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Design the experience first: A scenario-based methodology for the design of complex, tangible consumer products

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FOREWORD OF THE EDITOR

Problem

Positive user experiences influence directly the user satisfaction, which is the major factor contributing to product success. In our post-materialistic era, consumers obtain objects that are not only useful and intuitive to use, but moreover make life more enjoyable; beyond monetary value they call for experience value. Major trends in product development, like the increasing global competition, product and process complexity, indicate that the importance of user experience design will grow. Manufacturers seek ways to address real users' needs through their products and stand out from the competition. Those factors led to a growing interest on user experience in the past decades. However, a study of current industrial practice indicates a need for approaches to design positive user experiences as reproducible results. This insight applies to great extent in the context of design of complex products. Although user experience design deals with soft aspects of interaction and requires a holistic view, informal practices were found inadequate for its successful implementation in the design of complex, tangible products. In this case, design processes have a high level of formalization, so new approaches have to be integrated successfully. Furthermore, user experience design calls for collaborations across disciplines, which need to be organized in a structured way. For all these reasons, a methodology is valuable for managing and executing design activities. The literature review and empirical studies conducted within this thesis revealed that known user experience methods provide only partial support to face the aforementioned challenges.

Objectives

The overall objective of this thesis was to provide a practical support for the systematic design of user experiences mediated through complex, tangible products, specifically in early design phases. Furthermore, to build a theoretical basis to increase the understanding of the practice of user experience design, as well as to display how scenario-based methods can support it. In the first part of the thesis, existing user experience methods in literature and practice. Practitioners' attitude was explored, to identify requirements and build the basis for a new methodological support. For developing the support, methods were applied by design practitioners and adapted according to the identified opportunities and challenges. The iterative development and assessment of the methodology took place in real-life settings. Finally, to ensure the transfer of the gained insights into practice, a practical guide was developed.

Results

The main outcome of this research is a systematic, practitioner-centred support for designing positive user experiences as reproducible results: a scenario-based methodology consisting of five methods. Its unique focus on complex, tangible consumer products and early phases of design, as well as its holistic approach differentiate it from previous research. The first result of the thesis was the identification of a research gap in the study of user experience practice in

the context of complex, tangible products. An empirical study of the practice of user experience design in 20 companies complemented the theoretical findings. Five methods were selected, structured and tailored to meet the identified practitioners' requirements. Three case studies in the automobile and household appliances domains provide insights about their applicability, advantages and limitations. The proposed methods result in formal artefacts and provide a frame to collaborate. At the same time, scenario-based methods are supposed to inspire practitioners to think and work with scenarios in an informal way in their overall practice. This is beneficial for the communication and envisioning of user experiences. Finally, this thesis contributes with practical guidance in the implementation of the proposed support. It introduces the role of a "storykeeper" for managing user experience, while a practical guide was implemented to support the introduction of the methodology in the organization.

Conclusions for industrial applications

This research showed that the study and support of the user experience practice are highly relevant, particularly in the design of complex products. The successful implementation of user experience design requires a change in practice and mind-sets. The outcomes of this thesis are beneficial towards those directions. From a design practitioner's perspective, the methodology provides the necessary guidance to act, manage and collaborate. The provided guidelines and recommendations are expected to be useful for practitioners, since they root in the real application of the support in various design cases. From an industrial perspective, the developed support is valuable, because it provides a formal way to design experiences as reproducible results. The application of the proposed methodology would open the opportunity to work beyond disciplines and conceptualize products with positive impact on users' life.

Conclusions for scientific researches

This thesis introduces to scientific researches a study of the intersection of the fields of user experience and scenario-based design from a product development perspective. Formalizing and investigating scenario-based methods with a special focus on user experience is a promising research area, since the communication and envisioning of user experiences were found to be only partially supported by existing methods. This research highlights the importance of designing the user experience *first*, so early in the design process. Moreover, the results of this thesis encourage researchers to conduct further empirical studies on user experience practice. The literature review showed that many studies focus on understanding the phenomenon of user experience, while fewer works aim at studying and supporting its practice. Findings of this thesis can build the fundament for further studies. Moreover, the new methodology was developed hand-in-hand with practitioners; such an approach is recommended for researches, who aim at scientific outcomes with high relevance for the real design practice.

Garching, May 2017

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Researchers at German universities have much freedom in their work. It is possible to work within several projects and define a research topic, in which they dedicate their PhD, in agreement and under the guidance of a so-called “Doktorvater”. My research would have not been possible without the trust and guidance of my Doktorvater, Udo Lindemann. He has welcome me to his team in October 2011 and opened up a journey of amazing opportunities. Not only did he make it possible to participate in several projects, which helped me gain experience and confidence; moreover, he gave me the privilege to work in a respectful and inspiring environment and visit research institutions around the world. For all that and the personal development Professor Lindemann allowed me to have, I am truly grateful to him.

