subjective experience gathering techniques for interaction design:

subjective psychological exploration techniques based in the constructivism paradigm for informational and inspirational purposes

With the support from the Department of Education and Universities
of the Catalan Government and the European Social Fund.

Subjective experience gathering techniques for interaction design:

Subjective psychological exploration techniques based in the constructivism paradigm for informational and inspirational purposes

Oscar Tomico Plasencia

Director Joaquim Lloveras Macià

contents

Part VI: Conclusions

/ Appendices: Exploratory studies gathering users' subjective experience

/ Appendices on CD: Results from analyzing users' subjective experience gathering techniques.

list of figures

list of tables

acknowledgements

Special thanks to Hannaliissa Hailahti, Ilpo Koskinen, Jaime León, Marc Pifarré, Joaquim Lloveras, Joan Masarnau, Peter McGrory, Shorn Molokwane, Julio Montoya, Kees Overbeeke, Angel Sanz, Pilar del Real, Jefferson Rose and my friends and family. Without their guiding, help, comments, support and collaboration this thesis wouldn't have been possible.

Another contribution to this thesis consisted in the pictures courtesy of Anthony Dunne, Roger Ibars, Sietske Klooster, Mattias Ludvigsson, Rania Mazé, Michihito Mizutani, Sigi Moeslinger, Fiona Raby and Brendan Walker.

In addition, many students helped me with their great works and ideas. Many thanks to Likka Airas, Erja Alander, Henri Andell, Korhan Büyükdemirci, Orhan Daybelge, Alexandre Estadieu, Maja Gecic, Vilja Helkiö, Hong, Joonas Juutila, Michihito Mizutani, Simone Pallotto, Maikki Rytkönen, Bing Su, Paula Susitaival, Richard Widerberg, Minttu Wikberg and Yuan Ying from Taik (University of Arts and Design Helsinki) and Carles Adell, Christian Arriaga, Marta Alcarraz, Pablo Artieda, Alberto Bardají, Adria Bassaganyes, Cinta Bosch, Joan Borrell, Nuria Cabanas, Marino Caballero, Guillem Cebollada, Josep Colomo, Lucas-Miguel Colas, Joan Figueras, Ruben García, Eva Ibañez, Montse Jané, Ignacio Lopez, Pau Lladó, Jeremie Martin, Katharina Mast, Laura Mont, Alba Morales, Javier Nebot, Ester Prado, Mª Lluisa Puig-Solé, Cristina Regot, Laura Roura, Pau Sans, Rosa Simó, Xavier Solà , Asun Uria, Montse Vicente, Cristian Verge from ETSEIB (Technical University of Catalonia).

Finally I would like to thank the Centre for Person-Computer Studies, to support constructivist educators and students with a simplified Personal version freely available for non-commercial use of the Rep IV program (http://repgrid.com/) and Dr. Guillem Feixas and Dr. J. Manuel Cornejo to provide a demo version of the Gridcor v. 4.0 programme (http://www.terapiacognitiva.net/).

glossary

Partially extracted from Wikipedia (http://www.wikipedia.org/) and Interaction Design Enciclopedia (http://www.interaction-design.org)

Design research: Using design research techniques (observations, interviews, and activities) designers investigate users and their environment in order to learn more about them and thus be better able to design for them.

Concept Generation in product design: Drawing on a combination of user research, technological possibilities, and business opportunities, designers create concepts for new software, products, services, or systems. This process may involve multiple rounds of brainstorming, discussion, and refinement.

Constructivism is a perspective in philosophy that views all of our knowledge as "constructed", under the assumption that it does not necessarily reflect any external "transcendent" realities; it is contingent on convention, human perception, and social experience.

Empathic design is an approach to design where researchers or developers try to get closer to the lives and experiences of (putative, potential or future) end-users, and to apply what they learn together with end-users in the design process. The goal of empathic design is to ensure that the product or service designed meets end-users' needs and is usable. Empathic design can be seen as a move of researchers and developers into the world of end-users, whereas participatory design can be seen as a move of end-users into the world of researchers and developers.

Hypothetico-deductive model or method is a proposed description of scientific method. According to it, scientific inquiry proceeds by formulating a hypothesis in a form that could conceivably be falsified by a test on observable data. A test that could and does run contrary to predictions of the hypothesis is taken as a falsification of the hypothesis. A test that could but does not run contrary to the hypothesis corroborates the theory. It is then proposed to compare the explanatory value of competing hypotheses by testing how stringently they are corroborated by their predictions.

Interaction is a kind of action that occurs as two or more objects have an effect upon one another. The idea of a two-way effect is essential in the concept of interaction, as opposed to a one-way causal effect. Combinations of many simple interactions can lead to surprising emergent phenomena. Interaction has different tailored meanings in various sciences. In product design and human factors, it relates to the feedback during the operation of machines such as a computer or tool, for example the interaction between a driver and the position of his or her car on the road: by steering the driver influences this position, by observation this information returns to the driver.

Interaction Design is the discipline of defining and creating the behavior of technical, biological, environmental and organizational systems. Examples of these systems are software, products, mobile devices, environments, services, wearables, and even organizations themselves. Interaction design defines the behavior (the "interaction") of an artifact or system in response to its users over time. Interaction designers, which are typically informed by user research, design with an emphasis on behavior as well as form, and evaluate design in terms of usability and emotional factors.

Participatory design is an approach to design that attempts to actively involve the end users in the design process to help ensure that the product designed meets their needs and is usable. It is rooted in work with trade unions in several Scandinavian countries in the 1960s and 1970s.

Prototyping is a method used by designers to acquire feedback from users about future designs. Prototypes are similar to mock-ups (see this), but are usually not as low-fidelity as mock-ups and appear slightly later in the design process. Prototypes may be horizontal or vertical: A horizontal prototype appears to have a very broad range of the intended future features, but only very little of the actual functionality of the features is implemented. For example, a horizontal prototype of a computer application may have a very well developed and broad user interface (the horizontal dimension) but not much of the underlying functionality is implemented (the vertical dimension, i.e. the deeper layers of the software). Correspondingly, a vertical prototype only has very few features, which on the other hand are almost fully implemented or at least so-called "walking skeletons".

Objectivism, or metaphysical objectivism, is the view that there is a reality or realm of objects and facts existing wholly independent of the mind. Stronger versions of this claim might hold that there is only one correct description of this reality; they may or may not hold that we have any knowledge of it. Objectivity in referring requires a definition of what is true, and is distinct from the objects themselves which cannot be said to be true or false.

Social interaction is a dynamic, changing sequence of social actions between individuals (or groups) who modify their actions and reactions according to the actions by their interaction partner(s). In other words they are events in which people attach meaning to a situation, interpret what others are meaning, and respond accordingly.

Socratic method. To solve a problem you would ask a question and when finding the answer you would also have an answer to your problem. In this method, a series of questions are posed to help a person or group to determine their underlying beliefs and the extent of their knowledge. The Socratic method is a negative method of hypothesis elimination, in that better hypotheses are found by steadily identifying and eliminating those which lead to contradictions. It was designed to force one to examine his own beliefs and the validity of such beliefs.

Subjective experience relates to the subjective character of the experience. All subjective phenomena are associated with a single point of view ("ego") is called the subjective character of experience.

Subjectivity refers to the property of perceptions, arguments, and language as being based in a subject point of view, and hence influenced in accordance with a particular bias. Its opposite property is objectivity, which refers to such as based in a separate, distant, and unbiased point of view, such that concepts discussed are treated as objects.

User-centered design (UCD) is a design philosophy and a process in which the needs, wants, and limitations of the end user of an interface or document are given extensive attention at each stage of the design process. User-centered design can be characterized as a multi-stage problem solving process that not only requires designers to analyze and foresee how users are likely to use an interface, but to test the validity of their assumptions with regards to user behavior in real world tests with actual users. Such testing is necessary as it is often very difficult for the designers of an interface to understand intuitively what a first-time user of their design experiences, and what each user's learning curve may look like. The chief difference from other interface design philosophies is that user-centered design tries to optimize the user interface around how people can, want, or need to work, rather than forcing the users to change how they work to accommodate the system or function.

Usability is a term used to denote the ease with which people can employ a particular tool or other human-made object in order to achieve a particular goal. Usability can also refer to the methods of measuring usability and the study of the principles behind an object's perceived efficiency or elegance. In human-computer interaction and computer science, usability usually refers to the elegance and clarity with which the interaction with a computer program or a web site is designed. The term is also used often in the context of products like consumer electronics, or in the areas of communication, and knowledge transfer objects (such as a cookbook, a document or online help). It can also refer to the efficient design of mechanical objects such as a door handle or a hammer.

Usability testing techniques are the means for measuring how well people can use some human-made object (such as a web page, a computer interface, a document, or a device) for its intended purpose, i.e. usability testing measures the usability of the object. Usability testing focuses on a particular object or a small set of objects, whereas general human-computer interaction studies attempt to formulate universal principles. If usability testing uncovers difficulties, such as people having difficulty understanding instructions, manipulating parts, or interpreting feedback, then developers should improve the design and test it again. During usability testing, the aim is to observe people using the product in as realistic a situation as possible, to discover errors and areas of improvement.

User experience, often abbreviated UX, is a term used to describe the overall experience and satisfaction a user has when using a product or system. In recent years, "User Experience" has transcended simple interactions within computing environments and is used as a qualifier for various online and offline experiences, ranging from person-to-person interactions, such as customer service, as well as analogue products such as the automobile.

Part 1: introduction

1. Summary

2. Focus and aims of the study.

3. Research methodology.

4. The structure of the dissertation.

1.

summary

The field of User Experience (UX) consists of a wide range of different aspects about the interaction with products or services. User experience differs from the performance-based objective paradigm, focusing on a wider point of view where users needs, desires and fantasies have a role in the users decision-making process. Quantitative analysis and hypothesis and validation approaches have difficulties to deal, in a structured way, with information other than that, which is strictly related to aspects regarding product usage (i.e. emotions and affect, social interaction) and the results obtained are ephemeral and complex to measure.

The aspects of user experience that involve feelings related to inherent needs, desires and fantasies are called subjective experience information. To obtain this kind of information, user experience analyzes the psychological relationship between users and products or services. This thesis describes constructivist psychology and its relevance for user experience research in early stages of product development. First, a general overview of the proposed point of view introduces constructivist psychology to user experience practitioners. Then several exploratory studies illustrate, with examples, how these techniques should be used as subjective user experience information gathering tools:

- The experience landscapes technique use the repertory grid as an alternativist approach to constructivism for gathering information about consumers' response to a certain group of products and extract users' experience requirements.

- The tightening procedure uses laddering techniques (discursive approach to constructivism) to get core information, the values a person holds. In order to increase the level of accuracy, obtaining design relevant information that relates emotional, functional and physical product attributes.

- The sensory metaphor generation method can be considered a rhetorical approach to constructivism and uses products, objects and contexts as carriers of meaning of subjective experiences.

- The visualization of inner needs and desires technique is a narrative approach to constructivism. It uses video presentations to unveil future interactions behaviours that fulfil users' desires and aspirations.

The Subjective Experience Gathering and Inspiring Techniques proposed in this PhD thesis (SEGIT) emerges from the analysis of the strengths and weaknesses of those exploratory studies. It can be considered a set of techniques (explorative and projective techniques) to be used throughout the design process as an inspirational tool to guide the creative process, a generation technique of experience ideas to develop interaction concepts and a model for consumers' future response validation. The information obtained with the SEGIT method is analyzed for inspirational and informational purposes:

- From an inspirational point of view, the set of techniques provide key aspects of the inspiration process in relation to exploratory (detailed and complete ideas) and projective techniques (concepts with high level of abstraction and coherence at the same time). In addition, results show that different aspects like the participants' linguistic abilities and practitioners' guiding skills affect consistency.

- From an informational point of view this set of techniques can be used to obtain subjective experience construing profiles about consumers' product preference. At the same time the results show how variables like participants' cognitive complexity of consumers' response and the cognitive structure of the valuation process affect its reliability.

In conclusion, the approach to interaction design presented by this research and the proposed techniques for inspirational and informational purposes show an optimistic path to explore with the aim to help designers to bring peoples' sensorial experience and technology closer together.

2.

focus and aims of the study

The field of user experience (UX) consists of a wide range of different aspects in relation to the interaction with products or services, ranging from person-to-person interactions, such as customer service, as well as user-product interaction, such as using a microwave oven. User experience differs from the performance-based objective paradigm of traditional usability, focusing in a wider point of view where users needs, desires and fantasies have a role in the user decision-making process.

Today's methods and tools to evaluate user experience present some limitations if practitioners want to apply them to evaluate other issues (like emotions and affect, social interaction) rather than strictly related aspects of product usage. Quantitative analysis and hypothesis and validation approaches cannot deal in a structured way with this amount of information and the results obtained are ephemeral (in relation to peoples' moods) and complex to measure (tacit knowledge interpretation is subject dependent). That's why different questions emerge about the validity of existing UX evaluation methods.

UX research may be improved by including new sociological, anthropological and psychological methods to envision possible futures and behaviours [Green, 2003] based in a new approach, the subjective paradigm. Towards the accomplishment of this goal, this PhD thesis will focus in the following hypothesis:

- Addressing the complex world of user experience, their inner needs, desires and fantasies (users' subjective experience) can be analysed with a high level of detail using constructivist psychology techniques in order to obtain relevant information for design purposes.

- The Repertory Grid (an alternativist approach to constructivism) as a subjective experience information gathering technique brings about the possibility of obtaining tacit or intuitive understanding as highly conscious, verbalized constructions, contributing to a better understanding users' inherent needs.

- Projective techniques (rhetorical approach to constructivism) as a subjective experience information gathering techniques can be described as a mode of guidance that underlies intuitive knowing by using meaning transports, which extend our level of understanding to users' unconscious desires.

- Narratives techniques (narrative approach to constructivism) encourage an imaginary associative play, placing emphasis on those events or combinations of events that have an affective meaning in relation to one's inner fantasies.

As technologies evolve new sensorial qualities emerge. A major challenge in the coming years is to align people's sensorial experience and technology closer together to create a more intuitive way of interacting using natural gestures and sensory-emotive qualities to fulfill peoples inner needs, desires and fantasies. To achieve this idea, the objectives of this research are orientated to create, through experimental practice, reliable mechanisms to assure the correct interpretation of the user experience:

- To allow the designer and the potential user the ability to create a mental picture of the desired sensations to transmit-receive (tacit knowledge) with the product during the design phase, facilitating the understanding of the complex emotional system through intuitive ideas.

- To use this methods as inspirational techniques to guide designers to develop interaction ideas and product concepts and as informational techniques to assure the decision making process during the design phase.

The limitations of this study come from the academic character of this research. First of all, design students were used to apply the methods (with the purpose to analyze the validity of their results and the applicability of the method) and not design professionals. Moreover, the duration of the courses didn't allow for develop a fully functional prototypes. The methods applied to develop conceptual products used detailed drawings, 3d models or rough mock ups in their testing and validation process.

3.

research methodology

This PhD thesis was carried out using an iterative process based on a research through practice approach structured in 3 fundamental pillars: development and characterization of methodologies, revision of methodologies through visits and interviews in research centres and university departments specialized in the subject and experimental analysis of methodologies through their application in particular cases proposed to students in the product and interaction design field. For the experimental analysis, six groups of five people on average in each course applied several different techniques developed in order to design a new consumer product (i.e. kitchenware, office supplies, furniture, sports equipment, clothes and accessories). Then both cross-evaluation tests about the other groups work (design concepts) and self-evaluation tests about their work and the methodology were done to gather information of the validity of the results and the applicability of the methods.

In the next paragraphs the research process is presented step-by-step according to the different iterations carried out. The first stage focused on improving the communication of perceptions and experiences of products among users and designers. With this purpose two tools were developed: a creativity technique for designers and engineers to develop innovative behaviours for new product concepts and a method for evaluating the appreciation of static and dynamic product qualities in the first phases of product development (conceptual design). These tools were configured in the Sensory Metaphor Generation method (SMG), which can be considered a user centred design method focused creating engaging user-product interactions. In order to develop and analyze the methodology theoretically, a stage of one month in the "Designed Intelligence Research Group" in the Department of Industrial Design of TUe (Technical University of Eindhoven) was done. The experimental analysis of the method was carried out in the "Product Appreciation and Aesthetics" course at the ETSEIB (UPC) in autumn, 2004. This course focused on the early stages of product development, and more specifically, on information screening and gathering methods used to improve the definition of product criteria and requirements.

The second stage was based on the development of a reliable method for gathering information about users' subjective experience based on psychological explorations. Constructivist psychology was chosen as a basis and constructivist techniques were adapted for its application in the product design process. The Experience Landscapes (Exland) method was developed from the Repertory Grid interview in order to obtain information about users' subjective experience in their own words (tacit and explicit knowledge). In this cycle the collaboration of different psychologists specialized in constructivist psychotherapy helped to adapt the Repertory Grid for use as a research tool in product design. The experimental analysis of the Experience Landscapes method was carried out in the "Products And Technical Systems Engineering I" course held at the ETSEIB (UPC) in spring, 2005. This was a fourth year undergraduate design engineering specialization course at the Industrial Engineering School of Barcelona. Its objective was to introduce engineering students to issues associated with product innovation and design methods.

The third stage focused on developing a technique to obtain prospective information about future experiences (visual representation storytelling scenarios from individual needs and values as video advertisements). The experimental analysis of the method Vfi (Visuals for Inspiration) was carried out in the "Design and creativity teamwork workshop" course in the School of Design / Industrial Design at UIAH (University of Art and Design Helsinki) in the summer of 2005. A one-week intensive workshop, aimed to provide participants with a theoretical and practical overview of teamwork and creativity processes, particularly emphasized iterative, generative and collaborative learning processes, typical in cross-disciplinary projects from the conceptual phase of product design.

In the fourth stage the SMG method and the Exland technique were merged to develop the set of Subjective Experience Gathering Techniques (SEGIT), which can be used as inspirational techniques to guide designers to develop interaction ideas and product concepts and as informational techniques to assure the decision making process during the design phase. A three months stay as a visiting researcher in the "Design Research Group" in the School of Design / Industrial Design in UIAH (University of Art and Design Helsinki) was done in order to analyze and revise the methodology theoretically. The experimental analysis of the SEGIT method was carried out in the "Sensory Metaphor Generation workshop" course in the School of Design / Industrial Design at UIAH in autumn, 2005. The aim of this course was to train students to be capable of obtaining product appreciation and users' experience information and translate it into design-relevant issues like scenarios, interaction concepts and detailed design guidelines.

The fifth stage focused on the general applicability of augmented subjective experiences in the conceptual phase of product design as a non-intrusive way of introducing smart products into everyday life. Precisely, the emerging possibilities in combining textile materials, multimodal information technology and interaction design techniques in order to create emotionally richer experiences were explored in the "Multimodal Workshop" course from the Functional Design

Project Module. It was carried out together among the School of Design and the Medialab at UIAH in autumn, 2005. The emphasis was presented to the user experience with the purpose of exploring the easing of peoples' dislikes, aversions and fears in everyday life that lead to unpleasant subjective experiences. The aim was to create scenarios and applications for coming design projects and study the possibilities to commercialize the innovations. The workshop started with brainstorming and lectures given by experts of intelligent textile design, multimodal design, interactive design and mobile technologies.

The sixth stage was the final one and its aim was the experimental validation of the SEGIT method for inspirational and informational purposes. This analysis was carried out in the "Products And Technical Systems Engineering" course held at the ETSEIB (UPC) in spring, 2006. The goal was to introduce the engineering students to issues associated with product innovation and design methods. To train students to be capable of obtaining product appreciation and users' experience information and translate it into design-relevant issues like scenarios, interaction concepts and detailed design guidelines.

4.

the structure of the dissertation

This dissertation is divided into seven parts. Each part relates to one aspect of the research. Part 1 sets up the background of this research. Part 2 introduces users' subjective experience. Part 3 looks for methods to gather information about peoples' needs, desires and fantasies. Part 4 analyzes the developed methods for informational and inspirational purposes. Part 5 explores designer and user roles with subjective experience gathering techniques. Part 6 concludes this dissertation by analyzing the proposed hypothesis through the results obtained in this research. The appendices show different exploratory studies, which precede the development of the SEGIT method.

PART 1: INTRODUCTION.

This first part of the dissertation describes the context of this research. Chapter 1 presents a brief summary of this research. In chapter 2, the focus and aims of the study are related to the proposed research hypothesis. Chapter 3 presents the research methodology used. Chapter 4 describes the structure of this dissertation.

PART 2: FOCUSING ON USERS' SUBJECTIVE EXPERIENCE.

Product interaction design deals with a broad number of aspects, as it is the link between different product characteristics, functions, usage and users' needs, desires and fantasies. The role of the interaction designer consists of designing new complex and dynamic interactions with converging hardware and software, spaces and services. This emerging field demands new design approaches, specific considerations and, ultimately, the design of integrated experiences set in a context, rather than in individual components, to go beyond and attain a deeper relational sense with the user, especially on the emotive level (users' subjective experience).

Chapter 5: The challenges of dealing with subjective experience.

This chapter presents the social and technological context that drives this research towards focusing on users' needs, desires and fantasies related to their personal experiences with consumer products and services. In addition, making it interesting to use this information about personal experiences as a starting point to design products and services that fulfill customers and their desired experiences.

Chapter 6: Characterizing a subjective experience approach to interaction design.

This chapter explores the complex field of study of understanding user experience and focuses on defining the users' subjective experiences. It then describes the design for experiencing as an approach for augmenting subjective experiences, positioning it in user experience frameworks and illustrating it with some examples of conceptual smart textile designs.

Chapter 7: Emerging difficulties in addressing the subjective experience.

This chapter analyzes the emerging difficulties in addressing the subjective experience in relation to the current methods used for gathering user experiences. Furthermore it underlies the basis for a more adequate perspective to subjective experience gathering techniques.

PART 3: CAPTURING USERS' SUBJECTIVE EXPERIENCE INFORMATION.

Constructivist psychology's essential task is understanding how peoples' characteristics (values, beliefs and assumptions) are involved in the process of experiencing. This includes how people otherwise participate in co-creating dynamic personal realities (needs, desires and fantasies) to which they individually respond. In constructivist psychotherapy techniques, like projections and narratives, meaning arises from communicative action rather than residing within individual selves. These techniques become an exercise in co-creative language among all of the members. This shift leads to a radical change in traditional formulations of experience design research.

Chapter 8: Focusing on constructivist psychology for gathering information on the subjective experience.

This chapter describes constructivist psychology as an example of this change of paradigm and why is it relevant for user experience research in early stages of product development. A general overview of this proposed point of view is introduced through constructivist psychology techniques to user experience practitioners. In this case, the study focus is the psychological relationship between users and products or services, analyzing the subjective experience from the users viewpoint.

Chapter 9: Analyzing the role of constructivist psychology methods into subjective experience gathering techniques.

In this chapter different approaches to constructivist psychology are presented (alternativist, discursive, rhetorical and narrative) and some techniques and examples illustrate their application as subjective user experience information gathering tools.

Chapter 10: Applying constructivist psychology methods into user subjective experience gathering techniques.

The aim of this chapter is to analyze the complex area of users' individual and subjective experience, develop subjective product experience gathering and inspiring methods to then apply as user experience research methods in early stages of product development. The ensuing method can be defined as a set of inspirational, concept generation and evaluation techniques to design the users' experience based on unveiling their needs, desires and fantasies.

PART 4: ANALYZING USERS' SUBJECTIVE EXPERIENCE GATHERING TECHNIQUES.

New tools and methods of human-centered design research are converging on the conceptual phase of the design development process. Basically, there is a co-evolution of two approaches: informational and inspirational research. Human-centered design research that informs the design development process tends to be conducted by people who are trained in the applied social sciences. Human-centered design research done by designers has mainly focused on the inspirational approach.

Chapter 11: Analyzing subjective experience information for informational purposes.

This chapter analyzes the information acquired in relation to obtaining more details about the participants' response from the constructivist psychology point of view. First, it measures subjective experience correlations between different products in order to create subjective experience construing profiles about users' product preference. Then, it evaluates the cognitive complexity of participants'

response with differentiation and integration measures, which can be represented in cognitive complexity profiles. Finally, it analyzes the cognitive structure of the valuation process through discriminative power and extremity scores.

Chapter 12: Analyzing subjective experience information for inspirational purposes.

This chapter defines key aspects of the inspirational process and applies them to the analysis of subjective experience information gathering techniques. With the purpose of analyzing the SEGIT method as an inspirational aid for designers, the inspirational process is divided into three phases in relation to the concrete, relational and conceptual level of the generated ideas and concepts.

PART 5: EXPLORING DESIGNERS AND USERS ROLES WITH SUBJECTIVE EXPERIENCE GATHERING TECHNIQUES.

A number of factors determine the nature of a user-product relationship. Subjective information such as ideals, wishes, or dreams play an important role. They can make the user experience much more personal and have a big impact on the design process and the final product design. Ideally, a designer likes to map all these possible factors and their interrelations, but that process also relies on the intended users to determine what is required.

Chapter 13: Modelling designers and users subjective experience communication framework into interaction design.

This chapter focuses on user experience information vs. the designer inspiration dichotomy in order to analyze designers' and users' subjective experience information workflow. Users' subjective experience information characterization is based on Norman's information processing model [Norman et al., 2003]. The interaction design process and levels of product description is based on Hekkert's Vision in Product design (ViP) approach [Hekkert & van Dijk, 2001]. Then, both visions are merged in an attempt to model designers and users subjective experience communication framework into interaction design.

Chapter 14: Analyzing designers' and users' roles with subjective experience gathering techniques.

The information processing model allows for describing users' and designers' communication workflow during the product design process. In this chapter this framework is used in order to characterize different subjective experience in information gathering exploratory techniques (experience landscapes, sensory metaphor generation, visual narratives) and the resulting SEGIT method within the design process.

PART 6: CONCLUSIONS.

This part concludes this dissertation by analyzing the proposed hypothesis through the results obtained in chapter 15 and presenting the accomplished objectives in chapter 16. Then its contributions to the User Experience field are presented in chapter 17. Moreover, the limitations of this research and future work are discussed in chapter 18.

APPENDICES: EXPLORATORY STUDIES GATHERING USERS' SUBJECTIVE EXPERIENCE.

Appendix A: Exploring subjective experiences (from the article "Experience landscapes: A subjective approach to explore user-product interaction" presented at DESIGN 2006)

The experience landscapes exploratory case can be defined as a cooperative inquiry between the designer and the user. It is described as an organized interview, which uses comparison in its development. Thus, creating a set of constructs or bipolar dimensions related among each other where adjectives and characteristics correlate with the appraisal. It enables users to tell designers something of the way in which they see and order the world, building up mental maps of the users' world in their own words.

Appendix B: Using metaphors as carriers of subjective information (from the article "Creating Pleasurable User-Product Interaction Experiences through Movement Analogies" presented at DPPI 2005)

The sensory metaphor technique is a projective process in the behavioral information processing level used to enhance sensitivity to tacit understandings (it works as a mode of guidance that underlies intuitive knowing). Projective techniques are based on the idea that new chains of implications become possible as broad levels of abstraction open a much wider network of subordinate categories and ideas. From the expertise in one domain, this level of abstraction allows one to grasp connections between otherwise irrelevant concepts. The results are sensory reconstructions of high-generality imagery described as being somewhere between perceptions (visceral level) and symbolic thought (reflective level).

Appendix C: Considering users as motivated storytellers (from the article "Unveiling People's Inner Needs, Desires And Fantasies To Help Forecast Future Interaction Experiences" presented at IDEC 2006)

The visualization of inner needs, desires and fantasies explorative case applies narrative procedures. By relating users' subjective experiences into a well-known context like telling a story, these sub-conscious experiences can migrate to a storytelling experience as people schematize it, communicate it, and add levels of meaning. This process is based in a self-exploration and expression loop, contributing to a better understanding of personal values from the reflective information processing level.

APPENDICES ON CD: RESULTS FROM ANALYZING USERS' SUBJECTIVE EXPERIENCE GATHERING TECHNIQUES.

Appendix D: Results from analyzing subjective experience information for informational purposes.

This appendix contains the Repertory Grids generated from the kitchenware study with existing products, products concepts and final design. It also includes the results from the GRIDCOR analysis with the cognitive measures.

Appendix E: Results from analyzing subjective experience information for inspirational purposes.

This appendix contains the SEGIT results obtained from the paper clip study (Repertory grid results, generated analogies and scenario) and the first design concepts generated. It also includes the results from the self-evaluation analysis of the results for inspirational purposes.

Part 2: focusing on users' subjective experience

5. Challenges dealing with subjective experience.

6. Characterizing a subjective experience approach to interaction design.

7. Emerging difficulties dealing with subjective experience.

5.

challenges dealing with subjective experience

This chapter presents the social and technological context that drives this research towards focusing on users' needs, desires and fantasies related to their personal experiences with consumer products and services. In addition, making it interesting to use this information about personal experiences as a starting point to design products and services that fulfill customers and their desired experiences.

First, it describes existing consumer trends and evolution related to future economy paradigms and society's logic, starting from the experience economy, the dream society, to the creative man. Then, it analyzes the technology evolution in relation to the realms of interaction in the foreseeable future, considering it as a challenge for a new sensoriality, for new ways of interacting. Finally, this chapter relates the social and technological contexts previously presented to the emerging roles of design.

EMERGING ECONOMY PARADIGMS; FUTURE CONSUMER RESPONSE

In the past, people have tended to view entertainment and enjoyment as a separate experience from their daily work life and education. However, it is increasingly changing to where people integrate and expect pleasure and enjoyment in their daily lives, work or otherwise [Tomico et al., 2006b]. Moments of entertainment and experience are no longer seen as extraordinary events but part of our everyday experience [Green, 2003] and can be bought and sold like other goods or services. In other words an Experience Economy [Pine, 1995].

Furthermore, as most physical needs have been satisfied, people are turning their attention more to satisfying emotional, aesthetic, sensory and even spiritual needs. There is a transition to a Dream Society [Jensen, 1999], where consumers follow their feelings and emotions to guide the decision making process. They do this in order to buy products or services, which evoke pleasant feelings and allow for the projection of their personalities. This move to the Dream Society is based on three facts [Ardèvol, 2006]:

- The change acceleration results from an information society, which spreads ideas in a much faster way and inspires other new ideas more rapidly.

- The economy transition in rich countries to an experience economy, where the immaterial consumption is growing much faster than material consumption because the material part has been saturated or fulfilled on a wide scale.

- Technological development, implying that most everything can be produced, increased the importance of emotions in product choices.

In a broader social context, the Dream Society is embedded in what is called the Model of the Society Logics, which relates it to the Industrial logic and the emerging Creative Man logic. It is a new social playground, where feelings and experimentation lead to an emotional consumption. [Morgensen, 2006]

Experience economy, the fourth economic offering

Joseph Pine [Pine, 1995] describes a new economy where experiences are a fourth economic offering, as distinct from services as services are from goods. When a person buys a service, he purchases a set of intangible activities carried out on his behalf. But when he buys an experience, he pays to spend time enjoying a series of memorable events that a company stages to engage him in a personal way.

The other three economic offerings described by Pine [Pine, 1995] are the following: Commodities, Goods, Services and Experiences. Commodities are materials extracted from the natural world (animal, mineral, vegetable) and by definition fungible. Goods are standardized tangible items that use commodities as raw materials. Services are intangible activities customized to the individual request of known clients. Service providers use goods to perform operations. See **table 5.1** for a comparison of the four different economic offerings.

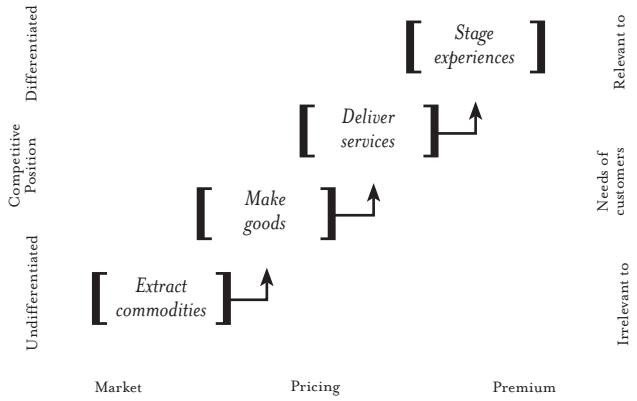
Economic offering	COMMODITIES	GOODS	SERVICES	EXPERIENCES
Economy	Agrarian	Industrial	Service	experiences
Economic function	Extract	Make	Deliver	Stage
Nature of offering	Fungible	Tangible	Intangible	Memorable
Key attribute	Natural	Standardized	Customized	Personal
Method of supply	Stored in bulk	Inventoried after prod.	Delivered on demand	Revealed over a dur.
Seller	Trader	Manufacturer	Provider	Stager
Buyer	Market	User	Client	Guest
Factors of demand	Characteristics	Features	Benefits	Sensations

> table 5.1:

Characterizing experiences as the fourth economic offering from Pine [Pine, 1995]

Experiences have always been at the heart of entertainment, from plays and concerts to movies and TV shows. But this doesn't mean that experiences rely exclusively on entertainment, companies stage an experience whenever they engage customers, connecting with them in a personal, memorable way. Experiences are inherently personal. They occur within any individual who has been engaged on an emotional, physical, intellectual, or even spiritual level. Each experience derives from the interaction between the staged event and the individual's prior state of mind and being [Pine, 1995].

Experiences are now gaining importance in the economic offering. This is because technology, which allows so many experiences, and the increasingly competitive intensity drives the ongoing search for differentiation. However, the most important factor resides in the nature of economic value and its natural progression from commodities to goods to services and then to experiences (see **figure 5.1**).



> figure 5.1:

The progression of economic value in the experience economy [Pine, 1995]

When people's everyday lives become characterized by routine, they become hungry for experiences. Hence, there is a growing market for experiences, whether as holidays, events or simply entertainment (stories that make life more

interesting). These stories can often be linked to a set of physical products or services and when people consume such an experience, they likely feel that they become a part of it. Thus, they won't bother to pay an extra cost for these extra values.

A Dream society characterized by the commercialization of emotions

As society gets wealthy and it becomes easier to satisfy material needs, people increasingly focus on immaterial or emotional needs. Rather than consuming more material goods as wealth increases, people instead increasingly consume immaterial goods or material goods with a large immaterial content. Stories and emotions then become a large part of what they consume, and people increasingly favor products with built-in emotions or stories. This is the Dream Society logic [Jensen, 1999], characterized by the commercialization of emotions, where purely immaterial products or services can satisfy emotional needs.

Precisely because of this, once basic survival needs have been satisfied, people start focusing more on their social needs. They want to gain acceptance and recognition from the groups of people that they desire to be a part of [Marslow, 1943]. Hence they acquire products that are not strictly necessary for survival, but are valued as status symbols in these groups of people, whether it is a local community, a work community or a group of people with whom they share an ideological or cultural identity. Such status symbols are not just valued by their size but also by having the right qualities, such as being of a recognized brand or made by a famous designer or telling a certain story about the owner.

These status symbols have an important role in the Dream Society's logic. These are things people don't necessarily need, but which are used to tell something about the consumer's taste, identity and wealth. The Dream Society argues that traditional market segmentations (where products and services are categorized as food, transportation, clothes, entertainment, etc.) soon will be changed by emotional markets segmentations. The Dream Society identifies six emotional markets [Jensen, 1999]:

- The market of adventures for sale (experiences and impressions).
- The market of togetherness, friendship and love (human relations).
- The market for care (the need to show caring).
- The who-am-I market (the quest for personal identity).
- The market for peace of mind (the safe and the familiar).
- The market for convictions (values and opinions).

These immaterial qualities often become more important than the material qualities and become the primary factor in choosing one product over another

[Jensen, 1999]. Consumers trust that a product actually works as intended, either because of legislative requirements or because the technology is well established. Then, the positive perception of the product comes from an emotional standpoint and from the story it creates instead of the functional perspective.

In fact, as empathy and emotion impact people's lives (from work to social encounters and personal relaxation, from food to interiors and fashion) understanding the modern consumer is about digging into their emotional, spiritual and psychological needs. Emotional consumption is foremost about people whose outlook on life is focused on meaning rather than materialism. Anne Lise Kjaer [Kjaer, 2005] mapped out four types of emotional consumption, identifying the key drivers influencing future behavior and lifestyle patterns of most western consumers. The four consumer trends that describe the advanced stage of self-realization that the modern consumer has reached are [Kjaer, 2005]:

- Future consumer is a seeker, a worker and an artist, choosing motivational and emotionally rewarding priorities for both our work and personal lives (young experimental perfection seekers [Fox, 2005]).

- There is a renewed need for ritual and tradition. Traceability is essential as every aspect involved in preparing a meal (the taste, the smell, the textures, the sourcing of the ingredients, the cultural significance, and the emotional value).

- Fair sourcing represents the first vital step towards building a new sustainable world where ethics and eco-principles set the standard.

- The inner quest towards purifying our mind, body and spirit.

Model of Society Logics: a relationship between the Industrial Logic, the Dream Society and the Creative Man.

If we look at the evolution of the society logics over the time from the Industrial revolution till the present, each model of society is mainly driven by different basic needs. According to the Copenhagen Institute for Futures Studies [Morgensen, 2006] reformulation of the Maslow's hierarchy as a range of needs [Maslow, 1943] using Alderfer [Alderfer, 1972] classification (material needs, social needs and personal growth needs), the Industrial society was mainly driven by the desire for greater fulfillment of material needs (safety and psychological needs). The Dream Society then rose because the focus shifted to emotional, social needs (esteem and belongingness). Then, the next emerging society logic, which is a step up over the social needs, is based on personal growth needs (self-actualization and transcendence). The central idea of this new society logic is the Creative Man, in which creativity and innovation will be more important in consumption and leisure as well as in business and the workplace. See **table 5.2** for a detailed characterization of the three society logics.

> table 5.2:

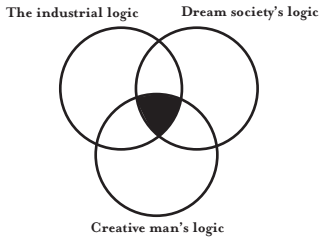
Comparison of the three society logics (Industrial, Dream Society and the Creative Man) adapted from CIFS [Morgensen, 2006]

SAFETY NEEDS	The Industrial Logic	Dream Society's Logic	Creative Man's Logic
Organisation	Hierarchy	Corporate values	Network
Motivation	Material needs, comfort and safety	Social needs, dreams and values	Personal growth, challenges and opportunities
The good workplace	Good physical work enviroment	Good social work enviroment	Good creative work enviroment
The good employee	Stable	Loyal	Innovative
Most important p. qualities	A good price, ease of use	A good story, branding	The personal touch, choices
Recreation	Relaxation	Adventure	Creative activities
Technology	Automation	Communication	Creation
The ideal	The millionaire	The storyteller	The innovator
The loser	The oddball	The boring	The uninventive
Religion (if any)	Church Religion - Organised and tradition.	New Age - Exciting and different	Individual Belief - Personal an unique

The different society logics are driven by different basic needs that have several interesting consequences. People aren't fully satisfied unless they can satisfy all three groups of needs at once. For this reason the three logics are not mutually exclusive and can be represented by overlapping circles (see **figure 5.2**). In fact, this means that Dream Society and Creative Man's society do not replace the Industrial society; instead they simply add their inner motivations to it. The needs that drive industry are still present, but have to be supplemented with the social needs that drive the Dream Society logic and the needs for personal growth that drive the Creative Man society logic [Morgensen, 2006].

> figure 5.2:

Representation of the overlap between the three different logics adapted from CIFS [Morgensen, 2006].



The methods that are used to satisfy the three different needs can be considered the underlying logics of the three societies [Morgensen, 2006]: The industrial logic is driven by material needs that are satisfied through mass-production and systematization. Dream Society's logic is driven by emotional, mostly social, needs that are satisfied through storytelling and exciting experiences. The Creative Man's logic is driven by needs for personal growth that are satisfied through individualism and creativity.

There are many examples of the successful combination of Industrial logic with Dream Society's logic, i.e. a mass-produced product that has achieved added value by being tied to a strong brand and some good stories. Thus, there is reason to believe that something similar could happen if the Creative Man's logic is combined with one of the two other logics. Industrial logic can be combined with Creative Man's logic in the shape of prosumer services [Morgensen, 2006], where the consumer becomes part producer in order to create a personal, unique product [Morgensen, 2006].

EMERGING TECHNOLOGY REALM

As technologies evolve new sensorial qualities emerge, they become incorporated into our culture and can have an impact both on how we experience our environment and on how we interact with it [Verbücken, 2003]. A major challenge in the coming years is to align people's sensorial experience and technology closer together to create a more intuitive way of interacting using natural gestures and sensory-emotive qualities to fulfill peoples inner needs, desires and fantasies [Verbücken, 2003].

One of the most noticeable effects of design in everyday life is the obtrusive prominence of technology. Technological developments are much faster than people's awareness and acceptance. Wireless communication, microsensors and artificial intelligence are increasingly imbedded into everything from mobile devices to home appliances and public architecture [Mazé, 2005]. However, technological developments can also be considered as a challenge for a new sensoriality, thus for new ways of interacting [Verbücken, 2003]:

- New skin (interface) materials that can be both sensitive and responsible.

- New materials with memory, electro-mechanical properties that enable them to harden or soften, contract or expand, and to change texture depending on the situation.

- New horizons in context awareness: objects will be able to propel themselves into the foreground of your attention or retreat to the periphery of your world.

- New responsiveness paradigms: Real-time, learning, self-organizing systems.

- New perspectives from enhanced senses.

- New spaces will enable all devices to become responsive to the playing of various forms of media, whether video, audio or interactive games.

- New presence projecting the self into remote locations.

EMERGING ROLE OF DESIGN:

Designing a creative and entertaining society (an Experience Economy embedded into the Dream Society and Creative Man logics) means developing products and services to co-create new experiences with a broad perspective of immaterial, multi-sensory, ideological and emotional qualities.

Design has to make a switch to exploring the narrative potential of consumer products to engage people in the ceremonies of using them. It has to consider technology as an experience in relation to the creation of products and services, which respond to subjectivity, and volatility of our moods, wishes and lifestyles. It should challenge new forms of intervention that create enriched interactions, anticipating behaviors with new technologies. Thus considering inner needs, desires and fantasies as user experience requirements to design highly innovative fantasy driven product interaction experiences.

This approach to design will be described further in the following paragraphs with some examples of design concepts, research projects and artistic installations.

Exploring the narrative potential of consumer products

Electronic products occupy a strange place in the world of material culture, closer to basic goods than furniture and architecture. Form and texture, function and behavior, are manipulated to evoke a realm of fantasy and fiction, decreasing the distance between everyday life and the world of advertising and branding [Dunne & Raby, 2001]. What is common for all existing relationships with electronic objects is that they carry within them a story or narrative that unfolds as people engage in the ceremonies of using them [Ailly et al., 2005]. Despite this fact, the unique narrative potential of consumer products has received surprisingly little attention from artists and designers [Dunne & Raby, 2001].

From a postmodern approach to design that is more interested in connotations than denotations, in storytelling rather than in strict functionalism [Cornell, 2005], electronic products and services could enrich and expand our experience of everyday life rather than closing it down. They could become a medium for experiencing complex aesthetic situations [Dunne & Raby, 2001]. Then, designers will need to understand that their products are less important than their stories. Designers will become storytellers, specialists in the art of conveying human emotions [Jensen, 1999]. Thus, design will rely on the basis of people's stories and myths, on their ability to create products and services that allow the expression of physical behaviors [Wensveen, 2005] and personal reflection. Two examples of experimental research focusing in this idea are the Placebo and Reflection through interaction projects.

Dunne and Raby have investigated different experiences and genres, environments and products that can be disturbing, subversive, funny and poetic. The Placebo project [Dunne & Raby, 2001] was developed to explore not only the relationship with electronic objects but also how these objects mediate personal stories and myths.

The project focused precisely on an invisible but very real landscape. One shaped by electromagnetic forces that people do not usually acknowledge and can hardly sense. It explored mental well-being in relation to domestic electromagnetic fields when items of furniture that made up the Placebo collection were 'adopted' by volunteers around London. **Figure 5.3** shows one example developed for the collection, the Electro-draught Excluder. The object is made from conductive foam, is not grounded, and therefore it does not really absorb radiation. However, people might place the object between them and the TV to create a sort of shadow, a comfort zone where they simply feel better.

> figure 5.3:

The Electro-draught Excluder photograph by Jason Evans, one of the items of furniture made for the Placebo collection [Dunne & Raby, 2001]

Mattias Ludvigsson in his MSc thesis (Reflection through interaction: Raising energy awareness among young people with interaction design and speculative re-design of personal objects [Ludvigsson, 2005]) introduces speculative re-design and suggests that it can be used for giving provocative properties to re-interpretations of existing objects. This design project resulted in three themes of conceptual design proposals, represented by sketches and mock-ups without technical functionality, which all exemplify how existing personal objects can be re-designed in order to raise energy awareness among young people. The provocative behaviors inherited in the design proposals are all illustrative examples of how interaction design can be used to achieve reflection through interaction. See **figure 5.4**.

> figure 5.4:

The Power-Aware Cord is a power strip visualizing the amount of electricity flowing through connected appliances, a design example illustrating the invisible nature of energy [Gyllensward & Gustafsson, 2005]

Viewing technology as experience

Most people engage in a never ending search for the next practical "must haves" in order to ease our everyday tasks, but what about our everyday thoughts, feelings and fears? [Ailly et al., 2005]. In Technology as Experience, John McCarthy and Peter Wright [McCarthy & Wright, 2004] argue that during the design process the emotional, intellectual, and sensual aspects of our interactions with technology must be taken into consideration.

Designers have to rethink technology as material [Mazé, 2005] in relation to the creation of products and services, which respond to the subjectivity and volatility of our moods, wishes and lifestyles. They have to consider technology as an experience that is open to the sensual, emotional, volitional, and dialogically imaginative aspects of the self to find meaning and recognize the potential of new technology for supporting complex emotions and desires [Dunne & Raby, 2001]. Two different research projects exemplify this point of view: IT+Textiles and Emotional Communication.

The IT+Textiles [Redström & Mazé, 2005] was a design research program where traditional textile design meets and, at least to some extent, falls in love with computational technology. This research program was motivated to use new textiles and computational technology as design materials as an attempt to introduce smart products into people's lifestyles. They combined perspectives from fashion, textile and interaction design to find new approaches to the design of computational objects. They used experimental design methods to broaden people's understanding of textiles and information technology as material for design, by means of creating examples illustrating what can be done within this area. Two design concepts developed in this research, the Interactive Pillows (**figure 5.5**) and Reach are described in depth in the following paragraphs.

The Interactive Pillows [Redström & Mazé, 2005] concept focuses on the need for more subtle forms of communication to complement existing IT devices. It explores enhancing long-distance communications through natural interaction with a pillow. Touching or holding one pillow in one location activates dynamic

> figure 5.5:

Images form the Interactive Pillows concept from the 'IT+Textiles' research [Redström & Mazé, 2005]

textile patterns in another pillow located elsewhere. Thus, the pillows offer new expressive possibilities that consider emotional, social, and aesthetic values, expanding the vocabulary for remote communications through tangible and aesthetic interaction. See **figure 5.5** where the colorful and dynamic patters from two different pillows are externally activated.

The Reach concept [Redström & Mazé, 2005] investigates the potential for communication and expression to be incorporated dynamically and interactively into the things we wear everyday, exploring both textile materials and interaction qualities of clothing and accessories. The initial prototypes explored person-to-person communication, proximity, and environmental sensitivity as expressive properties to develop a new dynamic language of wearable expression integrating aesthetics, pattern, and computation into everyday articles with increased personal and cultural meaning. See **figure 5.6** as one of this prototypes where two persons share the patterns in their hats.

> figure 5.6:

The Reach concept and prototype [Redström & Mazé, 2005]

The Michihito Mizutani MA work [Mizutani, 2006] explored the concept of emotional communication through the design and prototyping of three communication concepts for connecting friends and family. The project illustrates how common objects and interests (along with subtle ways of communicating) can connect people to each other and even encourage their communication. The strategy used in each prototype implemented some type of information design into a tangible object i.e. the Talking Glass and Sharing the Moment prototypes.

In the Talking Glass prototype [Mizutani, 2006], when toasting, an arrow is illuminated in both glasses and points in the direction of one of the people toasting. The intention of this work is to make people pay attention to each other and to encourage them to talk about what the arrows mean. At parties, a toast by the glass can function as an introduction between people that are new to each other. Although the arrow itself is very simple information, it is more ambiguous than a text message. It shows only directions but lets people pay attention to each other rather than the object so people can create their own game or way of communication through this tool. See **figure 5.7**.

> figure 5.7:

Talking Glass prototype where a drinking glass is used for social integration.

> figure 5.8:

Sharing the Moment concept to share personal moments by Michihito Mizutani [Mizutani, 2006]

The Sharing the Moment concept [Mizutani, 2006] explores the emotional content of moments that a couple share living together and try to recreate them when they are apart. As an example, brushing teeth is a private act that people do not usually do with other people. However, if a couple lives together, each one usually knows when the other one is brushing his/her teeth. This concept consists of a pair of toothbrush cups that communicate with each other through the Internet. Both cups detect whether a toothbrush is inside it or not and communicates this to the partner cup that is situated in another place. If the cup does not have a brush inside it, the other cup illuminates. When both cups illuminate, it means that, both are brushing their teeth at the same time, but in different places. See **figure 5.8**.

Designing as anticipating behaviors

A range of alternative perspectives and scientific foundations in the design of electronics devices allow for the possibility of imagining and forecasting possible effects on lifestyle and society [Mazé, 2005]. Design should be considered as a form of intervention, which pushes new ways of interaction [Udagawa & Moeslinger, 2007] with the purpose to guide the user, through artifacts, towards not yet existing behaviors.

For this reason, design should go beyond the existing communication paradigms and investigate different paths, from personal to collective interaction. Unassuming intervention from the performer vs. spectator dichotomy should be widely explored to get more information about public intervention. Unexpected reactivity, resulting from aware and unaware interactions, can help us understand how illusory dialogs alter people's behavior, thus reflecting latent desires. Intervention for social interaction should use the intervisitor play to facilitate encounters amongst strangers and enhance cultural dialogue through interaction. Artistic performances to anticipate behaviors are an example of this approach to design [Udagawa & Moeslinger, 2007]. The exploration of the boundaries between art and design can be seen in Antenna's designs and interactive installations, and in Sietske Klooster's [klooster, 2005] Choreography of Interaction product design approach described in the following paragraphs.

