
Average	3.07	2.50

	RC	
W5	A	C
Q1	4	2
Q2	0	4
Q3	2	5
Q4	3	2
Q5	4	2
Q6	1	4
Q7	3	4
Q8	0	1
Q9	5	3
Q10	0	4
Q11	4	5
Q12	5	3

	RC	
W6	B	C
Q1	3	5
Q2	4	5
Q3	3	5
Q4	3	5
Q5	4	4
Q6	3	4
Q7	4	4
Q8	4	4
Q9	3	4
Q10	4	4
Q11	3	4
Q12	2	3

Q13	4	4	Q13	3	4
Q14	4	4	Q14	3	3
Total	39	47	Total	46	58
Average	2.79	3.36	Average	3.29	4.14

W7

REF	A	B
Q1	2	3
Q2	3	4
Q3	4	5
Q4	5	3
Q5	1	2
Q6	5	4
Q7	4	3
Q8	3	1
Q9	1	0
Q10	4	4
Q11	3	2
Q12	1	0
Q13	4	4
Q14	2	0
Total	42	35
Average	3.0	2.5

W8

REF	A	C
Q1	4	5
Q2	3	5
Q3	5	5
Q4	3	4
Q5	5	2
Q6	4	4
Q7	5	5
Q8	3	3
Q9	1	2
Q10	3	5
Q11	2	2
Q12	1	2
Q13	5	4
Q14	3	2
Total	47	50
Average	3.36	3.57

W9

MIXTURE	B	C
Q1	2	4
Q2	4	5
Q3	5	5
Q4	2	5
Q5	1	2
Q6	5	4
Q7	3	4
Q8	2	2
Q9	2	2
Q10	3	4
Q11	2	4
Q12	2	3
Q13	2	4
Q14	2	3
Total	37	51
Average	2.64	3.64

JUDGES

S1 & P	A	B	C	S2 & P	A	B	C
Q1		3	5	Q1	5	4	
Q2		2	5	Q2	0	0	
Q3		4	5	Q3	1	2	
Q4		2	4	Q4	1	1	
Q5		4	4	Q5	1	0	
Q6		1	5	Q6	1	1	
Q7		0	4	Q7	0	0	
Q8		5	5	Q8	5	5	
Q9		4	5	Q9	5	5	
Q10		3	3	Q10	0	0	
Q11		3	4	Q11	5	4	
Q12		3	4	Q12	5	5	
Q13		3	4	Q13	0	0	
Q14		5	4	Q14	5	5	
Total		42	61	Total	34	32	
Average		3.0	4.36	Average	2.43	2.29	

E2			E2		
S3	A	B	S4	A	C
Q1	2	4	Q1	4	5
Q2	0	4	Q2	0	5
Q3	4	2	Q3	3	5
Q4	2	4	Q4	1	3
Q5	1	2	Q5	0	5
Q6	5	4	Q6	1	4
Q7	5	0	Q7	0	3
Q8	1	2	Q8	2	5
Q9	1	2	Q9	5	5
Q10	0	3	Q10	0	5
Q11	3	2	Q11	5	5
Q12	1	2	Q12	4	5
Q13	4	0	Q13	0	5
Q14	1	1	Q14	4	5
Total	30	32	Total	29	65
Average	2.14	2.29	Average	2.07	4.64

RC			RC		
S5	A	C	S6	B	C
Q1	4	3	Q1	3	5
Q2	0	3	Q2	4	5
Q3	3	3	Q3	4	5
Q4	1	2	Q4	3	5
Q5	3	1	Q5	3	2
Q6	5	4	Q6	4	4
Q7	5	3	Q7	4	5
Q8	2	2	Q8	2	2
Q9	4	2	Q9	2	3
Q10	0	4	Q10	4	4
Q11	2	2	Q11	3	2

Q12	3	4	Q12	3	3
Q13	0	3	Q13	0	4
Q14	3	2	Q14	1	2
Total	35	38	Total	40	51
Average	2.50	2.71	Average	2.86	3.64

	REF	
S7	A	C
Q1	5	5
Q2	0	2
Q3	2	4
Q4	1	2
Q5	3	3
Q6	1	4
Q7	1	1
Q8	0	2
Q9	5	5
Q10	0	3
Q11	5	4
Q12	4	5
Q13	0	1
Q14	4	2
Total	31	43
Average	2.21	3.07

	REF	
S8	A	B
Q1	5	4
Q2	4	3
Q3	2	4
Q4	4	2
Q5	2	4
Q6	1	4
Q7	5	3
Q8	1	4
Q9	5	4
Q10	4	4
Q11	4	4
Q12	5	4
Q13	5	0
Q14	3	4
Total	50	48
Average	3.57	3.43