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The following publications are part of the work presented in this thesis:

- Michailidou, I., Saucken, C. v., & Lindemann, U. (2013).** How to create a user experience story *Design, User Experience, and Usability. Design Philosophy, Methods, and Tools* (pp. 554-563): Springer.
- Michailidou, I., Saucken, C. v., & Lindemann, U. (2013).** *Extending the product specification with emotional aspects: introducing user experience stories.* Paper presented at the DS 75-7: Proceedings of the 19th International Conference on Engineering Design (ICED13), Design for Harmonies, Vol. 7: Human Behaviour in Design, Seoul, Korea, 19-22.08. 2013.
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- Michailidou, I., Saucken, C. v., Kremer, S., & Lindemann, U. (2014).** A User Experience Design Toolkit *Design, User Experience, and Usability. Theories, Methods, and Tools for Designing the User Experience* (pp. 163-172): Springer.
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- Michailidou, I., Diergarten, L., & Lindemann, U. (2015).** *Applying matrix-based methods for improving user experience of a driver advisory system.* Paper presented at the Proceedings of the 20th International Conference on Engineering Design (ICED15), Milan, Italy, 27.-30.07.2015.
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Glossary

Term	Chapter	Definition in this thesis¹
<i>Affect</i>	2.2.1.2	An <i>affect</i> is a response to a subjective experience that involves a certain level of perceived pleasantness and arousal.
<i>Analogy</i>	4.2.3.1	<i>Analogies</i> express the perceived likeness between two entities, a source and a target. In analogical thinking, a pattern is transferred from a source to a target.
<i>Character</i>	2.2.2.3	<i>Character</i> is a person appearing in a story. Unlike an actor, a character has a motivation and special characteristics that become apparent in the story and shape his/her actions and reactions.
<i>Complexity</i>	1.3	The term <i>complexity</i> may refer to product, process, market or organisational complexity. Number, art and variability of elements and relations, as well as dynamics (i.e. art and number of possible states) determine the level of product complexity. Products with high level of complexity are products with a large amount of different elements, interrelations and different states.
<i>Emotion</i>	2.2.1.2	<i>Emotions</i> arise when interactions are appraised as having beneficial or harmful consequences for individual concerns. They are instances of subjective feelings accompanied by activation of a specific physiological response and expressive behaviour.
<i>Experience</i>	2.2.1.2	<i>Experience</i> is the irreducible totality of people acting, sensing, thinking, feeling, and meaning making in a setting, including their perception and sensation of their own actions.
<i>Function</i>	4.2.2.1	A <i>function</i> describes a solution-neutral, operational relationship between input and output variables of a system. This thesis refers to functions of the observed system are that are perceivable from a user's point of view. Such functions describe the "do-goals" of an activity.
<i>Integration</i>	4.2.2.1	<i>Integration</i> is the approach of combining individual elements of user experience (user, motive, need, use case, function) by avoiding conflicts and redundancies.
<i>Key event</i>	4.2.2.2	A <i>key event</i> is as a use case, in which there are critical (positive or negative) influences on the user experience.
<i>Method</i>	1.1.3	<i>Methods</i> describe a rule-compliant, scheduled procedure. They are prescriptive and operative in nature and guide the applier through a series of goal-oriented actions.
<i>Methodology</i>	1.1.3	A <i>methodology</i> is a combination of methods, which makes it possible that results of individual methods contribute to a goal.

¹ Explanations and references related to the definitions are included in the main document

<i>Motivation</i>	2.2.1.2	<i>Motivation</i> involves needs, motives and goals that lead to certain activities, actions and operations.
<i>Motive</i>	2.2.1.2	<i>Motives</i> are expressions of needs in specific situations and the reasons leading to actions. When an object is given, which can contribute in fulfilling the motive, the motive is concretized in goals.
<i>Mood</i>	2.2.1.2	<i>Moods</i> describe a valenced (i.e. subjectively perceived as pleasant or unpleasant) affective state and are typically elicited by no direct stimuli, but combinations of internal and external causes.
<i>Plot</i>	4.2.2.2	The <i>plot</i> ties together the sequence of events, experiences, or actions described in a story through causal relations.
<i>Process</i>	4.1	A <i>process</i> describes a series of actions or steps taken in order to achieve a particular end.
<i>Product</i>	2.2.1.2	A <i>product</i> is the object with which a user comes into contact through interaction.
<i>Scenario-based methods</i>	2.2.2.1	The umbrella term <i>scenario-based methods</i> describes methods, techniques and tools that make use of scenarios, like the storytelling and storyboarding techniques.
<i>Scenario</i>	2.2.2.1	A <i>scenario</i> is an explicit description of hypothetical events concerning a product during a certain phase of its life cycle.
<i>Story</i>	2.2.2.1	A <i>story</i> is a rich description of hypothetical events, experiences, or actions of a character concerning a product, tied together in a plot. This thesis refers to stories constructed especially for describing events related to an interaction of a user with a product. <i>Storytelling</i> is the activity of creating and communicating stories.
<i>Storyboard</i>	2.2.2.1	A <i>storyboard</i> is a short graphical depiction of a narrative, typically consisting of multiple frames that describe important actors and actions. The storyboard is in itself a design, both as a process and as a result.
<i>Storykeeper</i>	4.3.3	A <i>storykeeper</i> is the manager of the user experience design process. He/she is not just a project controller, but also a requirements manager and the ambassador of user experience principles with a unique combination of tasks and skills.
<i>Substory</i>	4.2.2.2	A <i>substory</i> describes a vision of future practice and shows how the early product ideas would change the use practice and fulfil the user needs –without yet describing the product.
<i>Tool</i>	1.3	<i>Tools</i> support the execution of individual steps of a procedure, e.g. of a method.
<i>Use case</i>	2.2.2.1	A <i>use case</i> is a series of events, described from the point of view of an actor.
<i>User</i>	2.2.1.2	A <i>user</i> (synonymous: consumer) is the human interacting with a product and actively contributes in creating value. A customer can but is not necessarily the user of a product. A customer demands a product from the side of the market and purchases it against a price from a supplier.