Antenna's Blowing Gently interactive installation [Udagawa & Moeslinger, 2007] is a reflection on ephemerality as essence of digital aesthetics, a culturally charged object used as an instruction (a familiar action strangely reinterpreted). In fact, a nostalgic memory from childhood, a soap bubble, serves as the point of interaction, hinting at the subtle action of blowing. Thus, visitors become an

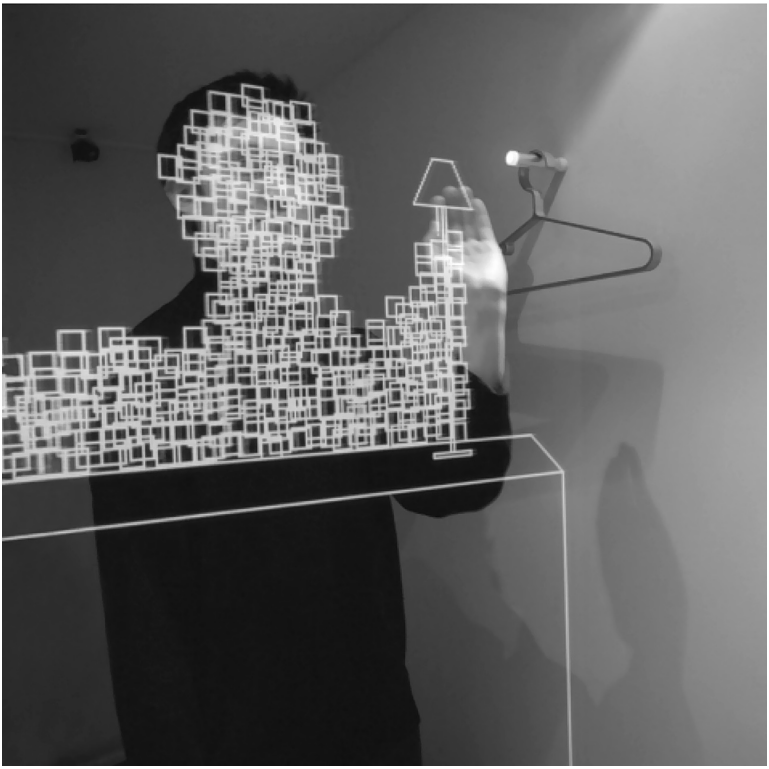
integral part of the installation, as it is their breathing that opens up a succession of events. By blowing at different lengths and intensities, visitors create male and female creatures, which seem to float of into space. Each creature has an individual behavior, which causes different reactions when bumping into each other. See **figure 5.9** for a general view of the installation.

> **figure 5.9:**

Blowing gently interactive installation. Frederieke Taylor Gallery, New York 2001 [Udagawa & Moeslinger, 2007]

The Emperor's New Clothes interactive installation utilizes a classic tale as a conditioning device, where interaction reveals the story. Faced with five illuminated coat hangers carrying invisible clothes (like the famous Andersen's fairy tale), the visitor is encouraged to pick up a hanger. The fitting room

features a magic mirror, which shows floating animated images superimposed onto viewer's reflection. The images react to the visitor's body and movement, thus creating a notion of altered/augmented self. The projected images are not clothes, but are the effects of transformations that the invisible clothes create. See **figure 5.10**, which shows the magic mirror in the fitting room where visitors can see their augmented clothes.



> figure 5.10:

The Emperor's New Clothes interactive installation. Artists Space, New York, 2001 [Udagawa & Moeslinger, 2007]

In Sietske Klooster's Design Movement approach [klooster, 2005] Choreography of Interaction is explored and created in interaction and through the moving body of the designer. Consequently, the designer becomes an interaction choreographer, putting himself in the place of the protagonist, or the user. Being involved in the creation, interaction wakens the bodily awareness of various basic issues comprehensively and, at the same time, activates creativity (like in improvisational dance). The use of the moving body as an embodying tool empowers the interaction choreographer to discover and create unexpected, and formerly unexplored, interactive possibilities and combinations.

The Meeting Duet [Boerdonk et al., 2006] challenges people to a sort of body language meeting. The idea is to invite people to jointly explore the possibility of increasing and changing the contact area between them (see **figure 5.11**). Most naturally, touch starts with small groping movements, only with hands and fingers. Gradually people may gain trust, and dare to decrease the distance between themselves and others. With decreasing distance the area of contact increases, together with the level of intimacy. In order to invite people to participate further in this meeting event, tangibility was enriched with visual and audible feedback. The screen shows a nap where it is stroked and a pattern that suggests areas and directions for movement and incorporates an irregular net of hidden points that generate different music samples when touched on both sides of the screen at the same time. Thus, it keeps the people in continuous mutual bodily search to discover new compositions of music, exploring each other's attitude using very direct and mutual body language.

> figure 5.11:

The meeting duet, challenging people into a body language of meeting [Boerdonk et al., 2006]

Creating emotionally driven product interaction experiences

Consumers are adept to life in realms outside their own reality, at times more comfortable in a fantasy realm than in reality. An example of this is the entertainment industry where i.e. movies, video games, amusement parks represent desirable experiences that, at least currently, are not the reality of their own lives [Vogel et al., 2005]. Humans have common fantasies and collective dreams. People dream of adventure, independence, security, sensuality, confidence and power. Design should allow users to explore and reach their fantasies, considering inner needs and desires as user experience requirements to design highly innovative emotionally driven product interaction experiences [Vogel et al., 2005].

Brendan Walker's Chromo II project explores the dynamics of euphoric experiences and offers a design tool for creating tailored emotions. This research investigates the experience of thrill [Walker, 2005a]: how it works, why it works, and what such insights might mean for designers. It specifically explores the idea that thrill can be reverse engineered into contributing factors, drawing on techniques used in criminology and sociology.

> figure 5.12:

Seatbelts, part of Airlife collection of thrill [Walker, 2005b]

These factors were used as a resource to create new ways to thrill. Current areas of design application include dining (Neophile) and air-culture (Airlife). Neophile [Walker, 2005b] is a dining menu of thrilling gourmet experiences based on industrial conveyance systems, fine cuisine and theatre. Airlife [Walker, 2005b] is a collection of thrill rides based on the fusion of the European Airbus A340 and the English home (see **figure 5.12** as an example).

The Hard-wired devices by Roger Ibars are a collection of vintage electronic devices (from 70s and 80s) in which two cultures of interface blend: the computer game culture and the household appliances culture. The first one is represented by the golden age of computer games. Devices such as joysticks attract people's attention to touch and use them in the sense that they are very welcoming. More functional and serious electronic devices such as alarm clocks represent the second one (products with a rational interface that simply tells people what to do). The result is a new functional electronic device with an upgraded interface that allows you to set up the time and the alarm of the clock using different joysticks, game pads or light guns, changing the predetermined experience people have about how a object should function and its meaning. This project reviews the contradictions and beauty of these two different interaction design cultures. All devices have been restored and re-manufactured to create new interaction beyond impersonalized and mass produced interfaces. The final objects are unique and functional pieces that review the last 20 years of electronics objects and point the direction of interaction design towards the fundamental values of playing like flexibility and fun. See **figure 5.13** for an example of the Hard-wired devices.

> figure 5.13:

Atari gun shoots Panasonic from the Hard-wired devices by Roger Ibars, 2006 ©

CONCLUDING REMARKS

The emerging economy paradigms leave the door open to a population hungry of new experiences and the emerging technology realm gives the rough material to create them. Thus, these design examples show an optimistic path to explore these emerging possibilities through an experience driven approach where the interaction leads the design process in order to create behaviors closer to users' needs, desires and fantasies.

6.

characterizing a subjective experience approach to interaction design

Partially extracted from Tomico, O., Hailahti, H. and Lloveras, J. "Augmented subjective experiences: a non-intrusive way of introducing smart textiles into the everyday life" In User Experience – Towards a unified view workshop at NordiCHI 2006, Oslo, Norway. October 2006.

Product interaction design deals with a broad number of aspects as it is the link between different product characteristics, functions, usage and user's needs, desires and fantasies. The role of the interaction designer consists of designing new complex and dynamic interactions with converging hardware and software, spaces and services. This emerging field demands new design approaches, specific considerations and, ultimately, the design of integrated experiences set in context, rather than of individual components [Fulton Suri & Buchenau, 2000] to go beyond and attain a deeper relational sense with the user, especially on the emotive level.

Too much effort has been put into the functional area of perceived experience (form, color, texture and material). In fact, dynamic aesthetics not only considers how humans perceive products, it also shows how to respond to them (i.e. the resulting effective relationship ensuing from the encounter between the product and the user). Therefore, the design effort and creativity have to be focused on creating enriched interfaces that fulfill users' expectations and desires and also evoke pleasurable experiences. Precisely, interaction design has to move from communicating product characteristics and functions through physical appearance and behavior to envision contexts for enriched subjective experiences [Hummels & Overbeeke, 2000].

This chapter explores the complex field of study of understanding user experience and focuses on defining the users' subjective experiences. It then describes the design for experiencing as an approach for augmenting subjective experiences, positioning it in user experience frameworks and illustrating it with some examples of smart textiles designs.

REACHING THE SUBJECTIVE SIDE OF USER EXPERIENCE

Different studies on the topic of user experiences have lead to a variety of definitions of the term. User experience can be considered as a very dynamic, complex and subjective phenomenon based on appreciation and the resulting relationship ensuing from an encounter between the object and the observer:

- It is something that occurs continuously, because the interaction with the environmental conditions is involved in the basic process of living [Dewey, 1980].

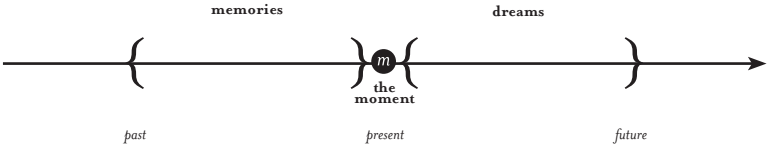
- Depends on the perception of multiple sensory qualities of a design (visual, taste, olfactory, kinesthetic, auditory and touch).

- It is interpreted through filters relating to contextual factors [Fulton Suri & Buchenau, 2000].

Sanders [Sanders, 2001] describes the experience domain relating it to present, future and past times (See **figure 6.1**). Present experiences last only for the moment and are ephemeral. Past experiences are memories. Future experiences (not yet lived but imagined) are dreams. Finally, experiencing the present is the point where memory and imagination meet [Sanders, 2001]. The present moment is based on past memories as people interpret what is happening around them, referencing past experiences (memories) while also relating to the dreams of our imagination. People interpret what is going on around them in anticipation of their hopes and fears for the future.

> figure 6.1:

The experience domain related to the present, past and future by Sanders [Sanders, 2001]



Gathering information about user experience can be done in many ways, but each route to experience reveals a different story [Sanders, 2001]:

- Listening to what people say tells us what they are able to express in words (explicit knowledge).

- Watching what people do and seeing what they use provide designers with observable information (observable knowledge).

- Discovering what people know helps us to communicate with them.

- Understanding how they feel gives designers the ability to empathize. This form of investigation provides knowledge that cannot readily be expressed in words (tacit knowledge).

- Evoking people's dreams shows their personal aspirations for the future. It can reveal inner needs not recognizable in the present time (latent knowledge) through a guided discovery process, putting them in touch with their feelings and dreams.

These aspects of user experience involving feelings about accomplished needs, desires and fantasies are called subjective experience information. To obtain this kind of information and use it for design purposes, user experience design process needs to be analyzed from a different perspective, focusing on the psychological relationship between users and their personal world of products and services.

DESIGN FOR EXPERIENCING AS AUGMENTING SUBJECTIVE EXPERIENCES

Design for experiencing addresses the whole user experience [Sanders, 2001] considering the product related to the environment, the social situation, knowledge, culture and personality of the user. It puts human experience first and builds to support and enhance it (starting with real people and their needs and expectations, not with technology [Sanders, 2001]).

Although the common use of the term 'user experience' is recent, experiences have always been a design related topic. Nowadays, the term experience has become an umbrella concept that encompasses different aspects of the user-product interaction, including usability as well as more ephemeral feelings and additional aspects such as entertainment and events [Battarbee, 2004]. Despite the fact that the term is used widely and is related to the complex domain of personal emotions, there are key differences between the study of product-related emotions and user experience studies [Battarbee, 2004].

User experience can be approached from different points of view. Consequently, different user experience frameworks have been developed, i.e., person-centered frameworks, product centered frameworks and interaction centered frameworks [Battarbee, 2004]:

- Person-centered frameworks are approaches that focus on the individual's experience and the elements that contribute to it.

- Product-centered frameworks have their basis in connecting product features to experience and creating checklists describing the product-related experience contexts.

- Interaction-centered frameworks base their approach in focusing on the interaction between person and the product in its context. There are two ways of developing the latter approach: from an experience focus (describing user's experience in relation to time) and from a focus on perception and meaning (describing changes to how the moment is experienced).

The aim of augmenting subjective experiences is to create enhanced contexts for experiencing. Positioning this point of view in the user experience frameworks described above, makes for the abandon of person-centered and product-centered approaches as they are too static and, in some cases, time sequence is not included [Battarbee, 2004]. Focusing on an interaction-centered framework can lead designers to develop design and information methods from an experience of interaction point of view as experiences happen in a scene of various dynamic aspects [Jääskö et al., 2003]. In an active relationship with other people, places and objects [Fulton Suri & Buchenau, 2000].

Considering design for experiencing as augmenting subjective experiences, designers should focus on unveiling people's inner needs and desires (i.e.

consumers' unmet and unconscious fantasies for a broad spectrum of product experiences with the purpose) to forecast future interaction behaviours and increase people's awareness and acceptance of technological developments. Thus, the aesthetic understanding is sought through the subjective experience of the object to establish guiding ideas of aesthetic sensibilities and product appreciation for improved design practice. Intrinsic and affective product qualities that a designer needs to take into account in the object-user relationship were studied, so as to incorporate them into the design object and/or the design process.

To apply this approach based on augmenting subjective experiences into interaction design, different themes need to be addressed in the product development process:

- From the design team point of view, designers need to acquire a sensitive and emphatic understanding of what user-product interaction consists of and also creative skills to comprehend and assess it [Klooster et al., 2004]. In order to consider designing subjective experiences as a way to design a product that is multi-sensorially delightful.

- Based on this participatory approach, designers take into account the user's point of view. Subjective experience design is about designing with people and not just for them. This leads to the development of new tools of design for subjective experience [Sanders, 1999] based on collective generation and a participatory culture. Generative methods are a new language that enables all stakeholders to contribute directly to the development of products and services. Participatory methods allow for the people's need to express themselves and to participate directly and proactively in the design process.

- Thinking about integration into product design process, there are three different kinds of activities where a subjective experience approach should be used [Fulton Suri & Buchenau, 2000]: understanding and evaluating existing user experiences and contexts, exploring and generating new design ideas and communicating this ideas among the design group and with the users.

EMERGING EXAMPLES OF AUGMENTED SUBJECTIVE EXPERIENCES

As part of a Functional Design project module in the School of Design, University of Art and Design Helsinki, a Multimodal workshop was held for the MA students during autumn 2005 with the purpose of exploring the easing of people's dislikes, aversions and fears in everyday life that lead to unpleasant subjective experiences. It was a collaborative interdisciplinary workshop for two separate schools, the School of Design and Media Laboratory. Students from several study programs explored the emerging possibilities of combining textile materials, multimodal information technology and interaction design techniques to create more emotionally rich experiences. The following conceptual examples (Lighting Curtains, Wax de Luxe, Story Pets and Hugging Friends) provide descriptions and analysis of the unpleasant experiences that were chosen for improvement, the augmented experiences generated, the product concepts and the emotional impacts.

The unpleasant subjective experience addressed with the Lighting Curtains concept was the shock and dismay that occurred after being woken early in the morning by an alarm sound. The generated augmented subjective experience was to create a natural way of waking up, much like waking up with the sunrise. When we wake up with light it is because a reduction of the secretion of melatonin hormone, the natural regulator of sleep-wake cycles [Cajochen et al, 2003]. On the other hand, when we wake up with a high sound from an alarm clock the body segregates adrenaline, which plays a central role in the short-term stress reaction (it is the physiological response to threatening, exciting or environmental stressor conditions such as high noise levels).

The product developed was a light-emitting curtain connected to a mobile phone and programmed to increase the amount of light minutes before the alarm starts. To stop the alarm and the light from the curtains the user would have to open the curtains (See **Figure 6.2**). The emotional impact of this experience prototype helped the user to have a natural awakening experience, as a gradually increasing light can be considered more relaxing and non-disturbing. Allowing connectivity with electronic devices also made this curtain suitable for other uses. It could be a critical objects reminder (use extra sockets in the electric supply connection to communicate with Bluetooth to the curtain), for example a steady light on the sides, which signifies that the oven is on.

> figure 6.2:

Image samples from the conceptual experience scenario from the Lighting curtains concept Orhan Daybelge, Korhan Büyükdemirci and Michihito Mizutani.

The unpleasant experience addressed in the Wax de Luxe concept was related to cleaning clothes and the way to verify if they are dirty. Students analyzed the never-ending exasperating experience of going inside your children's room to pick up dirty clothes from a messy pile. They concluded that smelling clothes on the floor to determine which are clean or dirty triggered an unpleasant subjective part of the experience. The generated augmented experience was to create a new way of perceiving dirt in the clothes instead of smelling them. They considered communicating with the clothes in such a way that they 'tell' you if they are dirty or not. The product developed was a special textile for clothing or for a clothes label that reacts to the PH level (acidity) changing the color after a certain period of time (See **Figure 6.3**).

> figure 6.3:

Image samples from the conceptual experience scenario from the Wash de luxe concept by Paula Susitaival, Alexandre Estadieu, Hong and Joonas Juutila.

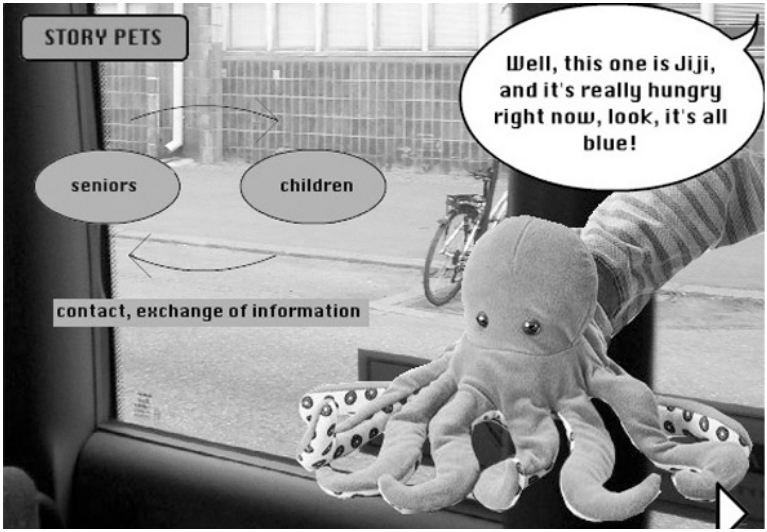
The emotional impact of these textiles is based on informing the user of odors by changing color as the odor level passes a certain standard. Unpleasant odors can evoke unpleasant memories and avoiding this perception can help easing anger in this situation. Studies on the effects of pleasant and unpleasant odors on retrieval of happy and unhappy memories reveal that subjects in a pleasant odor condition produced a significantly greater percentage of happy memories than did subjects in an unpleasant odor condition [Cattan et al., 2005]. This can be considered added brand value in terms of the customer's feeling of security and wellbeing and is also suitable for other uses. For example, these textiles applied to children's clothing can also be educational as they teach appropriate cleanliness.

In the Story Pets concept, the unpleasant subjective experience was the loneliness that people have because a less real, face-to-face contact with other people, affecting their abilities to share and be empathic. This situation worsens with communication between different age groups. Nowadays, the contact between elders and their grandchildren tends to decrease, as most adults move from their

parent's homes and are busy with their own lives. The care and support among individuals in a community is essential for everyone. Due to different reasons, some elders may become socially isolated. Preventing and alleviating social isolation and loneliness among older people is an important area to study. The review of health promotion interventions [20] suggests that educational and social activity group interventions that target specific groups can alleviate social isolation and loneliness among older people. With this product concept, the generated augmented experience was to create something in which grandparents and younger generations would share an interest.

The idea for the story pets was to create an attractive product for children, in this case stuffed animal-shaped gloves, covered with a chameleon fiber textile that changes color when 'hungry' and has to be fed with stories from elderly people (see **figure 6.4**). This product was designed to bridge a generation gap, to enable communication face to face through storytelling and even to create accidental friendships. For kids, this product can increase their curiosity about the past and elderly people through their stories. For elderly people, this product can help them to share their experiences and feel valuable and useful.

In the Hugging Friends concept, the stress reactivity that arises when people get lost in an unknown space was the subjective experience to improve. It focused on urban people moving in cities, such as a family or groups of friends that want to stay together, and explored the situation where young children feel lost (e.g. in the metro, park, museum) because of lack of visual contact. The generated augmented experience was to carry your friends in your pocket and to support finding friends or relatives through an analogy with the cold/warm game. The subjective enhancement is based in that attachment security in childhood is related



> figure 6.4:

Image sample from the conceptual experience scenario from the Story Pets concept by Simone Pallotto, Minttu Wikberg, Maja Gecic and Vilja Helkiö.

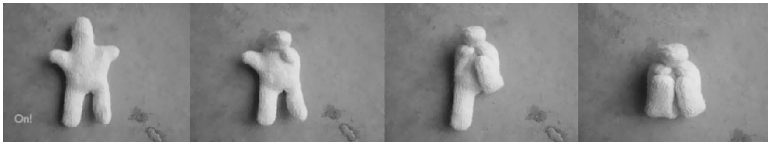
> figure 6.5:

Image samples from the conceptual experience scenario from the Hugging Friends concept by Maikki Rytkönen, Richard Widerberg and Erja Alander.

to the warmth of their relationship and moderates the physiological consequences of fearful, inhibited temperaments [Gunnar et al., 1996].

The product developed was a human-shaped doll that becomes warmer when someone carrying a doll with the same clothing is near (See **Figure 6.5**). Different clothing can be made for different settings and different groups. The clothing changes color according to temperature, but only changes color for the people from the group that are near.

Because this soft tactile product becomes warmer and warmer as the friends or relatives come closer it stimulates a relaxing feeling of proximity (security attachment) and makes the user look forward to giving and receiving a handshake or a hug (physical contact that can be considered warm). The user will respond to the artifact's function with natural human interaction activity. Moreover, opening its arms means the user is open to meet someone. Closed arms mean the person is trying to protect himself/herself. (See **Figure 6.6**) This product was designed with the idea of keeping track of each other and can be applied to families, group of tourists and children in the kindergarten. But could also be used as a game (e.g. playing with your friends in the urban jungle).



> figure 6.6:

Image samples from the on/off sequence in Hugging Friends concept by Maikki Rytkönen, Richard Widerberg and Erja Alander.

CONCLUDING REMARKS

These design examples give an idea about the usefulness of users sharing their needs, desires and fantasies and even their dislikes, aversions and fears with designers in order to create meaningful experiences. Moreover, they show how designing for experiencing, as augmenting subjective experiences, is a creative and powerful source of innovation and a door open to a non-intrusive introduction of new technologies in everyday life.

7.

emerging difficulties in addressing the subjective experience

Partially extracted from Tomico, O., León, J., Molokwane, S. and Lloveras, J. Designing product experience through user perception and interaction methods (2005) In Proc. of the 2nd International Design and Engagability Conference (iDec2) at the 19th British HCI Conference, UK.

Human needs, values and emerging socio-cultural trends are the key aspects to a design process that generates initial ideas for experience solutions [Goulden & McGroary, 2003]. Yet, how can values, beliefs, and assumptions be extracted from the potential users? There is not much history in terms of traditions, expectations and interpretations to lean on and react against when introducing new kinds of objects such as new technologies [Reström & Mazé, 2005]. The way people interact is temporary and circumstantial.

Connecting with consumers' emotions and desires makes one experience more appealing than another [Vogel et al., 2005], but how are these values, beliefs and assumptions translated into a product or a service? Which physical characteristics, functionalities and interaction behaviors of a product induce the desired experience to the user? Currently there is a lack of vision and anticipation about future interaction possibilities.

This chapter analyzes the emerging difficulties in addressing the subjective experience in relation to the current methods used for gathering user experience. Furthermore it underlies the basis for a more adequate perspective to subjective experience gathering techniques.

ANALYZING THE LIMITATIONS OF GATHERING SUBJECTIVE EXPERIENCE INFORMATION

Listening and interpreting thoughts of intended users is the first step in the process of gathering subjective experience information. By determining users' needs and desires, latent or explicit, the designer is then able to translate them into functions and product characteristics to be accomplished by the product. Nevertheless, the process of listening and interpreting presents a fundamental problem: the difficulty of achieving adequate communication between user and designer. Emotional and aesthetic elements, which (because of their subjective nature) need to be considered methodically, depend substantially on the product's design and also are intrinsically differentiated in people by social and cultural factors. The origin of communication problems between designer and user is summarized by three main causes, explained as follows:

- Language differences. User perception of a product is comprised by a context and circumstances different than the designer and therefore expressed in a different language, absent from technical jargon.

- Semantic differences. There is no common language and no common base of semantic meaning of words describing products and the way they describe product requirements.

- Knowledge limitations. There is no cognizance from the designer of methods to collect, prioritize and interpret subjective user needs regarding a product.

At the same time, product design theory lacks structured and trustworthy mechanisms to compile, interpret, hierarchize and incorporate intangible, qualitative product attributes, allowing for an answer to these questions:

- How to predict users' subjective needs, desires and fantasies?

- How to identify the desired subjective experience before designing the object?

- How to anticipate the evoked emotions before one design proposal?

EXISTING USER EXPERIENCE INFORMATION GATHERING TECHNIQUES

There are many ways in which we can learn from people about their memories, their current experiences and their ideal experiences. The most widely used techniques used for gathering information about user experience can be classified in inquiry methods, inspection methods and test methods [Horn & Rauterberg].

Inquiry methods obtain information about users' likes, dislikes, needs, and arrives at a common understanding by talking to them, observing them using the system in real work, or letting them answer questions verbally or in written form. Thus, inquiry methods can have a contextual approach (like Contextual Inquiry, Ethnographic Study, Field Observation, Naturalistic Observation, Proactive Field Study, Rapid Ethnography), a group approach (like Focus Groups, Group Discussion, Future Workshops), an individual approach (like Surveys, Questionnaires, Interviews) or a remote approach (like Journaled Sessions, Self-reporting Logs, Screen Snapshots) depending on the way users are approached.

Inspection is the analysis of the user experience with a product or a service by specialists and users. Using task scenarios or a set of heuristics, experts evaluate problems and determine ways to improve the experience. Inspection methods like Formal Usability Inspections, Feature Inspection, Consistency Inspection, Standards Inspection, Heuristic Evaluation, Cognitive Walkthroughs, Pluralistic Walkthroughs or Guideline Checklists are the basic forms used in this approach.

In testing methods, representative users work on typical tasks using a product (or the prototype) and the evaluators use the results to analyze the experience and see how the interaction supports the users to accomplish their tasks. Testing methods like Performance measurement, Thinking Aloud protocol, Question asking protocol, Coaching method, Shadowing method, Teaching method, Co-discovery method, Retrospective testing or Eye-tracking are widely used.

The problem with these user experience gathering techniques is that the overall information (e.g. diaries, photos, stories) can hardly be used in the design process without being interpreted and modified (an indirect link between subjective information about users needs, desires and fantasies; and product characteristics). Today's methods and tools to evaluate pragmatic aspects of user experience (which are closely related to issues like usability and designed to be used at the task level) are not useful if practitioners want to apply them to evaluate other issues (i.e. emotions and affect, social interaction) that are strictly related to aspects of product usage. Quantitative analysis and hypothesis and validation approaches cannot deal in a structured way with this amount of information and the results obtained are ephemeral and complex to measure. This is why different questions emerge about the validity of existing user experience evaluation methods.

Traditional user research in early stages of product development is based on the objective thought approach to psychology. This is a way of thinking that separates the subject from the object and attempts to define features in the real

world that cause certain behaviors [Hammond et al., 1991]. It proposes that the experiential world consists of separate objects, whose dimensions and properties can ultimately be known and measured; with causal relations exist between them [Butt, 2003]. Unfortunately the world is more complicated than this. Everything in it is ambiguous, and objective thought simply does not represent the lived world of personal experiences [Butt, 2003].

For example, when psychologists and later design researchers have studied emotions they have at times attempted to account for the complex mix of feelings in the subjective experience by proposing a number of primary emotions that can be mixed together (like primary colors) to produce any number of secondary emotions [Russell, 1995][Desmet, 2002]. Instead, people often feel two supposed opposite emotions at the same time (love and irritation, joy and sadness). When this happens, one emotion does not cancel the other out [Butt, 2003].

Traditional user research has usually separated a person's processes into different faculties (thought, emotion and behavior), but personal experiences cannot be split up in this way [Butt, 2003]. Therefore, internal relations apply where one feature of the lived world cannot be specified without implying the others. In a similar way, internal relations apply between the person and their world. Every description comes from a particular perspective, and people cannot put all perspectives together to arrive at a God's eye view and separate the subjective from the objective point of view [Butt, 2003].

Research on practice from an objective perspective adopts correlational or quasi-experimental methods. It normally uses descriptive and inferential statistics and adopts an instrumental view of the relationship between the researcher and the researched, in which the studied field is understood in a third person perspective [Kennis et al, 2000]. Thus, an approach that attempts to reduce, quantify and materialize user experience obtains an impoverished representation of user experience that does not adequately represent interaction with a product or service and thereby dismisses the designer's ability to build enriched and pleasurable experiences [Kaye & Taylor, 2006].

PROPOSED POINT OF VIEW TO SUBJECTIVE EXPERIENCE GATHERING TECHNIQUES

The user experience field includes a broad number of different aspects regarding interacting with products or services. These aspects of user experience involving feelings about inner needs, desires and fantasies are what we call subjective experience information. To obtain this kind of information, user experience must to be analyzed from a different perspective. Subjective experience gathering techniques move beyond performance-based objective paradigm from traditional usability and other current user centered design techniques. It focuses on a wider point of view where users needs, desires and fantasies have a role in users decision-making process.

User experience information gathering techniques should study the psychological relationship between the user and products or services and focus on simultaneously analyzing the four threads that relate to the experiential world [McCarthy & Wright, 2004]:

- The Sensual Thread is concerned with the sensory engagement with a situation and orients people to the concrete, palpable, and visceral character of the experience.

- The Emotional Thread is related to the understanding or sense-making process (the sense or meaning ascribed to an object or person because of their values, goals, and desires).

- The Compositional Thread, which establishes relationships between the parts and the whole of an experience.

- The Spatial-Temporal Thread, which encompasses the spatial and temporal component of experience, particularly, how it is connected to our past and is related to our future.

With this notion of threads, the idea is to capture the multi-facetted, interweaving nature of the different aspects of human experience, which are continually active in parallel and perceived as unity when people are trying to make sense of the continuous flow of experience. This emphasizes that understanding experience is becoming aware of the construction of self through objective and subjective thoughts. Objective or extrinsic thought is the meaning placed on a purpose outside the immediate experience in which a person is engaged. In other words, this is the meaning that traditional human computer interaction (HCI) would focus on. Subjective or intrinsic thought, however, refers to what is called the emotional-volitional shading of an event [McCarthy & Wright, 2004]. That is what a person feels about a situation and what his or her primary goals and concerns are.

Therefore, user experience information gathering techniques should allow for the analysis of user experience from the perspective of the construction of the self, relying on the following six steps of the sense-making process [McCarthy & Wright, 2004]:

- Anticipation, a continuous process in experience that also comprises the reflection on the consequences of some planned future action.

- Connection, referred to the immediate, pre-conceptual and pre-linguistic sense of an encountered situation.

- Interpretation, involving the narrative structure, the agents, and possible actions, what has happened, and what is likely to happen.

- Reflection, involving judgments about an experience as it unfolds.

- Appropriation, which makes an experience personal by relating it to the sense of the self, personal history and the anticipated future.

- Recount, which is fundamentally dialogical and involves telling the experience to others or ourselves.

Having provided some ideas of the key processes approaching subjective experience, is important to understand and interpret the threads and the sense-making processes in the context of personal receptiveness in order to enhance the relationship between the participants integrating the information gathering process (users and researchers) [McCarthy & Wright, 2004]:

- A situated creativity of action allows personal involvement of people creating both goals and means related to the engaged activity.

- The openness of experience encourages people to see the difficulties and the process that underlie order.

- A weight of answerability enables people to see experiences as simultaneously aesthetical and ethical.

- Holism and unity avoids reducing the relational and multi-layered quality of the experience of living.

- Sensory engagement orients people toward its immediate, pre-linguistic sense and its reflective interpretation.

- The emotional-volitional character of experience makes visible the sensing of self-other relations.

CONCLUDING REMARKS

This proposed point of view allows for analyzing user experience from the perspective of the construction of the self in order to enhance the personal receptiveness of the participants and increase the reliability, thoroughness and validity of the information obtained. The developed subjective experience gathering techniques described in the following parts of this dissertation are developed following this approach.

Part 3: capturing users' subjective experience information

8. Focusing in constructivist psychology for gathering subjective experience information.

9. Analyzing the role of constructivist psychology methods into subjective experience gathering techniques.

10. Applying constructivist psychology methods into user subjective experience gathering techniques.

8.

focusing on constructivist psychology for gathering information on the subjective experience

Partially extracted from Tomico, O., Pifarré, M. and Lloveras, J. "Analyzing the role of constructivist psychology methods into user subjective experience gathering techniques for product design" In ICED'07, August 2007, Paris, France.

For the last several years, the design process has been seen as a close dialogue between various competences. Research into users, contexts and cultures has increasingly taken part in product development cycles. Yet this structured by the objectivist assumption that users are not creative and do not know what they want. [Jensen, 2004]

A new approach is emerging in which potential users are invited to participate with designers in the actual development process. People are now beginning to take part in the design process, as adapters of the designed artifact or even as co-creators [Sanders, 2005]. Therefore, design research may be improved by including new sociological, anthropological and psychological methods to envision possible futures and behaviours [Green, 2003] based in the new approach, a subjective paradigm.

This chapter describes constructivist psychology as an example of this change of paradigm and why is it relevant for user experience research in early stages of product development. A general overview of this proposed point of view is introduced through constructivist psychology techniques to user experience practitioners. In this case, the study focus is the psychological relationship between users and products or services, analyzing the subjective experience from users viewpoint.

INTRODUCTION TO CONSTRUCTIVIST PSYCHOLOGY

From the Constructivist point of view, the world of human subjective experience (human affective experience [Neimeyer R., 1995a]) is a fragile human construction, supported by an innate private and shared search for an acceptable level of order and predictability in life, as well as the need to find some foundation for personal actions.

Constructivist psychotherapy is based in a diverse and subtle interchange and negotiation of personal meanings (constructions) between the client and the therapist. The process involves precisely articulating, elaborating, and revising the constructions that the client uses to organize her or his experience and actions [Neimeyer R., 1995a]. Several features of the psychotherapy process have to be emphasized, including:

- The delicacy with which the therapist must explore the experiential world of the client
- The dialogical and discursive basis of their interaction
- The contributions of the client and the therapist to their mutual investigation

These three aspects reflect a more fundamental human approach in the search for relatedness, connection, and mutuality of meaning, between the client and the therapist, using the common ground provided by our own language and our embodiment to form an inter-subjective bridge between their phenomenal worlds [Neimeyer R., 1995a]. At a more general level, this process involves working with clients to develop a detailed representation of often inaccurate constructions in which they are emotionally related and define what they consider a viable course of action.

Constructivism emphasizes the role of the individuals in defining meaning, and in that way framing experience, constituted by the linguistic conventions and cultural narratives in which they are embedded. However, constructivist techniques can be useful with both individuals and collectives. It is possible to apply this perspective even in such subjective processes, like memory, that have collective dimensions. In these processes, thought is in an important sense distributed through larger social and linguistic networks, with individuals organizing the meaning-making process [Neimeyer R., 1995a].

CONSTRUCTIVISM, A CHANGE OF PARADIGM IN PSYCHOLOGY

Constructivist psychology can be considered a change of paradigm as its foundations differ from previous approaches. Constructivism is based on the constructive and semantic processes of human memory, language and cognition, breaking from the more associacionist, determinist, and more precisely, the objectivist perspective [Neimeyer R., 1995b]. See **table 8.1** as a brief summary of the main epistemological contrasts between objectivist and constructivist approaches to psychology.

> **table 8.1:**

Summary of the main epistemological contrasts between objectivist and constructivist approaches to psychology by Neimeyer [Neimeyer R., 1995b]

	APPROACH	
Assumption	**Objectivist**	**Constructivist**
Nature of knowledge	Representation or copy of real world	Construction of subject's experience & action
Validation of knowledge	Correspondence theory of truth; veridical matching of knowledge claims and real world as revealed through senses	Coherence theory of truth; pursuit of viable knowledge through internal consistency and social consensus
Nature of truth	Singular, universal, ahistorical, incremental	Multiple, contextual, historical, paradigmatic
Goal of science	Unificationist; discovery of nomothetic laws	Pluralist; creation of local knowledges
Scientific method	Prescriptive; emphasis on quantitative measurement and controlled experimentation	Anarchistic; emphasis on qualitative methods and narrative-hermeneutic anaylisis
Human mentation	Reactive; "map" of actual events and relationships; meditational	Proactive; "plan" for organising activity; predicational
Basic unit of meaning	Concept or schema assimilating events on the basis of similar inherent features	Construct or distinction stablishing meaning through contrast
Relations between meanings	Associationist; cognitions as isolated self-statements or rules based on past contingencies	Systemic; constructions hierarchically arranged in self-organising structure
Role of language	Mediates social reality; system of signs	Constitutes social reality; system of differentiations

Contemporary cognitive psychology is still dominated by rationalist and objectivist perspectives, which have traditionally avoided the phenomenological realm and the complex nature of the lived human experience. From their point of view, reality is understood as an objective external order that exists independently from people's observations [Guidano, 1995]. Subsequently, they focus their preoccupation with objectivity, experimental control, and the development of a secure knowledge base to guide applications to practice and obtain a veridical matching of the knowledge claims and real world as revealed through the senses (correspondence theory of truth) [Neimeyer R., 1995b].

Three central theses underlie the objectivism concept of the human experience [Mahoney, 1988]:

- An objective, separate real world lies beyond the organism and exists independently of being perceived.

- True or valid knowledge about the world is ultimately rendered through sensory experience.

- Knowledge can be totally separated from the individual.

The ensuing psychotherapy relationship between the client and the therapist coming from this approach can be considered hierarchical. The client has a passive role and the therapist uses an indirect procedure, looking at the client's experience from the outside.

From such a non-objectivist perspective like constructivism, an essential task becomes understanding how people's characteristics as observers are involved in the process of experiencing. How people participate in co-creating the dynamic personal realities to which they individually respond [Mahoney, 1989]. This shift to a participatory epistemology leads to a radical change in traditional formulations of human experience, human knowledge, and professional assistance [Guidano, 1995].

Constructivism psychology includes a diverse family of theories and methods, but all of them are based in three interrelated principles of human experience [Mahoney, 1995]:

- Humans are proactive participants in their own experience-that is, in all perception, memory, and knowledge.

- The vast majority of the ordering processes organize human lives to operate at tacit levels of awareness.

- Human experience and personal psychological development reflect the ongoing operation of individualized, self-organizing processes that tend to favour the maintenance of experiential patterns. Although uniquely individual, these organizing processes always reflect and influence of social systems.

From these principles, four basic metaphors for therapy, explicit or implicit in constructivism writing, emerge showing therapy as personal science, as a selfhood development, as a narrative reconstruction and as a conversational elaboration [Neimeyer R., 1995b].

Therapy as a personal science signifies the consideration of clients as experts in their own experiential world, adopting what Kelly [Kelly, 1955] has referred as a credulous approach. The therapist takes the client's perspective seriously and respects it [Neimeyer G., 1995].

Therapy as self-development is understood as a willingness to use the client's personal knowledge system and to see the problem and the world through his or her eyes. The constructivist therapist's attitude, therefore, is more inquisitive than disputational, more approving than disapproving, and more exploratory than demonstrative [Neimeyer G., 1995].

Considering therapy as a conversational elaboration means establishing an equal relationship between the therapist and the client. Thus the therapeutic conversation can be seen as an emotionally resonant form of symbolic exchange or performance, rather than as a thin line of verbal assertion.

In therapy as a narrative reconstruction, meaning arises from the communicative action rather than residing within individual selves or knowers. Therapy itself becomes an exercise in co-creative languaging among all of members [Anderson & Goolishian, 1992].

A TURNING POINT FOR GATHERING SUBJECTIVE EXPERIENCE INFORMATION

Today's standards in user research do not actively involve the intended user in the conceptual design process. Ethnography (observing user behavior) and closed interviews are the most used techniques by user experience practitioners and are structured on the assumption that users are passively reactive (not creative and do not know what they want) [Jensen, 2004]. The way users are understood is primarily through objective information: pictures and the analysis of pictures (video ethnography, photo diaries or field notes which includes maps as well as sketches) or by quantitative data.

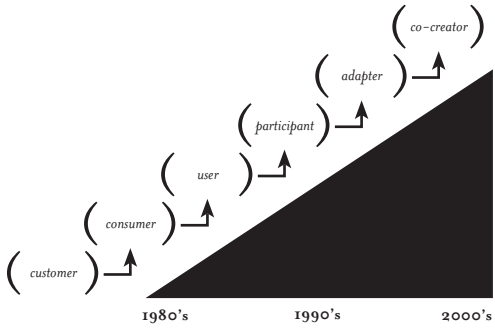
In spite of this, a new approach to user research is emerging in the field of interaction design. It is shifting from user centred to co-design and from empathy to co-experience. A participatory approach to user centred design with the aim to gather more detailed information about contexts and user experience focused in user needs, desires and fantasies. These attempt to understand practice from the inside, from the perspective of the individual practitioner. In this view, human action (including practice) cannot be understood as simple behaviour. It must be seen as shaped by the values, intentions, and judgements of the intended users [Kennis et al., 2000].

This approach to user experience can be understood as a subjective view of practice. Research on practice from this perspective generally adopts qualitative methods, is likely to make limited use of statistics, and is likely to adopt a practical view of the relationship between the researcher and the user [Kennis et al., 2000].

There is a very strong tradition in the human and social sciences based on just this view and the Constructivist psychology is a clear example of that. For this reason, applying Constructivist techniques for user research can help obtain direct information about the user's experience by balancing the relationship between the researcher and intended users while considering the later an expert in the experience being analyzed.

FROM USER CENTRED TO CO-DESIGN

How we think about and refer to the people we serve through design has undergone a significant change [Sanders, 2005]. There is a differentiation between the existing user-centred design and user design approaches. Indeed, user-centred design have been extensively used, but is primary based in taking users as centers in the design process, consulting with them without allowing them to make the decisions, nor empowering users with the tools that the experts use. In user design approaches (participatory design or co-design) researchers invite the people we serve through design (intended users) to participate in the designing process. Thus considering people as participants in the design process, as adapters of the designed product or even as co-creators (see **figure 8.1**).



> figure 8.1:

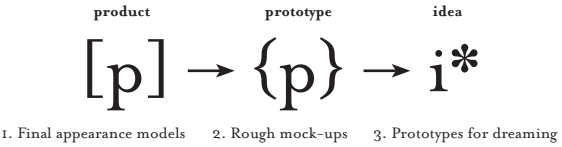
Evolutions of the roles that people play in the design process by Sanders [Sanders, 2005]

Participatory design is an approach to design that attempts to actively involve the end users in the process to help ensure that the product meets their needs. It is founded on the belief that users are creative and can play an active role in the design process. This shift means that we are designing with users, not just for them. Participatory design is a set of theories, practices, and studies [Schuler & Namioka, 1993] related to end-users as full participators in design activities [Jensen, 2004].

Participatory design can be seen as a move of users into the world of researchers. Intended users are invited to cooperate with researchers during an innovation process. Potentially, they participate during several stages: they participate during the initial exploration and problem definition both to help define the problem and to focus ideas for solution. During development, they help evaluate proposed solutions.

Co-design's aim is acquiring the most advanced level of creativity. The motivation behind creating is to express oneself or to innovate. Truly creative efforts are fueled by passion and guided by a high level of experience [Sanders, 2005]. Intended users can be considered experts when talking about their own experiences. Empowering users with proper tools and working collaboratively

throughout the design development process generates ideas. Co-design is based in creating and differs from making an incremental change that relies on the use of raw materials and the absence of a predetermined pattern [Sanders, 2005]. See **figure 8.2**.



> figure 8.2:

The evolution of prototyping in the design process by Sanders [Sanders, 2005]

These approaches, allowing designers and everyday people work together, need tools for both research and design such as [Muller, 2003]:

- Descriptive artifacts like collages where users apply artistic methods to express experiences and needs.

- Low-tech prototypes like Velcro models [Sanders & William, 2001] where users are asked to think about technology they have not used before.

- Cooperative or evolutional prototyping where a system is given to users in different stages to enhance communication and understanding

Different methods are needed as well to deal with these new roles and skills for designers and researchers [Muller, 2003]:

- Meetings to help diverse parties to communicate and commit to shared goals, strategies and outcomes.

- Stories to trigger conversations and share knowledge.

- Drama to help a group find its voice and articulate its position.

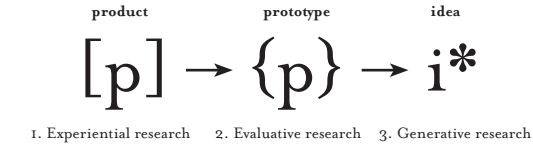
- Games to communicate and find a similar language.

FROM EMPATHY TO CO-EXPERIENCE

Different design approaches focus on the complex area of users' individual and subjective experience. User research about the study of emotions is relevant to design because emotions are a key part of experience and influence people's actions, expectations and future evaluations.

There are many ways to access and measure emotions. Observation and biometric measures from tacit expressions, body posture, voice modulation to galvanic skin response, heart rate and blood pressure are some ways to identify immediate emotional responses. However, the difference in seeing emotions responding to designed products compared to emotions as part of personal interaction, is significant [Battarbee, 2004]. For the practice of concept design it is rarely practical to use surveys or measuring devices.

Through observing what people do and how they behave, by becoming exposed to the same or similar experiences (emphatic design approach) and interacting with people (co-experience approach), designers can create working interpretations of the others to be used as informational and inspirational information to develop product concepts and interaction ideas. See **figure 8.3**.



> figure 8.3:

The evolution of emotional research in the design development by Sanders [Sanders 2005]

Emphatic design methods involve users in the product or service development process to unveil intrinsic and affective product qualities that a designer needs to take into account and from people's memories, current experiences and ideal experiences [Tomico et al., 2006b].

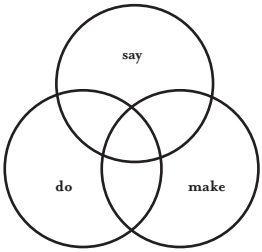
They key to emphatic design is understanding how the user sees, experiences and feels some object, environment or service in the situation in which he or she uses the object [Koskinen, 2003]. Empathy techniques are based in the altered subjectivity that can come from immersion into a particular context [Plowman, 2003]. In other words, the ability to imagine someone else's subjective experiences without having them directly [Koskinen et al., 2003].

The place of emphatic design methods in the product development process is the early conceptual stage: looking at what people really do, either in their current natural context or with prototypes to expose to them by asking people to participate by making records of their behaviour and the context in which the behavior occurs.

In the co-experience approach [Battarbee, 2004], people are involved and present in the design process to overcome studio-based contemplation of irrelevant issues. They are the authors of their own experiences, involved as creative actors, who can and will engage with available products that support them in their interests and their social interaction and experiences that they find meaningful.

Co-experience design is based on creating a way to let people access their inherent needs desires and fantasies: those parts of experience (subjective experience) which are not well constructed with words alone and cannot be shown [Battarbee, 2004]. Based on the symbolic interactionism [Blumer, 1986], co-experience reflects that people act upon things according to the meanings they have for them. These meanings arise from interaction with other people and are handled in and modified by people in an interpretive process.

Different generative techniques for accessing people's subjective experiences have been developed from these approaches and focus on what people make, what they create from the toolkits to use in expressing their thoughts, feelings, dreams and new ideas. These techniques differ from traditional design research methods (which were focused primarily on observational research) and traditional market research methods that have been focused more on what people say and think (through focus groups, interviews, and questionnaires). See **figure 8.4**.



> figure 8.4:

Different ways of accessing people's subjective experiences, a design research framework by Sanders [Sanders, 2005]

Cultural [Gaver et al., 1999] and emphatic [Mattelmäki, 2003] probes are tools for understanding human phenomena and exploring design opportunities by inspiration (enrich or improve designer's inspiration), information (collect information about users), participation (users participate in the ideation process) and dialogue (build a bridge between users and the design team) [Mattelmäki, 2006]. They are based in user's active role in recording and utilize the user's personal context and perceptions to explore new opportunities rather than known problems during the conceptual design phase.

Contextmapping sessions [Sleeswijk et al., 2005] with sensitizing tools [Stappers & Sanders, 2004] not only elicit contextual information, but also bring it to a design team in a form that presents a map indicating roads, dangers and opportunities, leaving room for the designer's creativity. Sensitizing tools

stimulate reflection among participants' daily experiences before the generative sessions. There they are triggered to express deeper levels of feeling or knowing with different toolkits. Afterwards, designers use the contextmapping information to make their way through the design process.

Experience prototyping [Suri & Buchenau, 2000] and Velcro models [Sanders & William, 2001] enable creative expression by giving people ambiguous visual or physical stimuli to work with. Being ambiguous, these stimuli can be interpreted in diverse ways, and can activate a variety of memories and feelings in different people. This visual experience liberates people's creativity from the boundaries of what they can state in words. Together, the ambiguity and the visual nature of these tools allow people room for creativity, both in expressing their current experiences and feelings and in generating new ideas [Sanders, 2001].

CONCLUDING REMARKS

The change of paradigm defined by constructivism gives a solid theoretical grounding for the emerging generative techniques in user research such as co-design and co-experience. Moreover constructivist psychology procedures can be used as a source for new subjective experience gathering techniques to be used in user research in early stages of product development.

9.

analyzing the role of constructivist psychotherapy methods into user subjective experience gathering techniques

Partially extracted from Tomico, O., Pifarré, M. and Lloveras, J. "Analyzing the role of constructivist psychology methods into user subjective experience gathering techniques for product design" In ICED'07, August 2007, Paris, France.

Constructivist psychology's essential task is understanding how people's characteristics (values, beliefs and assumptions) are involved in the process of experiencing, as well as how people otherwise participate in co-creating dynamic personal realities (needs, desires and fantasies) to which they individually respond [Guidano, 1995]. In constructivist psychotherapy techniques, like projections and narratives, meaning arises from the communicative action rather than residing within individual selves [Anderson & Goolishian, 1992]. These techniques become an exercise in co-creative languaging among all of the members [Anderson & Goolishian, 1992]. This shift leads to a radical change in traditional formulations of human experience design research.

Constructivist approaches have contributed significantly in both of these regards, on one hand transforming the nature of interpersonal and therapeutic relationship, and promoting a wide variety of novel methods of intervention on the other [Neimeyer G., 1995]. Mirror time, streaming, fixed-role therapy, controlled elaboration, tightening and loosening techniques, interpersonal transaction groups, bipolar sculptures, personal epilogues, repertory grid techniques, systemic bowties, time and place binding, laddering, and various forms of journaling have all emerged from constructivist traditions.

In this chapter different approaches to constructivist psychology are presented (alternativist, discursive, rhetorical and narrative [Neimeyer R, 1995b]) and some techniques and examples illustrate its application as subjective user experience information gathering tools.

REPERTORY GRID ANALYSIS TECHNIQUE, AN ALTERNATIVIST APPROACH TO CONSTRUCTIVISM

User's subjective experience, as defined before (aspects about user experience involving feelings about inherent needs, desires and fantasies while interacting with a product or service) has an embodied interaction perspective. Defined by Dourish [Dourish, 2001], embodied interaction is the creation, manipulation, and sharing of meaning through engaged interaction with artefacts. Embodiment is the common way in which we encounter physical and social reality in everyday world [Dourish, 2001]:

- Embodiment as central: Embodiment means being grounded and in emerging out of everyday, mundane experience. It is a foundational property out of which meaning, theory, and action arise.