MIXTURE

	B	C
S9		
Q1	2	5
Q2	3	5
Q3	4	4
Q4	3	5
Q5	5	5
Q6	3	3
Q7	4	5
Q8	4	5
Q9	3	5
Q10	0	5
Q11	2	5
Q12	2	5
Q13	3	5
Q14	3	5
Total	41	67
Average	2.93	4.79

	W1	W1	W2	W2	W3	W3	W4	W4	W5	W5	W6	W6	W7	W7	W8	W8	W9	W9	
1. DSL is attractive for the target group	4	5	4	3	4	0	4	3	4	2	3	5	2	3	4	5	2	4	61
2. DSL is predictable for the target group	5	4	2	3	0	0	2	1	0	4	4	5	3	4	3	5	4	5	54
3. DSL is technically and in views of production realisable	3	2	4	5	5	4	2	1	2	5	3	5	4	5	5	5	5	5	70
4. DSL is easy to understand and get an insight into (for the judges)	4	4	4	1	1	0	2	1	3	2	3	5	5	3	3	4	2	5	52
5. DSL reflects a new way to communicate through PDA's	1	5	4	3	4	0	4	3	4	2	4	4	1	2	5	2	1	2	51
6. DSL gives associations to similar product on the market	2	3	4	4	5	1	1	4	1	4	3	4	5	4	4	4	5	4	62
7. DSL fulfils the design tasks demands	4	3	4	3	5	0	1	2	3	4	4	4	4	3	5	5	3	4	61
8. DSL shows a creative way to interact with the product	4	2	4	1	0	1	5	4	0	1	4	4	3	1	3	3	2	2	44
9. DSL has an physical interesting design	5	4	3	4	1	0	4	2	5	3	3	4	1	0	1	2	2	2	46
10. DSL is easy to use and adapted to the target group	5	4	4	4	0	2	4	4	0	4	4	4	4	4	3	5	3	4	62
11. DSL is fun/amusing to use for the target group	4	4	2	3	4	0	4	2	4	5	3	4	3	2	2	2	2	4	54
12. DSL is aesthetically appealing for the target group	4	4	2	3	0	1	4	2	5	3	2	3	1	0	1	2	2	3	42
13. DSL is functional to use	2	3	4	2	1	0	1	4	4	4	3	4	4	4	5	4	2	4	55
14. DSL is a novelty concerning the PDA's physical form and interaction	4	4	3	4	1	0	5	2	4	4	3	3	2	0	3	2	2	3	49

	S1	S1	S2	S2	S3	S3	S4	S4	S5	S5	S6	S6	S7	S7	S8	S8	S9	S9	
1. DSL is attractive for the target group	3	5	5	4	2	4	4	5	4	3	3	5	5	5	5	4	2	5	73
2. DSL is predictable for the target group	2	5	0	0	0	4	0	5	0	3	4	5	0	2	4	3	3	5	45
3. DSL is technically and in views of production realisable	4	5	1	2	4	2	3	5	3	3	4	5	2	4	2	4	4	4	61
4. DSL is easy to understand and get an insight into (for the judges)	2	4	1	1	2	4	1	3	1	2	3	5	1	2	4	2	3	5	46
5. DSL reflects a new way to communicate through PDA's	4	4	1	0	1	2	0	5	3	1	3	2	3	3	2	4	5	5	48
6. DSL gives associations to similar product on the market	1	5	1	1	5	4	1	4	5	4	4	4	1	4	1	4	3	3	55
7. DSL fulfils the design tasks demands	0	4	0	0	5	0	0	3	5	3	4	5	1	1	5	3	4	5	48
8. DSL shows a creative way to interact with the product	5	5	5	5	1	2	2	5	2	2	2	2	0	2	1	4	4	5	54
9. DSL has an physical interesting design	4	5	5	5	1	2	5	5	4	2	2	3	5	5	5	4	3	5	70
10. DSL is easy to use and adapted to the target group	3	3	0	0	0	3	0	5	0	4	4	4	0	3	4	4	0	5	42
11. DSL is fun/amusing to use for the target group	3	4	5	4	3	2	5	5	2	2	3	2	5	4	4	4	2	5	64
12. DSL is aesthetically appealing for the target group	3	4	5	5	1	2	4	5	3	4	3	3	4	5	5	4	2	5	67
13. DSL is functional to use	3	4	0	0	4	0	0	5	0	3	0	4	0	1	5	0	3	5	37
14. DSL is a novelty concerning the PDA's physical form and interaction	5	4	5	5	1	1	4	5	3	2	1	2	4	2	3	4	3	5	59