<i>User experience</i>	2.2.1	A <i>user experience</i> is a worthwhile episode related to an interaction between a user and a product situated in context and involves all subjective aspects the user thought, felt, did while expecting, experiencing and/or remembering the interaction
<i>User profile</i>	4.2.1.1	A <i>user profile</i> is a databased description of a user representing a homogenous market segment.

1. Introduction

User satisfaction is the major factor contributing to product success, a trigger for purchasing decisions and differentiation of a product from competitor products. For satisfying their needs, users seek for products not just with monetary value, but also with experience value. Positive user experiences emerge when product interaction results to fulfilment of users' needs and when it fulfils or even exceeds users' expectations. In the past two decades, the interest of the scientific community and companies for user experience has increased rapidly. To address the opportunities that emerge from the shift of the focus in development towards experiences, it is essential to find ways *to design positive user experiences as reproducible results*.

Designing positive user experiences is not trivial. User experience projects involve various stakeholders, from experts of numerous disciplines to end-users. User experience is qualitative and subjective in nature, thus difficult to capture and hardly possible to measure. Furthermore, experiences have to be treated holistically throughout the design process. This is particularly important, when designing complex, tangible products. Consequently, user experience design bears many challenges, in terms of communication, collaboration and management.

One example to illustrate great user experience design is the driving mode button in cars. Many manufacturers provide such an interface element to enable users to select for "sport" or "comfort" driving. Each setup influences numerous car functions and settings, which shape the driving experience. In this example, the design of a complex system delivered a simple, intuitive interface and the possibility for enjoyable experiences. Referring to this example of designing the driving mode interface, we could get an initial glimpse of the challenges of user experience design. In order to design a complex interface, various stakeholders cooperate throughout the design process. The driving mode interface addresses a relevant drivers' motive, which had to be identified in the beginning of design. Knowledge about users and their needs is substantial for that. In this special case of designing a new system, several technical and qualitative requirements must have been specified. Examples for the multiple aspects to consider when envisioning the future system could be: Which driving situations are relevant? Which systems are affected? What is possible with the available technologies? Knowledge of various experts is therefore required. Having defined a goal for the new development, first concepts can be sketched –then evolve to mock-ups and integrated prototypes. Each time a new stakeholder becomes involved, the intended experience needs to be presented in a comprehensible manner and in a convincing way when decisions are made. In the example of the driving mode interface, a user experience story conceptualized in the beginning of the design process (a driver deciding for a sport or comfort driving experience) was implemented as a new feature, which mediated this experience for real drivers.

Designing for experience brings new facts and challenges to development processes, but more importantly, new opportunities. Opportunities to work beyond boundaries of disciplines, experiment with new methods and tools and focus on how to make users' life richer in positive emotions and experiences. Hopefully, this thesis will provide scientists and practitioners with theoretical understanding and practical support in their journey towards designing positive

experiences. The next sections describe the motivation and objectives of the thesis (1.1), the methodological framework (1.2), its focus (1.3) and structure (1.4).

1.1 Motivation and objectives of the thesis

The overall goal of this thesis is to provide *a guide to designing positive user experiences systematically*. To explain the motivation for this goal and specific objectives, this section will highlight three questions: (1) What is user experience and why is it important; (2) How to design experiences systematically; (3) Why and what kind of guidance is necessary?

1.1.1 What is user experience and why is it important?

A *user experience* is a worthwhile episode related to an interaction between a user and a product, situated in context, and involves all subjective aspects the user thought, felt, did while expecting, experiencing and/or remembering the interaction (Figure 1-1). Positive user experiences emerge, when product interaction results to fulfilment of users' needs and when it fulfils or even exceeds users' expectations. *User experience design* aims at creating products whose usage shapes and leads to positive user experiences.

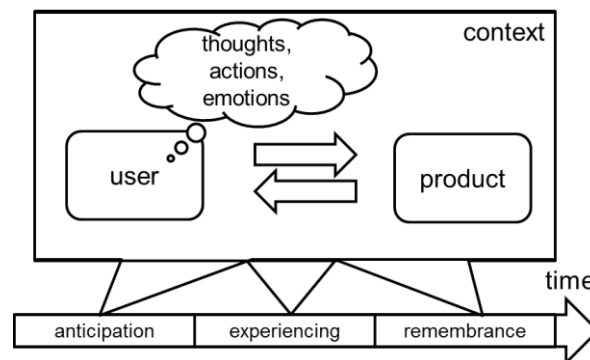


Figure 1-1: Aspects of user experience

Taking the example of the driving mode from the previous section, a driver could describe his interaction with the driving mode interface as positive experience. Which would mean that his motive for driving sporty was fulfilled in a way that exceeded his expectations. Additionally, the experience of driving sporty released positive emotions and thoughts, thus making driving an enjoyable, memorable episode. In this sense, we can talk about successful user experience design, because a team of designers stage-managed this experience by providing a new feature. Many further examples of successful products show that functional performance is not a guarantee for success –user experiences resulting from interaction with products are crucial for customer satisfaction, which ultimately influences the purchasing decision. For designers of new products it is an ultimate goal to create positive, rich and meaningful user experiences enabled through products that satisfy needs beyond the functional.