- Embodiment focuses on practice: everyday engagement with the world directed toward the accomplishment of practical tasks. Action in the word is fundamental to our understandings of the world and our relationship with it.

- Embodiment as a source of meaning. Source of intentionality.

This approach is closely related to the phenomenological approach, the model of the person as a form of motion, in which action, emotion and thought are intertwined [Merleau-Ponty, 1945]. Phenomenology explores our experiences as embodied actors interacting in the world, participating in it and acting through it, in the absorbed and unreflective manner of normal experience.

The Personal Construct Psychology (PCP), the theory behind the Repertory Grid technique, can be seen as a phenomenological approach to the person and that its methods for investigating the experience of individuals mirror and indeed extend phenomenology's reach [Butt, 2003].

Constructivist psychological foundations of the Repertory Grid

The Personal Construct Psychology (PCP) was one of the first psychology approaches to develop subjective exploration methods. It is based in the constructive alternativism and focuses on how the human process flows, how it struggles in new directions as well as in old, and how react for the first time to newly perceived dimensions [Kelly, 1955].

Kelly formalized Dewey's [Dewey, 1910] analysis of the role of anticipation in psychology as a constitutive and organizing power that subsumes both prediction and control. A concise explanation on the basic ideas of PCP are exhibited by the following points: Perceptions influence expectations, and expectations influence perceptions; the medium through which this happens is known as the construct system; construct systems (pairs of opposite attributes) are unique to the individual and develop throughout its life.

The psychology of personal constructs can be defined by a fundamental postulate and 11 corollaries [Kelly, 1955]:

- Fundamental Postulate: A person's processes are psychologically channelized by the ways in which he anticipates events.

- Construction Corollary: A person anticipates events by construing their replications.

- Individuality Corollary: Person differs from others in their construction of events.

- Organization Corollary: Each person characteristically evolves for his convenience in anticipating events, a construction system embracing ordinal relationships between constructs.

- Dichotomy Corollary: A person's construction system is composed of a finite number of dichotomous constructs.

- Choice Corollary: A person chooses himself that alternative in a dichotomized construct through which he anticipates the greater possibility for extension and definition of his system.

- Range Corollary: A construct is convenient for the anticipation of a finite range of events only.

- Experience Corollary: A person's construction system varies as he successively construes the replication the replication of the events.

- Modulation Corollary: The variation in a person's construction system is limited by the permeability of the constructs within whose ranges of convenience the variants lie.

- Commonality Corollary: If one person employs a construction of experience similar to that employed by another, their psychological processes are similar.

- Sociality Corollary: If one person construes the construction processes of another, he may play a role in a social process involving the other person.

The Repertory Grid as a subjective experience information gathering technique

Human judgments are due to a comparative process. Human perception, for example the aesthetic or emotional, depends on the relationship between different experiences and situations that have happened over time. Comparisons are used to create mental map of perceived differences, in which the decision making process relies.

The Repertory Grid (RG) is based in the constructive alternativism. It uses the comparison in its development, creating a set of constructs or bipolar dimensions related among each other where adjectives and characteristics correlate with the appraisal. The RG technique can be defined as a cooperative inquiry and described as an organized interview by its management and theoretical foundations. It enables the person to tell us something of the way in which he sees and orders the world, building up mental maps of the clients' world in their own words [Botella & Feixas, 1998].

The Repertory Grid as a subjective experience information gathering technique brings the possibility to obtain tacit or intuitive understanding as highly conscious, verbalized constructions [Stevens & Walker, 2002], contributing to a better understanding of the decision making process in consumer's future response. That's because the construing process is not exclusively, or even primary, a conscious experience and takes place at various levels of cognitive awareness.

Repertory Grid consists of three essential features: a set of elements, a set of constructs, and a series of ratings of those elements along those constructs [Neimeyer et al., 2002]. The RG is presented in a data matrix composed of tree different basic components [Botella & Feixas, 1998]: Elements (placed in columns) are defined as a representative sample of people, events, activities, places or objects from the area you want to explore. They are related to a specific personal experience domain. The rows of the matrix are filed with personal constructs (bipolar dimensions like semantic differentials [Osgood, 1957]), which represent personal views or judgments (qualities people use to describe the elements in their personal, individual world). Each cell of the matrix represents the quantitative evaluation of the elements by the constructs. See **table 9.1** as an example of the representation of the repertory grid results from the analysis of subjective experience with a baby chair by young mothers.

> table 9.1:

Repertory grid results from the analysis of subjective experience with a baby chair by young mothers done with Repgrid IV

	Display baby chair 2 "EPISTI"										
nice, straight lines, vertical (modern)	3	1	3	4	1	5	2	5	1	5	*overdressed, too many elements*
safety, reinforced joints	2	5	1	3	4	1	4	1	4	1	*weak, seems unstable*
comfortable, takes up little space	3	3	4	4	4	4	4	5	1	5	*bulky, occupies a lot of space*
ergonomic seat, body adaptable	2	5	1	4	3	2	4	1	4	1	*uncomfortable seat, non adaptable, rigid*
proportional seat back	5	3	5	3	3	1	3	2	3	1	*for really little babies seat back to big*
discreet, few colours	5	2	5	1	5	1	1	3	1	1	*kitsch, too many colours*
practical, can be used when baby is older	3	2	3	2	3	1	1	1	4	1	*short time of use, only for little babies*
reclinable seat, the baby can sleep	3	2	3	4	3	2	3	2	3	1	*rigid seat, only for eating or playing*
foldable structure, occupies little space	3	3	2	2	3	2	1	1	4	1	*rigid structure, occupies more space*
wood, nicer and more hygienic	3	5	4	5	2	3	1	1	3	2	*other matherials*
comfortable legs, lateral or without joints	3	3	4	4	4	4	4	5	1	5	*too open legs, it seems you are going to trip over*
tray with an elevated border	4	4	3	1	3	1	2	3	5	1	*smooth tray, unsafe*
chairs:	*n.1*	*n.2*	*n.3*	*n.4*	*n.5*	*n.6*	*n.7*	*n.8*	*n.9*	*ideal*	

The Repertory Grid move from the clinical application to product design is based on two main aspects:

- The concept of a guided interview, which searches the subjectivity of the information forcing the appearance of relevant items from the user. It focuses

participants to the core of their experiences by using personal interviews with a Socratic procedure (the individual is who defines the relevant elements of the product or service, not only verifying the existing hypothesis but also generating information).

• The concept of psychological relationship between the subject and the elements is preserved, although in this case the elements to analyze are products or services and not people closely related to the participant like in the clinical application. Precisely because of this, it considers personifications of products as closely related elements to the participants' experience and then studies the existing personal relationships among them. See **figure 9.1** as an example of the set of elements used in a RG analysis of baby chairs.

> figure 9.1:

Set of products used as elements in the RG analysis of subjective experience with a baby chair by young mothers

The purpose of the Repertory Grid, as a subjective experience information gathering technique, is not to analyze the subject (like in psychology) but the elements. Design relevant information (perception-related consumer preference behaviour) can be obtained by analyzing the personal constructs generated with different participants and sorted by the importance of the results obtained from the evaluation of products by the different constructs. The differences between elements, manifested in the personal constructs, are the design–relevant information that should bring design space to life [Hassenzahl & Wessler, 2000].

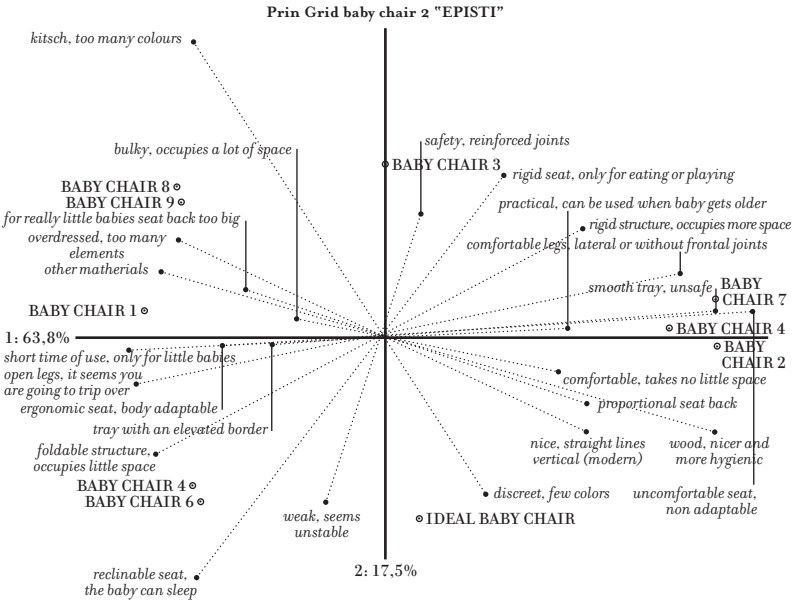
A Repertory Grid contains both qualitative and quantitative data. The identity of the elements and the nature of the constructs may provide qualitative information while the relationships between the constructs and elements may be interpreted as qualitative data [Bell, 2003]. However, the information in a grid clearly depends on the elements and constructs that have been elicited. See Appendix A for a more detailed explanation of the RG procedure.

Experience landscapes [Tomico et al., 2006a] (constructs and elements spatial analysis visualization of RG results) are a visual way of representing results from each participant RG interview. This procedure has been used in many other RG applications [Jaeger et al., 2005]. In this approach, which represents design relevant subjective information, the visual representation describes participants' product perception from their subjective experience, referenced with fictitious elements (ideal or real product image). See **figure 9.2** visual representation of baby chair RG analyzed with Principal Component Analysis [Slater, 1977] using the spatial model developed by Gower [Gower, 1966] and represented with Biplot [Glower and Hand, 1995].

Observations

Focusing attention on the quantitative data in the grid and its representation can be substantially interesting. Grid data can be analyzed at the univariate, bivariate and multivariate levels to answer different kinds of questions about the participants' presented subjective experience. It can be used to develop product experience benchmarking, weakness analysis and experience requirements for priority analysis. See Appendix A for more examples of RG applications.

Moreover, the qualitative part of the information could also be very valuable because of its reliability. As the participants have elicited constructs by a Socratic procedure, they provide unbiased information to the researcher about the key aspects of the participants' subjective experience with the analyzed product. The Socratic procedure allows unveiling rich subjective information about user experience with the least possible amount of previous information, without realizing any previous research tasks or establishing any hypothesis about the results. The participants replace researchers in aspects of development and analysis in which they are more capable, or in other words, their personal subjective experience.



> figure 9.2:

Visual representation of a baby chair RG analysis referenced with an ideal element done with Repgrid IV

LADDERING TECHNIQUES, A DISCURSIVE APPROACH TO CONSTRUCTIVISM

Discursive techniques highlight the way people construct versions of mental, social and material events and processes as parts of particular communicative practices to inquire into the causes of social phenomena and to generate a set of forecasts of the future response by understanding topics like memory, attribution and attitudes and the implications between them.

One of the most important subjects in psychology, which led to an understanding about how people modify their thoughts after a period of time, is the resistance to change attitude. From the point of view of constructivism, it can be considered as a resistance to change of personal constructs. The Change of Personal Constructs from the Viewpoint of a Theory of Implications [Hinkle, 1965] is a theory that has come from the Personal Construct Psychology and suggests that the meaning of a personal construct is provided by that construct's relationship to other constructs [Fransella, 2003]. The more abstract (superordinate) personal constructs, the more likely they are to resist change.

In order to establish an individual's superordinate personal constructs Hinkle [Hinkle, 1965] described a method, the hieratical technique for eliciting the superordinate constructs of the preferred self hierarchy (laddering), where a construct ladder usually ends up as a statement of the values that underlie a person's construing of their personal world. These values that are likely to have a wide range of implications are more resistant to change than constructs lower down the ladder.

Many practitioners see laddering as possibly the most powerful procedure for eliciting the values a person holds, and with which they organise their world, to have come out of personal construct psychology [Fransella, 2003]. Having looked at the reasons why people choose not to change how they see themselves and their problems, the experience of such choice can be analyzed in terms of personal values, the reasons for product acceptance, elements of a customer's response and/or key aspects of the decision making process.

Constructivist psychological foundations of laddering: a tightening procedure

Laddering techniques, to obtain unvarying predictions with which people organize their world, can be considered as a tightening procedure, which imply a narrowing or concentration to minimize incompatibilities. The basic functions of tightening are [Kelly, 1955]:

- Define what is predicated (help the client expand the possibilities of making his world more predictable)

- Stabilize construction (stabilize the client's psychological processes)

- Facilitate organization (If the elements are first more tightly construed or

more objectively defined, it becomes possible to step up a more superordinate level and do something about the client's overall outlook)

- Reduction of certain constructs to the state of impermeability (the value of closing out the contexts of certain troublesome constructs)

- Facilitate experimentation (the reconstruction of life might well involve a considerable amount of creative imagination)

Different procedures allow psychotherapeutic tightening; some of the most representative are the following [Kelly, 1955]:

- Judging or superordinating (put a superordinate construction upon a group of constructs which the client has expressed unsystematically)

- Summarization (summarize what the client has been saying requires a systematization).

- Historical explanation (explain thoughts on a historical basis).

- Relating one's thinking to that of others.

- Direct approach (ask the client to be more explicit, to explain what he means).

- Challenging construction (challenge client's thinking).

- Enactment (there are occasions when the client is forced by demands of extemporaneous role playing to tighten up certain minor constructions to the point where he can take explicit action on the basis of them).

- Concept formation (exploring similarity and difference to shape concepts).

- Asking for validating evidence.

- Word binding (name each of his constructs and stick with the same name).

- Time binding (date the constructs and thus to eliminate from their realm memberships all elements which occur at other times narrowing the range of convenience).

- Other forms of symbol binding (place, person, situation blinding).

Laddering procedures as subjective experience information gathering techniques

A laddering interview is a guided interview, where the psychologist is trying to get to the root of the problem through questioning, revealing insights into their lives that are not apparent. Laddering techniques, as do subjective experience

information gathering techniques, serve the same function with the exception that researchers are not looking for the root of a problem. Rather, they are trying to find the key reasons for the customer's response to a particular product. The object of a laddering interview is to uncover how product attributes, usage consequences, and personal values are linked in a person's mind [Wansink, 2003]. Doing so will help create a meaningful mental map of the consumer's experience.

Laddering can be seen as a structured interview. It is structured in the sense that needs to ensure the participant does not stray away from the current information hierarchy. To the initial answers given by consumers result in statements that begin to reveal more about the abstract and emotional qualities the customer associates with the experience [Wansink, 2003]. These are not merely statements about the product, but thoughtful, personal reflections that are one step closer to finding personal values or explain the way a value is linked to an attribute of a product.

There are no formal instructions for the laddering process but it basically involves the laddering up and laddering down procedures. The laddering up procedure is a technique that asks 'why' questions and elicits constructs of increasing superordinacy, which are very frequently also core constructs (values). Precisely, by asking which pole of the construct you prefer and then why you prefer it. Later the opposite pole is asked to complete the construct. The laddering up process continues until descriptions become extremely self evident to the client and increasingly difficult to express. R. Neimeyer [Neimeyer, 1993] modified this procedure and called it dialectical laddering. It is useful when both poles may have negative implications and a person cannot say which pole of a personal construct is the preferred one. It differs from the laddering up procedure because it asks why a person would prefer to be described by one pole of a personal construct rather than the other.

The laddering down technique or also called pyramiding [Landfield, 1971] is used to obtain more detailed and explicit information. It can be described as a way of moving downwards to more concrete or subordinate constructs [Bannister & Mair, 1968] to know more precisely what a particular superordinate construct actually means. The laddering down procedure asks how and what questions (how would I know if … was interesting? What would something that is … be like?) to elicit an increasingly subordinate construing. The resulting answer helps to give the therapist and the client the first of what are often several poles of new constructs to elaborate more detailed and defined (subordinate) constructs. After receiving an answer, one asks for the opposite pole. This gives the other end of a dichotomous construct, which is relevant with regard to the explored construct. The laddering down process continues until descriptions become extremely concrete.

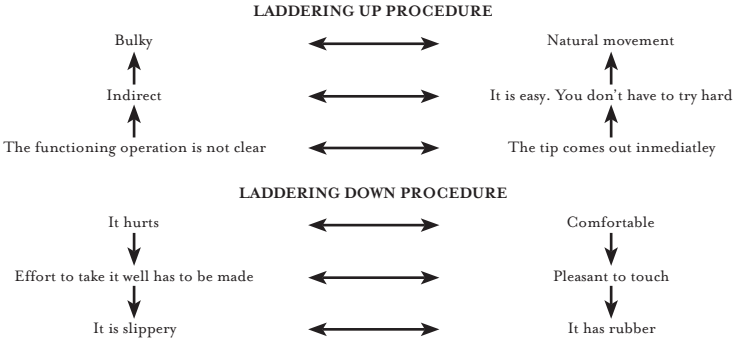
Laddering procedures as subjective experience information gathering techniques departs from the same basis than in the clinic case to discover hierarchical relations of different aspects of the experience analyzed with existing products (see **figure 9.3** as an example). It focus participants to the core of their experiences by:

> figure 9.3:

Set of advertising pens used as elements for subjective experience construing using laddering up and down techniques

- Unfolding detailed functional characteristics and physical attributes from a general emotional observation (laddering down). See **figure 9.4**.

- Extracting emotional values from the perceived product characteristics (laddering up). See **figure 9.4**.



> figure 9.4:

Constructs obtained from laddering up and down techniques applied to the analysis of advertising pens

The subjective experience information that can be extracted directly from the participant mainly relates physical, functional and emotional characteristics. In spite of this, the participants usually elicit these characteristics separately and the design relevancy of the information obtained differs from each type. Physical information is easily translated into product characteristics, but is related to certain products (it is based directly on product comparisons) so it is not possible to determine its importance and relation to a broader product spectrum. Functional information can be used to generate new product features related to user experience but don't give enough information about how to design its functionalities. Emotional information is too ambiguous and general that can only be used for inspiration.
The laddering up and down techniques allow that most of the information

generated from the interviews can be considered mixed information, relating physical, functional and emotional characteristics. Therefore, it solves emotional constructs ambiguity with information about usage experience and it adds physical characteristics to the functional construct's lack of detail.

Observations

Laddering procedures require complex skills and are not simple interviewing techniques [Fransella, 2003]. They involve applying different skills: the ability to be a credulous listener, to suspend one's own value system and, thereby, to be able to guide the clients construing. Laddered constructs take more time to put into words than subordinate ones [Neimeyer, 2001]. Moreover, some difficulties encountered in the design application of the technique emerge from the limitations of psychotherapeutic process of tightening [Kelly, 1955]:

- Shifting meanings of a constant symbol (the client could be consistent only in his symbolization and the construct itself could be still vague and inconsistently applied).

- Tightness at the expense of permeability (the client could be incapable of abstract thinking and any attempt to get him to reduce certain constructs to a tight formulation will result in his becoming too specific).

- Producing a construct, which is too incidental (if the construct has been obtained incidentally by tightening, it will have historical value only).

- Difficulty in producing constructs which are both tight and superordinate (since the client can grasp the principle, he choices to mix up the facts).

- Dealing with impulsivity (decisions are made and action taken before the client has looked at his situation from all the appropriate views).

- The client who wants relationship only (client who wants to constrict his world to the interview).

- Unwillingness to test (many clients resist tightening to the bitter end because they do not dare to risk).

- Difficulty with preverbal construction (because of nature of human development, loose constructs are preverbal and can't be readily expressed in words).

Despite these limitations, laddered constructs had more implications than the previously elicited constructs [Fransella, 1972], are more important than non-laddered constructs and provide a measure of hierarchical structure [Neimeyer, 2001] and existing relationships between constructs.

PROJECTIVE TECHNIQUES, A RHETORICAL APPROACH TO CONSTRUCTIVISM

The existing tension between the material world of objectivity and the mental world of subjectivity is transcended by the rhetorical world of projectivity (the application of reason to imagination). Four central assumptions of this approach to the constructivist paradigm [Gonçalves, 1995b]:

- Proactive cognition: Human knowledge processes entail and anticipatory construction. The individual knower projects reality, and people construct reality through a process of embodied understanding.

- Morphogenic nuclear organization: The energy of human projectivity originates a hieratical structural organization with more explicit and tacit levels of knowing.

- Humans are metaphors of the environment: Humans do not have theories of their environments; they are those theories. At least at the more tacit level of structural organization, human knowledge is an analogical embodiment.

- Development nature: Knowledge involves a process of structural differentiation operating through continuous assimilation and accommodation in the direction of more complex, integrated, and viable structures.

Projective techniques can be described as a mode of guidance that underlies intuitive knowing by using meaning transports, which extend our level of understanding. Projections are sensory reconstructions of high-generality imagery described as being somewhere between perceptions and symbolic thought [Stevens & Walker, 2002] and represent more aesthetically rich and personally felt descriptions.

Psychological foundations of projective techniques in the PCP: a loosening procedure

The path to insight requires the use of high-level abstractions, variably described as metacognitions, high-generality heuristics, schematic anticipations, analogy and metaphor, themata, failure indices, or inceptions. The defining feature of all these abstractive styles of thought is that they are superordinate, permeable structures allowing the person to simultaneously entertain a wide array of elements, ideas, and images [Stevens & Walker, 2002]. They are conducive to looser, imaginary associative play, and allow one to entertain unusual, even absurd, combinations of ideas and elements.

Projective techniques can be related to Personal Construct Psychology's loose construction. Loosening is defined by Kelly [Kelly, 1955] as characteristic of those constructs leading to varying predictions. Thus a loose construct tends to be elastic, relating itself to its elements only slightly, however it retains its identity as personal construct in the client's system. Loosening is a necessary phase of creative

thinking. It releases facts, long taken as self-evident, from their rigid conceptual nets. Loose construction serves important functions in the psychological life of the person and psychotherapy loosening serves certain special purposes [Kelly, 1955]:

- The shifting of elements in the construct context represents an incipient movement in the construction system. The result is that new experience is produced and new responses are elicited from one's associates. It is a way of getting the client to recall events he would not otherwise remember.

- The shifting permits certain elements to come into the field of one's attention, which might otherwise be firmly ruled out by logic-tight construction. It is a way of getting him to shuffle some of his ideas into new combinations. By encouraging loosening, the therapist can sometimes elicit an approximate verbal expression of a pre-verbal construct.

- Looseness permits some extension of the construct's range of convenience. Loosening may help release a client from a blocking situation;

- Sometimes the loosening tends to make the construct more permeable to new experience. Shifting its context admits new elements to which other constructs are also applicable.

The basic approach to this technique is that the client may simply be told to say whatever comes into his mind and therapist should be using different procedures to produce loosening [Kelly, 1955]:

- Apparent irrelevancies (look for contrast patterns).

- Association without report (review what the client has been thinking during periods of time without talking).

- Initial point, (back-track the client's associations, be brought back to the initial take-off point from time to time).

- Association away from an initial point (give the client an initial point and then suggest that he associate away from it).

- Breaking up tight construction (take positive steps to break up a tightly drawn discourse)

- Avoid the important (staying away from what is important demonstrate some loose thinking, it brings into play underlying loose preverbal-construct system, as well it reveals contrast poles).

There are four principal ways in which loosening is produced in psychotherapy by [Kelly, 1955]: relaxation, chain association, recounting of dreams, and therapist's uncritical acceptance of the client. Projective techniques can be seen as a chain association loosening techniques based in an association away from an initial point procedure.

Constructivism psychology projective procedures in subjective experience information gathering techniques

Projective techniques such as subjective experience information gathering techniques are used to enhance sensitivity to tacit understandings. They work as a mode of guidance that underlies intuitive knowing [Ippolito & Tweney, 1995]. The results are sensory reconstructions of high-generality imagery described as being somewhere between perceptions and symbolic thought. They represent a more aesthetically rich and personally felt mode of mental awareness [Stevens & Walker, 2002].

Projective techniques are based in the idea that new chains of implications become possible as broad levels of abstraction open a much wider network of subordinate categories and ideas. From the expertise in one domain, this level of abstraction allows one to grasp connections between otherwise irrelevant concepts.

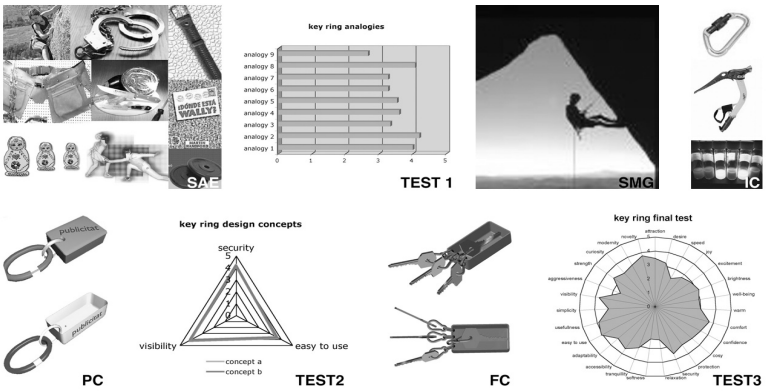
Different projective techniques have been developed to evoke contexts and increase creativity in the product design. Some of these techniques make use of semantic linguistic resources like metaphors (ViP approach [Hekkert & Van Dijk, 2001] Zaltman Metaphor Elicitation Technique [Zaltman & Coulter, 1995]), hyperboles (Design for Extreme Characters [Djajadiningrat et al., 2000]), personification (Product Personal Profiling [McDonagh et al., 2002]) and allegories (Interaction Relabelling [Djajadiningrat et al., 2000]).

In this case, sensory metaphors are proposed for describing subjective experiences. It is based in the idea that there are so many concepts, really important ones, which are abstract or are not precisely defined in participants' daily experience (emotions, ideas, time...) and this makes necessary the use of other easy understandable concepts (objects, contexts, orientations...) [Lakoff & Johnston, 1980]. Sensory metaphors, defined as sensorial interaction metaphors, allow the designer and the user to create a mental picture of how impressions can be evoked while designing the product interaction. Sensory metaphors facilitate the understanding of the complex emotional system through an intuitive idea (an existing example in the everyday life with some high emotional contents). They are useful to know information in terms of what and how participants like to experience products by moving this preferred actions or situations to a parallel product, context or experience.

Sensory metaphors can be used throughout the conceptual phase of design when determining the product interaction characteristics. Furthermore, they can be used to communicate among members of the design team and with the potential users. The latter also enables the experimental validation of the perception of the emotions the product evokes. See **figure 9.5** as an example of a key ring design, where users information challenges different concepts and their feedback helps to choose between different design ideas and to guide and validate the product development in three different stages. For a key ring design process the first test was used to choose the most suitable analogies (handcuff the keys, climbing, where's Wally). The second test was used to choose between different product concepts with different details and the third one to evaluate the final product. For a more elaborate description the reader is refered to appendix B.

> figure 9.5:

Representation of the key ring design and test process. [Tomico & Lloveras, 2005]



Observations

Participants understand the idea of using Sensory Metaphors as embodied experience communicators but occasionally they didn't use their full potential because they applied them in a reduced way. Different difficulties emerge in producing loosened construction [Kelly, 1955] based in the nature of resistance [Kelly, 1955]:

- Therapist's difficulty in finding symbols, which reveal its truly abstract nature.
- Client's creativity thinking, where the development of constructs is from loose to tight.
- The vulnerable feeling of the client who looses his construction.
- Difficulty in communication between client and therapist. Intrusion of distracting elements from any source.
- Interference. Some loosely construed thought bears a superficial resemblance to a more conventional idea.
- The use of enactment techniques sometimes reduces the threat which loosened constructs present (if the client thinks he is playing a role, does not see himself so deeply involved as he would otherwise be and what he produces does not have to be consistent with his core construction himself).
- Use of context. There are context areas where loosened construction can't be done and others where the person may be capable of thinking loosely.
- The role structure (the role the client adopts in relation to the therapist)

Despite these difficulties, rich interaction contexts were created translating the subjective experience (note that this refers to human response from the perception of the senses) behind the sensory metaphor into interaction concepts.

STORYTELLING, A NARRATIVE APPROACH TO CONSTRUCTIVISM

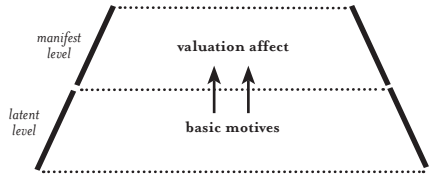
Narrative techniques consider users as motivated storytellers and that they tell their stories selectively and colourfully, placing emphasis on those events or combinations of events that have an affective meaning of that appeal to them emotionally [Hermans, 2002]. The defining feature of narratives is that they are permeable structures allowing the person to simultaneously enchain a wide array of elements, ideas, and images [Stevens & Walker, 2002]. They are conducive to an imaginary associative play, which allows one to create unusual, even possibly strange, combinations of ideas and elements [Stevens & Walker, 2002].

If narratives are viewed as a deliberate quest whose goal is to construct meaning, then it can be said that people must establish implicit or explicit end points and arrange events that are relevant to these projected conclusions [Gergen & Gergen, 1986]. In this sense, narrative emphasizes order and sequence [Bruner, 1986a]. It has both a historical dimension (in the sense of selectively recruiting past events, whether real or imagined) and an anticipatory thrust (in the sense of reaching toward a conclusion or end point that is posited with more or less clarity and conviction) [Neimeyer, 1995d].

Psychological foundations of narrative techniques in the PCP

Life is a narrative, a story co-constructed through an exhaustive dialectical interchange between individuals and their ecological niches [Gonçalves, O. F., 1995a]. People of all ages and cultures have used stories or narratives (myth, folklore, fairy tale, legend, epic, opera, motion picture, biography, novel, television play. Personal anecdote, etc.) to give meaning to their environment and their own lives. [Hermans, 2002]

People are not simply storytellers; they are passionate storytellers [Hermans, 2002]. People tell their stories selectively and colourfully, placing emphasis on those events or combinations of events, that have an affective meaning of that appeal to them emotionally [Hermans, 2002]. In constructivist valuation theory it is assumed that each valuation, as a unit of meaning in one self-narrative, carries an affective connotation where the basic subjective motives are reflected in. Each valuation has a certain degree of emotionally personal involvement and reflects a particular set of feelings [Hermans, 2002]. See **figure 9.6** for a representation of the relationship of the basic motives and the valuation effect between the latent level and the manifest level.



> figure 9.6:

Relation between valuation, affect and basic motives [Hermans, 1995]

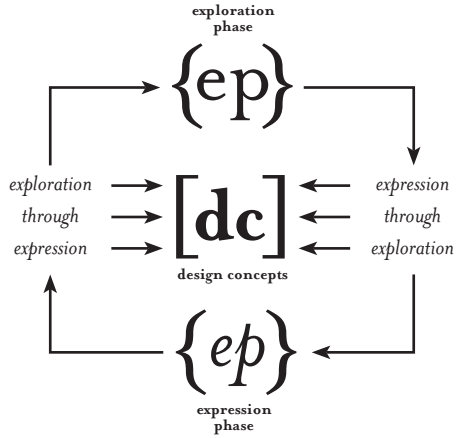
Constructivism psychology narrative procedures in subjective experience information gathering techniques

Approaching storytelling as subjective experience information gathering techniques takes into account narrative psychology to attempt to understand and try to solve part of the problem of how people express their thoughts. By relating user's subjective experiences into a well-known context like telling a story, these sub-conscious experiences can migrate to a storytelling experience as people schematize it, communicate it, and add levels of meaning [Forlizzi & Ford, 2000]. It avoids the inherent problems of participants not being able to identify the existing inner relationship between the interpretation and meaning-creating process, social context information and latent needs.

Narrative procedures applied to obtain direct information about subjective experience, visual narratives based in a self-exploration and expression loop are an example of that. The self-exploration and expression loop is based in the information flow between the expression phase and the exploration phase. Basically, it means that information from the exploration phase can be used in the expression phase (expression through exploration) contributing to a better understanding of personal values and increasing the exploration phase level of detail; and information from the expression phase can be used in the exploration phase (exploration through expression) enabling reflection from the expression phase. See **figure 9.7** for a visual representation of the procedure.

> figure 9.7:

The self-exploration and expression loop [Tomico et al., 2006b]



The expression phase is based on narrative techniques. Participants have to advertise themselves through a presentation or visual narrative. They have to choose and relate different objects, products or situations from the exploration phase to create a narrative that describes them. Therefore, considering narratives not only static, dynamic visual information can also be analyzed. The symbolic component of rhythm, tempo, and movement can also be used in order to foresee the intrinsic values of the participants.

The results were participants' personal presentations advertising themselves, presenting their inner needs and values. They explored and generated 30 sec. animated visual presentations (e.g., movies, PowerPoint, Flash and Director animations) separately as part of the self-exploration and expression loop (expression through exploration). **Figure 9.8** shows an example, in which the exploration phase relates participants' desired physical features (e.g. size, lightness, textures), functional qualities (e.g. visualization, hidden spaces) and symbolic qualities (e.g. simplicity, nature, mystery) in a 30 seconds presentation [Tomico et al., 2006b]. See Appendix C for a detailed explanation of the procedure and its application to obtain information about personal values in social communication.

WHAT INSPIRES ME? *(adjectives)*	WHERE CAN I FIND IT? *(objects, products, situations…)*	DESCRIPTION	SCENARIO
High tech	Microchips	*technology revolution, size reduction*	
	Foams	*light and semi-transparent, multiple propierties*	
Simplicity	Simplicity	*you can then play with textures easily*	
	Sea	*tension between air and water, anything else*	
Nature	Nature	*purity, calm, …*	
	Rough Matherials	*strong feelings, contact with the elements, …*	
Mistery	Hidden places	*makes work your imagination*	
	Presents	*unknown features*	
	Comics	*detectives, black and white visuals, tension atmosphere…*	

> figure 9.8:

Results from an example using the self-exploration and expression loop

Observations

The exploration and expression process denotes the existing communication problem between designers and users and among themselves. Semantic differences between values were found within the results. Thus exemplifying the lack of common language base of semantic meaning to words describing products and showed how the narrative techniques used in the description of personal values, beliefs and assumptions facilitated the communication and understanding of this tacit knowledge without misinterpretations.

CONCLUDING REMARKS

These explorative techniques show how different constructivist psychology methods can be successfully applied to design baby chairs, key rings and pens focusing in its physical characteristics, behavior or context (from an interaction design point of view).

10.

applying constructivist psychology methods into user subjective experience gathering techniques

Partially extracted from Tomico, O., Pifarré, M. and Lloveras, J. "Needs, desires and fantasies: techniques for analyzing user interaction from a subjective experience point of view" In User Experience – Towards a unified view workshop at NordiCHI 2006, Oslo, Norway. October 2006.

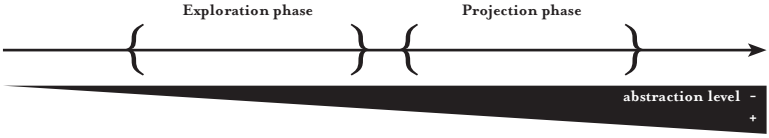
The aim of this chapter is to analyze the complex area of users' individual and subjective experience, develop subjective product experience gathering and inspiring methods to then apply them as user experience research methods in early stages of product development.

With this purpose, subjective psychological exploration and projection techniques for characterizing user experience like the Repertory Grid, laddering procedures, projective techniques and narratives are applied together as a method to help designers obtain a correct understanding of user's emotional requirements and present guiding ideas for how to assess user subjective experience in order to generate more emotionally rich concepts. The ensuing method can be defined as a set of inspirational, concept generation and evaluation techniques to design user's experience based on unveiling user's needs, desires and fantasies.

A practical example based in the redesign of an office chair is also presented. Basically, the process involved obtaining product appreciation and user's subjective experience information and translating it into design-relevant issues like scenarios, interaction concepts and detailed design guidelines.

DEVELOPING A SET OF SUBJECTIVE EXPERIENCE INFORMATION GATHERING TECHNIQUES

This chapter presents a guided interview system that merges different constructivist psychological techniques to gather subjective information relevant for design purposes. The interview is mainly divided into two phases (see **figure 10.1**). First, an exploration phase that analyzes, with a high level of detail, the user's experience with existing products, prototypes or services (present experience). This phase is the base for developing a projection system (second phase), which abstracts users to their emotions and desires (called the projection phase). The latter, allows the discovering of unmet and unconscious desires from the analyzed range of experiences. See **figure 10.2** for a visual representation of the exploration and projection phases in the experience domain.



> figure 10.1:

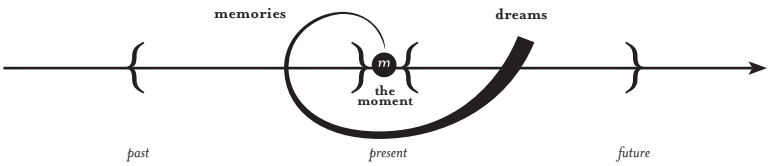
Relationship between the exploration and projection phases from the guided interview and the abstraction level of the information obtained

The exploration phase focuses in the moment, the present experience with existing products, prototypes or services as a starting point of the process (see **figure 10.2**). It is based in the Experience landscapes research [Tomico et al., 2006a] where Kelly's Repertory Grid (RG) [Kelly, 1955] method was used to generate experience mind maps so as to present determine product experience requirements and benchmark the new design concepts with related existing products. Experience landscapes (spatial analysis visualization of RG constructs and elements) are a visual way of representing results from each participant RG interview.

This procedure has been utilized in many other RG applications in user-centered design [Hassenzahl & Wessler, 2000][Fallman & Waterworth, 2005]. In this approach, as it dealt with design relevant subjective information, the visual representation described participants' product perception from their experience, referenced by fictitious elements (e.g. the kind of existing product the participant would buy or an imaginary product that fulfils all their needs). Moreover, the advantage of this exploration technique from other ones involving the unmet needs and wants of consumers like category appraisal [Guinard et al., 2001], conjoint analysis [Green et al. 2001], free elicitation [Anderson, 1983], information acceleration [Urban et al., 1997] and lead user technique [von Hippel & Katz, 2002] is that provides structured information relating product characteristics, perceived benefits and user values at the same time [van Kleef et al., 2005].

The projection phase analyzes the past memories to project them into personal dreams from future experiences (see **figure 10.2**). It is based in the Sensory Metaphor Generation (SMG) method [Tomico & Lloveras, 2005]. SMG method bases are concepts of sensory analogies and sensory metaphors. Sensory Analogies

can be defined as analogies among the user's basic actions with the product and high emotional content tasks with a similar sequence of movements [Tomico et al., 2005]. Different projective techniques have been developed to evoke contexts and increase creativity. Some of these techniques make use of semantic linguistic resources like metaphors (ViP approach, [Hekkert & van Dijk, 2001]), hyperboles (Design for Extreme Characters [Djajadiningrat et al., 2000]), personification (Product Personal Profiling [McDonagh et al., 2002]), allegories (Interaction Relabelling [Djajadiningrat et al., 2000]) and metaphors (Zaltman metaphor [Zaltman & Coulter, 1995]). The advantage of the proposed technique is that focuses the global experience creating a detailed context of how the desired behaviour should be perceived through the senses.



> figure 10.2:

Representation of the exploration and projection phases in the experience domain from Sanders [Sanders, 2001]

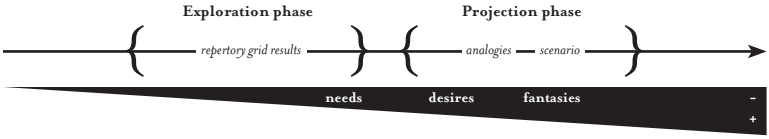
Sensory metaphors can be defined as a mental picture of how experiences can be evoked, while designing the product interaction (e.g. a "Christmas Night" sensory metaphor for a backpack concept was characterized by the novelty and accessibility interaction with a present and feeling comfortable and cosy with the family [Tomico & Lloveras, 2005]). They facilitate the understanding of a complex emotional system through an intuitive idea (an existing example in the everyday life with some high emotional contents [Tomico et al., 2005]). Sensory metaphors can be used throughout the conceptual phase of design when determining product interaction characteristics. Furthermore, they can facilitate communication among members of the design team and also with potential users, which enables the experimental validation of the perception of the experiences the product evokes [Tomico & Lloveras, 2005].

DESCRIBING THE SET OF SUBJECTIVE EXPERIENCE INFORMATION GATHERING TECHNIQUES

The proposed method consists of a combination of techniques for assessing personal user experience from exploratory phases with existing products, transforming them to analogies of interaction and then into scenarios grounded in users imagination. Precisely, a psychology based subjective interview, an experience analogies generation technique and an experience scenario-writing technique compose the method (**figure 10.3**).

> figure 10.3:

The figure relates the information abstraction level (needs, desires and fantasies) with the method (repertory grid, analogies generation and scenario writing)



These different techniques can be combined in a single interview; a maximum of two hours per participant divided into two parts. The first part (exploration phase) consists of a pre-test (participants basic information) and a subjective psychological exploration. The second (projection phase) consists of analogies and scenario definition. The different techniques are developed to create a psychological breakthrough to jump into higher levels of abstraction in users' mind (starting from users' basic needs in the repertory grid analysis, shifting to unconscious desires in the analogy generation and description, and achieving the most delightful fantasies with the scenario generation).

> figure 10.4:

Sample of products used as elements for an advertisement pens analysis

The exploration phase is based on Kelly's RG [Kelly, 1955] structured interview adapted by Botella [Botella & Feixas, 1998]. The RG technique can be defined as an organized interview by its management and theoretical foundations. Its aim is to "build up mental maps of the clients' world in their own words" [Botella & Feixas, 1998]. The RG results are presented in a data matrix composed of three different basic components [Botella & Feixas, 1998]. Elements are defined as a representative sample of people, events, activities, places or objects from the area of interest. They are related to a specific personal experience domain. For example, **figure 10.4** shows a sample of products for an advertisement pens analysis and B6, B8, B3, B1 columns in **table 10.1** represent the pens selected as elements for the advertisement pens analysis).

The rows of the matrix are filed with personal constructs (bipolar dimensions like semantic differentials [Osgood et al., 1957]), which represent personal views or judgments. It is precisely these qualities that people use to describe the elements in their personal, individual world (e.g. "comfortable hands position" vs. "it hurts", "right length, no more than thumb size" vs. "too long" positive pole from constructs in **table 10.1**). Each cell of the matrix represents the quantitative evaluation of the elements by the constructs.

		B6	B8	B3	B1	
PICK UP	*easy to see*	2	1	5	5	*hides with the background*
	small	2	1	1	4	*bulky*
	handy	2	1	3	4	*bulky*
WRITE	*fast*	4	2	1	3	*it runs aground*
	slides easily	4	1	1	3	*can feel the paper roughness*
	comfortable hands position	1	1	5	5	*it hurts*
	think and round	3	1	5	5	*sharp edges*
HOLD	*well-balanced*	1	4	4	2	*unbalanced to one side*
	right length (not more that thumb size)	1	4	3	5	*too long*
	Similar thickness than one finger	1	1	2	4	*different thickness*
ON/OFF	*fast*	4	1	2	3	*indirect system*
	don't have to move the hand	4	1	2	4	*change hands position*
	effortless mechanism	3	1	5	4	*too much effort and it hurts*
	direct movement	5	1	3	4	*takes too long time*

> table 10.1:

RG results from the pilot analysis of advertisement pens. Basic actions (first column) are used to guide the interview and generate constructs (rows)

The technique is adapted to gather information about user's perception related to the consumers' preference behaviour in their own words from a subjective experience point of view. It uses Hinkle's [Hinkle, 1965] laddering techniques, which are based in asking details (e.g. why, why do you say that) to each response in order to go as far as possible and obtain detailed design relevant information (like mixed constructs that relate physical, functional and emotional characteristics [Tomico et al., 2006a]).

The experience analogies generation tool is where participants find out and describe other products, objects or situations that represent the best experience related to the topic of each construct. It can be considered a guided brainstorming followed by psychological projection. The products described can be considered as carriers of user experience knowledge. Therefore, by describing related products they are adding the desired context and behaviour to the product attributes described in the exploration phase (e.g. "easy to see" attribute can be found in a fluorescent toy and is described as unnatural, weird and mystic by a participant in **table 10.2**).

The scenario-writing tool generates product interaction experience scenarios by grouping different analogies. Participants are then free to choose some of the analogies and their descriptions as an inspiration to write a desired interaction behavior (e.g. the fluorescent toy, touching lightly a surface, baton and touch button descriptions were used by the participant to generate the "magic stick" scenario in **table 10.2**). This process forces participants to break with the real world (experience

landscapes and analogies are related to past experiences, real ones) and reach the highest abstraction level i.e. their fantasies. The scenario-writing tool helps to identify participant's compatible analogies in a way to create a context suitable for them.

> table 10.2:

Experience scenario from the pilot analysis of advertisement pens. This table shows positive poles, selected analogies and a scenario description

	Construct Pole +	Analogies	Description	Scenario
PICK UP	*Easy to see*	*Fluorescent toy*	*Weird, unnatural, mystic.*	*I would like to have a mystic object that when you look at it for the first time looks like something with hidden powers.*
	Small	*Fruits*	*Has bright colours and smells.*	
	Handy	*Round fruits*	*Can roll your hand. Soft and fresh touch.*	
		Dices	*Different useful positions.*	
		Sand	*Slips between fingers.*	
WRITE	*Fast*	*Ice cubes over a surface*	*Continuous and pleasant movement.*	*Using it will consist in something like moving the stick in the air. You do not make any pressure to the surface, just pass nearby like touching lightly.*
		Touch lightly a surface	*It calms you down.*	
	Slides easily	*Spoon*	*Natural unstrained movement.*	
	Comfortable hands pos.	*Paper airplane*	*Can hold it by one point and it is stable.*	
	Thick and round	*Bowling ball*	*It guides you while using it.*	
HOLD	*Well-balanced*	*Water ball*	*Has inerttia, it thwarts sharp movements.*	
		Small handbags	*It adapts to your hand.*	
	Right position and length	*Archery*	*The arrow slightly moves to right position.*	
	Similar thickness than a finger	*Baton*	*The movement inertia guides you.*	
		Paintbrush	*Direct relation about the stroke and the way you use it.*	
ON/ OFF	*Fast*	*Touch button*	*Direct, effortless, hi-tech style.*	*The object will detect your intentions by the way you hold it and will enable its use.*
	Don't have to move the hand	*8 ball*	*Effortless movement (light shaking)*	
	Effortless mechanism	*PC mouse*	*You put your weight on the object.*	
	Direct movement	*Clap switch*	*Position independent.*	
		Pencil	*Just use it, no worries.*	

> figure 10.5:

Set of office chairs in the department student areas used as starting elements of the analysis

A PRACTICAL EXAMPLE APPLYING THE SET OF SUBJECTIVE EXPERIENCE INFORMATION GATHERING TECHNIQUES, AN OFFICE CHAIR REDESIGN WORKSHOP

The "SMG Workshop: Participatory Tools to Improve User-Product Interaction Experience" was held at the University of Art and Design of Helsinki (UIAH), in the Product Design Department for the Industrial and Strategic Design Masters Program during the first week in October 2005. The aim of the workshop was to train students to be capable of obtaining product appreciation and user's experience information and then translate it into design-relevant issues like scenarios, interaction concepts and detailed design guidelines.

The main assignment was to redesign an office chair, precisely the department chair. The starting point was six existing office chairs in the department student areas (see **figure 10.5**). Four groups of two students were formed for the interview part. They were told to apply the subjective product experience method to users of the selected chairs that are not directly related to the design field. They had two days to find the participants and run the interviews and then two days to create and develop redesign concepts from the tests results

The interview was done in the student's workspace, where the office chairs used were placed resembling a working environment. Participants used the chairs before and during the test to get fresh and direct information about its use, even thought they had been using them for a long time. Each group did one interview and used the results to generate different redesign ideas.

Table 10.3 and **figure 10.6** show a sample of the information obtained from one participant by Yuan Ying and Bing Su and its use for one of their chair redesign concepts. Comparing them, it can be said that the chair materials (wood and cotton to feel more natural), structure materials (stainless steal for joints for durability and legerity), cushion shape (cylinder shapes to enhance ventilation), behaviour (sitting and laying like a dental chair), fabric texture (rough textile but not hard), colours (red and orange, different from environmental colours) are directly obtained from the subjective interview information and relate to the participant' core needs, desires and fantasies.

> table 10.3:

Information extracted from one participant by Yuan Ying and Bing Su (positive constructs from the expression phase, analogies description and scenario from the projection phase)

	Construct Pole +	Analogies	Description	Scenario
MOVE	*Legerity* *Wheels* *Plastic* *The height is adjustable*	*Bird, feather, hair* *Car, pulley* *Smething white* *Crutch, radio antenna*	*Floating in the air. Very light, thin.* *Move continuosly and without friction.* *Looks strong but not hard.* *Has joints, can be pull out for extending length.*	*I want a chair like a bed. It means when I have to write I don't need to move a lot. The chair can be folded, when I feel tired I can unfold it to a bed. Comfortable, special feeling, like sitting without chair or sitting like lying. Feels soft and nature when touch it, no leather or other chemical materials.*
SIT	*Place for the feet* *Durable* *Ventilate* *Something upholds head* *Backrest is adjustable* *Wrench to adjustable backside.* *The vein is scatter, downy*	*Dental chair, clutch* *Metal, stainless steel* *Cotton, silk stockings* *Chair in the car/hair shop* *Dental chair* *Toy, watch* *Cloth, coat*	*Can be used for many years, not easy to break.* *Soft and anbsorb the heat.* *Good for neck.* *Flexible.* *Easy.* *Feel rough when touch but not hard.*	
CLEAN	*Easy to clean* *Made by brood* *Feel cool* *Soft*	*Dish, plastic* *Table, tree* *Ice* *Cake, cotton*	*Smooth surface. Don't absorve water.* *With wood pattern, nature.* *Transparent. Shaped easily.* *Fabric is sparse.*	
LOOK	*Backrest is curvy* *Simulate, vivacity*	*Water* *Traffic lights*	*Smooth curves.* *Very easy to use. Different from enviroment colors.*	

> figure 10.6:

Chair redesign sketches from Yuan Ying. Information from the interview translated into design concepts.

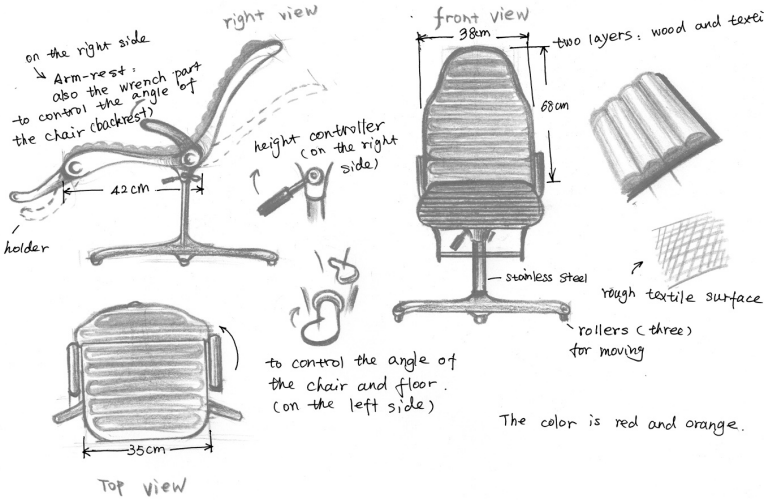


Table 10.4 and **figure 10.7** show a sample of the information obtained from another participant by Likka Airas and Henri Andell and its use for one of their chair redesign concepts. Most of the physical characteristics and functionality are directly obtained from the subjective interview information and relate to the participant' desired experience. The chair is stackable and equipped with wheels that enable the storage and transfer of multiple chairs, like the stacking dishes analogy. The wheels are locked while getting on the chair to prevent the chair moving, like the permanent dock analogy to avoid sliding under the feet. The surface of the chair is flexible and soft, but easy to keep clean and can easily be switched from hard and sliding to soft and sticky. It has a concave shape that allows good sitting support and an upright position that is good for the back and looks good (having the same feeling as wearing high heels). The adjustments are easy, reachable and do not require excess force. They can be done from the armrest. In addition, adjustments and wheels are silent allowing any movement to be done everywhere, even in a presentation or a meeting without anyone noticing (it does not bother you o the others work). The chair has colourful and simple design that looks strong and unbreakable appearance to signify the authority of the person sitting on it and at the same time to look absolutely fabulous and to attract young guys while sitting on it.

To analyze how valuable the method was for designing, students were asked to write a short essay about the method (personal feedback). They wrote about what they expected, what they learned in the theoretical section, the examples and the practical part. Some of them considered that the interviews took more time than expected and, after some time, they lost their concentration and aspirations. Also, some of them considered that the whole interview depended on how the interviewer guided the interviewee, meaning that the interviewer must be experienced and skilful and should know some psychological exploration theory. Despite these difficulties, most of them considered that the method was very sensitive to users emotional feelings and experiences and a good way to mix a subjective interview and a usage test together. They thought that the repertory grid was a good way of showing how different products are perceived and finally they found that picking the most suitable analogies was interesting and a good way of guiding a brainstorming.

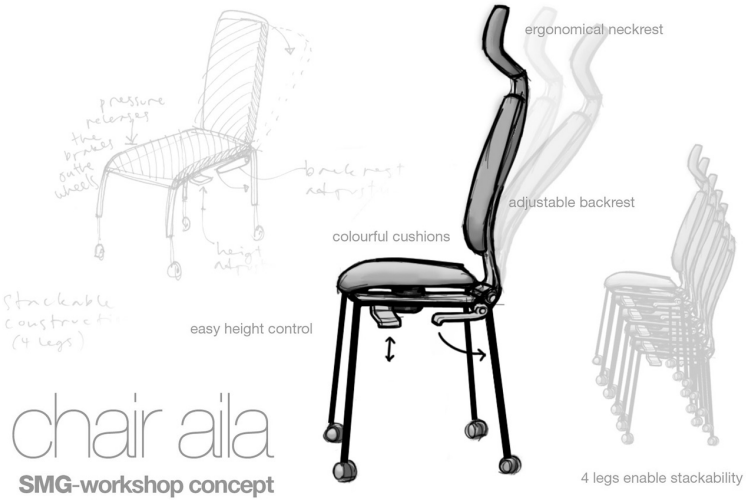
> table 10.4:

Information extracted from one participant by Likka Airas and Henri Andell (positive constructs from the expression phase, analogies description and scenario from the projection phase)

	Construct Pole +	Analogies	Description	Scenario
MOVE	*Silent, doesn't bother you or the others work.*	*Cell phone, silent mode.*	*Doesn't disturb a meeting.*	*It is importnat that it is my chair – it looks symphatic and has personality. The chair should make me look good in it, it should give moral support, it signifies my authority. (...) I don't have to get up to adjust the chair. Adjusting is easy and simple. My chair is mobile with very silent wheels. I hate to sit on something that looks dirty. I want my chair to be self cleaning.*
	Stackable, enables to store and transfer multiple chairs.	*Plates and glasses.*	*When setting up the table or putting dishes back to cupboard.*	
	Wheels, easier to move while sitting and change working direction.	*Rocking chair.*	*Relaxing.*	
	No wheels.	*Permament dock.*	*It's not sliding under your feet.*	
SIT	*Spinning chair.*	*Revolving door.*	*Exciting.*	
	Soft.	*Pillow.*	*It is precious.*	
	Fabric surface prevents sliding.	*Dungarees.*	*If you don't want to come down from the side.*	
	Adjustments don't require excess force.	*Light switch.*	*Easy and self-evident.*	
	Adjustments handles are reachables while siting on a chair.	*Wrist watc.*	*Reachable.*	
	Adjustments handles imlpy their function.	*Belt.*	*It is self explanatory.*	
	upright position is good for your back and looks good.	*High heels.*	*Absolutely fabulous.*	
	Silent and unnoticeable adjustment.	*Shirt buttons.*	*You can do it everywhere.*	
	Concave shape allows good sitting support.	*Sled.*	*Only one solution is required.*	
CLEAN	*Painted surface is easy to keep clean.*	*Sink.*	*When it is clean it's a very positive feeling.*	
	Doesn't collect dust.	*Tiles.*	*Easy to keep clean..*	
	Doesn't burn easily because of no textiles.	*Bath tube.*		
LOOK	*Funny.*	*Attracting young guys.*	*Self explanatory.*	
	Simple construction is unbreakable	*Spoon.*	*Simple.*	

> figure 10.7:

Chair redesign sketches from Likka Airas and Henri Andell. Information from the interview translated into design concepts.



CONCLUDING REMARKS

The developed method shows how different constructivist psychology procedures can be used together in order to obtain information about users' needs, desires and fantasies that can actually be used as design relevant information about product characteristics, user–product relationships and its context.

Part 4: analyzing users' subjective experience gathering techniques

11. Analyzing subjective experience information for informational purposes.

12. Analyzing subjective experience information for inspirational purposes.

11.

analyzing subjective experience information for informational purposes

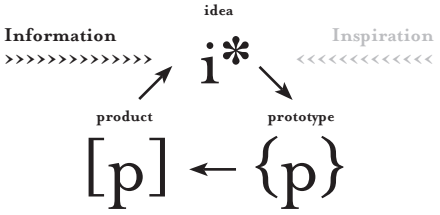
New tools and methods of human-centered design research are converging on the conceptual phase of the design development process. Basically, there is a co-evolution of two approaches: informational and inspirational research. Human-centered design research that informs the design development process tends to be conducted by people who are trained in the applied social sciences. It is heavily based on the scientific research model where reliability, validity and rigor are indispensable. The results are generated from an investigation through analysis and planning, and rely largely on past events as a way to look into the future. [Sanders, 2005]

The subjective experience gathering and inspiring techniques (SEGIT) mainly obtains subjective, qualitative information. Even though this is the case, quantitative information can also be extracted from the post-modern psychological exploration phase. The Repertory Grid (RG) interview generates data about product appreciation and user's experience information: product perception weakness analysis shows product shortcomings that can be translated into product perception characteristics to be improved, for consumer preference benchmarking that is useful for classifying different product experiences and allows for the comparison of results with different product characteristics and requirement priority analysis is useful for determining key product perception characteristics in order to create breakthrough products.

This chapter goes further by analyzing the information acquired in relation to obtain more details about the participants' response from the constructivist psychology point of view. First, it measures subjective experience correlations between different products in order to create subjective experience construing profiles about users' product preference. Then, it evaluates the cognitive complexity of participants' response with differentiation and integration measures, which can be represented in cognitive complexity profiles. Finally, it analyzes the cognitive structure of the valuation process through discriminative power and extremity scores.

THE SEGIT METHOD AS A SUBJECTIVE INFORMATION GATHERING TECHNIQUE FOR INFORMATIONAL PURPOSES

For informational purposes, the SEGIT method has been used to quantify requirements and plan milestones to achieve during a design process from a user-centric design point of view, like the first step of Quality Function Deployment (QFD). It also has been used to test, compare and validate interaction ideas and product concepts.



> figure 11.1:

Informational research approach in the conceptual phase of the design development process from Sanders [Sanders, 2005]

The challenge of this approach is to manage subjective and specific comments on personal user experiences from a subjective point of view, without loosing its design-engineering focus (informational approach). Therefore, the outcome from the SEGIT method can be represented in different ways and adapted to different design stages for informational purposes like: ideal product image, weakness analysis, product benchmarking, priority analysis and experience landscapes.

Ideal product image (fictitious elements RG results like the ideal and real pen in **table 11.1**) allows for the determining of construct roles related to users' desires and dreams. A comparison between ideal and real fictitious elements is a way to enhance design related information through the determination of user preferences (ideal ones) and perception requirements (real ones).

> table 11.1:

Repertory grid results from an advertisement pens analysis with the Rep Grid IV program.

shitty pen	3	1	3	4	1	5	2	5	1	5	5	practical
easy to write with it	2	5	1	3	4	1	4	1	4	1	1	rough writing
size too small	3	3	4	4	4	4	4	5	1	5	5	comfortable
fast writing	2	5	1	4	3	2	4	1	4	1	1	it runs aground
modern	5	3	5	3	3	1	3	2	3	1	1	plain
doesn't look like an advertisement	5	2	5	1	5	1	1	3	1	1	1	looks like an advertisement
comfortable to grip	3	2	3	2	3	1	1	1	4	1	1	bulky
thin pen	3	2	3	4	3	2	3	2	3	1	1	it is a piece of junk
nice feeling while touching it	3	3	2	2	3	2	1	1	4	1	1	have to make much effort to pick it up
you can play with the pen	3	5	4	5	2	3	1	1	3	2	2	difficult to make it spin
solid and compact	3	3	4	4	4	4	4	5	1	5	5	It easily breaks
natural open/close movement	4	4	3	1	3	1	2	3	5	1	1	bulky open/close mechanism
pens:	*n.1*	*n.2*	*n.3*	*n.4*	*n.5*	*n.6*	*n.7*	*n.8*	*n.9*	*ideal*	*real*	

Weakness analysis (difference between relevant and ideal elements RG results) shows relevant element shortcomings that can be translated into product perception characteristics to be improved (see **table 11.2** where the results from an analysis of advertisement pens are shown). Product benchmarking (weakness analysis comparison between the different elements, see **table 11.2** last row) is useful for classifying the different elements and allows for the comparison of results from different participants.

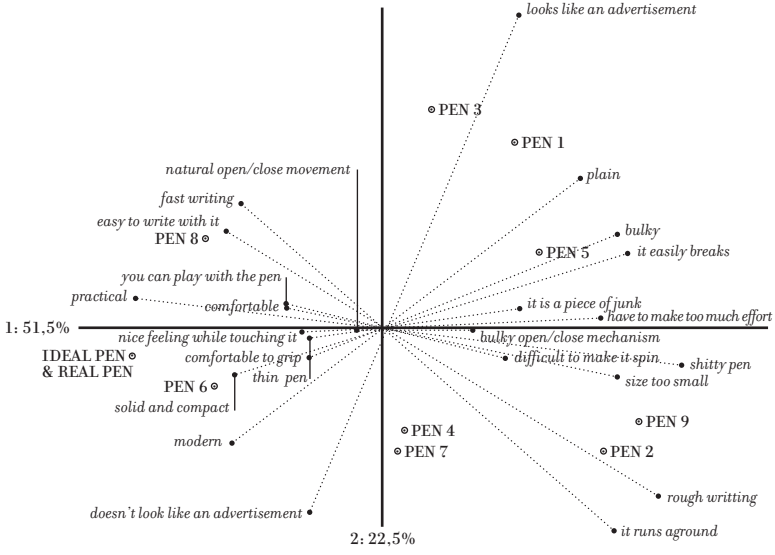
Priority analysis (weakness analysis comparison between the different constructs, see **table 11.2** last column) is useful for determining key product perception characteristics in order to create breakthrough products.

	p.7	p.4	p.6	p.1	p.R	p.8	p.3	p.1	p.5	p.2	p.9	total
looks like an advertisement - doesn't look like an ad.	0	0	0	0	0	-2	-4	-4	-4	-1	0	-15
plain- modern	-2	-2	0	0	0	-1	-4	-4	-2	-2	-2	-19
it is a piece of junk - thin pen	-2	-3	-1	0	0	-1	-2	-2	-2	-1	-2	-16
bulky - comfortable to grip	0	-1	0	0	0	0	-2	-2	-2	-1	-3	-11
too much effort to pick it up - nice feeling while touching it	0	-1	-1	0	0	0	-1	-2	-2	-2	-3	-12
size too small - comfortable	-1	-1	-1	0	0	0	-1	-2	-1	-2	-4	-13
it easily breaks - solid and compact	-1	-4	0	0	0	-2	-2	-3	-2	-3	-4	-21
shitty pen - practical	-3	-1	0	0	0	0	-2	-2	-4	-4	-4	-20
tough writing - easy to write with it	-3	-2	0	0	0	0	0	-1	-2	-4	-3	-16
it turns aground - fast writing	-3	-3	-1	0	0	0	0	-1	-2	-4	-3	-17
bulky open/close movement - natural o/c movement	0	-3	-2	0	0	0	-1	-2	-1	-1	-1	-11
difficult to make it spin - you can play with the pen	1	-3	-1	0	0	1	-2	-1	0	-3	-1	-9
	-14	-24	-7	0	0	-5	-21	-26	-25	-28	-30	

> table 11.2:

Weakness analysis results from a RG propaganda pens pilot test.

Experience landscapes (constructs and elements spatial analysis visualization of RG results) are a visual way of representing results from each participant RG interview. This procedure has been used in many other RG applications [Jaeger, S.R. et al., 2005]. In this approach, as dealing with design relevant subjective information, this visual representation describes participants' product perception from their experience, referenced with fictitious elements (ideal or real product image). See **figure 11.2** visual representation of propaganda pens RG analyzed with Principal Component Analysis [Slater, 1976][Slater, 1977] using the spatial model developed by Gower [Gower, 1966] and represented with Biplot [Glower and Hand, 1995].



> figure 11.2:

Propaganda pens RG pilot test experience landscape visualization with REP IV PrinGrid spatial analysis

ANALYZING THE SEGIT METHOD FOR INFORMATIONAL PURPOSES

A possible next step for a deeper understanding of participants' subjective experience is to summarize the way in which the interviewee construes their perspective by means of several indices. The structural characteristics of the construct system, certain cognitive dimensions, as well as the weight of a particular construct have been the focus of a number of grid measures with several indices. However, it is worth defining some aspects right at the beginning of this chapter in relation to the constructivist psychology in order to set a theoretical understanding of the methods and procedures of analysis [Feixas & Cornejo, 2002]:

- The term cognitive will be used in the broadest sense, as Kelly [Kelly, 1969] considers the cognition and emotion relation from a holistic approach which views behaviour, thought and emotion as the result of a process that involves the construction of meaning [Mancini & Semerari, 1990].

- The adaptation of cognitive measures it is based on the need to use analytic variables for the cognitive complexity of participants' response and cognitive structure of the valuation process such as: the number of independently available dimensions that enable the handling of information, the degree of one-dimensionality in the subject's construing of his/her interpersonal world, the hieratical integration of the construct system and indicatives of cognitive rigidity and polarised construing.

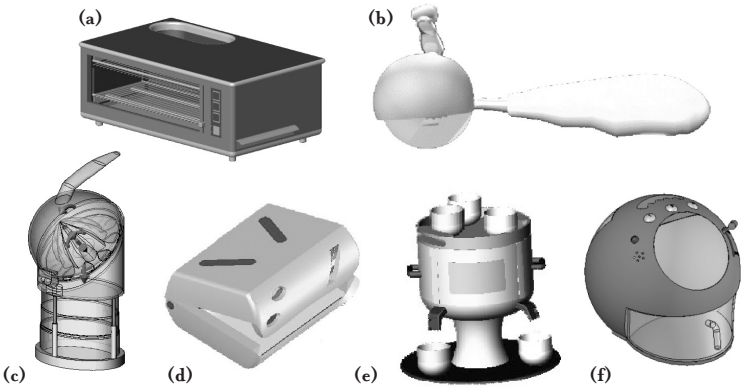
- As a result from the proliferation of measures for analyzing Repertory Grids and different ways of calculating, some measures lack of a clear psychological meaning [Fransella & Bannister, 1977]. The most conceptually solid measures and those most appropriate to the subjective experience analysis information will be chosen.

For this analysis, some of the existing indices in the GRIDCOR program developed by Feixas [Feixas & Cornejo, 2002] will be used. The GRIDCOR programme incorporates different indices with the intention of increasing the analysis potential of the grid by allowing for intra-subject and inter-subject comparisons. The selection done in the GRIDCOR program is based on the clinical value of the measurements and the support found in psychological literature. These measures are used in counselling and therapy, where they are likely to be just one of many information sources which the interviewer has about the interviewee. Thus, in the field of analyzing users' subjective experience information, these measures also have to be seen in that way, as summary information that can be used to make comparisons between different participants and different products.

In this chapter different indexes are classified in measurements of subjective experience construction of users' product preference, the cognitive complexity of consumers' response and the cognitive structure of the valuation process. This classification stands for the three different levels of validating consumers information processing system using the repertory grid as a subjective experience information gathering tool (consumer preference, consumer response, consumer

valuation process). It is precisely these measures that are use to analyze the grids obtained from a kitchenware case study that allowed for the analysis and comparison between different grids with different participants and products to test.

The case study done in the Product Design Engineering course at the ETSEIB in the UPC during 2006 included evaluating six existing products: a toaster from group a, an opener from group b, a juicer from group c, a sandwich maker from group d, a teapot from group e and a coffeemaker from group f. Then each group developed and evaluated design concepts and a final design for the product they evaluated. See **figure 11.3**.



> figure 11.3:

Design concepts of done in the kitchenware case study. Toaster from group a (M. Alcarraz, J. Borrell, N. Cabanas, G. Cebollada, E. Ibañez), opener from group b (P. Artieda, A. Bassaganyes, J. Martin, L. Mont, L. Roura), juicer from group c (I. Lopez, M. Caballero, L. Colas, J. Nebot, M. Ll. Puig-Solé), sandwich maker from group d (J. Colomo, J. Figueras, A. Morales, P. Sans, X. Solà), teapot from group e (E. Prado, A. Bardají, C. Adell, C. Arriaga, R. Simó) and coffeemaker from group f (R. García, C. Verge, P. Lladó).

Six groups of five students were told how to run the SEGIT interviews and apply it to redesign a product. Each group used three external participants as intended users during the different phases of the project. First an exploration of users' subjective experience was done. This exploration comprises three Repertory Grid interviews with the participants chosen by each group using six existing products to generate comparisons. In this repertory grid analysis also an ideal fictitious product was included. The results were used in the second phase of the SEGIT method (the projection phase) to generate new ideas to develop the redesign concept. Finally these redesigns were evaluated again with the constructs resulting from the initial Repertory Grid, comparing the existing products with the new concept and the ideal image about how the product should be.

This final grid, which was generated in the first analysis and then completed with the new concept evaluation, was the one used in the GRIDCOR program to measure the consumers' preference, response, and valuation process. **Table 11.3** shows a complete grid from the analysis of a toaster to be used with the GRIDCOR program. Observe that this figure shows the adaptation of the psychological elements (self, ideal, others) for this application (new concept, ideal product and the existing products analyzed). See appendix D on CD to look for the results obtained from the GRIDCOR program.

> table 11.3:

Repertory grid results of one participant from toaster analysis (a2) to be used with the GRIDCOR program

GRIDCOR ELEMENTS

	OTHERS						SELF	IDEAL	
	1	2	3	4	5	6	concept	ideal	
Decorative, lively colors, young and loud character	5	2	1	3	4	1	1	1	*It seems old, dirty and broken*
Thin, light and technological	4	3	3	3	3	2	3	1	*Bulky, robust and it occupies a lot of space*
The bread is well toasted, without burning, it warms if it burns detecting the smoke	4	2	2	4	5	1	1	1	*You have to be aware for that it does not burn, you really don't want to do it in the morning.*
Easy to clean, it comes apart and some parts can be put out in the dishwasher	2	2	2	2	2	3	3	1	*Difficult to access the dirty places, which get burned and makes it smell bad*
It seems realiable, with many indicators (lights) and it seems good	5	1	2	3	5	1	1	1	*Looks very manual and everything shakes, it seems that it comes apart*
It toasts all the dimensions of bread, thin and thick, very practical and saves time to cut	1	5	5	3	1	5	1	1	*You have to cut the bread for being able to toast it, a lot of work to do in the morning*
You can control the bread by looking at it and it is not necessary to shake it and to look through the hole	1	5	5	3	1	5	4	1	*You have to look if it burns or to make it jump because you do not see anything*
You do not burn on picking up the bread, the toasts come out of the device	4	2	2	2	4	2	1	1	*It is difficult to take it out the bread, you need some sttuff and sometimes you get burned*
It defrosts and it is useful to more things	1	4	4	3	1	4	1	1	*It is only useful for toasting bread*
Continously it toasts bread very quickly	3	5	5	4	3	5	1	1	*You have to wait, it toasts a little amount of bread every time*
It can work without electrical connection. For example it toasts bread in the mountain	5	5	5	5	5	5	1	1	*Needs power to work, restricts it to your house*
Little weight, it can be trasnported easily	3	3	1	4	2	3	2	1	*Weighing, uncomfortable for moving it*
It consumes little amount of electricity, I can have many more electrical devices working	3	1	1	3	3	1	1	1	*High consumption, it does not allow simultaneity with other devices*
Pleasant to the touch, soft cover, but not slippery	5	2	1	2	5	1	1	1	*Rough outer surface, does not invite to take it or clean it or move it*

MEASURES OF SUBJECTIVE EXPERIENCE CONSTRUCTION OF CONSUMERS' PRODUCT PREFERENCE

Consumers' subjective experience construction of product preference is one of the most important concepts of the consumers' decision-making process. Attitudes toward products are learned through direct experience or from secondary sources such as advertisements or public buzz [Keinonen, 1998]. Attitude is general by nature and is not tied to any particular behaviour. Attitudes are mental constructs that cannot be directly observed, but are deduced from human responses.

The GRIDCOR programme gives a simplified output of the original RG data about the definition of self, the self-ideal discrepancies and the self, others and ideal correlations. This information can be utilized to analyze consumers' subjective experience construction of product preference with minor adjustments. As in the experience landscapes approach [Tomico et al., 2006a] to the RG, the self element is converted in the concept or the product to study (prototype), the others (other elements) are the other products in the market selected to be analyzed as well, and the ideal element is the ideal product the participant will think about.

Concept definition and Ideal discrepancy

Feixas [Feixas & Cornejo, 2002] in the GRIDCOR programme shows the constructs that are relevant to the self. The self-definition constructs are those ones that have extreme scores loaded in the direction of the "self" element (a construct mark of 5) as well as their opposites (a construct mark of 1). This enables to notice which are the most representative constructs of how subjects see themselves. The perceived discrepancies between the self and the ideal are those constructs in which the difference in scores given to the self and the ideal elements implies a change in the direction of the construct pole.

The same kind of information can be obtained when this analysis is applied to consumer products. In this case, the "self" element is represented by the prototype or product concept and the ideal element relates to the ideal product. Thus, this self-definition relates to the defining aspects of the prototype perceived by the participant (concept definition). The self-ideal discrepancies, translated into the subjective experience with consumer products, relate to the product characteristics in which the prototype differs from the ideal image the participant has about similar products.

The Concept definition and Concept-Ideal discrepancies can also be considered a measure of the attachment of a new concept to an existing experience with the other market competitors and a measure of the detachment from the ideal image the participant has about similar products respectively. These measures can be used in order to evaluate the subjective experience construction of users' product preference within different concepts, participants and products. The **table 11.4** contains information about the subjective experience construction of users' product preference on six different kitchenware redesigns by 3 different

participants in each one. This information can be used to decide what is the most desired concept relating it to a high level of attachment from the existing experience and a low level of detachment from the ideal image of the product. In that case the concept design from the toaster analysis had the best marks in front of the designs of a grill, a juicer, a coffeemaker, a peeler and an opener.

> table 11.4:

Measures of attachment with the new concept (defining constructs) and detachment from the ideal image (discrepancy constructs) of 6 different kitchenware redesigns.

	a1	a2	a3	b1	b2	b3	c1	c2	c3
Def. const. (%)	75,00	71,43	80,00	50,00	25,00	50,00	42,86	52,94	36,36
Disc. const. (%)	00,00	07,14	13,33	00,00	12,50	14,29	07,14	05,88	00,00
	d1	**d2**	**d3**	**e1**	**e2**	**e3**	**f1**	**f2**	**f3**
Def. const. (%)	60,00	81,82	63,64	38,46	53,33	72,73	63,64	60,00	80,00
Disc. const. (%)	06,67	00,00	04,55	15,38	00,00	00,00	00,00	00,00	06,67

Concept, Market and Ideal correlations

Feixas [Feixas & Cornejo, 2002] in the GRIDCOR gives a summary of some important general indices describing the degree of relationship between three different pairs of variables (self-ideal, self-others, ideal-others). The self-ideal correlation can give quantitative information about the discrepancy between these two elements. This coefficient can be extracted from the correlations table between elements in the RG with the GRIDCOR. The distance between self and ideal can also be found at the distance matrix for elements. The self-ideal correlation gives us a quantitative evaluation of how respondents value themselves in their own terms related to effective functioning and a subjective sense of well-being.

The self-others and the ideal-others correlations are calculated (in the GRIDCOR program) by creating an artificial others element as the result of averaging the scores of all the elements, excluding the self and the ideal ones. These two correlations are calculated in the distance and correlation matrices of the RG elements from the GRIDCOR program. In PCT, the construction of the self is related to the construction of others [Bannister & Agnew, 1977]. The differentiation between the self and others (self-others correlation) has a particular relevance as a central feature of construing. For this reason, the processing of information about others also involves a degree of automatic self-comparison [Feixas & Cornejo, 2002]. In relation to that, the ideal-others correlation can be considered a measure of perceived adequacy of others. For example, a highly negative correlation indicates dissatisfaction and a positive correlation suggests a satisfaction.

The analysis of consumers' subjective experience construction of product preference in relation to the self-ideal, self-others and ideal-others correlations can be done considering the concept-ideal, concept-market and ideal-market correlations respectively from the product perception repertory grids in relation to the subjective experience construction of users' product preference:

- The concept-ideal correlation relates to the accomplished expectations with the developed concept. It can be considered a measure of future consumers' acceptance of the product.

• The concept-market correlation relates to the positioning of the concept in relation to existing products in the market (the concept-others discrepancy is a measure of the existing differentiation with the existing product offer).

• The ideal-market correlation relates to the accomplished expectations of the existing products. It is a measure of the level of acceptance or satisfaction of the existing products (the ideal-market discrepancy relates to the resentment to the existing products).

These correlations can be used in order to evaluate the subjective experience construction of users' product preference with different concepts from different participants and different products. The three different correlations (concept-ideal, concept-market and ideal-market) can be used to determine very useful information about the concepts future acceptance, future position in the market in relation to the consumers' perception and the level of accomplished expectations with existing products in the marked where it will be placed. **Table 11.5** contains information about the subjective experience construction of users' product preference on six different kitchenware redesigns by 3 different participants in each one. In that case, this information about future consumers' response to different concepts can be used to help to decide which one is safer for a market launch.

	a1	a2	a3	b1	b2	b3	c1	c2	c3
Concept – Ideal cor.	0,963	0,833	0,310	0,459	0,000	-0,226	0,140	0,443	-0,348
Concept – Market cor.	0,228	-0,372	0,576	-0,076	0,885	0,545	0,335	0,148	0,000
Ideal – Market cor.	0,285	-0,142	0,700	0,111	0,162	-0,440	-0,317	0,133	0,332

	d1	d2	d3	e1	e2	e3	f1	f2	f3
Concept – Ideal cor.	0,532	0,886	-0,097	0,540	0,944	0,797	0,953	0,954	0,705
Concept – Market cor.	-0,326	0,391	0,265	0,777	0,672	-0,188	0,016	-0,033	0,327
Ideal – Market cor.	-0,026	0,516	-0,136	0,539	0,631	0,095	-0,134	0,174	0,177

> table 11.5:

Measures of concepts' future acceptance, future position in the market in relation to the consumers' perception and the level accomplished expectations with the existing products in the marked where it will be placed

Consumers' subjective experience product preference construction profiles

In accordance with the available data in constructivist psychology, a series of general self-construction profiles can be identified based on the concept-ideal, concept-market and ideal-market correlations explored (see **table 11.6** for a brief description of the value of the correlations defining each profile) [Feixas & Cornejo, 2002].

PROFILES	concept - ideal cor.	concept - market cor.	ideal - market cor.
Positivity	+	+	+
Superiority	+	–	–
Negativity	–	+	–
Isolation	–	–	+
Resentment	–	–	–

> table 11.6:

Tentative proposal for consumers' subjective experience product preference construction profiles.

Other possible combinations of these three indices cannot be used because of the premise that the ideal element should always be considered the best. Moreover, these profiles should be taken as merely indicative and are at their greatest descriptive value when the correlations (positive and negative) are high enough [Feixas & Cornejo, 2002]. In order to determine when a correlation can be considered large, medium or small the classification applied by Cohen [Cohen, J., 1988] is used (see **table 11.7**). Thus, if the correlation is smaller than +/- 0,10 can be considered neutral. Hence, the other correlations can be used to choose the construction profile.

> table 11.7:

Large, medium or small correlation classification by Cohen [Cohen, J., 1988].

CORRELATION	Negative	Positive
Small	-0,29 to -0,10	0,10 to 0,29
Medium	-0,49 to -0,30	0,30 to 0,49
Large	-1,00 to -0,50	0,50 to 1,00

The Positivity experience profile in psychology is an overall positive image of the self and of others where everything is all right and there is an absence of conflict associated with a sense of psychological well-being. In the user-product relationships, a Positivity experience profile means that the ideal product, the concept developed and the existing products in the market are well perceived by the user. In this case reveals a situation were the level of accomplished expectations with the existing products is high (high level of satisfaction) and the new concept does not make huge improvements in relation to the existing products. It is a product that is positioned in a similar way to the similar products in the market, but even so, future consumers' acceptance of this new concept is high. This overall situation can happen in markets that have reached a state of equilibrium marked by the absence of significant growth or innovation (a mature technology market) but still have not reached saturation and there is still space for functional and cosmetic improvements. Table 11.6 contains information about the analysis of six different kitchenware redesigns classified with the users' subjective experience product preference construction profiles developed, where a 55,56 % of the concepts had a Positivity experience profile.

The Superiority experience profile in psychology is related to the idea that one is different from others and that others are not how they should be. In the user-product relationships, a Superiority experience profile relates to a situation with a high level of accomplished expectations with the existing products were a concept positioned in a better position that the existing products has a high future consumer acceptance of a new concept. This profile clearly defines an interesting future scenario for a new product that typically occurs in emerging markets with new technologies. The incremental differentiation from existing products could come from technological developments or a better product design or user experience enhancements. In the analysis of six different kitchenware redesigns (table 11.6), 22,22 % of the concepts had a Superiority experience profile.

The Negativity experience profile suggests a tendency towards pessimism in psychology. Both the self and others are perceived negatively. Under these conditions, if the self and others are construed negatively, the person may not

be strongly motivated to change. This pattern can also reflect a tendency to seek comfort in relating to others who are themselves distressed. In the user-product relationships, a Negativity experience profile relates to a weak market where the existing products don't reach the expectations from the consumer (the satisfaction level is very low) and nor the new concept, which is perceived at the same level of the other products in the market. This profile clearly defines a need for improvement in terms of product appearance and user-product interaction into the developed concept to reach consumers' expectations and secure success in its launch into the market. In the analysis of six different kitchenware redesigns (see table 11.6), 5,56 % of the concepts had a Negativity experience profile.

The Isolation experience profile would indicate a double tendency in information-processing terminology in psychology: information relative to the self is biased negatively, whereas information relative to others is biased positively. Under such conditions, the subject may show considerable dependency on others or be preoccupied with fantasies of being rescued by more powerful or competent others. In the user-product relationships, an Isolation experience profile reflects a situation where the accomplished expectations with the existing products are high (high level of satisfaction) but the new concept doesn't reach the expectations from the consumer and, at the same time, it is perceived on a lower level from the existing products. This case means that the direction chosen in the development of the concept was wrong and a change of direction was needed in relation to characterizing users' requirements in order to develop an entirely new idea that meets users' needs and desires. In the analysis of six different kitchenware redesigns (see **table 11.8**), 5,56 % of the concepts had an Isolation experience profile.

The Resentment experience profile means (in psychology) perceiving oneself as different from others as well as having a negative opinion of oneself and suggests that he or she may despair to the attitudes held by others. If this is the case, clinical exploration may reveal feelings of anger and resentment towards others. In the user-product relationships, a Resentment experience profile relates to a weak market where the existing products do not reach the expectations of the consumer (satisfaction level is low) and neither the new concept, which is perceived even worst than the other products in the market. This case signifies that the direction chosen in the development of the concept was wrong and a change of direction was needed in relation to market positioning (looking for market niches or other different markets). In the analysis of six different kitchenware redesigns (see **table 11.8**), none of the concepts had a Resentment experience profile.

	neutral	small	medium	large	total
POSITIVITY PROFILES (%)	16,67	16,67	11,11	11,11	55,56
SUPERIORITY PROFILES (%)	16,67	5,56	0,00	0,00	22,22
NEGATIVITY PROFILES (%)	0,00	5,56	0,00	0,00	5,56
ISOLATION PROFILES (%)	5,56	0,00	0,00	0,00	5,56
RESENTMENT PROFILES (%)	0,00	0,00	0,00	0,00	0,00
OTHER PROFILES (%)	5,56	5,56	0,00	0,00	11,11
TOTAL (%)	44,44	33,33	11,11	11,11	

> table 11.8:

Analysis of six different kitchenware redesigns by 3 different participants each one with users' subjective experience product preference construction profiles developed.

MEASURES OF COGNITIVE COMPLEXITY IN CONSUMER RESPONSE

Cognitive Complexity in Personal Construct Psychology is related to individual response to personal relationships and the capacity to construe social behavior in a multidimensional way [Bieri, 1955]. Thus, a more cognitively complex person has available a more differentiated system of dimensions for perceiving the behaviour of others than a less cognitively complex individual. This idea is applied to consumer response in the marketplace in order to validate qualitative experiential aspects of the user-product relationship obtained with the Repertory Grid.

In Personal Construct Psychology, Adams-Webber [Adams-Webber, 1979] suggests that cognitive complexity is not a single unitary concept but is bi-dimensional, involving both differentiation and integration. Differentiation is understood as the number of functionally independent dimensions available to the subject during the process of interpersonal construction. Integration is understood as the hierarchical structure derived from the superordinate constructs that give the system unity and coherence as a whole, facilitating the functions of the various subsystems at a higher level of abstraction.

There are different measures associated with the integration and differentiation dimensions of cognitive complexity. Most of all these structural indices are based on measures of association. In the following paragraphs different measures of cognitive differentiation and integration are analyzed in order to be used in the field of user-product relationships to obtain information about the cognitive complexity of consumers' response. Furthermore, from the different measures presented, the most suitable indexes will be used to create cognitive complexity profiles of consumer response.

Cognitive Differentiation measures of consumer response

The majority of research on cognitive differentiation measures has been used to examine interpersonal sensitivity and social cognition in psychotherapy. Non-psychotherapy studies relate to such diverse behaviors as career choices [Bodden, 1970] and audience response to theatrical productions [Gourd, 1977]. Cognitive Differentiation measures applied to consumer response analyze predictive power of the individual. Based on the assumption that independently available dimensions enable the handling of information related to social stimuli or evaluations of conduct, a cognitively complex person can construe events from different points of view and not just from a good-bad, black-white perspective which would be characteristic of a cognitively simple person [Neymeyer, 1983]. Thus, cognitive differentiation can be associated with the quality of the results obtained.

Bieri's Cognitive Complexity measures [Bieri, 1955] are an indicator of the cognitive structure of personality. These measurements are calculated to find the quantity of perfect matches by rating the elements of each pair of construct dimensions, divided by the maximum possible score that could be obtained from

a grid of the same size. Lower scores reflect a greater complexity [Neimeyer et al, 2002]. With the intention of standardizing the Bieri index, Feixas [Feixas & Cornejo, 2002] in the GRIDCOR programme divides the index by the possible number of comparisons [number of elements x number of constructs x (number of constructs-1) x 1/2]. The Bieri1 index is calculated from a matrix of original data and the Bieri2 index from a matrix of reconstructed data (after having focused the data). Although the Bieri1 index is normally used in the literature, Feixas [Feixas & Cornejo, 2002] considers the Bieri2 index to be the most appropriate, as it accounts for the constructs that score the data in a different direction. **Table 11.9** presents RG analysis of 6 different kitchenware studies with Bieri1 and Bieri2 scores, which have a coefficient of variation (standard deviation/ mean) of 0,167 (Bieri1) and 0,1793 (Bieri2).

> table 11.9:

RG analysis of 6 different kitchenware studies with Bieri1 and Bieri2 scores.

	a1	a2	a3	b1	b2	b3	c1	c2	c3
Bieri1 score	0,307	0,280	0,277	0,397	0,326	0,353	0,331	0,281	0,275
Bieri2 score	0,307	0,280	0,299	0,469	0,317	0,363	0,359	0,281	0,309
	d1	**d2**	**d3**	**e1**	**e2**	**e3**	**f1**	**f2**	**f3**
Bieri1 score	0,325	0,336	0,373	0,210	0,331	0,352	0,225	0,245	0,267
Bieri2 score	0,360	0,375	0,399	0,218	0,343	0,400	0,270	0,290	0,302

The functionally independent dimensions or Functional Independent Constructions (FIC) score indexes the degree of differentiation in the respondent's system by comparing the ratings of personal acquaintances on each construct with those performed on every other construct. In the GRIDCOR, Feixas [Feixas & Cornejo, 2002] presents the groups of linked constructs, the number of functional independent constructs, the elements and its total.

The total FIC score reflects the number of functionally independent constructs or construct clusters employed by the participant [Landfield, 1977]. The greater the FIC score, the greater the degree of differentiation of the individual's construct system [Neymeyer, 1983]. **Table 11.10** presents the RG characterization of 6 different kitchenware studies from the number of functionally independent constructs, elements and the total constructions (constructs and elements together). The total FIC score has a coefficient of variation of 0,3212 in these studies.

> table 11.10:

Functionally Independent Constructions FIC (constructs, elements and total) from the 6 different kitchenware RG analysis.

	a1	a2	a3	b1	b2	b3	c1	c2	c3
FIC Constructs (%)	15,00	50,00	*	60,00	62,50	28,57	42,86	52,94	63,64
FIC Elements (%)	25,00	37,50	*	50,00	75,50	37,50	37,50	25,00	50,00
FIC score (%)	17,86	45,45	*	55,56	68,75	31,82	40,91	44,00	57,89
	d1	**d2**	**d3**	**e1**	**e2**	**e3**	**f1**	**f2**	**f3**
FIC Constructs (%)	80,00	63,64	40,91	76,92	40,00	45,45	72,73	53,33	26,67
FIC Elements (%)	12,50	62,50	12,50	25,00	25,00	25,00	37,50	37,50	12,50
FIC score (%)	56,52	63,16	33,33	57,14	34,78	36,84	57,89	47,83	21,74

In order to choose an index to measure the cognitive differentiation of consumer response, the index with the highest Coefficient of Variation (CV) will be used for a better characterization of the cognitive complexity profiles. For this reason, the functionally independent constructions index (FIC score), with a CV of 0,3212, is going to be used.

Cognitive Integration measures of consumer response

Cognitive Integration measures in the field of consumer response are related to the integrity or identity of the consumers through the structure coordination or unification of their response. It has a prominent role moderating and focusing the response from personal perception and thought at a higher level of abstraction. Thus cognitive integration can be related to the reliability of the results obtained.

The PVAFF measure (Percentage of Variance Accounted by the First Factor) or Explanatory Power of the First Factor (EPFF) describes the percentage of variance accounted for the first factor (axis of representation) of the grid [O'keefe & Sypher, 1981]. This index assumes that the larger the first factor, the more unidimensional the underlying structure of the construct system. Greater scores reflect higher levels of integration [Neimeyer et al, 2002]. Feixas [Feixas & Cornejo, 2002] in the GRIDCOR presents the PVAFF measure in the Eigen values table.

This percentage indicates the importance of the main dimension of meaning. If this dimension accounts for a high percentage of variance, this indicates a degree of one-dimensionality in the subjects' construing of their interpersonal world given that the other factors, or axes, have less weight. On the other hand, if the first axis accounts for only a small percentage of variance, there is room for other dimensions to play relevant roles in the way the subject construes. **Table 11.11** shows the percentage of variance accounted by the first factor from the 6 different kitchenware RG studies. The PVAFF measure has a coefficient of variation of 0,2076 in this studies.

> table 11.11:

Percentage of Variance Accounted by the First Factor (PVAFF) from the 6 different kitchenware RG analysis.

	a1	a2	a3	b1	b2	b3	c1	c2	c3
PCT AXE 1 (PVAFF)	70,78	54,58	56,21	50,86	65,30	41,58	50,51	38,34	63,56
PCT AXE 2	10,97	36,03	23,58	29,89	23,09	24,26	26,87	24,26	18,07
PCT AXE 3	09,47	03,48	10,32	09,89	07,43	14,53	10,52	19,77	08,75
PCT AXE 4	04,59	03,11	03,91	06,26	02,35	12,25	06,83	07,68	04,98
PCT AXE 5	02,28	01,58	02,84	02,14	01,03	03,94	03,37	05,07	03,52
	d1	**d2**	**d3**	**e1**	**e2**	**e3**	**f1**	**f2**	**f3**
PCT AXE 1 (PVAFF)	45,72	52,86	53,80	35,23	49,99	74,78	51,30	39,80	62,96
PCT AXE 2	23,86	20,52	15,88	25,94	24,12	15,48	19,71	22,51	16,85
PCT AXE 3	11,92	14,99	14.01	14,67	12,42	06,51	12,34	16,71	11,06
PCT AXE 4	08,39	06,00	06,62	12,24	08,74	02,25	09,30	11,48	05,27
PCT AXE 5	04,78	03,12	06,25	07,97	02,95	00,00	05,01	06,41	02,35

Bannister's Intensity or Intensity scores [Fransella & Banister, 1977] are used as a structural measure related to the predictive capacity of the participant. A tight thought processes allow for a limited view of things, but excessively loose thought processes do not allow for associations (and, therefore, predictions) to be made. Intensity scores indicate the total degree of interrelation among the elements and constructs within the grid. Scores are obtained by summing the absolute values of the Pearson correlations between all possible pairs of ratings and then multiplying them by 100. Higher scores indicate greater conceptual integration,

and, therefore, lower levels of construct system differentiation [Neimeyer et al, 2002]. This measure is calculated by Feixas [Feixas & Cornejo, 2002] in the GRIDCOR programme from the sum of the squared values of the correlations of each construct with the rest of the constructs, averaged by the total number of constructs minus one. This process is repeated with each element, and the overall Intensity is calculated by averaging the Intensity scores of constructs and elements.

The Intensity score has a different meaning when taken as a general measure than when taken as a measure of the intensity of a particular construct in relation to other constructs. In the latter, the construct intensity cannot be taken as an indication of how superordinate it is, or of its hierarchical relevance [Feixas & Cornejo, 2002]. Rather, it should be seen as an indicator of how central or important the construct is in that grid, given that it is this construct that has the strongest correlation with the other constructs. In comparison, the least intense construct is the least connected to other constructs and is, therefore, the most peripheral in the overall system. **Table 11.12** shows the constructs, elements and total intensity from the 6 different kitchenware RG analysis. The total intensity score has a coefficient of variation of 0,3399 in these studies.

	a1	a2	a3	b1	b2	b3	c1	c2	c3
Constructs intensity	0,440	0,305	0,308	0,277	0,419	0,197	0,274	0,180	0,269
Elements intensity	0,405	0,231	0,202	0,160	0,246	0,111	0,156	0,152	0,234
Total intensity	0,422	0,268	0,255	0,219	0,333	0,154	0,215	0,166	0,251
	d1	**d2**	**d3**	**e1**	**e2**	**e3**	**f1**	**f2**	**f3**
Constructs intensity	0,220	0,310	0,346	0,175	0,289	0,491	0,238	0,205	0,401
Elements intensity	0,078	0,130	0,084	0,119	0,205	0,263	0,158	0,128	0,322
Total intensity	0,149	0,220	0,215	0,147	0,247	0,377	0,198	0,167	0,362

> table 11.12:

Constructs, elements and total intensity from the 6 different kitchenware RG analysis.

Both indices, the PVAFF score and the Total Intensity score measure the functional similarity between constructs, the participants' construing signs of hieratical structure. But the total intensity score represents the predictive capacity of the participant and the PVAFF score the degree of one-dimensionality in the subjects' construing of their interpersonal world. Thus, the PVAFF meaning suits better the characterization of cognitive integration described before and will allow for a better categorization of cognitive complexity profiles of consumers' response. For this reason, the PVAFF score is going to be used instead of the Total Intensity score. Even though it has a lover coefficient of variation (0,2076) than the total intensity score.

Cognitive complexity profiles of consumers' response

Following Adams-Webber's (1979) Freixas [Feixas & Cornejo, 2002] outlined four possible theoretical profiles based on the extreme examples of differentiation and integration that constitute cognitive complexity. See **table 11.13** for a brief description of the value of the indexes defining each profile.

> table 11.13:

Tentative proposal for cognitive complexity profiles of consumers' response.

		INTEGRATION	
		HIGH	LOW
DIFFERENTIATION	HIGH	complexity	chaos
	LOW	simplicity	fragmentation

Having outlined these theoretical profiles, it is worth considering the same precautions as with the consumers' subjective experience product preference construction profiles. This research involved finding the best indices or ways of measuring the degree of integration and differentiation but these profiles only achieve some descriptive potential when the measurements are differentiated enough. Cognitive integration and differentiation values are considered high and low when the mark is above or below 50 % for both measures.

High Differentiation, high Integration cognitive complexity measures of consumers' response generates a complex profile in which the participant has access to several dimensions of meaning that are differentiated as well as coordinated by a supraordinate structure. Relating it to subjective experience information gathering techniques is indicative of the good predictive capacity of the participant. In the analysis of six different kitchenware redesigns (see table 11.11), 29,41 % of the participants had a Complexity profile, which means that the results obtained from these participants can be considered rich and consistent.

High Differentiation, low Integration cognitive complexity measures of consumers' response creates a chaotic profile in which the subject has several dimensions of meaning that are not sufficiently organised to constitute a whole. Relating it to subjective experience information gathering techniques can result in confusion and difficulty in giving events meaning and predictive power as well as making it difficult for others to predict the person's behaviour. In the analysis of six different kitchenware redesigns (see table 11.11), 11,76 % of the participants had a Chaotic profile, meaning that the results obtained from these participants can be considered rich, but not consistent.

Low Differentiation, high Integration cognitive complexity measures of consumers' response outlines a profile best described by its simplicity (Simplicity profile), in which the participant uses very few dimensions when it comes to understanding and anticipating events. Relating it to subjective experience information gathering techniques, the predictive capacity of these people is limited by the few dimensions that they possess with their judgments being usually monolithic (all or nothing). In the analysis of six different kitchenware redesigns (see **table 11.11**), 35,39 % of the participants had a Simplicity profile, which means that the results obtained from these participants can be considered basic, but consistent.

Low Differentiation, low Integration cognitive complexity measures of consumers' response is related to the poor integration of the few dimensions that the participant uses to discriminate, suggesting a Fragmented profile. Relating it

to subjective experience information gathering techniques, the subject goes from one point of view to another without much sense or direction. In the analysis of six different kitchenware redesigns (see **table 11.15**), 23,53 % of the participants had a Fragmentation profile, meaning that the results obtained from these participants can be considered basic and not consistent.

profiles	complexity	simplicity	chaos	fragmentation
% USERS	24,41	35,29	11,76	23,53

> table 11.14:

Cognitive complexity profiles of consumers' response from the analysis of six different kitchenware redesigns.

These profiles can be used to assure the quality and reliability of the results. Complexity and Simplicity profiles are more reliable than Chaotic and Fragmentation profiles because their construction is more consistent and integrated. Moreover, the information obtained from Complexity profiles have a better quality that Simplicity profiles because is more complex thus having better predictive power. In this study the 64,7 % of the results obtained with the SEGIT method have a high level of reliability and a 29,41 % have a great quality. These results can be considered promising if it is considered that the SEGIT method deals with explicit and tacit knowledge about users' experiences.

MEASURES OF COGNITIVE STRUCTURE OF CONSUMERS' VALUATION PROCESS

Subjective experience information gathering techniques like the RG provides consistent and accurate consumer preference for conceptual products. However, the consumer valuation process with product attributes has often been overlooked. Valuations provide a numerical standard for comparison among products and product attributes as well as across different studies, a weakness of consumer sensory rating scales. Given that the valuation process is an important part of the RG process, there is considerable motivation to analyze it. The following paragraphs discuss different measures to analyze the cognitive structure of the consumer valuation process focusing on the RG procedure method where consumers have an incentive to truthfully reveal their values for a product. However, at this time they should be taken as merely indicative.

Discriminative Power (or Landfield's ordination) of the elements and constructs in the grid was originally described as a measure of hieratical integration of the construct system [Feixas & Cornejo, 1996] based on the distinction between differentiation and integration. This measure can be calculated using the formula "Dp = i (w - W)/ j" were "i" is the number of different rating used, "W" is the maximum rating used, "w" is the minimum rating used and "j" is the total number of ratings [Feixas & Cornejo, 2002]. However, Feixas [Feixas, 1988] considers it to be a measure of the subtlety and flexibility with which a construct is used (discriminative power). Greater flexibility reflects a greater degree of hierarchical integration of the construct system. Thus, the higher the ordination score, the more cognitively integrated the respondent was taken to be. In consumers' valuation process with product attributes, Discriminative Power assesses the flexibility with which participants employ particular construct scales to rate constructs. In the analysis of six different kitchenware redesigns (see **table 11.12**), the Discriminative Power scores relate to the participants variability and flexibility with which they rate their experience with different products. In this case high values of the Total Discriminative Power score (like 1,682 from d2 and 1,556 from b1) the richness of their valuation process.

> table 11.15:

Constructs, elements and total Discriminative Power from the 6 different kitchenware studies.

	a1	a2	a3	b1	b2	b3	c1	c2	c3
Constructs dis. power	1,738	1,500	1,708	2,100	1,969	1,536	2,009	1,926	1,545
Elements dis. power	0,825	1,161	0,892	1,013	1,031	1,018	0,920	1,000	1,170
Total dis. power	0,281	1,330	1,300	1,556	1,500	1,277	1,464	1,463	1,358

	d1	d2	d3	e1	e2	e3	f1	f2	f3
Constructs dis. power	1,525	2,182	1,619	1,471	1,617	1,739	1,950	1,475	1,942
Elements dis. power	0,883	1,182	0,784	1,308	0,950	1,364	1,727	1,200	1,050
Total dis. power	1,204	1,682	1,202	1,389	1,283	1,551	1,761	1,338	1,496

Extremity of ratings or Polarization represents the percentage of extreme ratings and is related to the degree of meaning of a construct or an element [Neimeyer et al, 2002]. Higher scores reflect greater meaning [Adams-Webber, 1979]. However, the total proportion of extreme scores can be considered indicative of cognitive rigidity and polarized construing [Feixas & Cornejo, 2002]. In consumers' valuation

process with product attributes, the use of Extreme scores in the RG is linked to the meaningfulness of the construct or element involved [Bonarius, 1977]. In the analysis of six different kitchenware redesigns (see **table 11.16**), the Polarization score relates to the participants' importance given to the product attributes with which they describe their experience with different products or concepts. In this case high values of the Polarization score (71,875 from a1 or 66,964 from b3) relate to a higher meaningfulness of participants' valuation process.