Future trends in product development indicate that the importance of user experience design will grow, as *global competition*, product and process *complexity* increase, while *users* remain

the target focus of design in our post-materialistic era. In competitive global markets, manufacturers should come up with unique selling propositions, which address real users' needs, to distinguish their products from competitors. User experience design is often associated with innovations and increased product value. Pleasurable products are used more regularly and would affect future purchasing decisions (Jordan, 1998). The fact that products become more complex in terms of integrated technologies and number of components makes it a challenge to create simple, intuitive interfaces. This is a major issue addressed in user experience design. Moreover, the design of products becomes an increasingly multi-disciplinary matter; user experience design builds exactly on the combination of skills and expertise of various professions. In regard to user-centeredness, it is important to emphasize that user experience design has a strong focus on creating knowledge about users, their needs and emotions. Such understanding is essential for designing for diverse users (e.g. diverse ages, cultures) and their interactions that result into positive experiences.

An indicator for the increasing importance of user experience in practice is that the term “user experience” seems to be a widespread element of current job descriptions listed by companies building interactive technology: user experience designers, user experience researchers and user experience managers seem to be badly needed (Loehmann, 2015). Furthermore, consulting agencies specialized on improving user experience are increasingly popular.

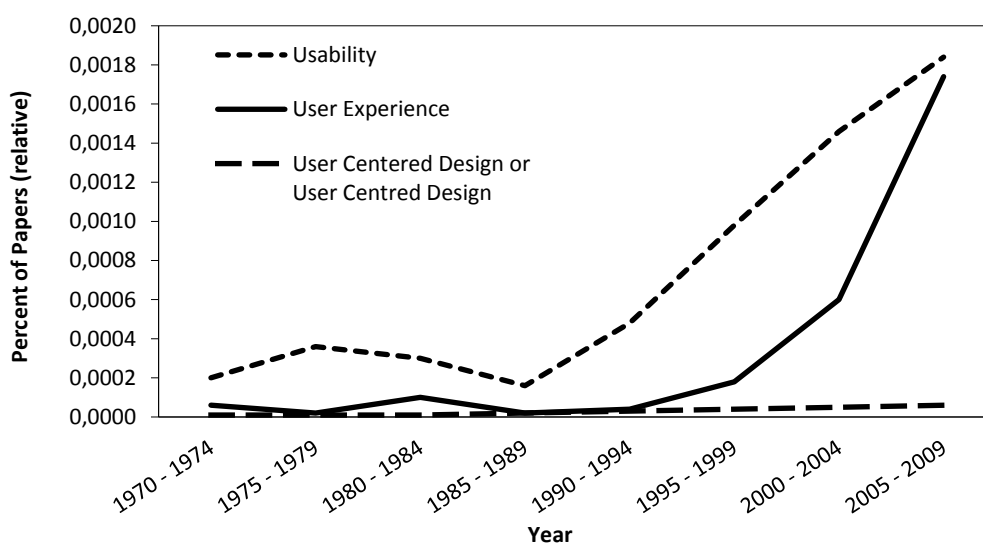


Figure 1-2 : Temporal evolution of literature on user experience (based on Woywode et al., 2012)

Being a relatively young field of research (making its appearance in the mid-nineties), user experience, has gained a lot of attention in the scientific world. Woywode (2012) puts into relation the number of papers containing the searched terms “usability”, “user experience” and “user centred design” to the total amount of scientific papers (Figure 1-2). It is obvious that the interest on user experience has been raising exponentially since the year 2000. The research field of user experience involves studies on the phenomenon itself, studies on means to design systems that enable particular experiences, as well as studies on investigation and development

of methods to create and assess user experience. The study of all aforementioned aspects is hardly saturated, but yet of great interest to explore.

Finally, from a users' perspective, it is also of increasing importance to obtain objects that are not only useful and intuitive to use, but moreover make life more enjoyable. Users look for valuable tangible products, but also intangible services and systems. Beyond monetary value they call for "*experience value, the objective of which is to meet the wants and needs of people, as well as social value, the objective of which is to be able to deliver on more sustainable and convivial ways of living*" (Sanders & Stappers, 2014).

1.1.2 How to design experiences systematically?

Despite the increasing importance of experience design in research and industrial practice over the past decades, methods that support a targeted and structured creation of positive user experiences are rare or fractional. Section 2.4 describes identified research gaps, while studies of current practice conclude that practitioners miss formal ways to design positive experiences.