A measure that goes in the opposite direction of meaningfulness is the Uncertainty score or Ambiguity score, which describes the proportion of elements that the subject has been unable to place on either pole of the construct. This measure is calculated by Feixas [Feixas & Cornejo, 2002] in the GRIDCOR via the percentage of middle-point ratings of the data matrix. In the consumers' valuation process with product attributes, a very high percentage of poorly defined ratings indicate an operational difficulty within the construct system related to the inability to give the elements significance. In the analysis of six different kitchenware redesigns (see **table 11.16**), the Ambiguity score relates to the participants' difficulty to rate the product attributes with which they describe their experience with different products or concepts. In this case, high values of the Ambiguity score (25,833 from d1 or 23,864 from d2) relate to a higher degree of uncertainty in participants' valuation process.

	a1	a2	a3	b1	b2	b3	c1	c2	c3
Total polarization	71,87	54,46	41,66	50,00	35,93	66,96	49,10	50,00	28,40
Ambiguity score	03,12	17,85	16,66	23,75	23,43	14,28	17,85	16,17	22,72
	d1	**d2**	**d3**	**e1**	**e2**	**e3**	**f1**	**f2**	**f3**
Total polarization	38,33	42,04	39,20	40,38	44,16	57,95	60,22	41,66	46,66
Ambiguity score	25,83	23,86	22,15	21,15	22,50	09,09	10,22	16,66	13,33

> table 11.16:

Total polarization and Ambiguity score from the 6 different kitchenware studies.

CONCLUDING REMARKS

This first attempt to apply psychological measures in design research has to be understood with the aim of analyzing the validity and reliability of the information obtained. Moreover, these psychological measures extracted from the Repertory Grid results leave a door open to the analysis of subjective information obtained not only from the RG also from other user experience exploration techniques.

12.

analyzing subjective experience information for inspirational purposes

New tools and methods of human-centered design research are converging on the conceptual phase of the design development process. There is basically a co-evolution of two approaches happening: information and inspiration. Human-centered design research done by designers has mainly focused on the inspirational approach. Research that inspires the design development process is based on the relevance, generativity and evocativeness of results [Sanders, 2005]. It is built through experimentation, ambiguity and surprise to obtain ideas and concepts about future contexts, behaviors and product characteristics. It uses imagination as the basis for expression. This type of research helps designers to increase empathy with users by revealing their inherent needs, desires and fantasies. Research that inspires the design development process shows designers that subjective experiences can be more meaningful in the conceptual phase of product design.

The subjective experience gathering and inspiring techniques (SEGIT) unveil and communicate users' inner needs, desires and fantasies using psychotherapy exploration and expression techniques. This approach allows for the gathering of participants' desired physical attributes as well as functional and symbolic qualities. The SEGIT method can be used in order to generate desirable product behaviors and physical appearance that will allow for an engaging experience beyond a users' first impression with a product.

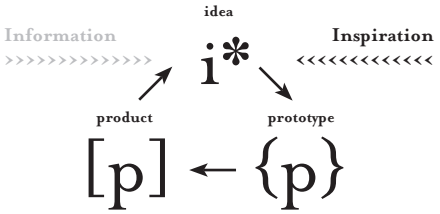
This chapter goes a little bit further by defining key aspects of the inspirational process and applies them in the analysis of subjective experience information gathering techniques. With the purpose of analyzing the SEGIT method as an inspirational aid for designers, the inspirational process is divided in the three phases in relation to the concrete, relational and conceptual level of the generated ideas and concepts.

THE SEGIT METHOD AS A SUBJECTIVE INFORMATION GATHERING TECHNIQUE FOR INSPIRATIONAL PURPOSES

Subjective experience information gathering techniques for inspiring purposes focuses on consumers' unmet and unconscious fantasies for a broad spectrum of product experiences with the purpose of forecasting future interaction behaviors and increasing people's awareness and acceptance of a new product. The SEGIT method is mainly used in the product ideation process before any product concept or prototype is done, in order to set up the right context (see **figure 12.1**).

> figure 12.1:

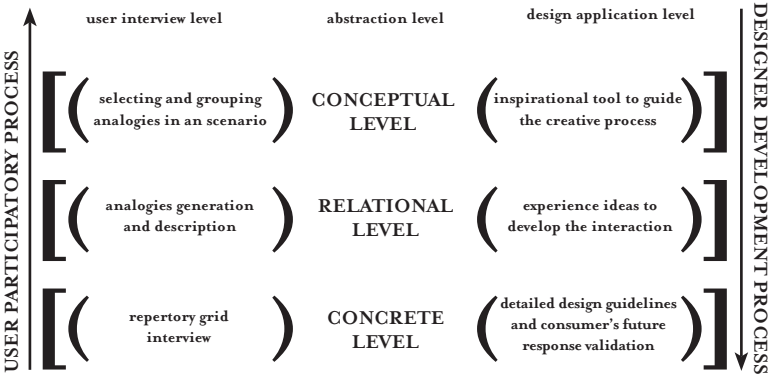
Inspirational research approach in the conceptual phase of the design development process from Sanders [Sanders, 2005].



The generated information and ideas are presented in filling cards, which have three separated parts coming from the three different techniques used. Each technique from the set is related to different user-product interaction levels of abstraction (see **figure 12.2**): the exploration tool (based in the Repertory Grid) is related to a concrete level based on physical appearance, the analogies generation tool is related to a relational level based in the interaction behavior and the scenario tool is related to a conceptual level which is about users' overall experience and satisfaction.

> figure 12.2:

SEGIT integration in the interaction design process



Design relevant information related to each level is useful in different phases of product development:

- The experience scenario can be used as a context tool to guide the creative process. Users experience fantasies can be considered as trends for future context possibilities. Thus using conducting ideas that are present during all the conceptual design process.

- The analogies description generates experience ideas on how to develop interaction concepts. In user experience, desires can be considered interaction style guides. The desired behaviors users would like to have in their relationship with the product to design.

- The repertory grid provides detailed design guidelines about the appearance and key aspects about consumers' future response (initial reactions and the immediate emotional impact). User needs can be considered basic experience requirements to fulfill by relating them to product physical characteristics (i.e. look, feel and sound) and functionality.

ANALYZING THE SEGIT METHOD FOR INSPIRATIONAL PURPOSES

The SEGIT method looks for inspiration purposes in two different directions. It starts from the present to look into past experiences (exploration) and then to future desires and fantasies (projection). The exploration phase focuses in the moment, the present experience with existing products, prototypes or services as a starting point of the process to obtain users' basic needs. The projection phase analyzes past memories to project them into personal dreams from future experiences, shifting to unconscious desires in the analogy generation and description and achieving the most delightful fantasies with scenario generation.

Moreover, to characterize and analyze the ideas and concepts generated with the SEGIT method, the inspirational process is divided into three phases in relation to the concrete, relational and conceptual level of the generated information. The concrete information comes from the exploration phase (RG analysis). Useful for designers in this phase is the detail and completeness of the ideas and concepts generated. Relational and conceptual information comes from the projection phase (sensory metaphors and scenario). What is helpful to designers is the level of abstraction achieved with the ideas and concepts generated without loosing its relation to the purpose or coherence.

Analyzing the SEGIT method for inspirational purposes presents some difficulties. The notions regarding what characterizes evaluating subjective information for inspirational purposes, described in the paragraphs above, come from practice. There is no theory behind this characterization. For these reasons, self-evaluation tests are proposed as the way of gathering, in order to get a direct perception of the usefulness of the method. The different measures chosen in the tests come from an analysis of the comments the students made about the method in previous studies with the repertory grid (see Appendix A), sensory analogies (see Appendix B) and visual narratives (see Appendix C). Each measurement to evaluate is formulated as a question to make it easily understood. Thus, designing the test means looking for suitable questions that represent these measures. See appendix E on CD to look for a sample of the self-evaluation tests and the results obtained.

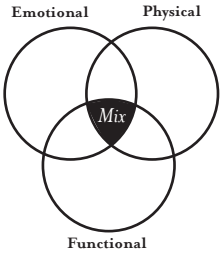
> figure 12.3:

Paper clips study elements from EPISTI course held at UPC

For the purpose of analyzing the SEGIT as an inspirational technique, a design example with paper clips for introducing the method in the Product and Technical systems Engineering I (EPISTI) course held at UPC in 2006 is used. Six groups of five students were told how to run the SEGIT interviews and used the example of analyzing they way papers can be stacked together with a simple mechanism (i.e. the paper clips presented in **figure 12.3**) in order to design a new product that better solves paper clips design flaws.

CONCRETE LEVEL INFORMATION: CHARACTERIZING THE RG

Within the RG results, generated constructs can be classified as: physical, functional, emotional and mixed (see Appendix A). Physical constructs are related to immediate perception, describing one or more product characteristics: straight lines, wood material, reinforced joints and trays with elevated borders. Functional constructs are related to product usage, for example: only for eating or playing, able to slide, short time of use and adjustable structure. Emotional constructs are related to user subjective thoughts, cultural background and experience, for example: comfortable, nice, hygienic, weak, overdressed, seems that you are going to trip over, and discreet. Mixed constructs relate emotional, functional and physical aspects of user experience together. See **figure 12.4** for a construct categorization in emotional, functional, physical and mixed characteristics.



> figure 12.4:

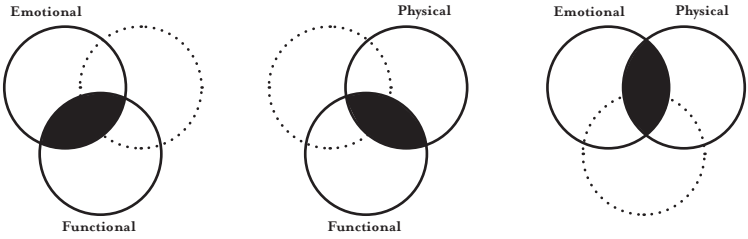
Construct categorization in emotional, functional, physical and mixed characteristics.

This classification can be used to analyze each kind of construct and its relevancy for inspirational purposes. Physical constructs are easily translated into product characteristics, but are related to certain products (based directly on product comparisons). Therefore, it is not possible to determine its importance and relation to user experience. Functional constructs can be used to generate new product features related to user experience, but do not give enough information on how to design their functionalities. Emotional constructs are too ambiguous and general that they can only be used for inspiration. Mixed constructs solve emotional constructs ambiguity with information about usage experience and add physical characteristics to the functional constructs' lack of detail.

The RG is part of the exploration of users' subjective experience. Thus, its usefulness for inspiration purposes depends on the detail and completeness of the ideas and concepts generated. Constructs' typology (physical, functional, emotional and mixed) is used to measure the simplicity or the complexity of the information in relation to the completeness of the ideas and concepts generated. Mixed constructs can be considered more complete because they are made of complex interrelations between physical, functional and emotional characteristics. Emotional, functional and physical constructs can be considered simpler as they contain one single aspect of the user experience. Different types of information relate to different kinds of constructs, see **figure 12.5** for some examples of the possible simple information combinations.

> figure 12.5:

Different combinations of constructs' typology, which characterizes simple information.



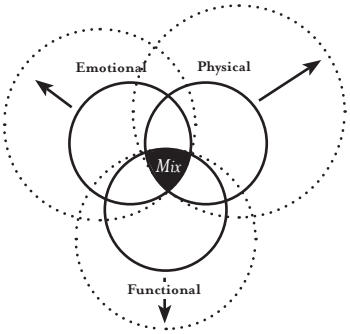
In order to analyze the completeness of the information obtained, the students from each group were asked to classify the constructs they generated as physical (p), functional (f), emotional (e) and mixed (m). **Table 12.1** presents the auto-evaluation analysis the students did by means of the most preferred characterization (mode) and the percentage of students that had the same answer (percentage of agreement). The results show variability in the constructs' categorization (the percentage of agreement is normally below the 60% and 40%), proving that simple constructs from the RG do not really exist and even some of the information that relates strongly to one typology of constructs (physical, functional, emotional) usually have characteristics of the others as well.

> table 12.1:

Results from construct categorization analysis in the paper clips study.

	GROUP 1		GROUP 2		GROUP 3		GROUP 4		GROUP 5		GROUP 6	
	mode	%	mode	%	mode	%	mode	%	mode	%	mode	%
Construct 1	M	0,40	E	0,60	F	0,40	M	0,40	F	0,80	P	0,67
Construct 2	M	0,40	P	0,60	P	0,40	F	1,00	M	0,40	P	0,67
Construct 3	P	0,40	F	0,60	P	0,60	E	0,40	E	0,60	E	0,33
Construct 4	F	0,60	P	0,60	P	0,40	P	0,80	F	0,80	E	0,67
Construct 5	F	0,60	M	0,40	F	0,60	F	0,60	P	0,60	F	0,33
Construct 6	F	0,60	P	0,80	F	0,80	E	0,80	E	0,60	M	0,67
Construct 8	F	0,80	F	1,00	F	0,60	F	0,80	F	0,60	E	0,67
Construct 9	E	0,60	F	0,80	E	0,80	P	0,40	P	0,40	P	0,67
Construct 10	F	0,60	P	0,60			M	0,40	F	0,80	P	1,00
Construct 11	F	0,80	M	1,00			M	0,40			E	0,67
Construct 12	F	1,00	P	0,60			M	0,40			M	0,67
Construct 13	F	0,60	P	0,60			F	0,60			E	0,67
Construct 14	F	0,60	E	0,80							M	0,67
Construct 15	E	0,60										

The repertory grid's usefulness for inspirational purposes, as part of the exploration of users' subjective experience, not only depends on the completeness of information, but also depends on the level of detail of the ideas and concepts generated. These concepts and ideas should give enough information about how to design new product features and product characteristics related to users' experiences. **Figure 12.6** shows how constructs with the same typology can have different levels of detail according to the description of product characteristics.



> figure 12.6:

Variations of the constructs' level of detail.

The in-depth detail of the generated constructs was obtained by asking students from each group to rate from 0 to 5 the level of detail shown in their descriptions. **Table 12.2** presents the auto-evaluation analysis the students did. The results show average values from each group from 3,2 to 3,6 with extreme values of 4,4. These results show no correlation with the typology of the constructs evaluated. Mixed constructs do not have better values than simple constructs with physical, functional or emotional characteristics. Thus, the detail level is independent from the typology and describes another dimension in the Repertory Grid analysis, which might relate to the correct application of laddering techniques during the Repertory Grid interview.

> table 12.2:

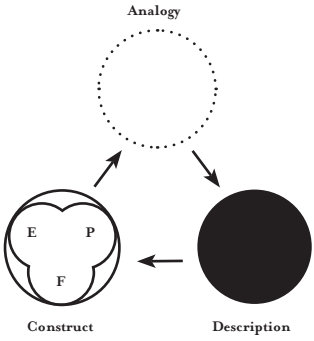
Results from construct level of detail in the paper clips study.

	GROUP 1		GROUP 2		GROUP 3		GROUP 4		GROUP 5		GROUP 6	
	mean	stdev	mean	stdev	mean	stdev	mean	stdev	mean	stdev	mean	stdev
Construct 1	4,2	0,837	2,2	0,837	4,5	0,577	2,6	1,342	3,0	1,414	2,3	0,557
Construct 2	3,0	1,414	4,4	0,894	3,8	0,500	3,2	0,837	3,0	0,816	2,7	0,557
Construct 3	3,8	1,304	3,4	1,817	2,5	0,577	3,6	1,140	4,0	1,414	2,7	0,557
Construct 4	4,6	0,548	3,6	1,342	3,0	1,414	2,8	0,837	3,5	1,732	3,0	1,000
Construct 5	3,4	1,517	3,2	1,304	3,8	1,258	2,4	0,894	3,3	1,258	3,3	0,577
Construct 6	3,2	1,643	4,2	1,304	3,3	1,258	3,0	1,414	2,3	1,258	3,3	0,577
Construct 7	3,8	1,304	3,0	1,581	3,5	0,577	3,4	0,894	3,5	0,577	2,7	0,577
Construct 8	3,2	2,049	2,8	0,087	3,8	0,957	3,4	0,894	3,3	0,957	3,7	1,528
Construct 9	3,6	1,517	4,0	0,707			3,0	1,225	3,0	1,414	3,7	0,577
Construct 10	4,4	1,342	2,4	1,140			3,2	0,837			3,7	0,577
Construct 11	3,6	1,517	2,8	1,304			3,2	0,837			4,0	1,000
Construct 12	4,0	1,000	2,6	1,140			3,2	0,837			3,7	0,577
Construct 13	3,0	1,581	1,4	0,548							3,0	1,000
Construct 14	3,2	2,049										
Construct 15	2,4	1,517										

RELATIONAL LEVEL INFORMATION: CHARACTERIZING SENSORY ANALOGIES

Projective techniques can be described as a mode of guidance that underlies intuitive knowing by using meaning transports, which extend our level of understanding. In this case, sensory analogies are used as carriers of tacit knowledge about subjective experience in order to characterize new behaviors that fulfill users' desires (see Appendix B). Sensory analogies provide useful information in terms of what and how participants like to experience products by moving these preferred actions or situations (constructs) to a parallel product, context or experience (analogy) and to finally illustrate it (description).

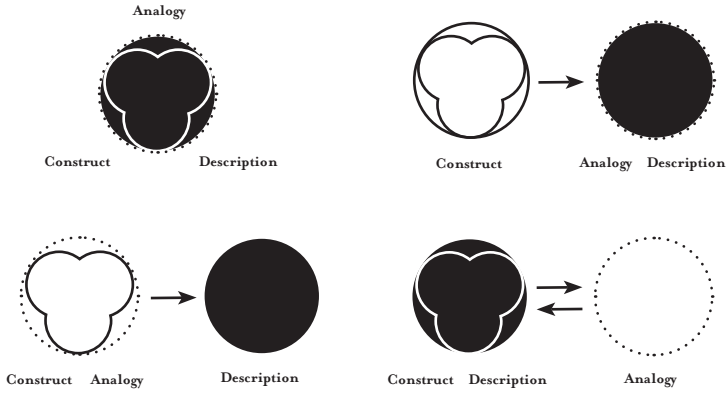
For this reason the analogy must be a sensory comparison about the product usage to be utilized as inspiring information. There has to be a relationship among the use of the product and another product with equal usage characteristics. Moreover, the analogy description has to complement information from both the constructs and analogies. The relationship between the two levels of application (real and projected) provides the designers with information on how to redesign the original product. See **figure 12.7** for a visual representation of the sensory metaphor process.



> figure 12.7:

Informational model of the Sensory metaphor process.

Using Sensory analogies as the projective technique part of the projection phase tend to achieve a high level of abstraction regarding the ideas and concepts generated, without loosing its relation to the purpose or coherence. The level of abstraction of the sensory metaphor is related to the degree of psychological projection, which is defined as the degree of parallelism between the experiences with both products (the distance between the original product and the projected analogy). **Figure 12.8** shows different sensory metaphor examples where the projection level is not high enough and an overlap exists between the construct, the analogy and/or the description. Note that the existing overlap between phases of the sensory generation process means that the information obtained is not substantially different.



> figure 12.8:

Overlap between the construct, the analogy and/or the description in sensory metaphors with a low level of projection.

In order to analyze the abstraction of the sensory analogies generated, the students from each group were asked to rate from 0 to 5 the projection level shown in sensory analogy generation process they guided. **Table 12.3** presents the auto-evaluation analysis the students did from the analogy generation phase in the paper clip study. The results show average projection values from each group from 2,8 to 3,6 with extreme values of 4,6. These results show no correlation with the typology and the detail level of the constructs evaluated. This means that the exploration phase (Repertory Grid analysis) is independent from the projection phase (generation of sensory analogies) in relation to the achieved level of projectivity. Moreover, the variability of the results revealed that external variables should be taken into account. In this case, after the groups' experimentation with the SEGIT method, it can be said that the ability of the participants in the interview (intended users) to relate to different contexts and experience can influence the projection level of the resulting sensory analogies.

> table 12.3:

Results from analogy generation phase projection level in the paper clips study.

	GROUP 1		GROUP 2		GROUP 3		GROUP 4		GROUP 5		GROUP 6	
	mean	stdev	mean	stdev	mean	stdev	mean	stdev	mean	stdev	mean	stdev
Analogy 1	3,2	1,304	3,6	1,342	3,0	0,816	2,8	1,304	3,3	1,500	2,7	1,528
Analogy 2	2,4	1,673	4,0	1,000	2,5	1,000	3,2	1,304	4,0	1,414	4,3	0,557
Analogy 3	3,2	2,049	2,6	1,342	2,5	1,291	2,8	1,304	3,3	0,500	2,7	1,528
Analogy 4	3,0	1,871	3,4	1,140	3,0	0,816	2,8	1,304	3,8	1,893	4,0	0,000
Analogy 5	4,6	0,894	3,0	1,225	3,0	1,826	4,2	0,837	3,0	1,414	2,3	1,555
Analogy 6	4,4	0,894	3,8	1,095	2,5	0,577	2,6	1,140	4,0	2,000	3,7	1,528
Analogy 7	4,0	1,000	3,6	1,517	2,8	0,258	2,6	1,517	3,8	0,957	3,7	0,577
Analogy 8	3,8	0,837	3,8	0,837	3,3	0,957	3,8	0,837	3,5	1,000	3,0	1,000
Analogy 9	2,6	1,817	3,4	1,517			2,4	1,517	4,0	1,414	2,7	0,577
Analogy 10	2,8	2,029	3,2	1,483			2,6	0,548			4,3	0,577
Analogy 11	3,4	1,517	3,0	1,225			2,4	1,140			3,0	1,000
Analogy 12	2,8	1,789	3,8	1,304			3,6	0,548			3,0	0,000
Analogy 13	3,0	1,871	1,4	1,789							3,0	2,000
Analogy 14	3,0	2,000										
Analogy 15	3,8	1,643										

Sensory metaphors as a projective technique part of the projection phase not only need to achieve a high level of abstraction with the ideas and concepts generated, they also have to be coherent with their own results and the information from the exploration phase. These coherence aspects of the sensory metaphor generation process are related to the feedback information it brings to the construct from where it originates. A high feedback level is achieved when a relational triangle exists among the information obtained from the construct, the generated analogy and its description. **Figure 12.9** represents an example of the sensory metaphor generation process with a low level of feedback. Observe that the analogy description does not relate at all to the construct it comes from, as there is no relation between the analogy description and the construct information. Thus a small training guided by the interviewer should increase these values.

> figure 12.9:

Example of a sensory metaphor generation process with a low level of feedback.

In order to analyze the feedback of the sensory analogies generated, the students from each group were asked to rate from 0 to 5 the feedback level shown in the sensory analogy generation process they guided. **Table 12.4** presents the auto-evaluation analysis from the analogy generation phase in the paper clips study. The results show average feedback values from each group from 2,8 to 3,5 with extreme values of 4,6. These results show no correlation with the typology and the detail level of the constructs evaluated. This forces us to consider the exploration phase (Repertory Grid analysis) independent from the projection phase (generation of sensory analogies) in relation to the achieved level of feedback. Moreover, the variability of the results again pointed out that external variables should be taken into account. In this case, after the groups' experimentation with the SEGIT method, the ability of the practitioners (students from the different groups) to guide the interview to relate different contexts and experience and later describe them, can influence the feedback level of the resulting sensory analogies. Thus a skilled performance done by the interviewer should increase these values.

> table 12.4:

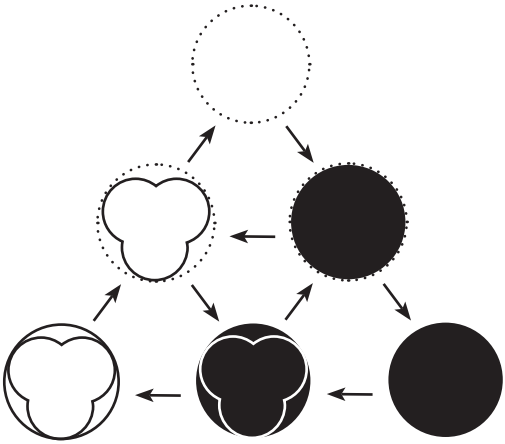
Results from analogy generation phase feedback level in the paper clips study.

	GROUP 1		GROUP 2		GROUP 3		GROUP 4		GROUP 5		GROUP 6	
	mean	stdev	mean	stdev	mean	stdev	mean	stdev	mean	stdev	mean	stdev
Analogy 1	4,0	1,000	4,6	0,548	3,0	0,816	3,4	0,894	3,5	1,000	2,3	1,528
Analogy 2	3,2	0,837	2,6	1,517	3,0	0,816	4,3	1,673	4,3	1,500	3,3	0,577
Analogy 3	2,0	1,000	3,2	0,837	2,5	1,000	4,0	1,000	3,0	0,816	2,3	1,155
Analogy 4	2,6	1,673	2,8	1,095	3,5	1,000	4,2	0,837	3,3	1,708	3,3	1,155
Analogy 5	4,0	1,414	2,8	2,049	3,5	1,191	3,4	1,517	4,3	0,957	2,3	1,155
Analogy 6	4,0	1,000	3,4	1,342	2,8	0,957	3,0	1,414	4,0	0,816	3,7	0,577
Analogy 7	3,8	1,643	3,2	1,304	3,8	0,500	2,0	0,707	4,0	0,816	2,7	0,577
Analogy 8	4,2	1,304	3,8	1,304	3,3	0,816	3,2	0,837	3,3	1,500	2,3	0,577
Analogy 9	2,4	1,140	2,0	1,414			2,0	1,000	1,8	0,500	2,7	0,577
Analogy 10	2,8	2,029	3,6	1,673			3,6	0,548			3,0	1,000
Analogy 11	3,8	1,304	2,4	1,140			3,8	1,095			3,0	1,000
Analogy 12	2,6	1,673	2,4	1,517			3,4	1,140			3,0	1,732
Analogy 13	3,4	0,894	2,8	1,483							2,3	0,577
Analogy 14	3,6	0,548										
Analogy 15	3,8	1,095										

CONCEPTUAL LEVEL INFORMATION: CHARACTERIZING THE SCENARIO

The defining feature of narratives is that they are permeable structures allowing the person to simultaneously enchain a wide array of elements, ideas, and images. Like in Visuals for inspiration (see Appendix C), narratives are used to create an imaginary associative play, which allows one to create unusual, even strange, combinations of ideas and elements. In this case, the scenario relates the different analogies as the most desired fantasies, creating a dream of the future.

In order to inspire, the generated narrative cannot have concrete physical aspects of the existing product, although it can have interrelated concrete physical aspects of other products that shape the scenario from the sensory analogy generation. See **figure 12.10** where the interrelations between the different analogies that create the scenario are shown.



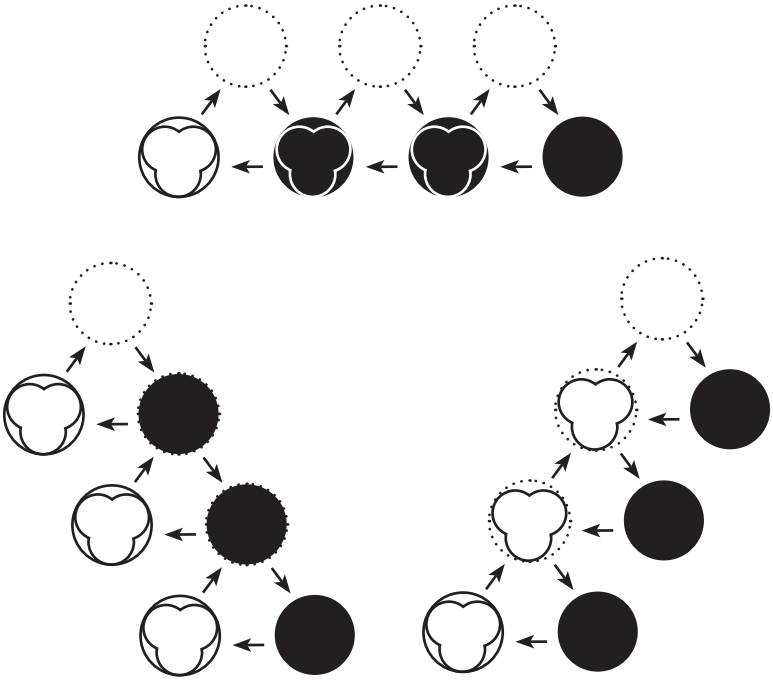
> figure 12.10:

Example of the interrelations between the different analogies that create a scenario.

The scenario as a projective technique part of the projection phase tends to achieve a high level of abstraction with the ideas and concepts generated without loosing its relation to the purpose or coherence. The level of abstraction of the scenario is related to the degree of fantasy. The breakthrough or distance between the analogies and the scenario defines this level of fantasy and is based on the way the analogies are interrelated to each other. **Figure 12.11** shows different ways in which these interrelations are done. If the connection is made between sensory analogies, by relating constructs and analogies (example a), then this bottom-up scenario increases the abstraction between each connection, thus generating a high level of fantasy. A top-down connection between analogies and descriptions (example b) decreases its abstraction with each connection generating a low level of fantasy. A scenario generated with connections between constructs and descriptions (example c) maintains the same level of abstraction as the used sensory analogies, generating a medium level of fantasy.

> figure 12.11:

Examples of different ways sensory analogies are interrelated to each other in a scenario with bottom up (a), top down (b) and leveled (c) connections.



In order to analyze the fantasy of the scenario generated, the students from each group were asked to rate from 0 to 5 the fantasy level shown in scenario writing process they guided. **Table 12.5** presents the auto-evaluation analysis the students did from the scenario phase in the paper clips study. On one hand, these results do not show any correlation with the exploration phase or the other part of the projection phase (sensory analogy generation), meaning that the scenario generation phase can be considered independent in relation to the achieved level of fantasy. On the other hand, the results show that 50 % of the groups achieved a high level of fantasy (4 or higher) and other groups mainly had medium results from 2,4 to 3,4, signifying that training the participants to use construct-analogy interrelations in the scenario writing process should help to improve these results.

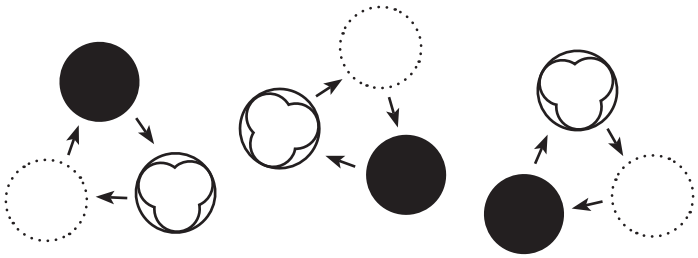
> figure 12.5:

Results from scenario generation phase fantasy level in the paper clips study.

	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6
	mean stdev	mean stdev	mean stdev	mean stdev	mean stdev	mean stdev
Scenario	2,4 1,342	3,4 0,548	4,0 0,000	4,0 0,707	3,0 1,155	4,3 0,577

The scenario as a projective technique part of the projection phase not only needs to achieve a high level of abstraction with the ideas and concepts generated, it also has to be coherent with its own results and the information from the previous phases (sensory analogies and RG results). These coherence aspects of the

scenario writing process are related to the interrelations that exist between the different analogies that generate the scenario. A high coherence level is achieved when a strong interrelation exists between the analogies through their elements (constructs, analogies and descriptions). **Figure 12.12** represents an example of the scenario writing process with a low level of coherence. Observe that there is no connection between the different analogies that take part in the scenario.



> figure 12.12:

Example of how sensory analogies are interrelated to each other in a scenario with a low level of coherence.

In order to analyze the coherence of the scenario generated, the students from each group were asked to rate from 0 to 5 the coherence level shown in scenario writing process they guided. **Table 12.6** presents the auto-evaluation analysis from the scenario phase in the paper clips study. These results show no correlation with the typology and the detail level of the constructs evaluated. Therefore, the exploration phase (Repertory Grid analysis) is independent from the exploration phase and the other part of the projection phase (sensory analogy generation) in relation to the coherence level achieved. Indeed, the coherence level in the scenario generation phase can also be considered independent from an achieved level of fantasy. Moreover, relating these observations to the variability of the results (values from 2,8 to 4,5) pointed out that external variables should be taken into account. In this case, after the groups' experimentation with the SEGIT method, it can be said that the ability of the practitioners (students from the different groups) to guide the interview to relate different sensory analogies into a narrative, can influence the coherence level of the resulting scenario. Thus a skilled performance done by the interviewer should increase these values.

	GROUP 1		GROUP 2		GROUP 3		GROUP 4		GROUP 5		GROUP 6	
	mean	**stdev**	**mean**	**stdev**	**mean**	**stdev**	**mean**	**stdev**	**mean**	**stdev**	**mean**	**stdev**
Scenario	3,6	0,548	4,0	1,000	2,8	0,500	3,8	0,447	4,5	0,577	3,0	1,000

> table 12.6:

Results from scenario generation phase coherence level in the paper clips study.

CONCLUDING REMARKS

This first attempt to analyze the thoroughness of the information obtained for inspirational purposes in design practice gives some interesting details about the key aspects about the relevancy of the information obtained with the SEGIT method It describes the ideal combination of different typologies of constructs, the informational model of the sensory metaphor generation process and the interrelations between the different analogies to create an scenario.

Part 5: exploring designers and users roles with subjective experience gathering techniques

13. Modeling designers and users subjective experience communication framework into interaction design.

14. Analyzing designers' and users' roles with subjective experience gathering techniques.

13.

modeling designers and users subjective experience communication framework into interaction design

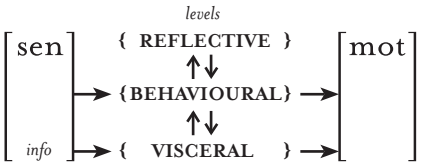
A number of factors determine the nature of a user-product relationship. Subjective information such as ideals, wishes, or dreams play an important role. They can make the user experience much more personal and have a big impact on the design process and the final product design. Ideally, a designer likes to map all these possible factors and their interrelations, but that process also relies on the intended users to determine what is required.

Users' subjective experiences have all kinds of specific and subtle manifestations and are often multifaceted. Given this information about complex relationships and dependencies between products and context, the identification and/or selection of relevant factors are tasks for the designer and the intended users.

This chapter focuses in the user's experience information vs. designer's inspiration dichotomy in order to analyze designers' and users' subjective experience information workflow. Users' subjective experience information characterization is based on Norman's information processing model [Norman et al., 2003]. The interaction design process and levels of product description is based on Hekkert's Vision in Product design (ViP) approach [Hekkert & Dijk, 2001]. Then, both visions are merged in an attempt to model designers and users subjective experience communication framework into interaction design.

SUBJECTIVE EXPERIENCE INFORMATION CHARACTERIZATION BASED IN NORMAN'S INFORMATION PROCESSING MODEL

Human beings have evolved a rich set of information processing mechanisms for engaging the world. These human attributes result from three levels of brain mechanism (visceral, behavioral, reflective) according to Norman's information processing model [Norman, 2004]. Each level plays a different role in the total functioning of people in order to assign meaning (cognitive component) and assign value (affective component) while interacting with products or services. See **figure 13.1**.



> figure 13.1:

Norman's information processing model [Norman, 2004] in terms of the sensory information and the motor response.

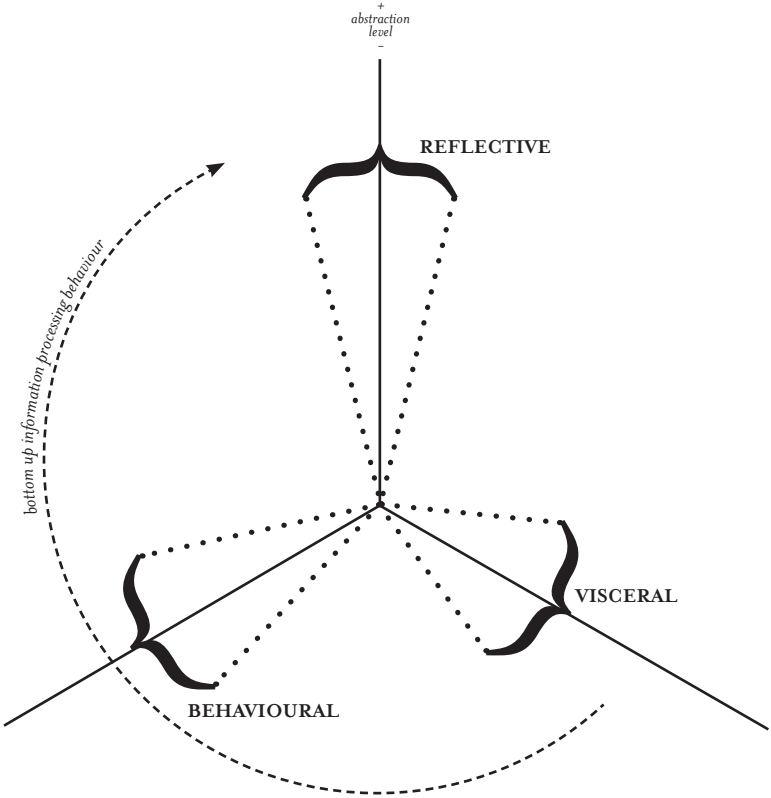
The visceral level consists of the lowest-level processes of the brain. It comprises immediate responses to information coming from the sensory systems (a rapid reaction to the current state) [Norman et al. 2003]. The output from the visceral level is a set of simple enabling signals, affective signals, and motor actions [Norman et al. 2003]. The visceral level related to user-product interaction is about fixed routines, where the brain analyzes the product and responds (initial reactions and the immediate emotional impact). Physical features like look, feel and sound dominate; shape and form also matter.

The Behavioral level is the home of most motor skills, including language generation. It is quite complex as it involves the process to select and guide behavior [Norman et al. 2003]. This level has access to permanent memory in relation to the learning process and working skills, as well as evaluative and planning mechanisms [Norman et al. 2003]. The Behavioral level related to user-product interaction is about use and performance. This refers to the subconscious process control of everyday behaviors and the feelings accompanied by skilled accomplishment, pleasure and effectiveness of use.

The Reflective level is the contemplative area of the brain capable of reasoning. It performs operations where the mind deliberates over its own internal representations of its experiences, of its physical embodiment, its current behavior, and the current environment, along with the outputs of planning, reasoning, and problem solving [Norman et al. 2003]. The Reflective level related to user-product interaction is all about the message, about culture, about the meaning of a product or its use (the personal remembrances something evokes).

The three levels interact with one another, each modulating the others. Within this model, user-product interaction can be considered a bottom up information processing behavior, where activity is initiated from the lowest, visceral levels.

Thus, if the information process behavior of gathering information about user product perception is characterized through these three levels of brain mechanism, the ensuing process can be represented as a clockwise progression. In the **figure 13.2**, the three axis represent the levels of information (reflective, behavioral and visceral). The area underlined can be considered the information obtained from experience gathering techniques and the distance from the center is the level of abstraction.



> table 13.2:

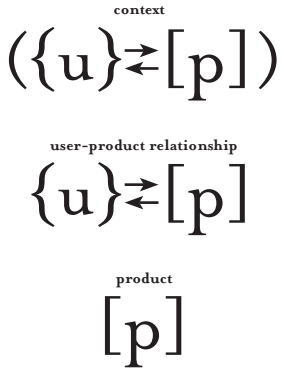
Experience information gathering process developed from user-product interaction information processing model.

INTERACTION DESIGN PROCESS AND LEVELS OF PRODUCT DESCRIPTION BASED IN THE VIP APPROACH

In trying to understand products from the designer point of view and why they are what they are, it is helpful to distinguish three description levels [Hekkert & Dijk, 2001] (see **Figure 13.3**). At the most basic level (product characteristics) designers can describe the product as a material shape with components, color, form, and other quantifiable characteristics. The second level of description (user-product relationship) is about product functionality and meaning. At this level, designers can describe a product in terms of what it affords, how it used and how it responds. The third level is the context and consists of all kinds of factors (e.g. social patterns, technological possibilities, and cultural expressions [Hekkert & Dijk, 2001]), which are embedded in it.

> figure 13.3:

Three levels of product description in the design process by Hekkert [Hekkert & Dijk, 2001]



In order to formalize the interaction design process in relation to a subjective experience approach an existing methodology is used. The Vision in Product design approach (ViP) [Hekkert & Dijk, 2001] is a methodology to predict an interaction with a product, by designing contexts for experience. According to this approach, the designer gets an image of the interrelation between the new need and the new product, which is supposed to sustain equilibrium in this new context. This image is called 'vision of interaction' and is defined as a view or consciousness of the interaction between a future user and a future product.

In the ViP approach, the theoretical framework of the three levels of description illustrated above is translated into a six-stage method a designer can use as a guideline. In the first stage the designer focuses on breaking preconceptions. The second stage is dedicated to the creation of a context through collecting relevant and interesting factors. Two intermediate stages (interaction and product vision stages) are used to describe the user concerns and the product features at the same time. The last two stages of the ViP method conceptualize and materialize this vision. These stages are described further in detail [Hekkert & Dijk, 2001]:

- The first stage is based in destructuring to break down preconceptions. During it, designers should leave all kinds of knowledge, conventions and assumptions they have regarding the focus of a study in order to freely choose which factors or conditions should be applied to the new context.

- In the second stage, which focuses on creating a new framework, designers have to select those aspects that they consider essential for the study domain to create a new framework coherent with these assumptions.

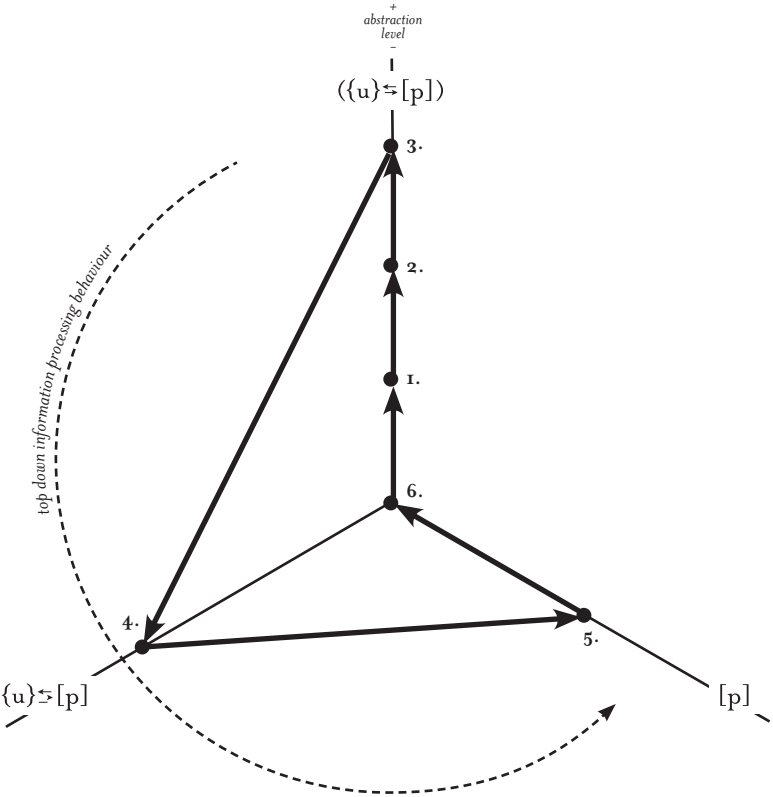
- The third stage aims to get an understanding of the new user-product relationship within the generated framework in order to create a vision of interaction. In it, designers have to build a global image of the relationship between the new framework and the new product to maintain a balance within this new context. This vision of interaction refers to the perceived or experienced qualitative aspects of the user-product relationship and how it relates user's needs, expectations and desires.

- The fourth stage creates a product vision from the vision of interaction. The product vision describes qualitative product characteristics such as appearance, function, meaning, and expression in relation to the intended interaction.

- The fifth stage generates product concepts based in the vision of interaction and the product vision. These two visions guide designers in this design process to create conceptual product design.

- The sixth stage translates the product concept into a product design that can be materialized into a tangible product.

This design process can be represented as a top down progression of information processing behavior in relation to the three levels of product description. **Figure 13.4** shows this process in an anti-clockwise progression where the distance from the center is the level of abstraction and the area underlined can be considered the information needed for the design process.



> figure 13.4:

Interaction design process developed from the three levels of product description.

TOWARDS A FRAMEWORK FOR MODELING DESIGNERS AND USERS SUBJECTIVE EXPERIENCE INFORMATION WORKFLOW

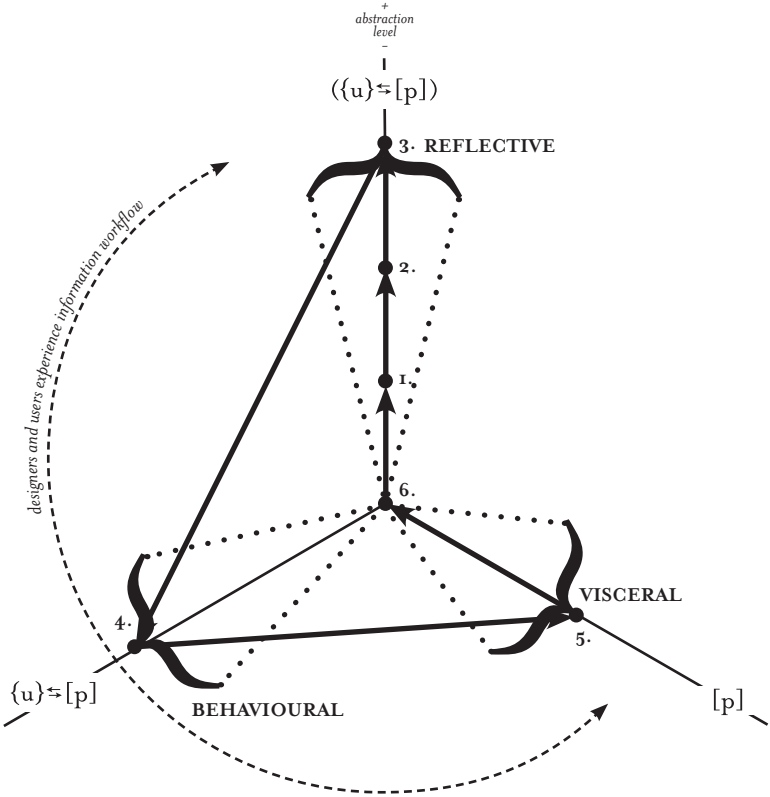
In the previous sections, product interaction was analyzed from two different points of view. On one hand the subjective experience information gathering process from user-product interaction and the other, the interaction design process. Each representation is generated in 2 dimensional space based on a 3-axis formula: the three levels of information processing (reflective, behavioral and visceral) and the three levels of product description (product characteristics, user-product relationship and context):

- Information from the product context can be considered part of the Reflective level as it relates information from a conceptual level. Social patterns, technological possibilities and expressions embedded in a product are the personal remembrances it evokes about a message, culture and meaning.

- Information from the user product relationship relates to the Behavioral level as it relies on the same relational level. What a product affords, how it is used and how it responds refer to the subconscious process that controls behavior and the feelings accompanying skilled accomplishment, pleasure and the effectiveness of use.

- Information from the product's attributes can be considered part of the Visceral level as it is relies on a concrete product description. Material shape with components, color, form, and other quantifiable characteristics trigger the initial reactions and the immediate emotional impact of how a product looks, feels and sounds.

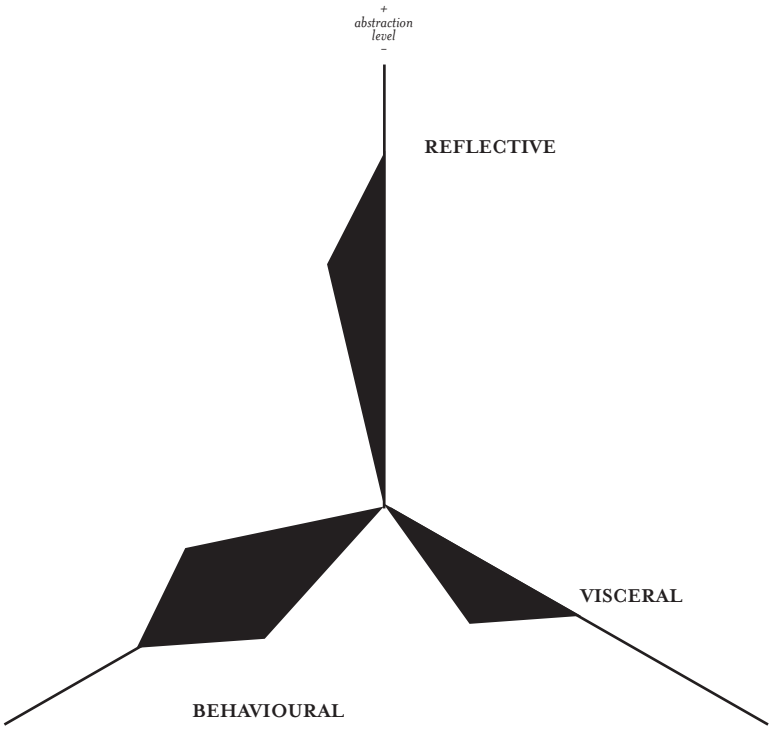
Then, the bottom up (clockwise) user process and the top down (anti-clockwise) design process can be represented in the same framework to model designers and users subjective experience communication. **In figure 13.5**, the intersection of the information areas of both processes represents the workflow between designers and users in a qualitative way.



> figure 13.5:

Resulting designers and users subjective experience communication framework into interaction design.

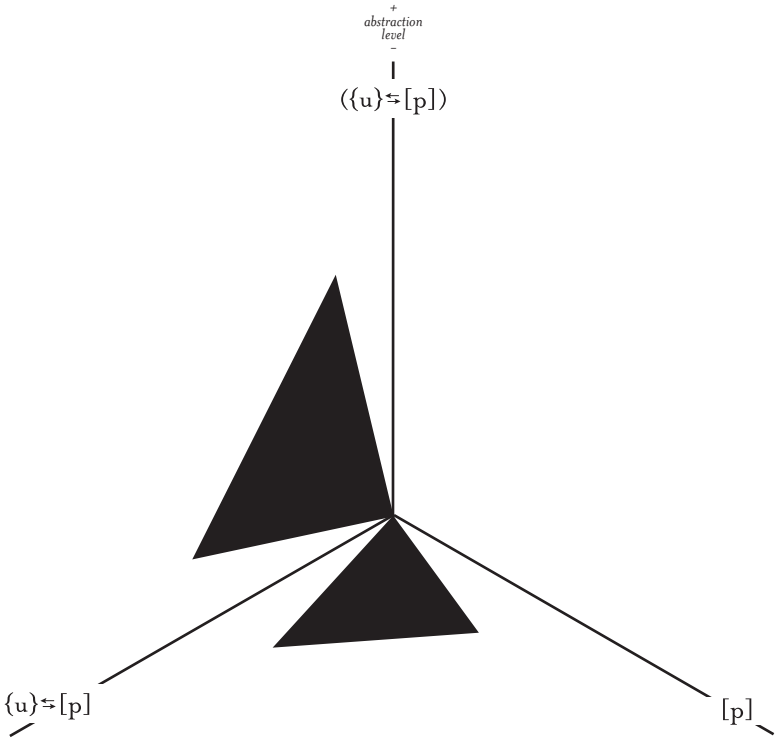
The user process starts from the bottom layers associated with interpreting sensory inputs to the body (from the Visceral level to the Reflective level). It is driven by perception [Norman, 2002]. **Figure 13.6** represents the design relevant information obtained from users on the three different levels, where the distance from the center is the level of abstraction.



> table 13.6:

User's subjective information relevant for designing purposes.

The design process starts from the high layers associated with higher thought process of the designer (from the context level to the characteristics) [Hekkert et al. 2003]. **Figure 13.7** shows the information that the designer must generate during the design process on the three different levels considering that the distance from the center is the level of abstraction.



> figure 13.7:

Information the designer needs to generate during the design process.

CONCLUDING REMARKS

The presented framework was developed with the goal to have a qualitative and visual representation of designers and users subjective experience communication. It provides the possibility of deconstructing the design process and the information needed into different parts in order to determine the roles of the designers and users. In the next chapter this framework is going to be used to compare and analyze the different techniques developed.

14.

analyzing designers' and users' roles with subjective experience gathering techniques

The information processing model allows for describing users' and designers' communication workflow during the product design process. In the following chapter this framework is used in order to characterize different subjective experience in information gathering exploratory techniques (experience landscapes, sensory metaphor generation, visual narratives) and the resulting SEGIT method within the design process.

The experience landscapes technique, which mainly focuses on the visceral information processing level, can be defined as a cooperative inquiry and described as an organized interview. It enables users to tell designers something of the way in which they see and order the world, building up mental maps of the users' world in their own words. The sensory metaphor technique is a projective process in the behavioral information processing level used to enhance sensitivity to tacit understandings. It works as a mode of guidance that underlies intuitive knowing. The results are sensory reconstructions of high-generality imagery described as being somewhere between perceptions and symbolic thought. The visualization of inner needs desires and fantasies technique apply narrative procedures based in a self-exploration and expression loop, contributing to a better understanding of personal values from the reflective information processing level.

The resulting SEGIT method can be defined as a set of inspirational, concept generation and evaluation techniques to design user's experiences based on unveiling users' needs, desires and fantasies. This set of techniques merge exploration and projection techniques to obtain a thorough understanding of user's emotional requirements from the three levels of information processing (visceral, behavioral and reflective).

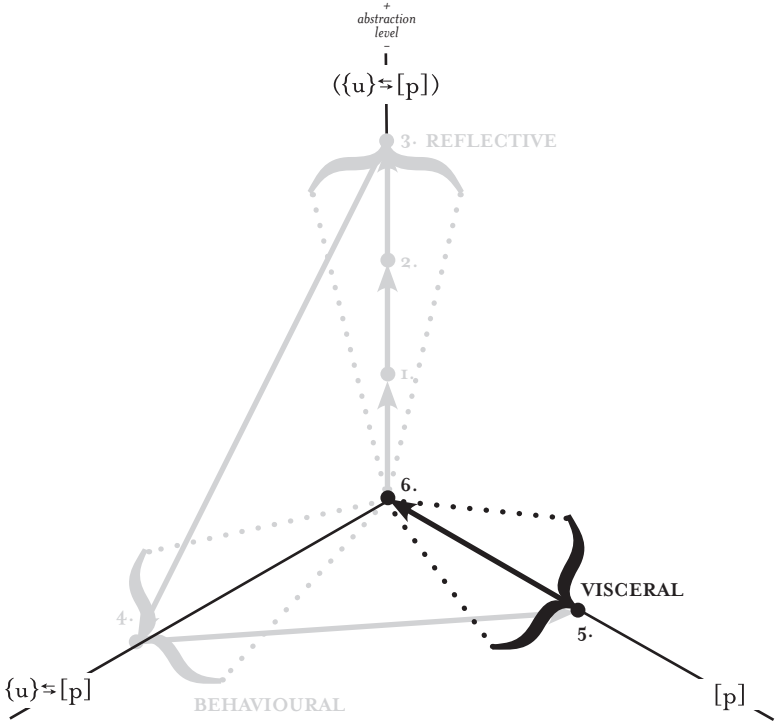
EXPLORATIVE CASE A: EXPERIENCE LANDSCAPES (EXLAND)

The experience landscapes exploratory case (see Appendix A for its application in the redesign of a baby chair) can be defined as a cooperative inquiry between the designer and the user. It is described as an organized interview, which uses comparison in its development. Thus, creating a set of constructs or bipolar dimensions related among each other where adjectives and characteristics correlate with the appraisal. It enables users to tell designers something of the way in which they see and order the world, building up mental maps of the users' world in their own words.

The information obtained with the experience landscapes gathering technique is mainly related to the visceral information processing level of the users (see **figure 14.1**). It comprises immediate responses to state information coming from the sensory systems emerged from the comparison of the experience obtained with different products or services. This information can be relevant in final stages of product development like the creation of product concepts (stage 5 in **figure 14.1**) and for translating them into a product design that can be materialized into a tangible product (product design specifications). It is mainly used for redesign purposes (stage 6 in **figure 14.1**).

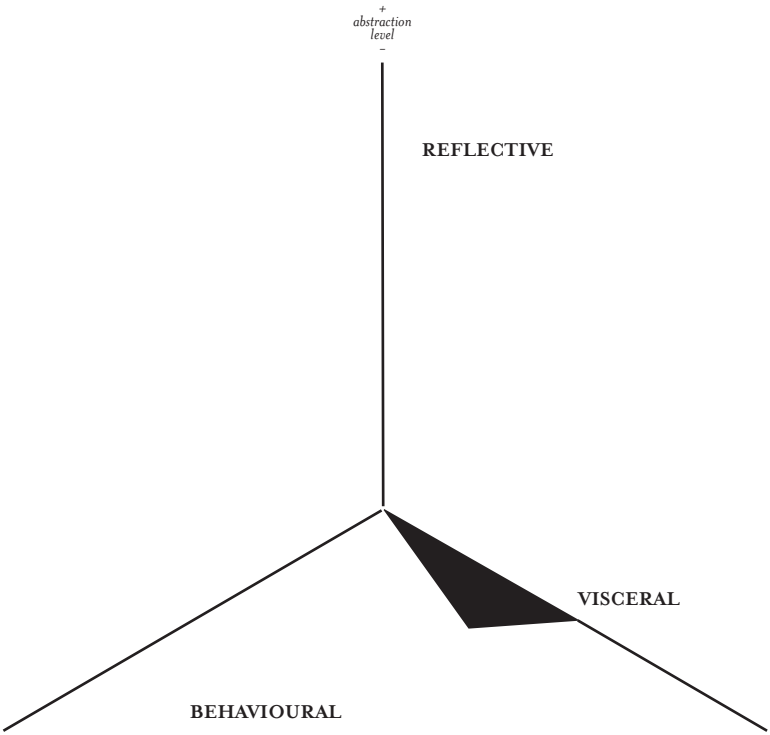
> figure 14.1:

Experience landscapes technique characterization within the design process.



The information obtained in the experience landscapes explorative case was detailed, reliable and mostly unknown to the user. The main drawbacks of the information gathering process can be summarized in the following learning problems: difficulty in forming non-biased open questions, characteristics grouping problems for construct generation and difficulties in applying the laddering method to obtain design-relevant information. Despite all these considerations, doing a pilot interview to get basic knowledge about the procedure can easily solve all of these problems.

Within the experience landscapes results, generated constructs come from the visceral level and can be classified as: physical, functional and emotional. Physical constructs are related to immediate perception, describing one or more product characteristics, like: straight lines, wood material, reinforced joints, and tray with an elevated border. Functional constructs are related to product usage, for example: only for eating or playing, able to slide, short time of use and adjustable structure. Emotional constructs are related to user subjective thoughts, cultural background and experience, for example: comfortable, nice, hygienic, weak, overdressed, seems that you are going to trip over, and discreet. Just some of these characteristics will be useful in the design process. That's why in **figure 14.2** the area of information is represented by part of the area comprising users' subjective information, following the design process and not by the whole theoretical information triangle from the visceral level.

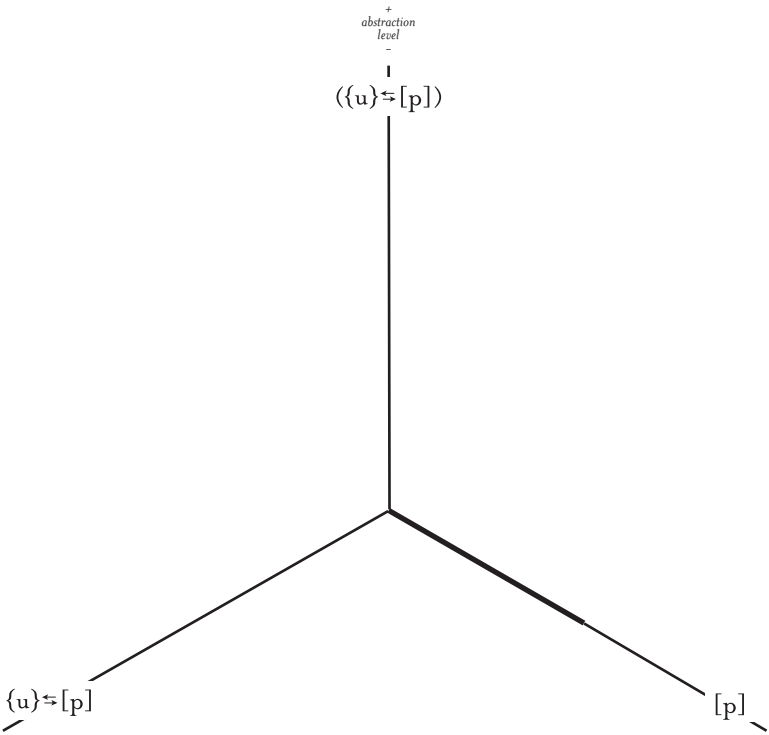


> figure 14.2:

User's subjective information obtained with the experience landscapes technique relevant for designing purposes.

From the designers' point of view, this classification can be used to analyze each kind of construct and its design relevancy. Physical constructs are easily translated into product characteristics but are related to certain products (they are based directly on product comparisons). Therefore, it is not possible to determine their importance and relation to user experience. Functional constructs can be used to generate new product features related to user experience but don't give enough information about how to design its functionalities. Emotional constructs are too ambiguous and general such that they can only be used for inspiration.

Despite these observations, it is important to highlight that by applying the laddering technique most of the generated constructs can be considered mixed constructs. Constructs of this kind relate physical, functional and emotional characteristics. Moreover, information that comes up from these kind of constructs can be considered design-relevant because they solve the emotional construct's ambiguity with information about usage experience while also adding physical characteristics to the functional constructs' lack of detail. That brings a level of usefulness to the subjective experience gathering technique that cannot be achieved by objective user-experience exploration methods like tests and surveys that are applied to obtain information about the user's visceral level of information processing. For this reason, the representation of the information that designers have to generate is the minimum possible (see **figure 14.3**).



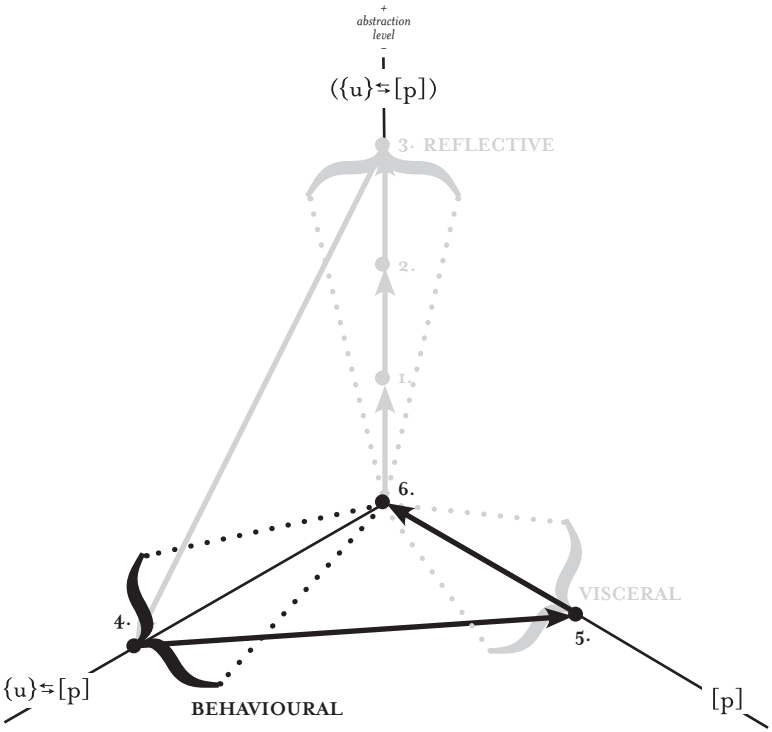
> figure 14.3:

Information the designer needs to generate during the design process after applying the experience landscapes technique.

EXPLORATIVE CASE B: SENSORY METAPHOR GENERATION (SMG)

The sensory metaphor technique (see Appendix B for its application in the redesign of a key ring, a table lamp, rollerblades, children's glasses and a backpack) is a projective process in the behavioral information processing level used to enhance sensitivity to tacit understandings (it works as a mode of guidance that underlies intuitive knowing). Projective techniques are based on the idea that new chains of implications become possible as broad levels of abstraction open a much wider network of subordinate categories and ideas. From the expertise in one domain, this level of abstraction allows one to grasp connections between otherwise irrelevant concepts. The results are sensory reconstructions of high-generality imagery described as being somewhere between perceptions (visceral level) and symbolic thought (reflective level). See **figure 14.4**.

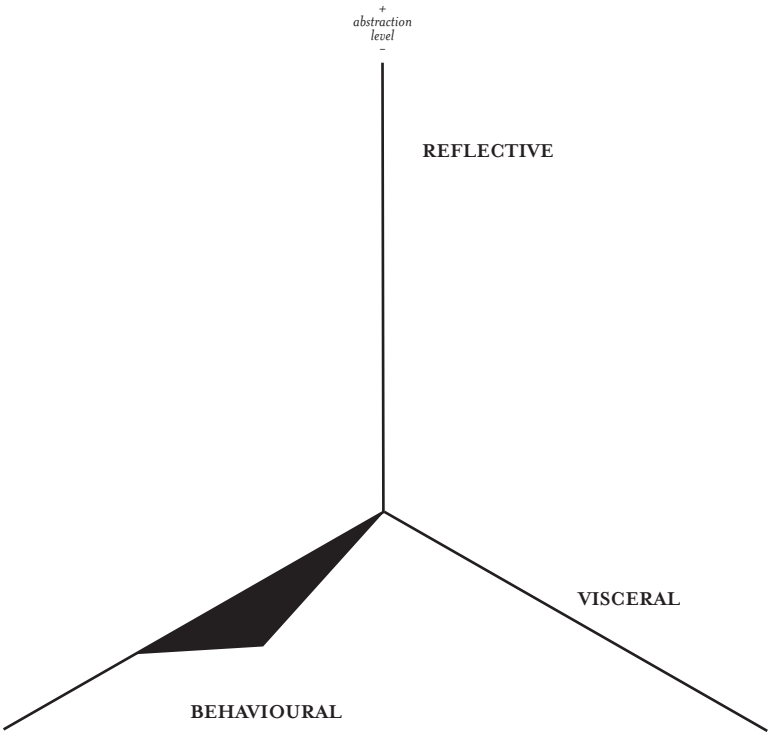
From the design process point of view, translating the behavioral experience (note that it refers to everyday behavior and feelings accompanying skilled accomplishment, the pleasure and the effectiveness of use) behind the sensory metaphor context into interaction concepts can create enriched user-product relationships (stages 4,5 and 6 from **figure 14.4**).



> figure 14.4:

Sensory metaphor generation technique characterization within the design process.

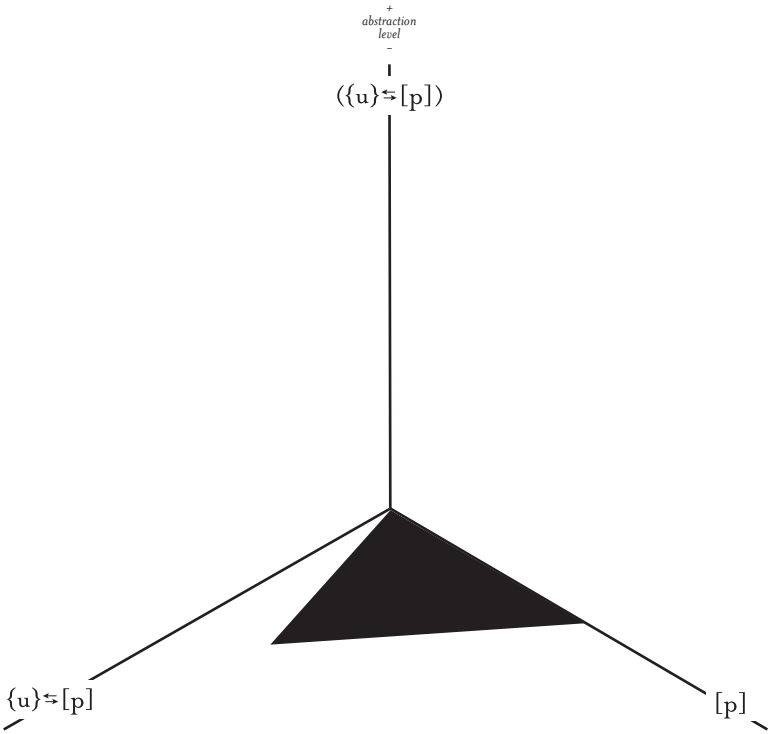
General issues emerge from this second exploratory case that attempts to obtain information about the user-product relationship description level (see **figure 14.5**). Success and limitations of the approach can be explored from the users' information gathering point of view, considering aspects about learning the methodology and the suitability of testing methods. For the sensory analogies tests and final product concept tests, attitude and product appreciation tests were chosen using attributes determined by the users and the designers collectively. The sensory analogy tests depended on the correct interpretation or misunderstanding of sensory analogies of thought images and a short description of the sensory analogy was used. Also product concept tests depended on the correct selection of emotional attributes and their correct interpretation from the sensory metaphor.



> figure 14.5:

User's subjective information obtained with the sensory metaphor generation technique relevant for designing purposes.

From designers' point of view, the usefulness of the methodology relies on the idea of using sensory metaphors as embodied experience communicators. Designers understood this concept but occasionally they did not utilize their full potential because they applied them in a reduced way. The information obtained was related to the behavioral level, to user-product interaction relationships but due to the lack of information relating to product characteristics, designers translated the exact physical characteristics from the sensory metaphors into the new design and not the general experience to transmit. See **figure 14.6** for a representation of the information designers need to generate after applying the sensory metaphor generation technique.



> figure 14.6:

Information the designer needs to generate during the design process after applying the sensory metaphor generation technique.

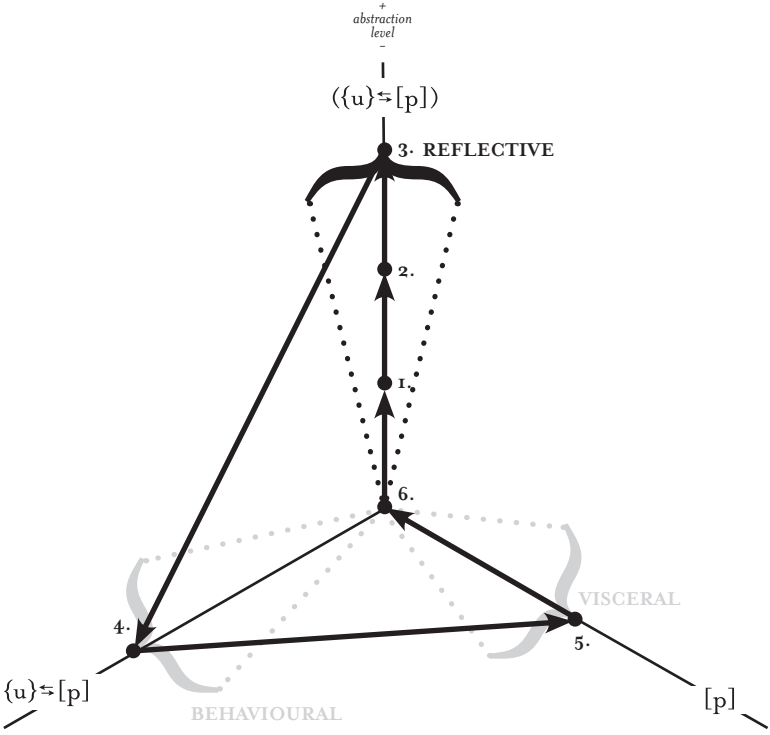
EXPLORATIVE CASE C: VISUALS FOR INSPIRATION (VFI)

The visualization of inner needs, desires and fantasies explorative case (see Appendix C for its application to forecast new mobile communication devices) applies narrative procedures. By relating user's subjective experiences into a well-known context like telling a story, these sub-conscious experiences can migrate to a storytelling experience as people schematize it, communicate it, and add levels of meaning. This process is based in a self-exploration and expression loop, contributing to a better understanding of personal values from the reflective information processing level.

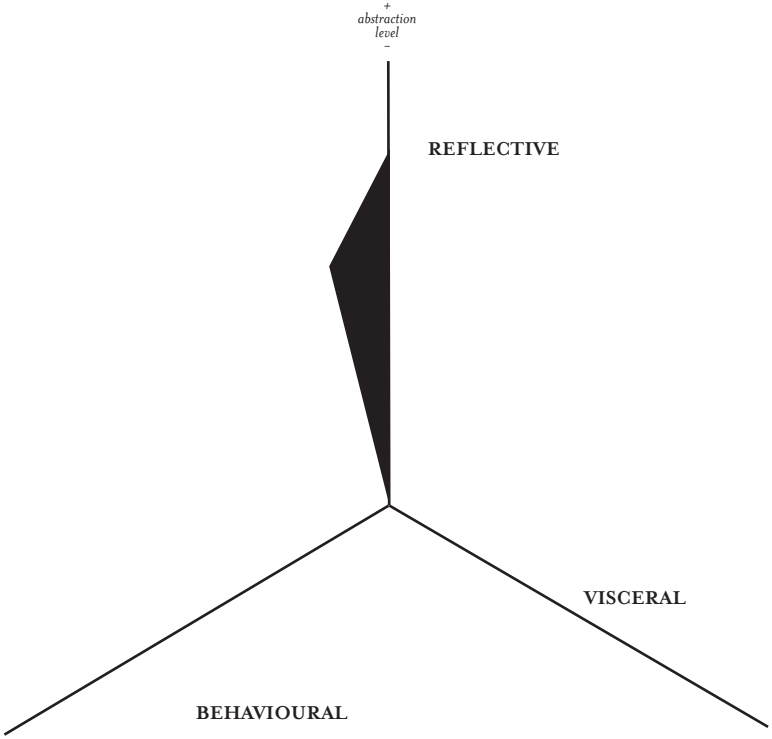
In this explorative case, the design process starts from the reflective level, were the user deliberates about the message, culture and the meaning of a product or the personal remembrances it evokes. Then designers have to build a global image of the relationship between the user and the product to maintain a balance within the new context obtained (stages 1, 2, and 3 from **figure 14.7**). This vision of interaction refers to the perceived or experienced qualitative aspects of the user-product relationship as it is related to the obtained user's needs, expectations and desires. During the rest of the design process the designer will use this information as a source of inspiration to generate the user-product interaction concepts, product concepts and product designs (stages 4,5 and 6 from **figure 14.7**).

> **figure 14.7:**

Visuals for inspiration technique characterization within the design process.



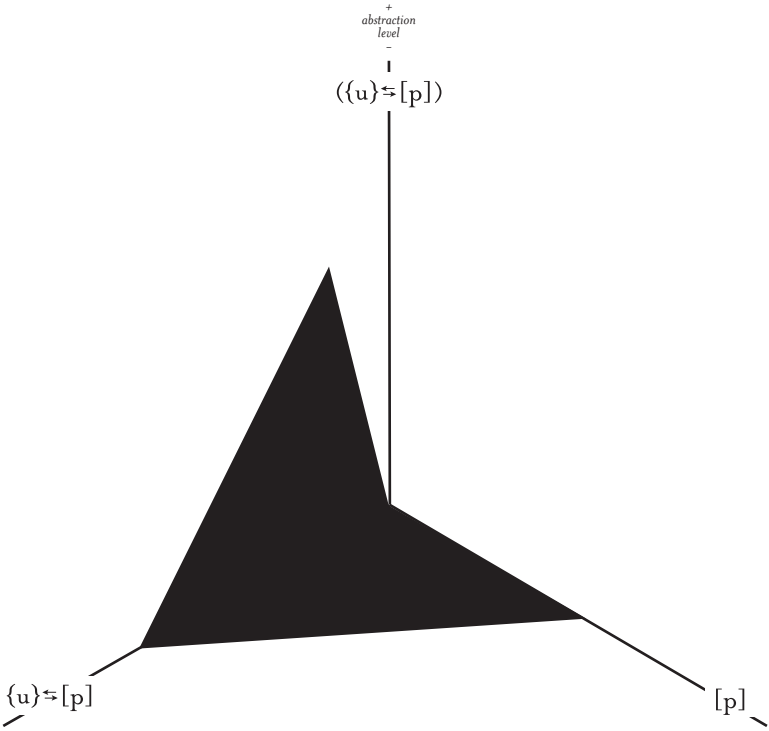
Analyzing the visuals for inspiration information obtained from the user perspective mainly relates to the reflective level (see **figure 14.8**). The exploration and expression loop has some limitations. Subjective experience information gathering techniques aim to get a clear understanding of future users in a cooperative framework, but knowledge limitations of multimedia presentation and video editing software and time constrains can make it difficult to get a proper representation of users' inner needs and personal values, which are the only input from the users in the design process. See **figure 14.8**.



> figure 14.8:

User's subjective information obtained with the visuals for inspiration technique relevant for designing purposes.

On the other hand, from the design process point of view, the exploration and expression process denoted the existing communication problem between designers and users and amongst themselves in dealing with this subjective information. Semantic differences between values were found within the results from the different teams unveiling inner needs and values for social communication (e.g. nature was related to pure figures with no decoration in team 1 and to discover and experiment in team 2, simplicity was related to something reliable in team 1 and to elegance and fluidity in team 2). These examples denote the lack of common language base of semantic meaning to words describing reflective information. It also showed how narrative and projective techniques (using visual narrations as carriers of meaning) applied in describing personal values, beliefs and assumptions (from the reflective level) facilitated communication, understanding and translation into product contexts of tacit knowledge without misunderstandings during the rest of the design process (see **figure 14.9**).



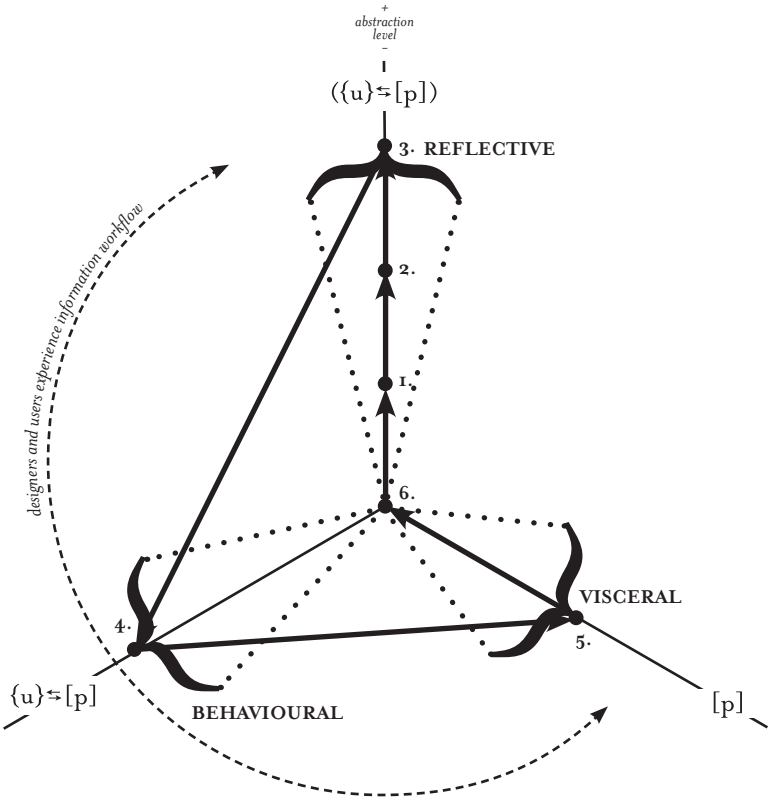
> figure 14.9:

Information the designer needs to generate during the design process after applying the visuals for inspiration technique.

FINAL CASE: SEGIT METHOD

The SEGIT method can be defined as a set of inspirational, concept generation and evaluation techniques to design user's experiences based on uncovering their needs, desires and fantasies. The interview is mainly divided into two phases. First, an exploration phase that analyzes, with a high level of detail, the user's experience with existing products, prototypes or services (present experience). This phase is the base for developing a projection system (second phase), which abstracts users to their emotions and desires (called the projection phase). The latter, allows the discovering of unmet and unconscious desires from the analyzed range of experiences.

The proposed method consists of a combination of techniques for assessing personal user experience from exploratory phases with existing products, transforming them to analogies of interaction and then into scenarios grounded in users imagination. See **figure 14.10** for a visual representation of the exploration and projection phases (analogies and scenarios) within the design process.



> figure 14.10:

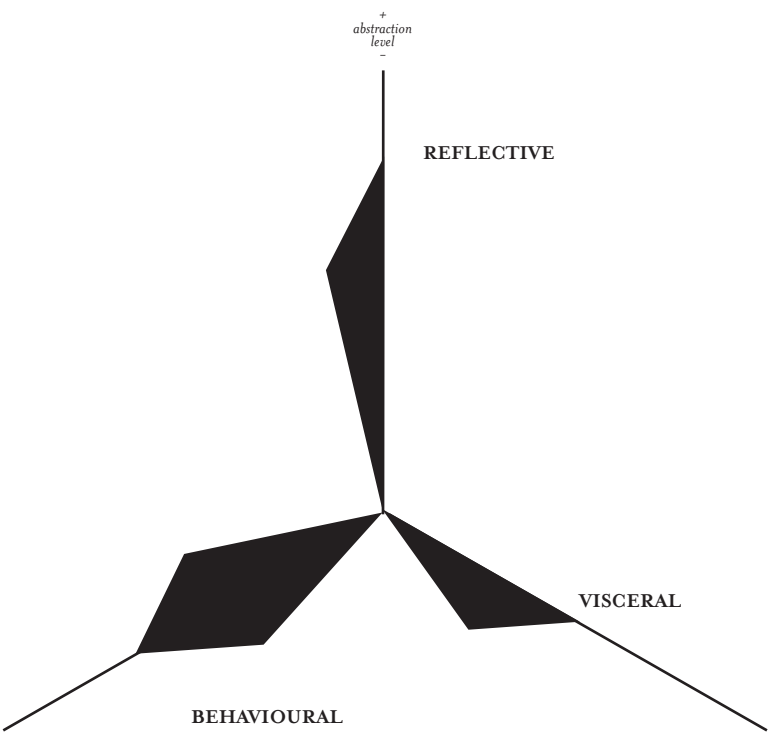
SEGIT method characterization within the design process.

The main goal of the SEGIT method is to present guiding ideas for how to assess subjective experience information. Implicit is that this experience from the three user information processing levels should be visualized and explained in such a way that interpretation from the designer is not needed to translate them into product characteristics, user-product interaction relationships and product context. The **figure 14.11** shows the design relevant information obtained from the SEGIT method in relation to the three levels of information processing.

From the user' experience information point of view, the usefulness of the method relies on the interviewer experience and psychotherapy skills as well as on users' verbal skills and initiative. Additionally, the reduced number of participants (due to time constrains) could be considered insignificant for the whole range of potential users. However, the SEGIT method was tested with designers and users from different countries, the sample of participants was quite small, and the results obtained were quite similar. In fact, the results level of similarity increased with the level of abstraction; therefore, even having different needs, the participants' desires and fantasies were very close. Thus, this information gave an idea about the usefulness of applying subjective psychological analysis on participatory techniques when it comes to in interaction design.

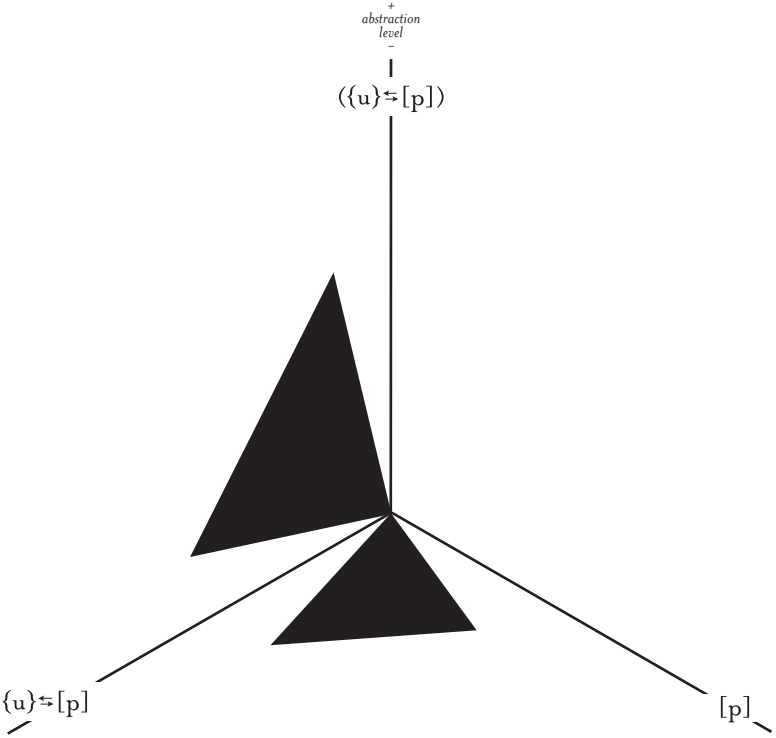
> figure 14.11:

User's subjective information obtained with the SEGIT method relevant for designing purposes.



From designers' point of view, this method has the advantage of a detailed level of results. The different techniques gave information from different points of view (about product characteristics, user-product interaction relationships and product context) and all of them were related and presented in a compact and practical way. The information gathered can be used to generate product requirements and also as an inspirational technique by designers as it gives them space to create and acts as a guide during the design process. See **figure 14.12** to see the information designers have to generate after applying the SEGIT method.

Thus, the SEGIT method increases users participation in the design process and at the same time reduces the information the designer needs to generate, compared with the Exland, SMG, Vfi methods applied separately.



> figure 14.12:

Information the designer needs to generate during the design process after applying the SEGIT method.

CONCLUDING REMARKS

The analysis of the presented techniques with the developed framework helps to understand the value of different typologies of information and its role in the design process. Moreover it shows how the SEGIT method can reduce the information the designer needs to generate by gathering from the user information about the reflective, behavioural and visceral levels.

Part 6: conclusions

15. Addressing the hypothesis.

16. Pursuing the objectives.

17. Final remarks.

18. Future work.

15.

addressing the hypothesis

In this research, Constructivist psychology is used to understand how peoples' characteristics (values, beliefs and assumptions) are involved in the process of experiencing. This includes how people otherwise participate in co-creating dynamic personal realities (needs, desires and fantasies) to which they individually respond. In constructivist psychotherapy techniques, like projections and narratives, meaning arises from communicative action rather than residing within individual selves. This shift leads to a radical change in traditional formulations of experience design research. In the following paragraphs the hypothesis developed to build up this approach are contrasted by means of the results obtained from experimental practice.

The primary hypothesis was that "addressing the complex world of user experience, their inner needs, desires and fantasies (users' subjective experience) can be analysed with a high level of detail using constructivist psychology techniques in order to obtain relevant information for design purposes". Chapter 8 and 9 supported this hypothesis by the review of the existing literature. Chapter 8 described constructivist psychology as an example of the change of paradigm from objective to subjective and why it was relevant for user experience research in early stages of product development. A general overview of this proposed point of view was introduced through constructivist psychology techniques to user experience practitioners. In chapter 9 different approaches to constructivist psychology (alternativist, discursive, rhetorical and narrative) were reviewed and some techniques and examples illustrated their application as subjective user experience information gathering tools.

The first secondary hypothesis was that "the Repertory Grid (an alternativist approach to constructivism) as a subjective experience information gathering technique brings about the possibility of obtaining tacit or intuitive understanding as highly conscious, verbalized constructions, contributing to a better understanding of users' inherent needs". Chapter 9 and appendix A supported this hypothesis by the review of the existing literature and from an exploratory case. Chapter 9 analyzed theoretically the psychological foundations of the Repertory Grid analysis technique as an alternativist approach to constructivism in relation to the Personal Construct Psychology, where comparisons are used to create mental map of perceived differences, in which the decision making process relies. In the appendix A, the experience landscapes exploratory case, based in the Repertory Grid, was applied as a cooperative inquiry between the designer and the user to validate through the experimental practice of this hypothesis. This application was described as an organized interview, which uses comparison in its development. Thus creating a set of constructs or bipolar dimensions related among each other where adjectives and characteristics correlated with the appraisal. It enabled users to tell designers something of the way in which they see and order the world, or in other words, building up mental maps of the users' world in their own words.

The second secondary hypothesis was that "projective techniques (rhetorical approach to constructivism) as subjective experience information gathering techniques can be described as a mode of guidance that underlie intuitive knowing by using meaning transports, which extend our level of understanding to users' unconscious desires". Chapter 9 and appendix B supported this hypothesis by the review of the existing literature and from an exploratory case. Chapter 9 analyzed theoretically the psychological foundations of projective techniques as a rhetorical approach to constructivism in relation to the loose construction in the Personal Construct Psychology, where loosening is considered a necessary phase of creative thinking. In the appendix B, the SMG method was applied and its results were used to validate through the experimental practice of this hypothesis. This method was based on a projective process in the behavioral information processing level used to enhance sensitivity to tacit understandings. This projective process was based on the idea that new chains of implications become possible as broad levels of abstraction open a much wider network of subordinate categories and ideas. From the expertise in one domain, this level of abstraction allowed one to grasp connections between otherwise irrelevant concepts. The results were sensory reconstructions of high-generality imagery described as being somewhere between perceptions (visceral level) and symbolic thought (reflective level).

The third secondary hypothesis was that "storytelling techniques (narrative approach to constructivism) encourage an imaginary associative play, placing emphasis on those events or combinations of events that have an affective meaning in relation to one's inner fantasies". Chapter 9 and appendix C supported this hypothesis by the review of the existing literature and from an exploratory case. Chapter 9 analyzed theoretically the psychological foundations of storytelling techniques as a narrative approach to constructivism in relation to the valuation theory in the Personal Construct Psychology, which assumed that each valuation,

as a unit of meaning in one self-narrative, carries an affective connotation where the basic subjective motives are reflected in. In the appendix C, the visualization of inner needs, desires and fantasies (Vfi) explorative case applied narrative procedures to extract information about the intrinsic values that define a group of users in a social context. Its results were used to validate through experimental practice this hypothesis. By relating users' subjective experiences into a well-known context like telling a story, these sub-conscious experiences can migrate to a storytelling experience as people schematize, communicate, and add levels of meaning. This process is based on a self-exploration and expression loop, contributing to a better understanding of personal values from the reflective information processing level.

In conclusion, chapter 10 analyzed the complex area of users' individual and subjective experience in order to develop subjective product experience gathering and inspiring methods to then apply them as user experience research methods in early stages of product development. From this the analysis of the strengths and weaknesses of those exploratory studies allowed for the development of the SEGIT method. The results from an exploratory case corroborated that this method can be used as a set of inspirational, concept generation and evaluation techniques to design the users' experience based on unveiling their needs, desires and fantasies.

16.

pursuing the objectives

A major challenge in the coming years is to align people's sensorial experience and technology closer together to create a more intuitive way of interacting using natural gestures and sensory-emotive qualities to fulfill peoples inner needs, desires and fantasies. The suitability of this approach is analyzed through experimental practice in chapter 6, which describes the design for experiencing, as an approach for augmenting subjective experiences, positioning it in a user experience framework and illustrating it with some examples of conceptual smart textile designs. More precisely, these enriched experiences can help users to switch their perception of smart technologies from a high-tech fear point of view (technology seen as an added function reserved for early adopters) to a pleasant quality by presenting solutions to everyday challenges.

Following this approach, the main objectives of this research were orientated to create, through experimental practice, reliable mechanisms to assure the correct interpretation of the user experience. Chapter 7 analyses its applicability through a theoretical review of existing literature. It analyzes the emerging difficulties in addressing the subjective experience in relation to the current methods used for gathering user experiences. Furthermore, it underlies the basis for a more adequate perspective to subjective experience gathering techniques.

On one hand, the proposal "to use these methods as inspirational techniques to guide designers to develop interaction ideas and product concepts and as informational techniques to assure the decision making process during the design phase" is developed through experimental practice with different case studies in chapters 11 and 12. Chapter 11 analyzed the information acquired in relation to obtaining more details about the participants' response from the constructivist

psychology point of view. First, it measured subjective experience correlations between different products in order to create subjective experience construing profiles about users' product preference. Then, it evaluated the cognitive complexity of participants' response with differentiation and integration measures, which can be represented in cognitive complexity profiles. Finally, it analyzed the cognitive structure of the valuation process through discriminative power and extremity scores. Chapter 12 defined key aspects of the inspirational process and applied them to the analysis of subjective experience information gathering techniques. With the purpose of analyzing the SEGIT method as an inspirational aid for designers, the inspirational process was divided into three phases in relation to the concrete, relational and conceptual level of the generated ideas and concepts.

On the other hand the proposal "to allow the designer and the potential user the ability to create a mental picture of the desired sensations to transmit-receive (tacit knowledge) with the product during the design phase, facilitating the understanding of the complex emotional system through intuitive ideas" is developed through the review of the users' and designers' communication workflow during the product design process in chapter 13 and 14 with the different methods developed during this research. Chapter 13 focuses on user experience information vs. the designer inspiration dichotomy, in order to analyze designers' and users' subjective experience information workflow. Users' subjective experience information characterization is based on Norman's information processing model. The interaction design process and levels of product description is based on Hekkert's Vision in Product design (ViP) approach. Then both visions are merged in an attempt to model designers and users subjective experience communication framework into interaction design.

In chapter 14, the information processing model allows for describing users' and designers' communication workflow during the product design process. This framework is used in order to characterize different subjective experience in information gathering exploratory techniques (experience landscapes, sensory metaphor generation, visual narratives) and the resulting SEGIT method within the design process.

17.

final remarks

The hypothesis and objectives presented in this PhD thesis have been accomplished within the limitations that come from its academic character. In this research, new techniques for gathering subjective experience information about users' needs, desires and fantasies have been proposed and applied in order to develop the SEGIT method, which has been validated for informational and inspirational purposes.

Moreover, the vision of experience design proposed in this research refers to all kinds of interaction, social and physical as well as to products and services. Therefore, everyday experience can be seen as the result of the social and physical interaction with an entire system (considering environment, interactive systems and people). Seeing everyday life as interaction with all of these factors leaves the door open for design all kind of products and services.

In fact, during the course of this research the techniques developed to gather subjective information were used to:

- Design different kinds of consumer products (kitchenware, office supplies, furniture, sports equipment, clothes and accessories).

- Forecast new communication behaviours applying emerging technologies (concepts of personal communication devices using brain activity, physiological measures about emotional states, shaping devices to express feelings and emotions and context-aware computing were developed).

- Ease people's dislikes, aversions and fears in users' everyday life that lead to unpleasant subjective experiences through the design of smart products combining textile materials and multimodal information technology.

To sum up, the approach to interaction design presented by this research and the proposed techniques for inspirational and informational purposes show an optimistic path to explore with the aim to help designers to bring peoples' sensorial experience and technology closer together.

18.

future work

In this research different limitations arose from the direct application of the developed techniques during practical examples. In the following paragraphs these limitations are presented and future research studies are proposed in order to solve them.

One of the main problematic parts of this research was the influence of interviewers experience and skills. To decrease this influence, objective evaluation systems should be used. This means that to systematize the interview by using the same questions for all the participants (i.e. a closed test). The richness of the results decreases dramatically as a consequence of adopting this approach. Moreover, there is information that cannot be reached with objective tests, like inner desires and fantasies. The new goal should be to improve the method to reduce the interviewers influence without losing the subjective analysis approach.

Another limitation is the integration of results from different participants in order to interoperate with the obtained data to establish global parameters. The SEGIT method allows for an indirect quantitative comparison of the results (see chapter 11), where different correlations and indexes obtained from statistical analysis of the results are compared in order to generate global parameters. Then, an interesting research topic would be to search for other psychological exploration methods that allow the direct quantitative comparison of results.

An additional possible research possibility is the development of validation techniques for information quality (psychological point of view) and inspiration applicability (design point of view) in the same line of the analysis done in chapter 11 and 12. The idea is that these validation techniques should be independent methods and could be applied to different subjective experience information gathering methods in order to analyze results and assure their quality and reliability.

references

Adams-Webber, J.R. (1979) Construing persons in social contexts. In P. Stringer & D. Bannister (Eds.) Constructs of sociality and individuality. London: Academic Press, 195-200.

Anderson, H. & Goolishian, H. (1992) The client is the expert: A notknowing approach to therapy. In S. McNamee & K. J. Gergen (Eds.) Therapy as social construction. Newbury Park: Sage, 25-39.

Anderson, J. R. (1983). A spreading activation theory of memory. Journal of Verbal Learning and Verbal Behavior, 22 (June), 261–295.

Alderfer, C. P. (1972) Existence, Relatedness and Growth: Human Needs in Organizational Settings. New York: Free Press.

Ailly, S., Olausson, L. Sten, M. (Eds.) (2005) Extra ordinary. Stockholm: Kulturhuset publication.

Ardèvol, M. (2006) Tendències de Futur i Noves Realitats. Informe Anual de l'Observatori de Mercats Exteriors. Barcelona: COPCA.

Bannister, D. & Mair, J. M. M. (1968) The Evaluation of Personal Constructs. London: Academic Press.

Bannister, D. & Agnew, J. (1977) The child's construing of self. In A. W. Landfield & J. K. Cole (Eds.) Nebraska Symposium on Motivation. Personal Construct Psycology, 24. London: University of Nebraska Press.

Battarbee, K. (2004) Co-Experience. Doctoral Dissertation. Publication Series of the University of Art and Design, A 51. Helsinki: UIAH.

Bell, R.C. (2003) The Repertory Grid Technique. In Fransella F. (Ed.) International handbook of Personal Construct Psychology. Chichester: John Wiley & Sons.

Bieri, J. (1955) Cognitive complexity-simplicity and predictive behaviour. Journal of abnormal and social psychology, 51, 263-268.

Blumer, H. (1986). Symbolic Interactionism: Perspective and Method. Berkeley: University of California Press.

Bodden, J. L. (1970) Cognitive complexity as a factor in appropriate vocational choice. Journal of Counseling Psychology, 17, 364 - 368.

Boerdonk, K., Deckers, E., Nagtzaam, H., Schwachöfer, J., Tieben, R. & Klooster, S. (2006). Meeting Duet: Challenging people into a body language of meeting, In Proceedings of the 2nd European workshop on Design and Semantics of Form and Movement. Eindhoven, the Netherlands.

Bonarius, H. (1977). The interaction model of communication: Through experimental research towards existential relevance. In A. W. Landfield, & J. K. Cole (Eds.) Nebraska symposium on motivation. Personal Construct Psychology, 26. Lincoln, NE/London: University of Nebraska Press.

Botella, LL. & Feixas, G. (1998) Teoría de los constructos personales: Aplicaciones a la práctica psicológica. Barcelona: Laertes.

Bruner E. (1986) Ethnography as narrative. In V. Turner, & E. Bruner (Eds.) The anthropology of experience. Chicago: University of Illinois press.

Butt, T. (2003) The Phenomenological Context of Personal Construct Psychology. In Fransella F. (Ed.) International handbook of Personal Construct Psychology. Chichester: John Wiley & Sons.
Cajochen C., Krauchi K. & Wirz-Justice (2003) A. Role of melatonin in the regulation of human circadian rhythms and sleep. J. Neuroendocrinology 15, 432–437.
Cattan, M., White, M., Bond, J. & Learmonth, A. (2005) Preventing social isolation and loneliness among older people. Ageing and Society 25: 41-67.
Cohen, J. (1988) Statistical power analysis for the behavioral sciences, 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates.
Cornell, P. (2005). A Poetic of Objects. In Ailly, S., Olausson, L. Sten, M. (Eds.) Extra ordinary. Stockholm: Kulturhuset publication.
Desmet, P.M.A. (2002) PHD Thesis: Designing Emotions. Delft: T.U. Delft.
Dewey, J. (1910). How we think. New York: Heath.
Dewey, J. (1934) Art as experience. New York: Perigee Books (reprint 1980).
Djajadiningrat, J.P., Gaver, W.W. & Frens, J.W. Interaction relabelling and extreme characters: methods for exploring aesthetic interaction. Conference proceedings DIS' 00. Brooklyn, New York.
Dourish, P. (2001) Where the Action Is. Cambridge: MIT Press.
Dunne, A. & Raby, F. (2001). Design Noir: The Secret Life of Electronic Objects. Berlin: Berkhauser.
Ehrlichman H. & Halpern JN. (1998) Affect and memory: effects of pleasant and unpleasant odors on retrieval of happy and unhappy memories. J. Pers Soc Psychol. 55 (5), 769-79.
Fallman, D., Waterworth, J. A. (2005) Dealing with User Experience and Affective Evaluation in HCI Design: A Repertory Grid Approach. Workshop Paper in Proc. CHI 2005, Oregon.
Forlizzi, J.& Ford, S. (2000) Building Blocks of Experience: An Early Framework for Interaction Designers. In DIS '00, Brooklyn, New York.
Fox, K. (2005) Coming age in the eBay generation. Oxford: Social Issues Research Centre.
Fransella, F. (1972) Personal change and reconstruction. Research on a treatment of stuttering. London: Academic Press.
Fransella, F. (2003) Some skills and tolls for personal construct Practitioners. In Fransella F. (Ed.) International handbook of Personal Construct Psychology. Chichester: John Wiley & Sons.
Fransella, F. & Bannister, D. (1977) A manual for the repertory grid technique. New York: Academic Press.
Feixas, G. (1988. L'anàlisi de construccions personals en textos de significació psicològica. Tesis doctoral microfichada (n. 328).
Barcelona: Publicacions Universitat de Barcelona.
Feixas, G. & Cornejo-Alvarez, J.M. (2002) A manual for the repertory grid: Using the GRIDCOR programme (version 4.0). Reviewed in 2006 [http://www.terapiacognitiva.net/record/pag/index.htm].
Fulton Suri, J. & Buchenau, M. (2000) Experience Prototyping. In DIS '00, Brooklyn, New York.
Gaver, W., Dunne, T. & Pacenti, E. (1999) Cultural probes. Interactions, 6 (1). New York: ACM Press.