This does not mean that there are no successful examples of user experience design. However, it is questionable whether those successful results are outcomes of a targeted process or by-products of the usual processes. This thesis emphasizes that the design of positive user experiences can be a reproducible result. Formalized procedures do not only have the advantage of leading to better outcomes, but also give the opportunity to learn and improve.

The approach to design experiences systematically that is introduced in this thesis is a *scenario-based approach*. The umbrella term scenario-based methods describes methods, techniques and tools that make use of scenarios, which are "*explicit descriptions of hypothetical events concerning a product during a certain phase of its life cycle*" (Anggreeni & Voort, 2008). Examples for scenario-based methods are storytelling and storyboarding. There are many reasons why a scenario-based approach is appropriate for user experience design (elaborated in 2.3). The main reason is the nature of user experience itself. Hassenzahl describes experience as "*a story emerging from the dialogue of a person with her or his world*" (Hassenzahl, 2010). User experiences are worthwhile, subjective, holistic, temporal and situated. Stories describe worthwhile events, are personal, holistic, have a defined beginning and end, while they are situated in physical and emotional context. A methodology consisting mainly of scenario-based methods is introduced as a holistic, process-accompanying approach to support the collection of user insights, enhance creativity and teamwork, enable the communication of "soft" aspects, as well as increase empathy and thus user-centred design. The main contribution of this research is the suggested way of combining and applying existing and new methods in a structured procedure, tailored to the special characteristics of user experience.

1.1.3 Why and what kind of support is useful in user experience design?

Methods describe a rule-compliant, scheduled procedure. They are prescriptive and operative in nature and guide the applier through a series of goal-oriented actions (Lindemann, 2009, p. 57). Methods propose ways to implement a procedure and often prescribe formal how to perform and document individual steps towards a goal. Methods support practitioners to

manage complex tasks, mostly by dividing them in handy subtasks. Positive effects of applying methods are that tasks are more focused, documented in a traceable way and, if necessary, supported through appropriate collaborations. Furthermore, it is more likely to identify conflicting objectives or errors and thus minimize risks, when working methodical (Lindemann, 2009, p. 59). All those advantages are highly relevant in the context of user experience design, where complex tasks of multiple actors have to be treated in a holistic way. It is even more appropriate to talk about a *methodology*. A methodology is a combination of methods, which makes it possible that results of individual working methods contribute to a goal (Lindemann, 2009, p. 58). The methodology introduced in this thesis would support practitioners to organise, apply and document operative tasks focused on user experience.

The application of methods requires effort. Moreover, it might take practice, infrastructures or expenses to establish a method (Lindemann, 2009, p. 59). To achieve a most effective cost – benefit ratio, it makes sense to know practitioners’ needs and tailor a method to meet them. The methodology introduced in this thesis builds on practitioners’ requirements (3.4). Moreover, methods were applied in praxis and method descriptions were structured in a practitioner-friendly way.

1.1.4 Objectives of the thesis

Goal of this thesis is to introduce a practical guide to design positive user experiences systematically, a scenario-based methodology. Furthermore, it builds a theoretical basis to increase the understanding of the practice of user experience design, as well as to display how scenario-based methods can support it. Figure 1-3 shows the specific objectives contributing to the phases of conceptualizing, developing and assessing the new scenario-based methodology for designing user experiences.

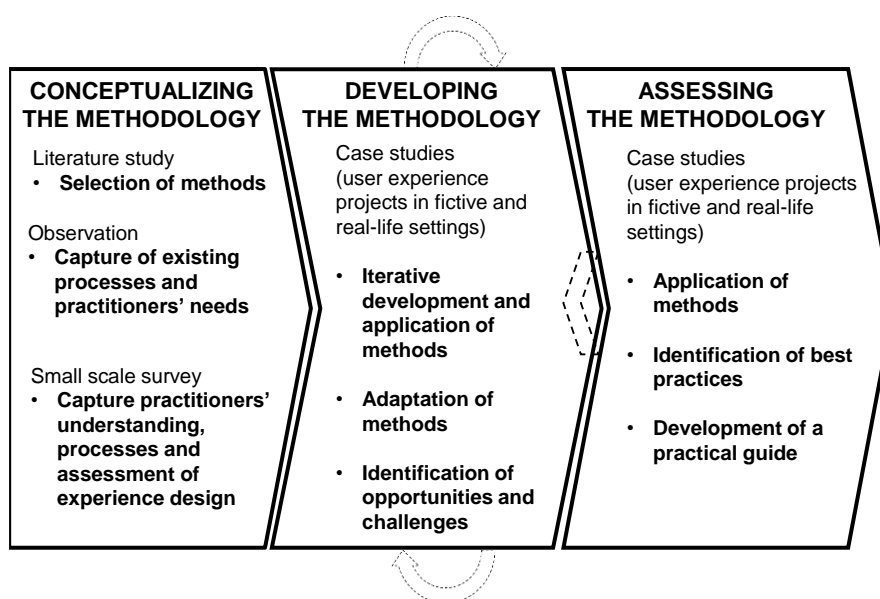


Figure 1-3 : Objectives of the thesis

To conceptualize the methodology it was necessary to explore existing user experience methods in literature and practice, as well as practitioners' understanding, processes and assessment. Specific objectives were to select appropriate methods and derive requirements for a methodological support. The main objective when developing the methodology was to apply the methods in practical cases and adapt it according to the identified opportunities and challenges. Finally, when assessing the methodology, the objective was to identify best practices related to the application of methods. The iterative development and assessment of the methodology took place in both fictive and real-life settings. It was important to observe how inexperienced in user experience designers coped with the introduced support, when aiming at developing and improving user experiences. All gained insights flowed into a practical guide (Appendix A8, www.uxfirst.com).

1.2 Research methodology and research context

This section describes the fundamentals of the thesis. The *scientific basis* lies in the selected research methods. The *empirical basis* is closely linked to the author's research activities in industrial projects and student theses.

Stage of DRM	Research activity	Result	Chapter
Research clarification	Literature study	Problem description, research questions	2
Descriptive study I	Case study (observations, protocol analysis), Questionnaire	Understanding of current practice, requirements on support	3
Prescriptive study	Iterative development of support, Case study (observations, protocol analysis)	Development of support	4, 5.2, 5.3
Descriptive study II	Case study (observations, protocol analysis, questionnaire)	Summative evaluation	5.4

Figure 1-4 : Research methodology of the thesis (DRM: Design Research Methodology)

The conducted research followed the stages of the *Design Research Methodology* (Blessing & Chakrabarti, 2009), which is a generic methodology that helps researchers to design their own research and select appropriate research methods. The Design Research Methodology is a framework tailored to satisfy the requirements of design research and consists of four stages, which provide the necessary flexibility to structure individual research. Figure 1-4 shows which methods were selected in this thesis for each of the stages of research clarification, descriptive study I, prescriptive study and descriptive study II to achieve the objectives presented in 1.1.4. Each stage resulted into deliverables, which build on each other; in many cases, iterations were necessary because of new insights (arrows in Figure 1-3). Individual results are described in detail in following chapters. In general, the conducted research can be described as phenomenological, since the considered phenomena (human behaviour and application of support) were studied in individual cases with qualitative methods. Because the topic of user experience is a relatively new field of research, it was considered appropriate to work with qualitative methods and conduct initial empirical studies.

The *research clarification*, described in chapter 2, is based on a literature review focused mainly on the topics of user experience and scenario-based methods. The aim was to create an understanding of the main themes of the thesis and identify research potentials. Results of this stage, which accompanied the complete research, is an understanding of the state-of-the-art and identified gaps that this thesis addresses. This refers mainly to the need for a practical guide for designing positive user experiences systematically and for applying scenario-based methods, in specific. This stage of research made clear that the intersection of those two topics could be the fundament of a promising approach. Furthermore, it built the fundament for the development of the methodology.

Case studies were implemented during the stages of prescriptive and descriptive studies. Developing the support was an iterative process, which took place hand-in-hand with practitioners. This approach underlines the relevance and applicability of the methods (practical value), which were conceptualized according to literature findings (theoretical/expected value), for target users of the support. The research context, in which the contents of this thesis emerged were two research projects in collaboration with industry (“CAR@TUM user experience” and “Innovative dish care solutions”), as well as student projects at the Institute of Product Development in the period 2011-2016 (Appendix A1).

The aim of *descriptive study I* was to capture current practices and requirements for future practices. This research stage was implemented within the “CAR@TUM user experience” project and within a small-scale survey. “CAR@TUM user experience” was a three-year research project (2011-2014), in which user experiences for future vehicles were analysed, implemented and evaluated comprehensively and multidisciplinary in a cooperation among the Technical University of Munich, the Ludwig-Maximilian-University and the BMW Group Research and Technology. The objective of the project was to develop a generic procedure to design and evaluate user experiences. The work within the multi-disciplinary team, as well as within meetings with the industry partner and scientific advisors offered a suitable setting for addressing the aims of the *descriptive study I* in a specific industry. Observations and results from document analysis from frequent meetings and workshops led to insights about current practices and needs (3.1). To confirm the insights gained in “CAR@TUM user experience”, the *descriptive study I* was complemented through a small-scale survey with 22 practitioners of experience design. Aim of the survey was to capture current practices and requirements of practitioners from a broad spectrum of companies and backgrounds. Through an online questionnaire, it was possible to capture practitioners’ views on user experience design and scenario-based methods, which confirmed the motivation of this work and led to the identification of requirements for future practices (3.4).

The aim of the *prescriptive study* was developing a support for user experience design. The development of the support was an iterative process of conceptualizing methods, applying them in case studies and refining them according to applicants’ feedback. Findings of the research clarification led to the conceptualization of methods, which incorporate characteristics with expected value. The rough, conceptualized methods were applied in various case studies and were further developed according to the lessons learned. The application of the support took place within the “CAR@TUM user experience” project and student projects. The “CAR@TUM user experience” project allowed observing the application of the new support while iteratively

developing it, according to the feedback of the project participants. Another part of the *prescriptive study* was conducted within student theses. In the period January 2012–April 2016, 21 student theses, which contributed to the iterative development and initial assessment of the support, took place. Appendix 1 summarizes the topics and significant conclusions of those theses, while section 5.3 presents the results of three student theses, which dealt with the application of the support for the design of experiences with automated coffee machines. Lessons learned from all applications contributed to the (final) support presented in chapter 4.