Gergen, K. J. & Gergen, M. M. (1986) Narrative form and the construction of psychological science. In T. R. Sarbin (Ed.), Narrative psychology. New York: Praeger, 22 - 44.
Gonçalves, O. F. (1995) From the object to the project. In Neimeyer, R. A., Mahoney, M. J. (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.
Gonçalves, O. F. (1995) Hermeneutics, constructivism, and cognitive-behavioral therapies: from the object to project. In Neimeyer, R. A., Mahoney, M. J. (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.
Gower, J. (1966) Some distance properties of latent root and vector methods used in multivariate analysis. Biometrika, 53, 325-338.
Gower, J.C. & Hand, D.J. (1995) Biplots. London: Chapman & Hall.
Goulden, L. & McGroary, P. (2003) Experience design. In Aarts, E and Marzano, S (Eds.) The new everyday: views on ambient intelligence. Rotterdam: Uitgeverij 010 Publishers.
Gourd, W. (1977) Cognitive complexity and theatrical information processing. Communication Monographs, 44, 136 - 151.
Green, J. (2003) Thinking the future. In Aarts, E and Marzano, S (Eds.) The new everyday: views on ambient intelligence. Rotterdam: Uitgeverij 010 Publishers.
Green, P. E., Krieger, A. M. & Wind, Y. (2001). Thirty years of conjoint analysis: reflections and prospects. Interfaces, 31(3, part 2), S56–S73.
Guidano, V.F. (1995) Constructivist pshychotherapy: A theoretical framework. In Neimeyer, R. A. & Mahoney, M. J. (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.
Guinard, J. X., Uotani, B. & Schlich, P. (2001) Internal and external mapping of preferences for commercial lager beers: comparison of hedonic ratings by consumers blind versus with knowledge of brand and price. Food Quality and Preference, 12(4), 243– 255.
Gunnar M.R., Brodersen L., Nachmias M., Buss K., Rigatuso J. (1996) Stress reactivity and attachment security. J. Developmental Psychobiology 29 (3), 191-204.
Gyllensward, M., Gustafsson, A. (2005) The Power-Aware Cord: Energy Awareness through Ambient Information Display. In: Proceedings of CHI, Portland USA.
Hammond, M., Howarth, J. & Keat, R. (1991) Understanding Phenomenology. Oxford: Basil Blackwell.
Hassenzahl, M. & Wessler, R. (2000) Capturing design space from a user prespective: the repertory grid technique revisited. International Journal of Human-Computer Interaction, 12 (3 & 4), 441-459.
Hekkert, P., Mostert, M. & Stompff, G. (2003) Dancing with a machine: A case of experience-driven design. Proceedings of DPPI03, Pittsburgh, USA.
Hekkert, P. & Van Dijk, M.B. (2001) Designing from context: Foundations and applications of the ViP approach. In P. Lloyd & H. Christiaans (Eds.) Designing in Context: Proceedings of Design Thinking Research Symposium, 5: 383 – 394.
Hermans, H.J.M. (1995) From assessment to change: The personal meaning of clinical problems in the context of the self-narrative. In Neimeyer, R. A., **Mahoney, M. J.** (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.
Hermans, H.J.M. (2002) The person as a motivated storyteller. In Neimeyer, G.J., Neimeyer, R.A. (Eds.) Advances in Personal Constructs Psychology, New directions and perspectives. Westport: Praeger Publishers.

Horn, J. Rauterberg, M. (2003) The Usability Methods Toolbox Handbook. [online]. URL<http://www.ipo.tue.nl/homepages/mrauterb/lecturenotes/UsabilityMethodsToolboxHandbook.pdf/> [18 February 2004]

Hinkle, D.N. (1965) The change of personal constructs from the viewpoint of a theory of implications. Doctoral dissertation, Ohio State university.

Hummels, C. & Overbeeke. K. (2000) Actions speak louder than words: shifting from buttons and icons to aesthetics of interaction. In Pizzocaro, S.; Arruda, A. & De Moraes, D. (Eds.) Design plus Research. Proceedings of the Politechnico di Milano conference. Milan, 284 – 290.

Ippolito, M.F. & Tweney, R. D. (1995) The inception of insight. In R. J. Sternberg & J. E. Davison (Eds.) The nature of insight Cambridge: MIT Press, 433 - 462.

Jääskö, V., Mattelmäki, T. & Ylirisku, S. (2003) The scene of experiences. In the proceedings of The Good, The Bad and The Irrelevant conference on September 3-5. University of Art and Design Helsinki.

Jaeger, S.R., Rossiter, K.L. & Lau, K. (2005) Consumer perceptions of novel fruit and familiar fruit: a repertory grid application. Journal of the science of food and agriculture, 85, 480-488.

Jensen, B. G. (2004) The role of the artefact in participatory design research. In Design communication, 3rd Nordcode Seminar & Workshop, Lyngby, Denmark.

Kaye, J. & Taylor, A. (2006) What does science know about experience? Alternatives approaches to evaluating user experience. In User Experience – Towards a unified view workshop at NordiCHI 2006, Oslo, Norway. October.

Keinonen, T. (1998) One-dimensional usability – Influence of usability on consumers' product preference. Doctoral dissertation. University of Art and Design Helsinki, A21. Helsinki: UIAH.

Kelly, G.A. (1955) The psychology of personal constructs, vol. 1 & 2. London: Routledge.

Kelly, G. A. (1969). Personal construct theory and the psychotherapeutic interview. In B. Maher (Ed.) Clinical psychology and personality: The selected papers of George Kelly. New York: Wiley.

Kennis, S. & McTaggart, R. (2000) Participatory action research. In N.K. Denzin & Y.S Lincoln. (Eds.) Handbook of qualitative research 2nd Ed. London: Sage, 567-605.

Kjaer, A. (2006) CIFS. Futureorientation, 2006 (2).

Klooster, S., Appleby, R. & Overbeeke, K. (2004) Design (Education) Moves International Engineering and Product Design Education Conference. 2-3 September 2004. Delft, The Netherlands.

Klooster, S. & Overbeeke C.J. (2005) Designing products as an integral part of Choreography of Interaction: the product's form as an integral part of movement. In Proceedings of the 1rst European workshop on Design and Semantics of Form and Movement. Newcastle, England.

Koskinen, I. (2003) User-Generated Content in Mobile Multimedia: Empirical Evidence from User Studies. In proceedings of ICME Vol. 2. New York: IEEE, 645–648.

Koskinen, I., Battarbee, K. & Mattelmäki T. (2003) Empathic Design. User Experience in Product Design. Helsinki: IT Press.

Lakoff, G. & Johnson, M. (1980) Metaphors we live by. Chicago: University of Chicago Press.
Landfield, A.W. (1971) Personal Construct Systems in Psychotherapy. Chicago: Rand-McNally.
Landfield, A. W. (1977). Interpretive man: The enlarged self-image. In A. W. Landfield, & J. K. Cole (Eds.) Nebraska symposium on motivation. Personal Construct Psychology, 26. Lincoln, NE/London: University of Nebraska Press.
Ludvigsson, M. (2005) Reflection through interaction. Raising energy awareness among young people with interaction design and speculative re-design of personal objects. MSc Thesis in Interaction Design. Report N. 2005:49. Göteborg IT: University of Göteborg.
Mahoney, M.J. (1998) Constructivist metatheory: I. Basic features and historical foundations. International journal of personal construct psychology, 1 (35).
Mahoney, M.J. (1995) Continuing evolution of the cognitive sciences and psychotherapies. In Neimeyer, R. A., Mahoney, M. J. (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.
Mahoney, M.J. (1989) Participatory epistemology and the psychology of science. In B. Gholston, W. R. Shadish, R.A. Neimeyer, & A. C. Houts (Eds.) Psychology of science. Cambridge: Cambridge Universitty Press, 138-164.
Mancini, F. & Semerari, A. (Eds.) (1990). Le teorie cognitive dei disturbi emotivi. Roma: Nuova Italia Scientifica.
Maslow, A. H. (1943). A Theory of Human Motivation. Psychological Review, 50, 370-396.
Mattelmäki, T. (2003) Probes: Studying Experiences for Design Empathy. In Koskinen, I., Battarbee, K., Mattelmäki, T. (Eds.) Empathic Design. User Experience in Product Design. Helsinki: IT Press, 119–130.
Mattelmäki, T. (2006) Design probes. Doctoral Dissertation Publication Series of the University of Art and Design, A 69. Helsinki: UIAH.
Mazé, R. (2005) What is the use? In Ailly, S., Olausson, L. & Sten, M. (eds) Extra ordinary. Stockholm: Kulturhuset publication.
McCarthy, J. & Wright, P. (2004). Technology as experience. Boston: MIT Press.
McDonagh, D., Brusseberg, A. & Haslam, C. (2002) Visual product evaluation: exploring user's emotional relationships with products. Applied Ergonomics, 33, 231 – 240.
Merleau-Ponty, M. (1945) The Phenomenology of Perception. English translation 1962. London: Routledge.
Mizutani, M. (2006) Emotional Communication. Products that connect friends and family. MA Thesis. Media Lab, UIAH.
Mogensen, K. (2006) Creative Man. Copenhagen: CIFS.
Muller, M.J. (2003) Participatory design: The third space in HCI. In J. Jacko and A. Sears (Eds.) Handbook of HCI. Mahway, N.J.: Erlbaum.
Neimeyer, G. J. (1995) The challenge of change. In Neimeyer, R. A., Mahoney, M. J. (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.
Neimeyer, R.A. (1983) Conceptual differentiation, integration and empathic prediction. Journal of Personality, 51 (2).
Neimeyer, R. A. (1993) Constructivist approaches to the measurement of meaning. In G. J. Neimeyer (Ed.) Constructivist Assessment: A Casebook. London: Sage Publications.

Neimeyer, R. A. (1995) An invitation to constructivist psychotherapies. In Neimeyer, R. A., Mahoney, M. J. (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.
Neimeyer, R. A. (1995) Features, foundations and future directions. In Neimeyer, R. A., Mahoney, M. J. (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.
Neimeyer, R. A. (1995) Client-generated narratives. In Neimeyer, R. A., Mahoney, M. J. (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.
Neimeyer, R. A. (2001). Meaning reconstruction and the experience of loss. Washington, DC: American Psychological Association.
Neimeyer, G.J., Neimeyer, R.A., Hagans, C.L. & Van Brunt, D.L. (2002) Is there a madness in our method? The effects of repertory grid variations on measures of construct system structure. In Neimeyer, G.J., Neimeyer, R.A. (Eds.) Adv. in Personal Constructs Psychology, New directions and perspectives. Westport: Praeger Publishers.
Norman, D.A. (2002). Emotion and design: attractive things work better. Interactions, 9(4), 36-42.
Norman, D. A., Ortony, A., & Russell, D. M. (2003). Affect and machine design: Lessons for the development of autonomous machines. IBM Systems Journal, 42 (1), 38-44.
Norman, D. A. (2004) Emotional design: Why we love (or hate) everyday things. New York: Basic Books, USA.
O'keefe, D.J.; Sypher, H.E. (1981) Cognitive complexity measures and the relationship of cognitive complexity to communication: A critical review. Human Communication Research, 8, 72-92.
Osgood, C. E., Suci, G.J., & Tannenbaum, P.H. (1957) The measurement of meaning. Urbana, USA: University of Illinois Press.
Pine II, B. J. & Gilmore, J. H. (1999) The Experience Economy. Boston: Harvard Business School Press.
Plowman, T. (2003). Anthropology and Design. In Laurel, B. (Ed.) Design Research – Methods and Perspectives. Cambridge, MA: MIT Press, 30–38.
Jaeger, S.R., Rossiter, K.L. & Lau, K. (2005) Consumer perceptions of novel fruit and familiar fruit: a repertory grid application. Journal of the science of food and agriculture, 85, 480-488.
Jensen, R. (1999) The Dream Society: How the Coming Shift from Information to Imagination Will Transform Your Business. New York: McGraw-Hill.
Redström, J., Redström, M. & Mazé, R. (2005) IT+textiles. Helsinki: Edita.
Russell, J.A. (1980) A circumplex model of affect. Journal of Personality and Social Psychology, 39 (6), 1161–1178.
Sanders, E. (1999) Design for experiencing: new tools. In Proceedings of the First International Conference on Design and Emotion, C.J. Overbeeke and P. Hekkert (Eds.), TU Delft, The Netherlands.
Sanders, E. (2001) A New Design Space In ICSID News: Special Congress Edition, October-December.
Sanders, E.B.-N. & William, C.T. (2001) Harnessing People's Creativity: Ideation and Expression through Visual Communication, In Langford, J. and McDonagh-Philp, D. (Eds.) Focus Groups: Supporting Effective Product Development. London: Taylor and Francis.

Sanders, E. (2005) Information, Inspiration and Co-creation. The 6th International Conference of the European Academy of Design, University of the Arts, Bremen, Germany.
Schuler, D. & Namioka, A. (1993) Participatory design: Principles and practices. Hillsdale, N.J.: Erlbaum.
Slater, P. (Ed.) (1976) Dimensions of Intrapersonal Space: Volume 1. London: John Wiley.
Slater, P. (Ed.) (1977) Dimensions of Intrapersonal Space: Volume 2. London: John Wiley.
Sleeswijk Visser, F., Stappers P. J., Van Der Lugt, R. & Sanders, E.B.N. (2005) Contextmapping: Experiences from practice. CoDesign Journal, 1 (2). London: Taylor & Francis, 119 –149.
Stappers, P. J. & Sanders E.B.N. (2004) Generative tools for context mapping: tuning the tools. In McDonagh, D., Hekkert, P., van Erp, J. & Gyi, D. (Eds.) Design and Emotion – The Experience of Everyday Things. London; Taylor & Francis, 77–81.
Stevens, C. D. & Walker, B. M. (2002) Insight: Transcending the obvious. In Neimeyer, G.J., Neimeyer, R.A. (Eds.) Advances in Personal Constructs Psychology, New directions and perspectives. Westport: Praeger Publishers.
Tomico, O. & Lloveras, J. (2005) Creating Pleasurable User-Product Interaction Experience through Movement Analogies. Proc. DPPI'05 Conf. TU Eindhoven.
Tomico, O., León, J., Molokwane, S. & Lloveras, J. (2005) Designing product experience through user perception and interaction methods. In Proc. of the 2nd International Design and Engagability Conference (iDec2) Napier University, Edinburgh.
Tomico, O., Pifarré, M. & Lloveras, J. (2006) Experience landscapes. In Proc. DESIGN 2006 Conf. Dubrovnik, Croatia.
Tomico, O., Pifarré, M. & Lloveras, J. (2006) Unveiling people's inner needs, desires and fantasies to forecast future user-product interaction experiences. Presented in the 3rd International Design and Engagability Conference at NordiCHI 2006, Oslo, Norway, October 2006.
Udagawa, M. & Moeslinger, S. (2007) Antenna design webpage. Reviewed January 2007 [http://www.antennadesign.com/]
Urban, G. L., Hauser, J. R., Qualls, W. J., Weinberg, B. D., Bohlmann, J. D. & Chicos, R. A. (1997). Information acceleration: validation and lessons from the field. Journal of Marketing Research, XXXIV (February), 143–153.
Van Kleef, E., van Trijp, H. & Luning P. (2005) Consumer research in the early stages of new product development: a critical review of methods and techniques. J. Food Quality and Preference, 16 (2005), 181–201.
Verbücken, M. (2003) Towards a new sensoriality. In Aarts, E and Marzano, S (Eds.) The new everyday: views on ambient intelligence. Rotterdam: Uitgeverij 010 Publishers.
Vogel, C. M., Cagan, J. & Boatwright, P. (2005) The Design of Things to Come: How Ordinary People Create Extraordinary Products. New Jersey: Wharton School Publishing.
Von Hippel, E. & Katz, R. (2002). Shifting innovation to users via toolkits. Management Science, 48(7), 821–833.

Walker, B. (2005) Thrilling Designs. Cromo II: Volume one. London: Aerial Publishing.
Walker, B. (2005) The Taxonomy of Thrill. Cromo II: Volume two. London: Aerial Publishing.
Wansink, B. (2003) Using laddering to understand and leverage a brand's equity. Qualitative Market Research: An International Journal, 6, 111-118.
Wensveen, S.A.G. (2005). A tangibility approach to affective interaction. PhD dissertation. Delft: TU Delft.
Zaltman, G. & Coulter, R. (1995) Seeing the Voice of the Customer: Metaphor-based Advertising Research. Journal of Advertising Research, July/August, 35-51.

appendices: exploratory studies gathering users' subjective experience

a. exploring subjective experiences.

“experience landscapes: a subjective approach to explore user-product interaction”

b. using metaphors as carriers of subjective information.

“creating pleasurable user-product interaction experiences through movement analogies”

c. considering users as motivated storytellers.

“unveiling people’s inner needs, desires and fantasies to help forecast future user-product interaction experiences”

a. exploring subjective experiences

"experience landscapes: a subjective approach to explore user-product interaction"

In INTERNATIONAL DESIGN CONFERENCE - DESIGN 2006, Dubrovnik, Croatia, May 2006.

INTRODUCTION

People use their perception to generate preference schemes and build up a selection criterion [Bedolla, 2002]. In addition, decision-making process and product usage are based in multimodal perception obtained from relations between the different perceptual systems (visual, auditory, haptic and taste-smell feedback). Despite that, different importance is given to user perception information while designing product interaction, leading to [Bedolla, 2002]:

·The use of visual and/or auditory attributes as the foremost design guidelines.
·The oversight of perception attributes related to haptic and taste-smell systems.
·The inappropriate use of perception attributes due to unawareness of perceived properties and related experiences.

A conventional, superficial way of doing user experience research. Without bases or real knowledge about the hedonic preferences, experience desires and perception interests for different typologies of users.

This unveils a need for developing new approaches to gather user's experience requirements for consumer research in early stages of product development, according to design enriched product interactions [Wensveen, 2001] and therefore, engaging products.

The aim of this text is to analyze and develop product experience gathering methods in user's own words, to help designers obtain a correct understanding of user's requirements. In this paper we propose the use of subjective psychological exploration techniques for characterizing user experience in a deeper and detailed way, thus unveiling the core multimodal perception aspects to describe user experience landscapes. An example from a propaganda pens pilot test is described among the method presentation for an easy understanding of the procedure. Moreover, we present some of the results from the "Products Engineering and Technical Systems I" course were the Repertory Grid (RG) method was used to generate experience landscapes so as to determine product experience requirements and benchmark the new design concepts with related existing products.

THEORETICAL BACKGROUND

Our approach to consumer research methods is based in clinic psychology techniques for a deeper understanding of user experience. Precisely, it is focused in post-modern approaches to clinic psychology [Botella, 1995] that base their exploration in the Socratic procedure (guiding participants to unveil unknown thoughts by themselves). This procedure allows explorations from the participant idiosyncratic point of view. Therefore, it prevents interviewers from biasing studies by influencing participants (making them to describe their experience along a specific dimension). This point of view considers diversity, recovers the meaning as study object and integrates the individuality and the communality of the participants. To fulfil those aspects, the subjective psychological exploration arises as one of the most important methods. This kind of exploration has been chosen due to its reliability.

Applying subjective psychological explorations as an information-gathering tool in early stages of product development can increase results quality and the percentage of design-relevant information. Precisely, this kind of subjective exploration allows for the acquisition of more reliable and precise information than with objective explorations (closed interviews and questionnaires), even though the amount of participants is smaller.

Kelly's Personal Constructs Psychology

The Personal Construct Psychology (PCP) developed by George Kelly [Kelly, 1955] was one of the first psychology approaches to develop subjective exploration methods. It focuses on *"how the human process flows, how it strives in new directions as well as in old, and how it may dare for the first time to reach into the depths of newly perceived dimensions"* [Kelly, 1955]. A concise explanation on the basic ideas of PCP can be presented by the following points: Perceptions influence expectations, and expectations influence perceptions; the medium through which this happens is known as the construct system; construct systems (pairs of opposite attributes) are unique to the individual and develop throughout its life.

Based on the PCP theory, different psychological evaluation methodologies have been developed. According to Neimeyer [Neimeyer & Neimeyer, 1993], the different constructivist evaluation techniques can be classified in those with in a construct system structure approach (Repertory Grid technique, Laddering up and down techniques and the Tschudi's ABC technique) and those with a construction process approach (Auto-characterization Analysis technique and Problem Knot technique).

Kelly's Repertory Grid (RG)

Among all the psychological evaluation techniques based on the PCP, Kelly's Repertory Grid [Kelly, 1955] is the most widely used due to the following aspects [Botella & Feixas, 1998]:

·It is closely related to the PCP theory
·It combines quantitative and qualitative analysis.
·Its mathematic basis allows calculating multiple measurement ratings from the input data.
·Its increased accessibility to statistics software allows improving result generation.

The RG technique can be defined as an

organized interview by its management and theoretical foundations. Its aim is to *"build up mental maps of the clients' world in their own words"* [Botella & Feixas, 1998]. The RG results are presented in a data matrix composed of tree different basic components [Botella & Feixas, 1998]: Elements (placed in columns) are defined as a representative sample of people, events, activities, places or objects from the area you want to explore. They are related to a specific personal experience domain. The rows of the matrix are filed with personal constructs (bipolar dimensions like semantic differentials [Osgood, 1953]), which represent personal views or judgments (qualities people use to describe the elements in their personal, individual world). Each cell of the matrix represents the quantitative evaluation of the elements by the constructs.

From a product design perspective, the RG purpose is not to analyze the subject but the elements. Design relevant information (perception-related consumer preference behaviour) can be obtained by analyzing the personal constructs generated with different participants and sorted by the importance of the results obtained from the evaluation of products by the different constructs. *"The differences between artifacts, manifest in the personal constructs a group of individuals comes up with, is the design–relevant information that should bring design space to life"* [Hassenzahl & Wessler, 2000].

EXPERIENCE LANDSCAPES: RETURNING TO A SUBJECTIVE RG APPROACH

The RG, as a psychological evaluation technique, has been broadly used as a subjective method focused on individual analysis. Its adaptation as a consumer research information-gathering tool has changed this approach to an objective point of view [Hassenzahl & Wessler, 2000] to allow for using a bigger sample of participants in order to apply statistical analysis and to generate global results as in questionnaires.

The objective approach is based in a quantitative point of view rather than a qualitative. Its basis is to establish a comparison between the results from different participants extracting general conclusions. This point of view can be considered a contradiction, as the RG is based on the individuality and subjectivity of the participants. Therefore, detailed design-relevant information (subjective and specific comments about personal user experiences while interacting with the product) is lost in the RG global analysis.

The text presented in the next pages shows the research done so as to adapt the RG technique, applied in the field of psychological analysis by Kelly [Kelly, 1955] and modified by Feixas [Botella & Feixas, 1998]), to be used as a design guiding tool without loosing its subjective approach. We propose some modifications to the RG design and development stage to be able to consider specific comments about personal user experiences as design-guiding information (experience landscapes). See **figure 1** - *next page*.

REPERTORY GRID DESIGN GUIDING TOOL

> figure 1:

Repertory Grid design-guiding tool proposal.

RG INTERVIEW PROCESS
[RG DESIGN PHASE]
[RG DEVELOPMENT PHASE]
[RG ANALYSIS PHASE]

DESIGN RELATED PROCESS
[IDEAL PRODUCT IMAGE]
[WEAKNESS ANALYSIS]
[RESULTS INTERPRETATION]

Repertory Grid interview process

The RG design phase main objective is to set up the Repertory Grid. The decisions to be taken are based in the three basic components of the RG elements (column headers in figure 2), constructs description (matrix files) and element evaluation (matrix cells in figure 2). To guide element selection for the Repertory Grid (real products, mock-ups, 3D models, services or experiences to evaluate by the participants), we propose different element typologies according to its characteristics and purpose (introducing psychology based fictitious elements):

·Relevant elements describe the research area to investigate. In our RG design approach, they will be a representative sample of heterogeneous products in the field of study.
·Fictitious elements are created for gathering direct information about participants' thoughts on the ideal product (ideal fictitious element) or the product they are able to buy for themselves (real fictitious element). Furthermore, fictitious elements determine the importance (role) of each construct related to their desires and dreams (ideal fictitious element) and their consumer behaviour (real fictitious element). As an example, in a propaganda pens pilot test two fictitious elements were used (ideal pen and real pen). See **figure 2**.

·Contrast elements differ from relevant elements because they have opposite characteristics, far from the ideal product ones. The value of these elements is to help participants to create basic constructs.

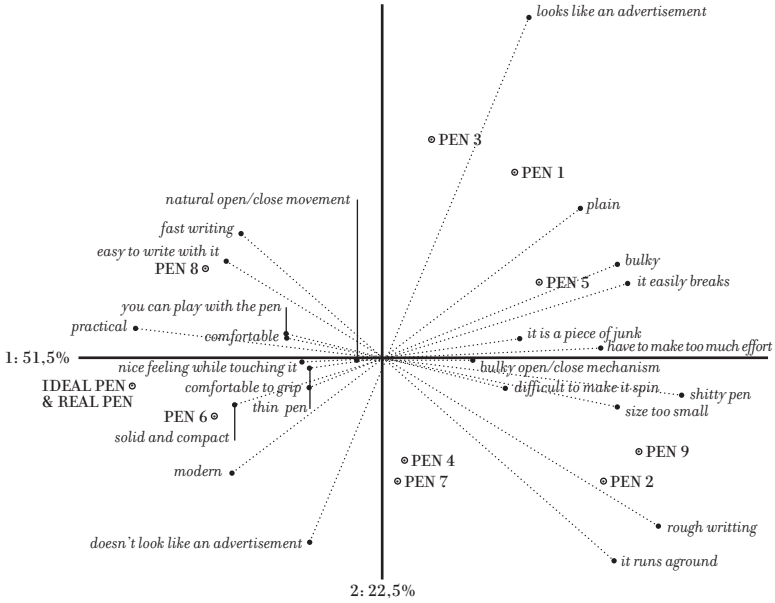
·Participants can generate personal elements. Evaluators use them just in case participants find interesting adding another element to the group of relevant elements during pilot tests. They can be used to validate representative samples of products if none is generated or to add more elements to the sample if a personal element is generated.

The RG development phase is a key aspect of this research because it is the main process of gathering users perception information (construct

> figure 2:

Repertory Grid results from a propaganda pens pilot test with 9 relevant elements and 2 fictitious ones represented with REP IV program using a 1-5 ordinal scale.

shitty pen	3	1	3	4	1	5	2	5	1	5	5	practical
easy to write with it	2	5	1	3	4	1	4	1	4	1	1	rough writing
size too small	3	3	4	4	4	4	4	5	1	5	5	comfortable
fast writing	2	5	1	4	3	2	4	1	4	1	1	it runs aground
modern	5	3	5	3	3	1	3	2	3	1	1	plain
doesn't look like an advertisement	5	2	5	1	5	1	1	3	1	1	1	looks like an advertisement
comfortable to grip	3	2	3	2	3	1	1	1	4	1	1	bulky
thin pen	3	2	3	4	3	2	3	2	3	1	1	it is a piece of junk
nice feeling while touching it	3	3	2	2	3	2	1	1	4	1	1	have to make much effort to pick it up
you can play with the pen	3	5	4	5	2	3	1	1	3	2	2	difficult to make it spin
solid and compact	3	3	4	4	4	4	4	5	1	5	5	It easily breaks
natural open/close movement	4	4	3	1	3	1	2	3	5	1	1	bulky open/close mechanism
pens:	*n.1*	*n.2*	*n.3*	*n.4*	*n.5*	*n.6*	*n.7*	*n.8*	*n.9*	*ideal*	*real*	



> **figure 3:**

Propaganda pens RG pilot test experience landscape visualization with REP IV PrinGrid spatial analysis

generation). In this phase, where participants keep their leading role as construct generators (carried out with the Kelly method [Kelly, 1955]), we propose that the interviewer's role should go beyond guiding. They should focus participants to the core of their experiences by using personal interviews from Socratic point of view and by applying laddering techniques [Hinkle, 1965].

Integration within the design process

For designing purposes, it is desirable to develop a subjective information-gathering tool for product experience that works out as product interaction guide styles, like trend maps. From a design-engineering approach, the RG method has been used to quantify requirements and plan milestones to achieve during a design process from a user centric design point of view, like first step of QFD. The challenge of our approach is to manage subjective and specific comments on personal user experiences from a subjective point of view without loosing its design-engineering focus. Therefore, we purpose an outcome from the RG analysis that can be represented in different ways and adapted to different design stages:

Experience landscapes (constructs & elements spatial analysis visualization of RG results) are a visual way of representing results from each participant RG interview. This procedure has been used in many other RG applications [Jaeger, S.R. et al., 2005]. In this approach, as we deal with design relevant subjective information, this visual representation describes participants product perception from their experience, referenced with fictitious elements (ideal or real product image). See **figure 3** visual representation of propaganda pens RG analyzed with Principal Component

Analysis [Slater, 1976] [Slater, 1977] using the spatial model developed by Gower [Gower, 1966] and represented with Biplot [Glower and Hand, 1995].

Ideal product image (fictitious el. RG results) allows determining construct roles related to users desires and dreams. A comparison between ideal and real fictitious elements is a way to enhance design related information through the determination of user preferences (ideal ones) and perception requirements (real ones).

Weakness analysis (difference between relevant and ideal elements RG results) shows relevant element shortcomings that can be translated as product perception characteristics to be improved (see **table 1**).

Product benchmarking (weakness analysis comparison between the different elements, see table 1 last row) is useful for classifying the different elements and allows for the comparison of results from different participants.

Priority analysis (weakness analysis comparison between the different constructs, see table 1 last column) is useful for determining key product perception characteristics in order to create breakthrough products.

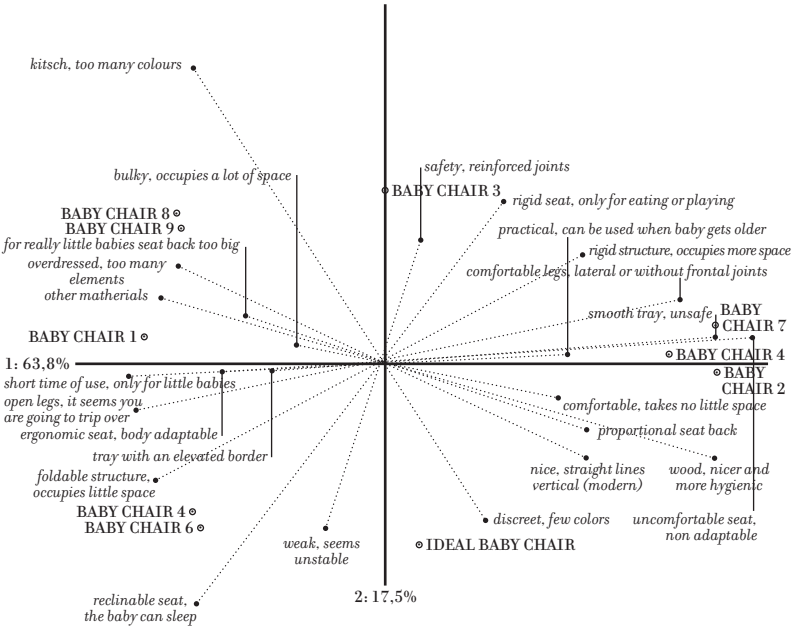
PRACTICAL APPLICATION

"Products Engineering and Technical Systems I" is a fourth year Design Engineering specialization course at the Industrial Engineering School of Barcelona that belongs to the Technical University of Catalonia. It introduces engineering students to issues associated with product innovation and design methods. The RG method was used in this course to determine product experience requirements and to benchmark their concepts with related existing products. The main aspect of the course was to create new and innovative products. Therefore, the course was a challenging test for experience landscapes as they were applied in new product development where nothing like it could already be found in the market.
The developed products in the 2004/2005 course were: Baby Swing-chair (a multipurpose modular child chair), Levy Slot (slot with magnetic levitation suspension and propeller propulsion systems), Fitness Swimming Pool (swimming pool with a water current counter flow system), Super shower (shower with an integrated full body drier), Home Press (home device to press plastic bottles with minimum effort), One Step Tire Chains (easy to use snow chains), and Handbag Lunchbox (carrying case with a separated lunch box).

> table 1

Weakness analysis results from a RG propaganda pens pilot test

	p.7	*p.4*	*p.6*	*p.1*	*p.R*	*p.8*	*p.3*	*p.1*	*p.5*	*p.2*	*p.9*	*total*
looks like an advertisement - doesn't look like an ad.	0	0	0	0	0	-2	-4	-4	-4	-1	0	-15
plain- modern	-2	-2	0	0	0	-1	-4	-4	-2	-2	-2	-19
it is a piece of junk - thin pen	-2	-3	-1	0	0	-1	-2	-2	-2	-1	-2	-16
bulky - comfortable to grip	0	-1	0	0	0	0	-2	-2	-2	-1	-3	-11
too much effort to pick it up - nice feeling while touching it	0	-1	-1	0	0	0	-1	-2	-2	-2	-3	-12
size too small - comfortable	-1	-1	-1	0	0	0	-1	-2	-1	-2	-4	-13
it easily breaks - solid and compact	-1	-4	0	0	0	-2	-2	-3	-2	-3	-4	-21
shitty pen - practical	-3	-1	0	0	0	0	-2	-2	-4	-4	-4	-20
tough writing - easy to write with it	-3	-2	0	0	0	0	0	-1	-2	-4	-3	-16
it turns aground - fast writing	-3	-3	-1	0	0	0	0	-1	-2	-4	-3	-17
bulky open/close movement - natural o/c movement	0	-3	-2	0	0	0	-1	-2	-1	-1	-1	-11
difficult to make it spin - you can play with the pen	1	-3	-1	0	0	1	-2	-1	0	-3	-1	-9
	-14	-24	-7	0	0	-5	-21	-26	-25	-28	-30	



> figure 4:

Baby chair 2nd experience landscape visualization with REP IV PrinGrid spatial analysis

As an example, we present part of the Baby swing-chair development process (the obtained user experience information and the final 3D model). First of all, to gather information about user experience, two experience landscapes from different participants with the RG analysis were generated. Participants used for the interviews were people that were going to buy a baby chair for they child. Precisely, couples that just have had a first baby or were going to have the first one. The first participant was a 31 year old woman with a 6 month baby and the second a 35 year old pregnant woman (see the results in **figure 4**).

Both user experience analyses (exp. landscapes and weakness analysis) were used to extract information for the swing-chair detailed design. Experience landscapes determine visually the most important constructs from the first participant: reclinable seat (so the child can sleep), practical (height adjustable structure), comfortable seat (padded) and wood as a nicer and cleaner material. In the same way for the second participant: discreet (few colours), comfortable legs (lateral or without frontal joints), reclinable seat (the baby can sleep and not just eat), wood as nicer and more hygienic, modern (with straight lines, vertical), proportional seat back. More design-relevant information from participant consumer preferences was extracted from the construct characterization process with the laddering technique and from the opposite pole generation

> figure 5:

Baby chair final 3D design concept

like: perception of wood as a hygienic and clean material, that safety is related to chair joints space for the baby and tray borders, that angle and joints distribution in chair legs as a key point to have a handy chair, and so on.

After that, weakness analysis was used to establish an order of importance between constructs for the first (reclinable back, wooden chair) and the second participant (foldable structure, reclinable back, wooden chair).

Results from the two participants were quite similar. Both detected the need for reclinable back and wooden baby chairs as the most important aspects. This information guided the students, as user experience requirements, to develop their concept of a new baby-chair that can also be used as a swing and a walking frame. See **figure 5**.

CONCLUSSIONS

This last part of the article is about students' RG learning process, results analysis (construct characterizations) and the usefulness of the approach. Firstly, some interesting things about the subjective RG development process where that the students got direct contact with user experience as RG can be considered a user centric design tool. They obtained detailed and reliable information (mostly unknown by the user). Main drawbacks can be summarized in the following learning problems: difficulty in forming non biasing open questions, characteristics grouping problems for construct generation and difficulties in applying the laddering method to obtain design-relevant information. Despite all this considerations, doing

a pilot interview to get basic knowledge about the procedure can easily solve all of these problems.

Within the RG results, generated constructs can be classified as: physical, functional and emotional. Physical constructs are related to immediate perception, describing one or more product characteristics, like: straight lines, wood material, reinforced joints, and tray with an elevated border. Functional constructs are related to product usage, for example: only for eating or playing, able to slide, short time of use and adjustable structure. Emotional constructs are related to user subjective thoughts, cultural background and experience, for example: comfortable, nice, hygienic, weak, overdressed, seems that you are going to trip over, and discreet. This classification can be used to analyse each kind of constructs and its design relevancy. Physical constructs are easily translated into product characteristics but are related to certain products (they are based directly on product comparisons). Therefore, it is not possible to determine its importance and relation to user experience. Functional constructs can be used to generate new product features related to user experience but don't give enough information about how to design its functionalities. Emotional constructs are too ambiguous and general that can only be used for inspiration.

Despite this observations it is important to highlight that, applying the laddering technique, most of the generated constructs can be considered mixed constructs. Constructs of this kind relate physical, functional and emotional characteristics. Moreover, information that comes up from this kind of constructs can be considered design-relevant because it solves emotional constructs ambiguity with information about usage experience and it adds physical characteristics to the functional constructs' lack of detail. That brings a level of usefulness to this subjective approach that cannot be achieved by objective user-experience exploration methods.

ACKNOWLEDGEMENTS

"Product Engineering and Technical Systems I" students (Baby swing-chair 2004/2005): Cinta Bosch, Montse Jané, Katharina Mast, Cristina Regot, Asun Uria and Montse Vicente.
Centre for Person-Computer Studies, to support constructivist educators and students with a simplified Personal version freely available for non-commercial use of the Rep IV program (http://repgrid.com/)

REFERENCES

Bedolla, D., "Diseño sensorial. Las nuevas pautas para la innovación, especialización y personalización del producto". 84-688-0748-6, UPC Barcelona, 2002.

Botella. L., "Personal construct psychology, constructivism, and postmodern thought", Advances in Personal Construct Psychology, vol. 3, 1995, pp. (3-36).

Botella, LL.: Feixas, G. "Teoría de los constructos personales: Aplicaciones a la práctica psicológica", Laertes Barcelona, 1998.

Gower, J. Some distance properties of latent root and vector methods used in multivariate analysis. Biometrika, No 53, 1966, pp. (325-338).

Gower, J.C. and Hand, D.J. "Biplots". Chapman & Hall London, 1995.

Hassenzahl, M. Wessler, R., "Capturing design space from a user prespective: the repertory grid technique revisited". International Journal of Human-Computer Interaction, Vol. 12, No 3 & 4, 2000, pp. (441-459).

Hinkle, D.N. "The change of personal constructs from the viewpoint of a theory of implications. Doctoral dissertation, Ohio state university, 1965.

Jaeger, S.R., Rossiter, K.L. & Lau, K., Consumer perceptions of novel fruit and familiar fruit: a repertory grid application. Journal of the science of food and agriculture, vol. 85, 2005, pp. (480-488).

Kelly, G.A. "The psychology of personal constructs" (vol. 1 & 2), Routledge London, 1955.

Neimeyer, G.J., Neimeyer, R.A. "Defining the boundaries of constructivist assessment", Constructivist assessment: A case book, Neimeyer G.J. (ed), Sage London, 1992.

Osgood CE, Suci GJ, Tannenbaum PH "The measurement of meaning" . University Illinois Press, 1957.

Slater, P., Ed. "Dimensions of Intrapersonal Space: Volume 1", John Wiley London, 1976.

Slater, P., Ed. "Dimensions of Intrapersonal Space: Volume 2", John Wiley London, 1977.

Wensveen, SA.G., Overbeeke, K. & Djajadiningrat, J.P. "Push me. Shove me and I show you how you feel. Recognising mood from emotionally rich interaction", Proceedings of DIS'02, ACM London, 2002.

Oscar Tomico
Technical University of Catalonia,
Project Engineering Department.
Diagonal 647, pl. 10,
08028 Barcelona, Spain.
Tlf:+34934010706
Fax: +3493340255
e-mail: oscar.tomico@upc.edu

Marc Pifarré
Universitat Ramon Llull,
La Salle, User Lab.
Quatre Camins, 18-34,
08022 Barcelona, Spain.
e-mail: marcpifarre@eresmas.com

Joaquim Lloveras
Technical University of Catalonia,
Project Engineering Department.
Diagonal 647, pl. 10,
08028 Barcelona, Spain.
Tlf: +34934016642
Fax: +3493340255
e-mail: j.lloveras@upc.edu

b. using metaphors as carriers of subjective information

"creating pleasurable user-product interaction experiences through movement analogies"

In Proc. Design Pleasurable Products and Interfaces 2005 Conference. TUe (The Netherlands). 24-28 October 2005.

INTRODUCTION

The work presented in this article discusses an experimental method (Sensory Metaphor Generation method) to facilitate the understanding of complex emotional systems through intuitive ideas. The method is illustrated through theoretical background (sections 1.1 – 1.3), method basis (chapter 2) and a case study where we tested the approach in a teaching and learning context (chapter 3).

The SMG method summarizes the firsts steps in our attempt to develop an emotional engineering framework based on user experience feedback. At the present time, it is focused in two different research fields (interaction design creativity methods and emotional requirements gathering and validating techniques).

Aim of the research

Too much effort has been put into the static part of product perception (form, colour, texture and material). Aesthetics not only considers how humans perceive products, but also how to respond to them, i.e., the resulting relationship ensuing from the encounter between the product and the user. We think that designing pleasurable products will lead to designing pleasurable interactions. Therefore, the design effort and creativity have to be focused on creating enriched interfaces that not only fulfil users expectations, but also evoke pleasurable experiences. Therefore, designing the user interface has moved from designing products to create contexts for experience [1].

To "redress the balance between appearance and action" [2] a more dynamic way of the interaction design has to be considered, focusing on user's experiences during product use

[3]. In this way, designing the user interface has moved to be the leading part of product design conceptual phase. "By making user experience the source of inspiration, we are better able to design for experiencing" [4]

Focusing in User Experience

Product interaction design deals with a broad number of different aspects, as it is the link between different product characteristics, functions, usage and users. The role of the interaction designer consists of designing complex and dynamic interactions with converging hardware and software, spaces and services. "This unknown terrain demands new design approaches, specific considerations and, ultimately, the design of integrated and holistic experiences set in context, rather than of individual artifacts or components" [5].

Design for experiencing addresses the whole user experience [6] considering the product related to the environment, the social situation, the knowledge, the culture and the personality of the user. It puts human experience first and builds to support and enhance it. "It starts with real people and their needs and expectations, not with technology" [6].

Although the common use of the term user experience is recent, experiences have always been a design related topic. Nowadays, "the term experience has become an umbrella concept that encompasses all aspects of the product including usability as well as more fleeting feelings of positive or negative quality and things such as entertainment and events" [7]. Despite the term is used widely and is related to the complex domain of personal emotions, there are key differences between the study of product-related emotions and user experience studies [7].

Different studies on the topic of user experiences lead to different definitions of the term. User experience can be considered as a very dynamic, complex and subjective phenomenon [5]:

(1) It is something that "occurs continuously, because the interaction of live creature and environment conditions is involved in the process of living" [8].
(2) Depends on the perception of multiple sensory qualities of a design (visual, taste, olfactory, kinaesthetic, auditory and touch).
(3) It is interpreted through filters relating to contextual factors [5].

User experience can be approached from different points of view. Consequently, different user experience frameworks have been developed, i.e., person-centred frameworks, product centred frameworks and interaction centred frameworks [7]:

(1) Person-centred frameworks are approaches that focus on the individual's experience and the elements that contribute to it.
(2) Product-centred frameworks have their basis in connecting product features to experience and create checklists describing the product-related experience contexts.
(3) Interaction-centred frameworks base their approach in focusing on the interaction between person and the product in its context. There are two ways of developing the latter approach: from an experience focus (describes the user experience in relation to time) and from a perception and meaning focus (describes the kinds of changes

that happen to how the moment is experienced).

As our goal is to create contexts for experiencing, person-centred and product-centred approaches are too static and in some cases time is not included [7]. Being focused on an interaction-centred framework, leads us to develop our design and information methods from an experience of interaction point of view as "experiences happen in a scene of various dynamic aspects" [9], "in a dynamic relationship with other people, places and objects"[5].

Designing User Experience

In our research on designing user experience, different themes need to be addressed in the development of a methodology:

(1) From the design team point of view, designers need to develop (in order to consider designing experiences as a way to design a product that is multisensorially delightful) a sensitive and emphatic understanding of what the interaction contains and also creative skills to comprehend and assess them [10].
(2) Based on the approach to develop, designers have to take into account the user's point of view (as experience relays upon user-product interaction). Experience design " is about designing with people and not just for them" [10]. These leads to the development of new tools to design for experience [4] based on collective generation and a participatory culture. Generative methods are a new language that enables all the stakeholders to contribute directly to the development of products and services. Participatory methods allow people's need to express themselves and to participate directly and proactively in the design process.
(3) Thinking about the integration into product design process, there are three different kinds of activities where experience design is valuable [5]: Understanding existing user experiences and context, exploring and evaluating design ideas and communicating this ideas.

THE SENSORY METAPHOR GENERATION METHOD

Theoretical basis

Different problems, confronted while dealing with the communication process between designers and users, can be summarized in the following principal causes [3]:

(1) Language differences (the user perception of a product is comprised in a context and circumstances different than the designer and therefore expressed in a different language, absent from technical jargon).

(2) Semantic differences (there is not a common language and a common base of semantic meaning to words describing products and the way they describe product requirements).

(3) Knowledge limitations (there is no cognizance from the designer of methods to collect, prioritize and interpret subjective user needs regarding a product).

The aim of our research is to improve the design of pleasurable products by solving the communication problem inside the design team and between the designers and the users ("to work effectively as a design team is important

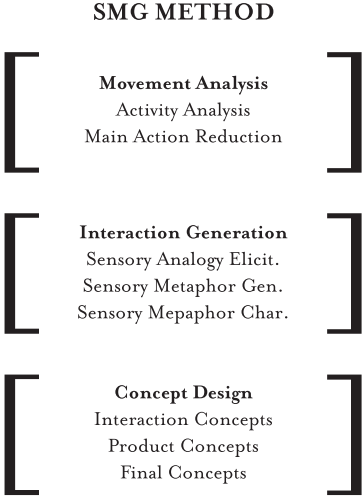
to develop a common vision of what the team is trying to bring into being" [5]). Therefore, we developed user-product interaction experience metaphors defined as Sensory Metaphors, which pretend to allow the designer and the user to create a mental picture of how experiences can be evoked, while designing the product interaction.

The development of the Sensory Metaphor is based in an experience of interaction point of view (as described in 1.2) "because experience as story is naturally communicative, it has relevance for sharing user findings with a design team of various disciplines" [11]. Sensory Metaphors can be used throughout the conceptual phase of design when determining the product interaction characteristics. Furthermore, they can be used to communicate among members of the design team and with potential users. The latter enables the experimental validation of the perception of the experiences the product evokes [3].

In our approach to experience design, we take into account narrative psychology to understand and try to solve part of the problem about how people express their own thoughts. By relating user's experiences into well-known situations like telling a story ("A sub-conscious experience can migrate to a storytelling experience, as we schematize it, communicate it, and add levels of meaning" [11]), we avoid the inherent problems of users not being able to identify the interpretation and meaning-creating process, social context information and latent needs. According to this approach, Sensory Metaphors facilitate the understanding of a complex emotional system through an intuitive idea ("an existing example in the everyday life with some high emotional contents" [3]). Precisely, "information becomes more vivid and engaging when it resonates with personal experience. If designers and clients can have informative personal experiences, it is easier for them to grasp the issues and feel greater empathy with both the people who will be affected by their decisions, and the experiences users may face" [5].

DEVELOPMENT METHOD: GENERATION PROCESS

To apply the developed technique, a broader interaction design context was needed to satisfy the generation of Sensory Metaphors. By merging the sensory metaphor generation with the ViP approach from Hekkert [12], a complete methodology can be used to test the validity of our sensory interaction technique (see **figure 1**). The Vision in Product design approach (ViP) is a methodology to predict the interaction with a product,



> figure 1:

The Sensory Metaphor Generation method [3].

by designing contexts for experience. According to this approach, the designer has to get an image of the interrelation between the new need and the new product, which is supposed to sustain equilibrium in this new context. This image is called vision of interaction and is defined as: "a view or consciousness of the interaction among a future user and a future product given a set of (future) conditions" [12].

The SMG method, from a creativity technique point of view, is strongly related to W. Gordon's Synectics [13]. Synectics creative process is based on two basic strategies: it could be said that it is centered on converting what is familiar into the unfamiliar and the unfamiliar into the familiar. Focusing in this approach, the SMG method is divided in three phases (Movement Analysis, Interaction Generation and Concept Design). Movement Analysis is used to determine familiar characteristics from the requirements of the future product. Then, with the Interaction Generation, familiar knowledge is transformed to unfamiliar by relating it to an unconnected experience to generate new ideas of interaction. Finally, in the Concept Design, results obtained in the Interaction Generation are transformed into known aspects of the future product (physical characteristics described in sketches, 3D models, etc.).

The Movement Analysis phase has been divided in product usage Activity Analysis and Main Action Reduction. Activity Analysis is based on the study of user's position, sequence of actions, typologies of movements, etc. Its purpose is to analyze user's movements and position with similar products as a starting point to get involved with product usage. Body movements are used to redefine the problem statements and build a completely product independent elemental knowledge level (breaking down any preconception about the new product). The Main Action Reduction is used to summarize product usage into a common sequence of body movements related to different tasks with the product (basic actions) in order to limit the interaction design problem.
The second phase (Interaction Generation) searches for new points of view, new ideas from known things. It relates the familiar basic actions to different experiences unfamiliar with the product context. From Synectics point of view, the process can be described as creating analogies or relations among the known elements with other aspects, environments or possibilities [14]. In the development of our interaction design methodology we named these analogies or relations Sensory Analogies. Sensory Analogies can be defined as analogies among the user's basic actions with the product and high emotional content tasks with similar sequences of movements [3]. See **fig. 2**, where different analogies have been developed from the user's basic actions with a telephone.

> figure 2:

Telephone sensory analogies collage [3].

In this SAE example, the key goal was to search for analogies among the user's basic actions with a telephone (pressing with a finger, picking and holding a telephone) and high emotional content tasks with similar sequences of movements. Different analogies were developed for pressing with a finger (dip a finger in a cake, play the piano) and for picking and holding the telephone (opening a bottle of wine, uncovering a pot, drinking a hot drink, etc). Some of them are represented as images in this overview collage.

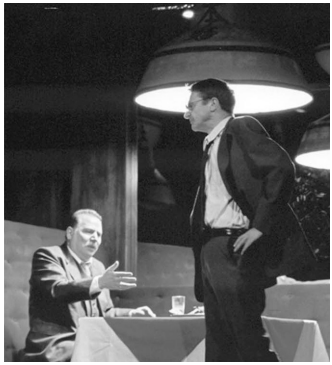
From the Sensory Analogies, a Sensory Metaphor is generated (see **fig. 3** where is described the process of choosing the Sensory Analogies and the Sensory Metaphor generation for a telephone). This process (the Sensory Metaphor Generation) is based in moving from an unfamiliar state (some unrelated Sensory Analogies) to an existing example in everyday life with high emotional contents (Sensory Metaphor). Sensory Metaphors allow the designer and the potential user to be able to create a mental picture of the experiences to be evoked with the future product (as described in 2.1).

The Interaction Generation phase last step is the Sensory Metaphor Characterization. It defines the Sensory Perception Goals to achieve with the product's final design. Sensory Perception Goals can be defined as emotional attributes that describe a Sensory Metaphor (see the characterization of an eating in a restaurant Sensory Metaphor in **fig. 3** as an example). These emotional attributes are used as design guidelines during the design process and for experimental validation of the perception of the experiences that the product evokes (for a detailed example see Product Concepts tests to measure users attitude upon different product concepts in section 3.2)

The "eating in a restaurant Sensory Metaphor" for using a telephone is based in the Sensory Analogies related to having a meal (open a bottle, uncovering the food and smelling it and dip a finger in a cake). After that, the following step is the definition of Sensory Perception Goals to achieve with the new design based on the generated metaphor (the SMC). Eating in a restaurant was characterized by perceiving a warmth atmosphere, feeling delighted to talk and being in a comfortable place isolated from the world.

> figure 3:

Restaurant sensory metaphor generated from the telephone Sensory Analogies [3].



The third phase (Conceptual Design) is mainly based in creating Interaction Concepts (general ideas about the interaction) and Product Concepts (detailed concepts like sketches, material description, mechanisms, ...) from the information obtained in Sensory Analogies and guided by the idea of the Sensory Metaphor. See **fig. 4** for a telephone Conceptual Design phase example.

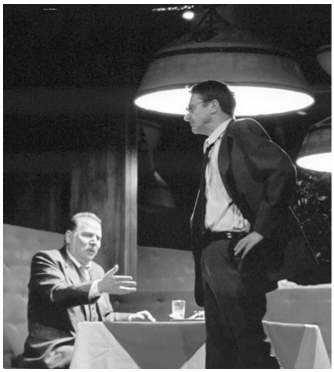
The Interaction Concepts (IC) are generated from the interaction ideas based on Sensory Perception Goals. For the "eating in a restaurant" metaphor three interaction concepts were developed. One was to search for the different numbers, as people look in a restaurant menu (classifying the numbers as the starters, main dishes, desserts and dish of the day) and having a "waiter" to guide you. The way to type the telephone numbers was to taste them (as augmented information each button or groups of buttons with similar functions can be easily differentiated by vision and touch, like in Japanese cuisine). And for picking up a telephone, like opening a bottle of wine to start a meal in a restaurant, you have to uncork it (as an augmented perception of the telephone state).

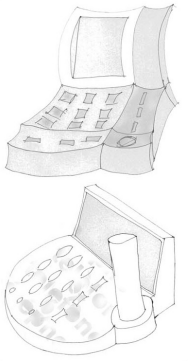
Testing method: Reduction process

With the aim to define the SMG method as a participatory tool ("to access and understand the experiences and dreams of ordinary people" [6]) we developed a parallel method to test and validate the design process while is carried out. It was named the Reduction Process.

The part of the SMG method described before, named as the creative part or the generation process, is where different ideas and concepts emerge from designer teams. In this second part, the reduction process, users are the ones who have the power to decide. Potential users select the most suitable ideas, concepts or designs by interacting with design teams using different participatory tools (reducing the solution space, helping to make choices and defining design guidelines).

In our first attempt to implement this participatory method we determined the most critical phases in the generation process (where a design team has to make choices that will impact in user's response with the final product): SAE (generation of





> figure 4:

Product Concepts and interaction ideas generated from the restaurant Sensory Metaphor [3].

different Sensory Analogies from basic actions), PC (generation of different product concepts from the interaction concepts) and FC (detailed design). These parts of the method increase the solution space together with the Interaction Concept phase, but the latter was not chosen due to the difficulty to evaluate interaction concepts from an idea (represented as images, writing descriptions or scenarios) without any physical or virtual mock-up.

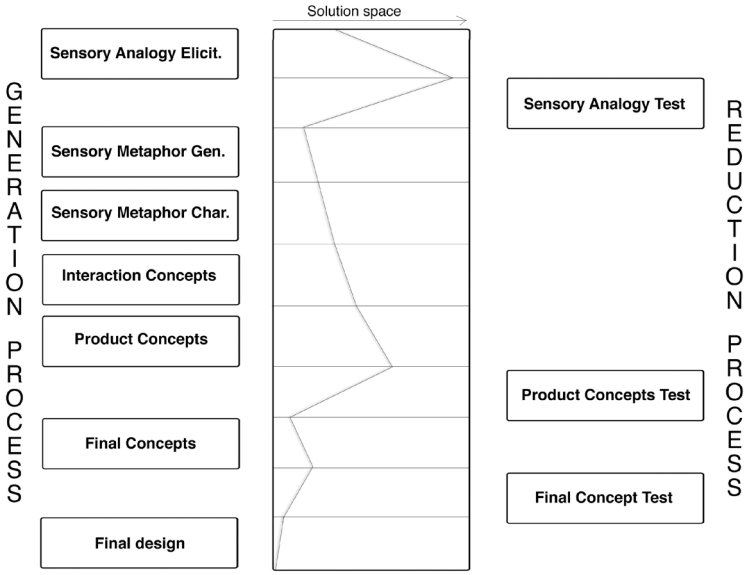
Therefore, three different tests were settled up (Sensory Analogy test, Product Concepts test and Final Concept test) and placed after the most critical decision making phases described before. A flowchart of the Interaction Generation and Concept Design process is presented in **figure 5** to represent the evolution of the solution space over different design phases.

Generation and reduction process are represented to link the increase and decrease of the number of different design solutions (ideas, concepts, ...) in the different phases of the SMG method. The reduction process is under development to improve the reliability of its results. For this first case study, attitude and perception tests were chosen for the Sensory Analogy test, Product Concepts test and Final Concept test:

(1) Sensory Analogy tests are used to measure users attitude upon generated Sensory Analogies (guiding the decision of choosing between them in order to create a general Sensory Metaphor) and get some general extra feedback about the attitude of the users with the generated ideas. See **figure 12** in results for an example of the Sensory Analogy tests carried out for this case study.

> figure 5:

Representation of the solution space among the design process.



(2) Product Concepts tests measure users attitude upon different product concepts using emotional attributes described in the Sensory Metaphor Characterization (Sensory Perception Goals). The results from this tests guide designers in the Product Concepts selection process by analyzing differences between the Sensory Perception Goals evaluation results. Moreover, PC tests help to determine emotional areas that have to be improved (Sensory Perception Goals with poor results) to accomplish desired experiences described as Sensory Metaphors. See **figure 13** in section 3.2 for an example of the Product Concept tests carried out for this case study.

(3) Final Concept tests are global perception test about users experience through representative emotional attributes. As final tests, FC tests have the aim to validate if the final product has reached the Sensory Perception Goals defined beforehand and assure that they have a prevalent role in users experience (by including them into the representative emotional attributes to evaluate). See **figure 14** in results for an example of the Final Concept tests carried out for this case study.

EXPERIMENTAL APPROACH

To get feedback about the Sensory Metaphor approach first hands on experiences were done in the Product Appreciation & Aesthetics course at the Universitat Politècnica de Catalunya (UPC) [15]. In this course artistic ideals, product perception and emotive responses were introduced to students of engineering design with little knowledge about the topic. It was presented in a way such as to open them to different resources and guide them to incorporate these in product development processes, such that the product outcome is more aesthetic or achieved improved appreciation [16]. The course was designed for 12 weeks in which the main themes are explored in the first 4 (imparting seminars in which various product design related topics are examined). The next 3 weeks students focused in choosing a product and define what they want to improve in the new design. Later on, they work on product design.

Student work

Student work is presented to get an idea about the application of the Sensory Metaphor Generation method (**fig. 6 - 10**). Their work is shown in different collages selected by the students to present their designs. The collages are divided in five different stages: the first stage represents the Sensory Analogy elicitation (SAE), the second represents the Sensory Metaphor Generation (SMG), the third represents the Sensory Metaphor Characterization (SMC), the fourth represents Product Concepts (PC) and the fifth the final design concept (FC).

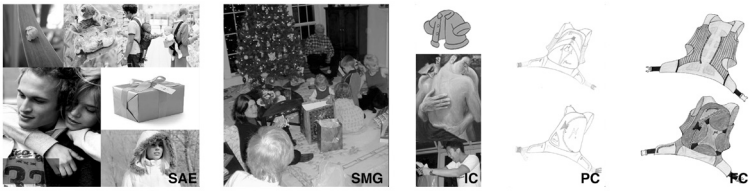
In **figure 6** (image collage from the backpack design process with the SMG method), The SAE generated different sensory analogies from the basic actions (put it on the shoulders, hold it on the back and open/close it). From the selected analogies (put on warming clothes, somebody is hugging on you and opening a present) the "Christmas Night" sensory metaphor was developed, characterized by the sensory perception goals to achieve (feeling of novelty and accessibility, feeling comfortable and cosy). For the "Christmas Night" metaphor two Interaction Concepts were developed (opening a bag ripping it and a mechanism of fastening like a waistcoat).

In **figure 7 (**image collage from the key ring design process with the SMG method), the SAE generated different sensory analogies from the basic actions (fixing the keys in the key ring, introducing the key into the lock and searching the key ring). From the selected analogies (keeping the keys with a screw gate carabineer, find Wally) the "Rock Climbing" sensory metaphor was developed, characterized by the sensory perception goals to achieve (security, easy to use and visibility). For the "Rock Climbing" metaphor three Interaction Concepts were developed (screw gate carabineer key ring fastening system and a rope with carabineer key disposition and an speleology location system to find the key ring).

In **figure 8** (image collage from the children's glasses design process with the SMG method), the SAE generated different sensory analogies from the basic actions (open the eyeglasses legs, get them closer to the face and fit them to the right position). From the selected analogies (open a book, a mother's caress, sunrise) the "opening a window in a sunny day" sensory metaphor was developed, characterized by the sensory perception goals to achieve (desire, curiosity, modernity and comfort). For the "opening a window in a sunny day" metaphor three Interaction Concepts were developed (opening the eyeglasses like a window, feeling a breeze of fresh air while putting on the glasses, discover a new world of clarity).

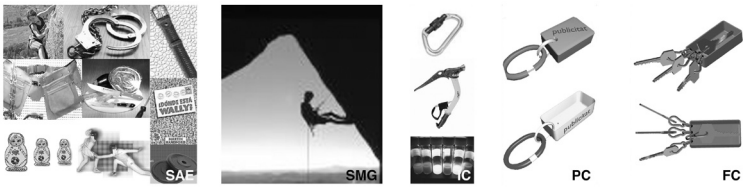
In **figure 9** (image collage from the rollerblades design process with the SMG method), The SAE generated different sensory analogies from the basic actions (put the rollerblades on, fastening the rollerblades, sliding). From the selected analogies (Formula 1, being a juggler, secure as a lock) the "Roller Coaster" sensory metaphor was developed, characterized by the sensory perception goals to achieve (speed, security, comfort, aggressiveness, attraction). For the "Roller Coaster" metaphor Interaction Concepts were developed (outside chain for a secure fastening, use light plastic materials to be like a feather and improved bearings to better sliding).

In figure 10 (image collage from the table lamp design process with the SMG method), the SAE generated different sensory analogies from the basic actions (turn on the light and adjust the intensity). From the selected analogies (sunbathing, staying near a heater) the "Beach Holidays" sensory metaphor was developed, characterized by the sensory perception goals to achieve (brightness, well-being and relaxation). For the "Beach Holidays" metaphor Interaction Concepts were developed (translucent screen like the water, different colored screen like the daylight colors and brightness adjustment).



> figure 6:

Image collage from the backpack design process with the SMG method.



> figure 7:

Image collage from the key ring design process with the SMG method.

> figure 8:

Image collage from the children's glasses design process with the SMG method.

> figure 9:

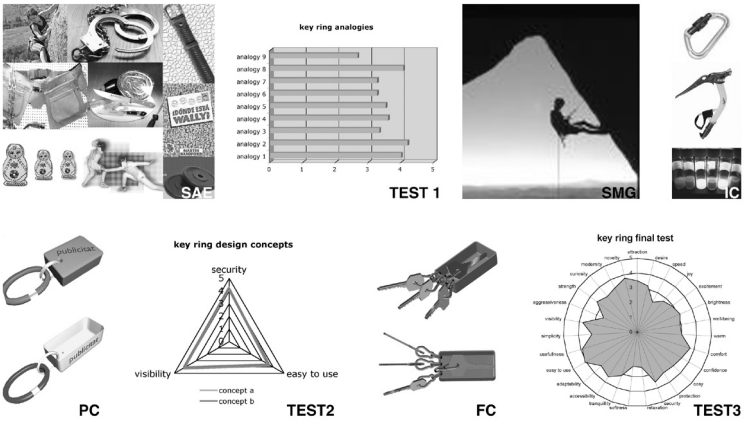
Image collage from the rollerblades design process with the SMG method.

> figure 10:

Image collage from the table lamp design process with the SMG method.

> figure 11:

Representation of the key ring design and test process.

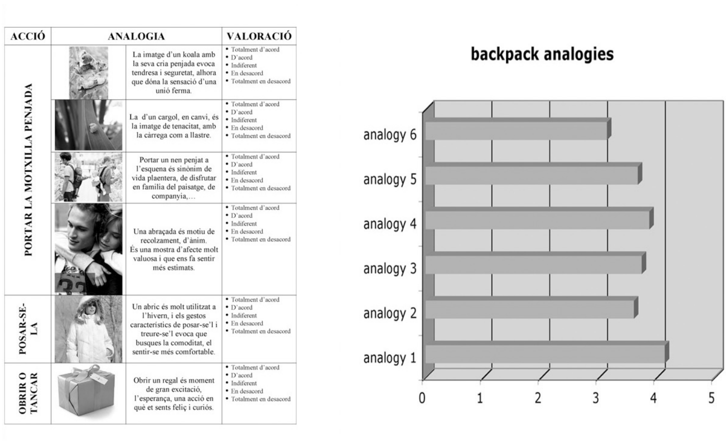


Results

To evaluate the SMG method the three tests described in the reduction process (section 2.3) were carried out using 20 students as potential users. The students were not allowed to answer questions related to their own designed product so 16 students were used for each test. See **figure 11,** where users feedback helps to choose between different design ideas and to guide and validate the product development in three different stages. For the key ring design process the first test was used to choose the most suitable analogies (handcuff the keys, climbing, where's Wally). The second test was used to choose between different product concepts with different details and the third one to evaluate the final product.

The first test (Sensory Analogy test) was used to measure the student's attitudes about different Sensory Analogies generated for each product using a 1 to 5 Likert-scale attitude questionnaire format [17]. The aim of this test was to help students to decide between the sensory analogies in order to create a general Sensory Metaphor and to get some feedback about users attitude concerning the generated ideas. See **fig. 12** for an example of the backpack design process Sensory Analogies test. This test was used to choose the most suitable analogies (koala backpack, somebody is hugging on you).

Due to the fact that the number of participants differs in different tests, standard means were calculated to compare the results. The maximum rating was 5 and values between 4 to 5 were considered acceptable for designing pleasurable and engaging products. After analyzing the results, two of the key ring design analogies reached the acceptable range (22,22% of the generated analogies), one analogy from the backpack (16,67%), one from the rollerblades (10%), two from the children glasses (28,57%) and one from the table lamp (16,67%). This means that overall 18,42% of the generated analogies could be considered engaging.



ACCIÓ	ANALOGIA		VALORACIÓ
PORTAR LA MOTXILLA PENJADA		La imatge d'un koala amb la seva cria penjada evoca tendresa i seguretat, alhora que dóna la sensació d'una unió ferma.	• Totalment d'acord • D'acord • Indiferent • En desacord • Totalment en desacord
		La d'un cargol, en canvi, és la imatge de tenacitat, amb la càrrega com a llastre.	• Totalment d'acord • D'acord • Indiferent • En desacord • Totalment en desacord
		Portar un nen penjat a l'esquena és sinònim de vida plaentera, de disfrutar en familia del paisatge, de companyia,…	• Totalment d'acord • D'acord • Indiferent • En desacord • Totalment en desacord
		Una abraçada és motiu de recolzament, d'ànim. És una mostra d'afecte molt valuosa i que ens fa sentir més estimats.	• Totalment d'acord • D'acord • Indiferent • En desacord • Totalment en desacord
POSAR-SE-LA		Un abric és molt utilitzat a l'hivern, i els gestos característics de posar-se'l i treure-se'l evoca que busques la comoditat, el sentir-se més comfortable.	• Totalment d'acord • D'acord • Indiferent • En desacord • Totalment en desacord
OBRIR O TANCAR		Obrir un regal és moment de gran excitació, l'esperança, una acció en què et sents feliç i curiós.	• Totalment d'acord • D'acord • Indiferent • En desacord • Totalment en desacord

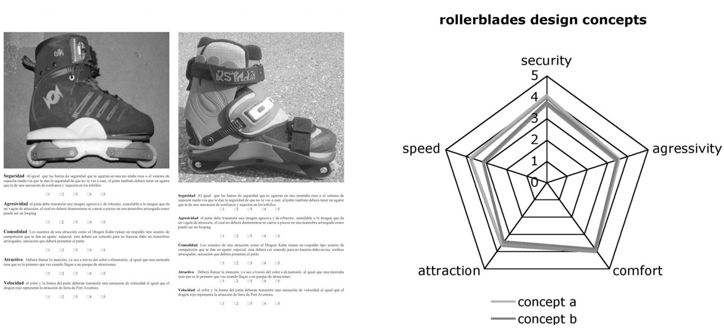
> figure 12:

The first test and the results for the backpack generated analogies.

The second test (Product Concepts test) evaluates different Product Concepts using Sensory Perception Goals to be achieved with new designs based on the generated metaphor (see **fig. 13** for an example of the rollerblades design process Product Concept tests).

The second test for the rollerblades makes the design group to choose "concept a" as the final concept to develop the product because had better results with the speed emotional attributes. This test was carried out after the presentation of the product concepts to ensure the understanding of the characteristics of each design concept. The results from this test helped students to choose between different product concepts and to determine areas that had to be improved.

For the second test, standard means were calculated to compare the results again, and an the same acceptance range from 4 to 5 was set. After analyzing the results, three key ring sensory perception goals reached the acceptable range (50%), none for the backpack (0%), one for the rollerblades (10%), one for the children glasses (12,5%) and four for

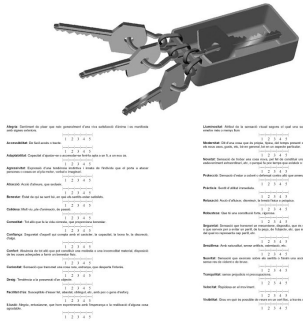


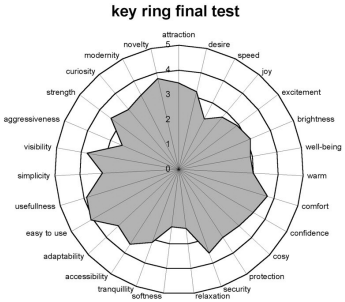
> figure 13:

The second test and the results for the rollerblades design concepts.

> figure 14:

Example of the third test and the results for the key ring design.





the table lamp (66,67%). This means that 21,43% of the perception goals reached the acceptance range and could be considered engaging.

The third test (Final Concept test) evaluates the general perception of the final concepts. This test was carried out after final presentations of the products to ensure the understanding of the characteristics of each final concept. All the different Sensory Perception Goals from the different products were used together with the aim to generate a broad representation of different emotional attributes. **Figure 14** shows an example of the developed test applied to the key ring design process. The sensory perception goals for the key ring were security, visibility and easy to use and the results from the third test showed that they are accomplished.

The different sensory perception goals were first classified by Russell's circumflex model of affect [18]. Later on they were placed in a circumference without leaving spaces between them because the aim of the test was to just evaluate them and there was not any need to make comparisons with other products (**fig. 14** shows the disposition of the different emotional attributes in the key ring tests results).

The results of the third test were analyzed in two different ways to determine if the Final Concepts had reached the Sensory Perception Goals and also if this Sensory Perception Goals had a prevalent role in users perception. The first comparison from the results measured the Sensory Perception Goals that reached the acceptable range in the final concepts. Analyzing the tests, one key ring Sensory Perception Goal reached the acceptable range (33,33%), none from the backpack (0%), two from the rollerblades (40%), none from the children glasses (0%), and one from the table lamp (33,33%). This means that the 21,05% of the Sensory Perception Goals reached the acceptable range and could be considered engaging.

The second comparison analyzes (for each product) the difference between the mean of the sensory perception goals and the rest of the attributes used in the test. Analyzing the tests, the key ring sensory perception goals reached a value 21% higher that the rest of the attributes, a 17% difference for the backpack, a 29% for the rollerblades, a 3% for the children glasses and a 24% for the table lamp.

CONCLUSIONS

General issues emerge from this first case study. Success and limitations of the approach can be explored in the field of learning the methodology, the suitability of the testing methods and the usefulness of the methodology. As a general overview, an interesting part to evaluate was how students learned to design emotionally enriched products during the design process. Students that took part were not used to take into account the subjective perception as a part of an engineering project. The decision to use user's psychological response about products as the main reason to choose between alternative ideas about product's form and function, made the design process completely new for them.

Basically, students understand the idea of using Sensory Metaphors as embodied experience communicators but occasionally they didn't use their full potential because they applied them in a reduced way. They translated exact physical characteristics from the Sensory Metaphor context into the new design and not the general experience to transmit. For example, see figure 7 (the image collage from the key ring design process) where carabineers where placed in the final design concepts as fastening mechanism like it is used in the climbing Sensory Metaphor.

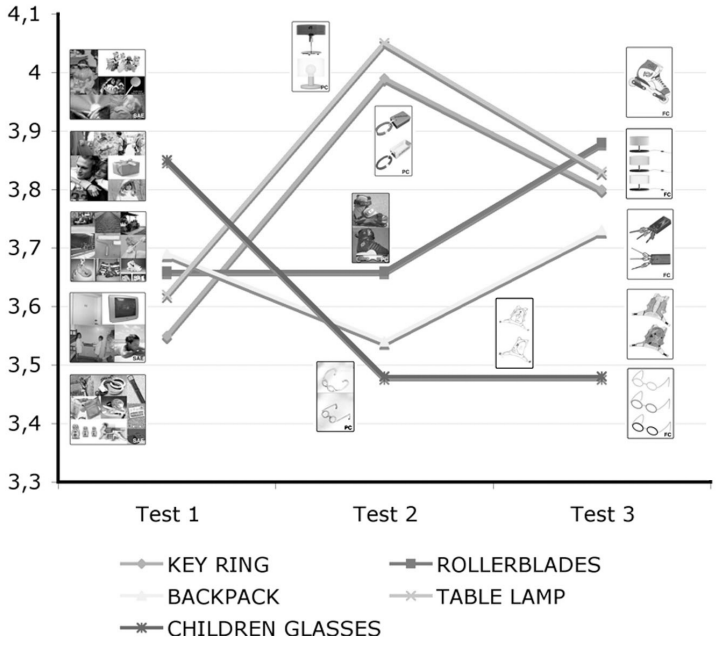
Moreover, rich Interaction Concepts were created by translating the experience (note that it refers to human response from the perception of the senses) behind the Sensory Metaphor Context into Interaction Concepts. See figure 6 (the image collage from the backpack design process) were Interaction Concepts like opening a bag ripping it and a mechanism of fastening like a waistcoat emerged from a "Christmas night" Sensory Metaphor.

The second topic of the conclusions studies the suitability of the testing methods. In this first case study we chose attitude tests for Sensory Analogies tests and product appreciation tests using attributes determined by the students for the Product Concept and Final Concept tests as it is described in section 2.3. After this first case study we can end up that Sensory Analogy tests depended on the correct interpretation or misunderstanding of the Sensory Analogies even thought images and a short description of the Sensory Analogy were used. Also Product Concept tests depended on the correct selection of the emotional attributes and their correct interpretation, as there was no room for additional user input.

The way to analyze the usefulness of the SMG method was to compare the evolution of the results over all the design process. Precisely, a comparison between the standard mean of the sensory perception goals to be achieved from the different tests was chosen. The first test measurement was calculated for each product as the standard mean of the different generated sensory analogies (the average results from the test). The second test measurement was the standard mean of the values of sensory perception goals (the average results from the test). The third test measurement was the standard mean of the values of sensory perception goals that were used in the second test (the rest of the attributes were not used).

> figure 15:

General comparison of the SMG method.



On one hand, the results obtained are very positive for this first application of the methodology. The average results from the 3 tests are above 3,5 (the standard mean from the first test was 3,67, from the second test 3,74 and from the third 3,74) and do not decrease as product design concepts get more detailed (following the design guidelines determined by sensory perception goals from each product). See **fig. 15**.

On the other, the results for each product show an irregular tendency (magnified in the figure 15 by showing just a small range of the Y-axis between 3,3 and 4,1). Just two of the five design teams improve their results, as the design concept gets more detailed. The results were conditioned by the level of detail in the presentations of their concepts. In the second test can be determined a correlation between the level of detail in the product concepts representation used in the test and the results obtained. The best results were for table lamp and the key ring (virtual 3D model) then the physical model of the rollerblades done with retail parts and finally the sketches from the backpack and the children glasses.

FUTURE WORK

Improvements of in generation process of the SMG method are going to be focused in developing a coding for movement analysis, in order to reduce the solution space from the sensory analogy elicitation (SAE). The reasons are, basically, to make easier to determine user movements (establishing a preset number of basic actions) and to study the possibility to realize an inspiration tool to increase the creativity of the design team (a database to link the coded movement actions to other personal contexts to help designers to determine the sensory analogies).

Improvements in the reduction process are going to be based in the development of a participatory technique for gathering emotional requirements based in interview-oriented methods. With the aim to base our research upon the reliability of the information obtained from users, we are going to:

(1) Adapt this interview method to obtain emotional requirements in user's own words (to allow all kinds of user input like social elements of pleasure).

(2) Determine the minimum number of users needed to reduce time and money resources and determine the usefulness of the technique in the different stages of the SMG method to choose the most appropriate ones to be used.

(3) Less importance is going to be given to the quantitative results and additional qualitative results will be generated from the evaluation process, shifting from tests to guided interviews.

For the next study cases, participants who are not familiar with the SMG method are going to be used to answer the tests to improve the reliability of the evaluation of the method. Moreover, some requirements related to the product concepts level of detail will be added to assure the equity of the results.

REFERENCES

1. Hummels, C.; Overbeeke. K. (2000) "Actions speak louder than words: shifting from buttons and icons to aesthetics of interaction". In: Pizzocaro, S.; Arruda, A. & De Moraes, D. (Eds.) Design plus Research. Proceedings of the Politechnico di Milano conference. Milan. pp. 284 – 290.

2. Djajadiningrat, T.; Wensveen, S.; Frens, J. & Overbeeke, K. (2004) "Tangible products: redressing the balance between appearance and action". Personal and Ubiquitous Computing. Springler-Verlag, London. 8: 294 - 309.

3. Tomico, O.; León, J.; Molokwane, S. & Lloveras, J. (2005) Designing Product Experience Through User Perception And Interaction Methods. iDec2 at the 19th British HCI Group Annual Conference Napier University, Edinburgh, UK 5-9 September 2005.

4. Sanders, E. (1999) Design for experiencing: new tools. In Proceedings of the First International Conference on Design and Emotion, C.J. Overbeeke and P. Hekkert (Eds.), TU Delft, 1999.

5. Fulton Suri, J. Buchenau, M. (2000) Experience Prototyping. In DIS '00, Brooklyn, New York.

6. Sanders, E. (2001) A New Design Space In ICSID News: Special Congress Edition, October-December 2001, p. 16.

7. Battarbee, K. (2004) Co-Experience. Doctoral Dissertation Publication Series of the University of Art and Design, A 51.

8. Dewey, J. (1980) Art as experience. New York: Perigee Books 1934 (reprint 1980).

9. Jääskö, V.; Mattelmäki, T.; Ylirisku, S. (2003) The scene of experiences. In the proceedings of The Good, The Bad and The Irrelevant conference on September 3-5, 2003. University of Art and Design Helsinki.

10. Klooster, S.; Appleby, R.; Overbeeke, K. (2004) Design (Education) Moves International Engineering and Product Design Education Conference. 2-3 September 2004. Delft, The Netherlands.

11. Forlizzi, J.; Ford, S. (2000) Building Blocks of Experience: An Early Framework for Interaction Designers. In DIS '00, Brooklyn, New York.

12. Hekkert, P. Van Dijk, M.B. (2001) "Designing from context: Foundations and applications of the ViP approach". In P. Lloyd & H. Christiaans (Eds.) Designing in Context: Proceedings of Design Thinking Research Symposium, 5: 383 – 394.

13. Gordon, W. J. (1961) "Synectics: The development of Creative Capacity". New York, Harper and Row.

14. Chaur, J. (2005) "Diseño conceptual de productos asistido por ordenador: Un estudio analítico sobre aplicaciones y definición de la estructura básica de un nuevo programa". PhD thesis. Barcelona, UPC.

15. Lloveras, J.; Molokwane, S. & Montoya, J. (2004) Product appreciation and aesthetics, subject structure. International Engineering and Product Design Education Conference. 2-3 September 2004. Delft, The Netherlands.

16. Montoya, J.; Molokwane, S.; Tomico, O. (2005) Searching For A Balance Between Aesthetics And Technical Bias: New Approaches In Teaching Arts And Crafts In Design Engineering. Engineering And Product Design Education Conference 15-16 September 2005, Napier University, Edinburgh, UK.

17. Elejabarrieta, F.J.; Iñiguez, L. (1984) Construcción de escalas de actitud tipo Thurst y Likert. Universitat Autònoma de Barcelona.

18. Russell, J.A. (1980) A circumplex model of affect. Journal of Personality and Social Psychology. 39(6):1161–1178

Oscar Tomico
Technical University of Catalonia,
Project Engineering Department.
Diagonal 647, pl. 10,
08028 Barcelona, Spain.
Tlf:+34934010706
Fax: +3493340255
e-mail: oscar.tomico@upc.edu

Joaquim Lloveras
Technical University of Catalonia,
Project Engineering Department.
Diagonal 647, pl. 10,
08028 Barcelona, Spain.
Tlf: +34934016642
Fax: +3493340255
e-mail: j.lloveras@upc.edu

c. considering users as motivated storytellers

"unveiling people's inner needs, desires and fantasies to help forecast future user-product interaction experiences"

In the 3rd International Design and Engagability Conference at NordiCHI 2006, Oslo, Norway, October 2006.

INTRODUCTION

In the past, people have tended to view entertainment and enjoyment as quite separate from their daily work life, learning and education. However, is increasingly changing where people integrate and expect pleasure and enjoyment in their daily lives, work or otherwise. As most physical needs have been satisfied, people are turning their attention more to satisfying emotional, aesthetic, sensory and even spiritual needs. Therefore, moments of entertainment and experience are no longer seen as extraordinary events but part of our everyday experience [1].
As technologies evolve new sensorial qualities emerge, a major challenge in the coming years is to align people's sensorial experience and technology closer together to create a more intuitive way of interacting using natural gestures and sensory-emotive qualities to fulfill peoples inner needs, desires and fantasies [2]. We have to rethink technology as a material [3] in relation to the creation of products and services, which respond to the subjectivity, and volatility of our moods, wishes and lifestyles.

Objectivist based research into users, contexts and cultures is increasingly part of product development cycles, but it may better include new sociological, anthropological and psychological methods to envision possible futures and behaviors [4]. Our proposal merges post-modern narrative and projective psychotherapy techniques in an iterative, generative and collaborative process to better unveil people's inner needs and desires. It focuses on consumers' unmet and unconscious fantasies for a broad spectrum of product experiences with the purpose to forecast future social interaction behaviors and increase people's awareness and acceptance of technological developments.

INNER NEEDS, DESIRES AND FANTASIES EXPLORATION AND EXPRESSION

Human needs, values and emerging socio-cultural trends are the key inputs to a design process than generates initial ideas for experience solutions [5]. But how values, beliefs and assumptions can be extracted from the potential users? There is not much in terms of traditions, expectations and interpretations to lean on and react against when introducing new kinds of objects such as new technologies [3]. Connecting with consumers' emotions and desires will make an experience more appealing than another [6]. But, how are this values, beliefs and assumptions translated into a product or a service? Which physical characteristics, functionalities and interaction behaviors of a product induce the desired experience to the user?

To solve these issues we propose to use post-modern psychotherapy techniques in a collaborative, generative and iterative process (in the following paragraphs these conceptions are going to be described in detail):

· Collaborative because it is based on user centered design with an emphatic design approach.
· Generative because follows a post-modern psychotherapy paradigm and applies projective and narrative techniques.
· Iterative because it applies a self-exploration and expression loop that allows exploration through expression and expression through exploration.

Emphatic design focuses in the complex area of users' individual and subjective experience. Emphatic design methods involve users in products or services development process to unveil intrinsic and affective product qualities that a designer needs to take into account and from people's memories, current experiences and ideal experiences [7]. Post-modern psychology's essential task is understanding how people's characteristics (values, beliefs and assumptions) are involved in the process of experiencing, as well as how people otherwise participate in co-creating the dynamic personal realities (needs, desires and fantasies) to which they individually respond [8]. In post-modern psychotherapy techniques, like projections and narratives, meaning arises from the communicative action rather than residing within individual selves [9]. The techniques themselves become an "exercise in co-creative languaging among all of the members" [9]. This shift leads to a radical change in traditional formulations of human experience design research.

Projective techniques can be described as a mode of guidance that underlies intuitive knowing by using meaning transports, which extend our level of understanding. Projections are sensory reconstructions of high-generality imagery described as "being somewhere between perceptions and symbolic thought" [10], and, they represent a more aesthetically rich and personally felt descriptions.

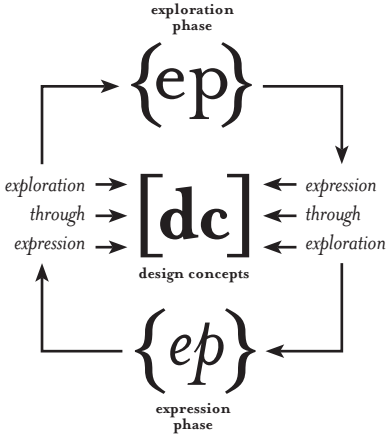
Narratives techniques consider users as motivated storytellers and they tell their stories selectively and colorfully, "placing emphasis on those events or combinations of events that have an affective meaning of that appeal to them emotionally" [11]. The defining feature of narratives is that they are "permeable structures allowing the person to simultaneously enchain a wide array of elements, ideas, and

images" [10]. They are conducive to looser, imaginary associative play, and allow one to entertain unusual, even absurd, combinations of ideas and elements [10].

The self-exploration and expression loop is based in the information flow between the expression phase and the exploration phase. Basically it means that information from the exploration phase can be used in the expression phase (expression through exploration) contributing to a better understanding of personal values and increasing the exploration phase level of detail; and information from the expression phase can be used in the exploration phase (exploration through expression) enabling reflection from the expression phase. See **figure 1**.

The exploration phase is based on projective techniques. Participants are asked to find out what inspires them. Then, they have to look where can they find their desired values (e.g. objects, products, situations) and they describe them. This method avoids semantic differences by projecting symbolic qualities in existing products. That relates the desired personal values (products' symbolic qualities) with existing physical characteristics, contexts or behaviours.

The expression phase is based on narrative techniques. Participants have to advertise themselves through a presentation or narrative. They have to choose and relate different objects, products or situations to create a narrative that describes them. Therefore, considering narratives not only static, also dynamic visual information can be analyzed. The symbolic component of rhythm, tempo, and movement can also be used in order to foresee new interaction behaviors.



> figure 1:

The self-exploration and expression loop.

EMERGING SOCIAL COMMUNICATION EXPERIENCES CASE STUDY

With a research through design approach, a hands on exercise was carried out in the "Design and creativity teamwork workshop" (1st year master students design course at University of Arts and Design Helsinki) to unveil inner needs and values for social communication to forecast future interaction possibilities with mobile communication devices. The aim was to explore projective and narrative psychotherapy techniques' strengths in creating future behaviors for products and services.

The workshop had two differentiated parts (no information was given in the first part about the second one). In the first part, the students act as future users and explored and generated animated visual presentations separately with the self-exploration and expression loop. In the second part, teams developed product concepts (with sketches, storyboards, 3d models) to exemplify the design from the personal video

> table 1:

Results from an example using the self-exploration and expression loop.The exploration phase relates participants' desired physical features (e.g. size, lightness, textures), functional qualities (e.g. visualization, hidden spaces) and symbolic qualities (e.g. simplicity, nature, mystery) in a 30 seconds presentation.

WHAT INSPIRES ME? *(adjectives)*	WHERE CAN I FIND IT? *(objects, products, situations...)*	DESCRIPTION	SCENARIO
High tech	Microchips	*technology revolution, size reduction*	
	Foams	*light and semi-transparent, multiple propierties*	
Simplicity	Simplicity	*you can then play with textures easily*	
	Sea	*tension between air and water, anything else*	
Nature	Nature	*purity, calm, ...*	
	Rough Matherials	*strong feelings, contact with the elements, ...*	
Mistery	Hidden places	*makes work your imagination*	
	Presents	*unknown features*	
	Comics	*detectives, black and white visuals, tension atmosphere...*	

presentations. Finally, the concepts were presented with video animations to describe behaviors and interaction experiences and student's feedback was asked.

Part 1: Unveil inner needs and values for social communication.

In this first part of the workshop, the students were asked to present their inner needs and values as personal presentation advertising themselves. They explored and generated 30 sec. animated visual presentations (e.g., movies, PowerPoint, Flash and Director animations) separately as part of the self-exploration and expression loop (expression through exploration). See **table 1**.

Afterwards teams were formed and they ask to analyze their personal presentations relating them to mobile communication devices. They were looking for their personal inner needs and values inside their personal presentations related to social communication (exploring their personal narratives as the second part of the exploration and expression loop).

To summarize the information obtained in this phase we present a graphical representation of the design criteria (qualitative and quantitative information) extracted from the intrinsic values extracted from exploration through expression for four different design teams (figure 2). These representations relate the desired symbolic qualities (circles), behaviors (rectangles) and attributes (rounded rectangles) from the different students and its relevance between the people in the teams (size of the circle):

· In team 1 (see **figure 2 1st graphic**), nature was perceived as one of the most important values and represented by pure figures with no decoration (raw) attributes. Observation also arose as an important value for them, focused in colors and contrast perception through repetition and variation. They considered these two values together with the openness and spaces ones (to "have a direct look" and still "see things in perspective") and created the concept of "natural ambience". Furthermore, the democratic and solitude values were directly connected through "experience together" and "public spaces" behaviors.

· In Team 2 (see **figure 2 2nd graphic**), nature was also perceived as one of the most important values, but was related to discover and experiment diversity and mobility (e.g. traveling, exploring observing). At the same time, other values like the "sense of communion" and love were very important. From

the relation of these two groups of value, they created the "separate vs. communion" behavioral paradigm, which leaded them to communicate with people using sensorial connections and exchanges.

· For team 3 (see **figure 2 3rd graphic**), finding an ethical justification describes sustainable, one of their most important values. This idea was related to the recycling (as taking advantage of existing solutions) and respect (with principles and rules) values. From these two last values together with the "private vs. openness" dichotomy, they created the "anonymous objects" concept. Furthermore, they considered openness, randomness and endless as values and created the spontaneous challenging creation of "heterogeneous opinions" behavior.

· For team 4 (see **figure 2 4th graphic**), one of the most important values was to have a story behind that "arouses attention from the past". They considered that these stories would allow appropriation to create an inspiring atmosphere through behaviors with a "strong sense of the self". Patterns, as a value for communicating, were related to the evolving and contrast values. That leaded them to consider communication an evolution and indicate definite and short information with changes. At the same time, they thought that affective and contagious values would create "motivating and engaging" behaviors (like love) and avoid nonsense using simple interactions.

Part 2: Forecast future behaviors with mobile communication devices.

One of the main challenges of using intrinsic values as requirements is how they are communicated through a product. That's because there is no common language and no common base of semantic meaning to words describing products and the way they describe product requirements [12].

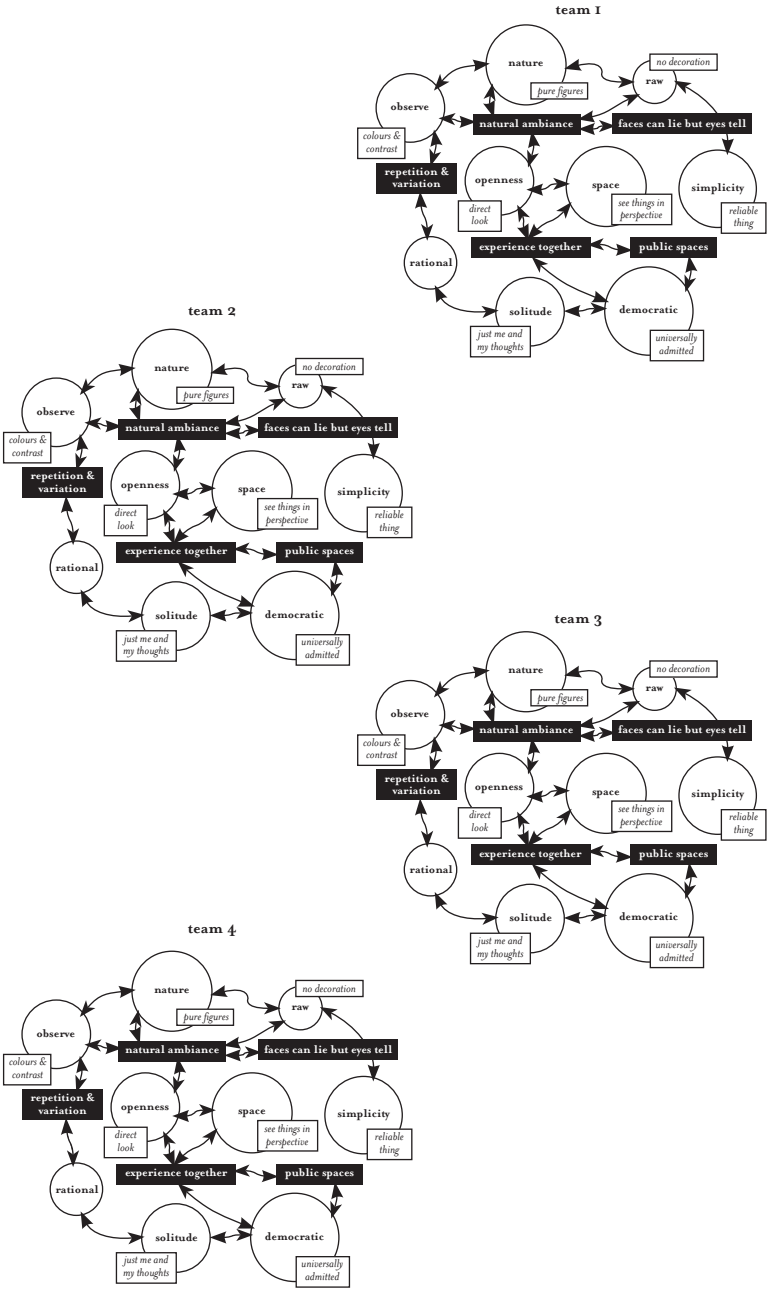
The approach applied is based in materializing values in objects [13] using the exploration and expression loop projective information (see results in figure 2). Thus, products, objects or contexts are used as symbolic carriers of meaning for personal values, beliefs and assumptions. Consequently, values can be seen as raw material to be shaped into products.

The results were "OPENMIND" (visual representation device for human electromagnetic fiends), "e-senser" (shake hands in the distance), "My Toiletdoor" (an anonymous mobile communication drawing table) and "MOBALL" (mobile ball to express feelings and emotions). All of them were highly innovative and technological non-intrusive products concepts as they were related to the core aspects of participants' expected experience, merging their needs, desires and fantasies for mobile communication (**see figure 4**):

· Team 1's product behaviors, extracted from unveiling inner needs and values for social communication, where "natural ambience" and "faces can lie but eyes tell" (see figure 2). These ideas were materialized as an anti-communication device in the "OPENMIND" concept. This concept made introspection as a new way of

> figure 2:

Graphical representation of the intrinsic values extracted from exploration through expression part of the exploration and expression loop in teams 1, 2, 3, and 4.



communication, translating brain activity into visual representations through repetition and variation.

· Team 2 developed the "e-senser" (holding hands from distance concept) from the separation vs. communion behavior paradigm. Mobility and traveling, together with sense of communion and closeness were some of their most important values. Therefore, they explored the contact with people using sensorial connections and exchanges and developed a product concept, which would allow communication with all the senses (e.g. holding hands from the distance using pressure to change the tightness of a bracelet, making the change of the feeling visible by coding the heart rate into colors).

· Team 3 with "My Toiletdoor" (an anonymous mobile communication drawing table) explored the private vs. openness dichotomy through "anonymous objects". The idea, to share intimate comments anonymously in a specific location, was borrowed from toilet doors where people post a question anonymously to get some advice or answers. The device could be any multimedia device than allows a location-based communication (e.g. in a cafe, on the train) with the 10 nearest people. The idea and the device were taken from existing products because the recycling (as taking advantage of existing solutions) was one of their important values. Therefore, they focused on the service it offers, the experience people would have, what would people write (e.g. philosophy, politics, personal matters) ...

· Team 4 explored affection and storytelling to indicate definite and short information with a strong sense of the self with the "MOBALL" (mobile softball to express feelings and emotions). Their concept enabled a close contact relationship between two persons expressing feelings and emotions by creating their own language changing the shapes of soft balls. The shape of this moballs were

> figures 3:

Images extracted from the presentations of team 1 "OPENMIND", team 2 "e-senser", team 3 "My Toiletdoor" and team 4 "MOBALL" concepts.

always synchronized and stayed in the manipulated form for 10 seconds. Later, they formed back to their original shape.

The concepts were presented with video animations to describe and exemplify behaviors and interaction experiences from their product concepts and feedback from students (table 2) allowed analyzing teams' acceptance to the developed concepts. Precisely, the key elements were:

· An intermediate distance from today's reality and futuristic trends (e.g. the "OPENMIND" and "MOBALL" were considered cool and fun but at the same time too sci-fi, the "My Toiletdoor" as another extra item because it used an existing platform).

· A clear and simple communication that maintains human contact and allows having a personal signature (e.g. "MOBALL" and "My Toiletdoor" were perceived as a fast and clear way of communicating, the "OPENMIND" as not clear because it was too unrestricted, the "e-senser" as fuzzy because it had too many options).

· The intimacy of the communication when showing personal emotions (e.g. the "e-senser" was perceived as it would not evoke the right emotions and as not a personal medium because it showed your emotional state in public).

· The honesty and good spirit of the communication (e.g. My Toiletdoor and OPENMIND concepts were designed keeping in mind the values of respect and openness and were highly appreciated by the other groups).

> figure 4:

Feedback comments from each team (rows) to the different concepts (columns).

	"OPEN MIND"	"E-SENSER"	"MY TOILETDOOR"	"MOBALL"
Team 1		Missing core	Great. Hard to understand. Good spirit.	Cool. New.
Team 2	Not clear. Fun.		Extra item. Fast communication. Personal signature.	Scary (self animated). Simple and clear. Fresh concept.
Team 3	Interesting philosophy. Far from reality. Somewhat obvious.	Surprising. Fuzzy, too many options. May not evoke the right emotions.		Cool idea. Easy to communicate. Far from reality. Too sci-fi.
Team 4	Honest. Crazy idea. Too unrestricted.	Well applied emotions. Medium not personal. Shows intimate emotions.	Loses human interaction. Too digital.	

CONCLUSIONS

On one hand, the exploration and expression process denoted the existing communication problem between designers and users and among themselves. Semantic differences between values were found within the results from the different teams unveiling inner needs and values for social communication (e.g. nature was related to pure figures with no decoration in team 1 and to discover and experiment in team 2, simplicity was related to a reliable thing in team 1 and to elegance and fluidity in team 2). That exemplified the lack of common language base of semantic meaning to words describing products and showed how the narrative and projective techniques used in the description of personal values, beliefs and assumptions facilitated the communication and understanding of this tacit knowledge without misunderstandings by using objects, products or situations as carriers of meaning.

On the other hand, the exploration and expression process has some limitations. Emphatic design aims to get a clear understanding of future users in a cooperative framework, but for this case study designers were considered as users to unveil inner needs and values for social communication. The main reasons were the knowledge limitations of multimedia presentation and video editing software and time constrains. In future work, these knowledge limitations will be analyzed to allow users to take their leading role in the process.

Finally, the ensuing concepts from forecasting future behaviors with mobile communication devices helped to understand how new technological possibilities can foster expressivity in digital communication and how it will affect the way we treat other people.

ACKNOWLEDGMENTS

Design and creativity teamwork workshop 1st year master students at University of Arts and Design Helsinki: team 1 (Johanna Lappi, Jussi Ruokomäki, Veikko Savijoki, Malin Hjorth, Philipp Thesen), team 2 (Likka Airas, Eerika Korhonen, Birgit Frank, Pekka Kumpula, Bruno Dushmine), team 3 (Minni Kanerva, Ingvild Sundby, Francesca Jakin, Bert De Neil, Päivi Aro, Teemu Vaarakallio, Eunsie Park, Vladimir Zak, Martijn The), team 4 (Ilkka Heino, Juha Nieminen, Katri Vainiomäki, Piritta Winqvist, Simon Tsang, Björn Saunes, Bing Su, Ryan Sohlden, Kimmo Wihinen. Antti Pitkänen).

REFERENCES

1. Green, J. (2003) Thinking the future. In Aarts, E and Marzano, S (eds) The new everyday: views on ambient intelligence. Rotterdam: Uitgeverij 010 Publishers.

2. Verbücken, M. (2003) Towards a new sensoriality. In Aarts, E and Marzano, S (eds) The new everyday: views on ambient intelligence, Rotterdam: Uitgeverij 010 Publishers.

3. Redström, M. & J., Mazé, R. (2005) IT+textiles. Helsinki: Edita.

4. Mazé, R. (2005) What is the use? In Ailly, Stella d', Olausson, L. Sten, M. (Ed.) Extra ordinary. Stockholm: Kulturhuset publication.

5. Goulden, L. & McGroary, P. (2003) Experience design. In Aarts, E and Marzano, S (eds) The new everyday: views on ambient intelligence, Rotterdam: Uitgeverij 010 Publishers

6. Vogel, C. M., Cagan, J., Boatwright, P. (2005) The Design of Things to Come: How Ordinary People Create Extraordinary Products. New Jersey: Wharton School Publishing.

7. Koskinen, I., Battarbee, K. and Mattelmäki, T. (2003). Empathic Design. Helsinki: IT Press.

8. Guidano, V.F. (1995) Constructivist pshychotherapy: A theoretical framework. In Neimeyer, R. A., Mahoney, M. J. (Eds.) Constructivism in Psychotherapy. Washington: American Psychological Association.

9. Anderson, H. & Goolishian, H. (1992) The client is the expert: A notknowing approach to therapy. In S. McNamee & K. J. Gergen (Eds.), Therapy as social construction (pp. 25-39). Newbury Park, CA:Sage.

10. Stevens, C. D.; Walker, B. M. (2002) Insight: Transcending the obvious. In Neimeyer, G.J., Neimeyer, R.A. (Eds.) Advances in Personal Constructs Psychology, New directions and perspectives. Westport: Praeger Publishers.

11. Hermans, H. J.M. (2002) The person as a motivated storyteller. In Neimeyer, G.J., Neimeyer, R.A. (Eds.) Advances in Personal Constructs Psychology, New directions and perspectives. Westport: Praeger Publishers.

12. Tomico, O., León, J., Molokwane, S. and Lloveras, J. Designing product experience through user perception and interaction methods. In Proc. iDec2 at the 19th British HCI Conference, UK (2005).

13. Dunne, A., & Raby, F. (2001). Design Noir. Basel: August/Birkhäuser

Oscar Tomico
Technical University of Catalonia,
Project Engineering Department.
Diagonal 647, pl. 10
08028 Barcelona, Spain
Tlf:+34934010706
Fax: +3493340255
e-mail: oscar.tomico@upc.edu

Peter McGrory
School of Design, UIAH.
Hämeentie 135 C,
00560 Helsinki, Finland
fdmi@uiah.fi

Joaquim Lloveras
Technical University of Catalonia,
Project Engineering Department.
Diagonal 647, pl. 10,
08028 Barcelona, Spain.
Tlf: +34934016642
Fax: +3493340255
e-mail: j.lloveras@upc.edu


UPC