Aim of the *descriptive study II* was to evaluate the developed support in an industrial case. Criteria for the evaluation were the requirements collected in the first descriptive study. The evaluation took place within the “Innovative dish care solutions” project (2015–2016). In a cooperation of the Institute of product development and B/S/H/ Household Appliances, a team of students, scientific assistants and B/S/H/ employees developed concepts for future dish care. A major interest of B/S/H/ was improving user experience, so besides the developed concepts, methods for reproducing this effect were inquired. Within this frame, the developed support was evaluated in a real-life setting (real data, products and practitioners) and overall conclusions and recommendations were drawn.

The whole thesis includes reflections and results presented from a researcher’s perspective and based on individual decisions of the author. Therefore, the formulations have in some cases the form of personal statements.

1.3 Focus of the thesis

User experience is a matter of interest for many domains and can be studied from different perspectives. Therefore, this section describes the focus of this thesis as defined by existing research, the author’s background and the overall goal of the thesis. In short, the thesis has the perspective of product development and focuses on supporting practitioners without expertise in user experience in the practice of envisioning and representing experiences mediated by tangible products of high complexity.

User experience can be studied from three perspectives: user experience as phenomenon, as practice and as field of study (Roto, 2011). The practical perspective deals with the tasks of envisioning, representing and evaluating user experience, as well as delivering designs that enable certain user experiences. The focus of this thesis lies on *the practice of envisioning and representing user experience* and *investigating and developing user experience design methods*. The other aspects of user experience are reviewed in chapter 2, because an understanding of the phenomenon is essential for improving practice.

The tasks of envisioning and representing user experience concern primarily *early design phases*. The research clarification and descriptive study showed that those phases encompass most opportunities and challenges. In general, early phases of product development focus on creating a situational understanding of the market and its opportunities and defining the problem to be solved through the new design (Gausemeier, 2006; Hales & Gooch, 2011; Lindemann, 2009; Pahl et al., 2007). The thesis refers to the definition of Pahl et al. (2007), according to which, a product development process consists of the phases of task clarification, conceptual

design, embodiment design and detail design. This research focuses on the task clarification and conceptual design phases.

The studies of user experience in this thesis have the *perspective of product development*. On the one hand, this represents the author's background; on the other hand, the research clarification showed that much less work has adopted such a perspective compared to an interaction design or software design perspective. The developed support is inspired from and aims at product developers *without prior knowledge in user experience*. That is important because user experience is a relatively new focus in the traditional design practice. The thesis focuses on studying and supporting non-experts' practice; thus the overall approach can be characterized as *practitioner-centred*. The developed methodology proposes ways to collaborate with experts from various other disciplines, but does not primarily address them. Finally, this thesis provides guidance for practitioners. However, there are some precognitions for applying the methodology, like making available necessary resources or meeting required strategic decisions. The thesis sensitizes readers about some of those aspects, but does not primarily address them.

Finally, the thesis focuses on user experiences mediated through *tangible consumer products of high complexity*. The emphasis on tangible products differentiates this research from existing works on user experience enabled by software products, websites and services. Tangible products bring along limitations, like material, dimensioning, interfaces, which convey constraints for user experience design. As to the term complexity, it may refer to product, process, market or organisational complexity. Number, art and variability of elements and relations, as well as dynamics (i.e. art and number of possible states) determine the level of complexity. Products with high level of complexity, which are the focus of this thesis, are products with a large amount of different elements, interrelations and different states. For example, the automated coffee machines, which are the object of the second case study (5.3), consist of about 800 modules of different arts (mechanical, electronic) that are geometrically and functionally linked, while the existence of a user interface enabling various settings/manipulations results to a high number of possible states. The consideration of complexity requires a *system view*, which differentiates this thesis from existing approaches and applications of user experience design. The case studies of the thesis concerned consumer products of the domains of automobile and household appliances. Findings could be applicable to other product domains, but future studies should explore under which circumstances.

1.4 Structure of the thesis

The thesis consists of a glossary, a main part with six chapters (Figure 1-5) and appendices. In the beginning of the thesis, the glossary gives an overview of key terms of the thesis and corresponding definitions in its specific context. The current first chapter introduces readers to the objectives, research methods, thematic focus and structure of the thesis. Chapter 2 defines the research context of the thesis, before summarizing relevant existing works on experience design (2.2.1) and scenario-based design (2.2.2). After exploring the intersection of those two main fields (2.3), research gaps and research questions arising therefrom are formulated (2.4). In chapter 3, current practices of user experience and scenario-based methods are explored in two studies. Their analysis results to goals and requirements for ideal future practices (3.4).

Chapter 4 describes how such future practices could look like. After describing objectives, roles and phases of a prototypical process for user experience design (4.1), section 4.2 introduces the “scenario-based methodology for user experience design”. The chapter closes with a discussion of the new methodology and particularly about the need for managing the required changes for its implementation (4.3). Chapter 5 describes the application of the scenario-based methodology for user experience design in three different cases: application by a multi-disciplinary team and for developing new user experiences in automobile (5.2), application by individual developers for improving user experiences with automated coffee machines (5.3) and finally, application by a team of developers for improving user experiences with dishwashers (5.4). The application in three corner cases provided useful insights for further applications (5.5). The final chapter of the thesis includes a discussion of findings (6.1) and resulting general conclusions (6.2), emphasizes on research contributions (6.3) and proposes ways to conduct future research building on that (6.4).

The thesis is addressed to researchers and practitioners of user experience design. Detailed information, which is not included in the main body of the thesis, but might interest one of those groups, can be found in the appendices. Particularly addressed to interested practitioners is Appendix A8, which includes detailed method descriptions for applying the new methods. Even practitioners without prior related knowledge will be introduced to the theoretical background of methods (4.2) and insights from their application in various settings (5.2, 5.3, 5.4), as well as be guided through planning and executing their detailed steps (Appendix A8).

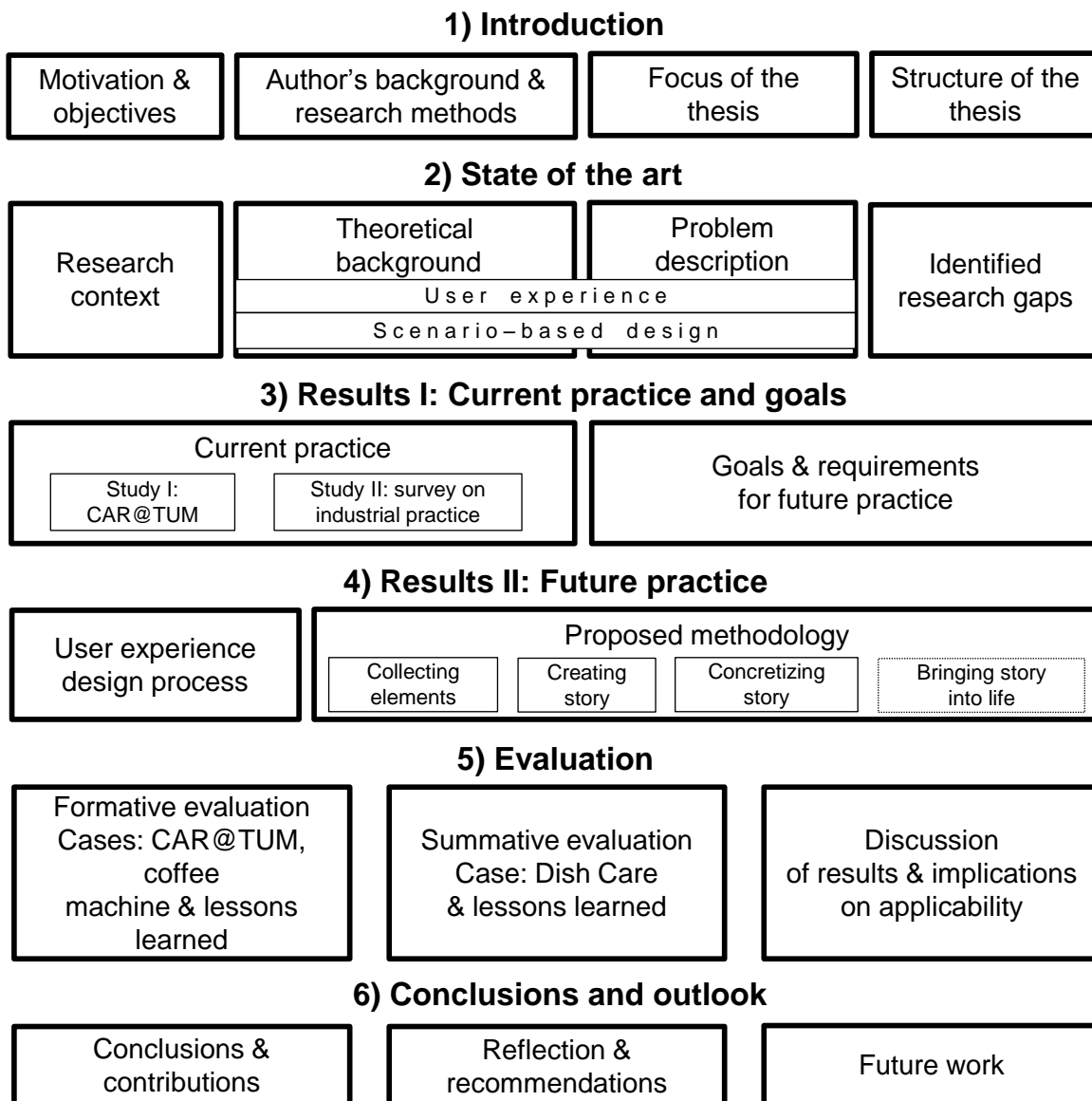


Figure 1-5: Structure of the thesis

2. State of the art

Chapter 2 first defines the research context in which this thesis emerged and which shaped its perspective (2.1). To provide the reader with the essential theoretical background, two major research areas are reviewed more extensively in section 2.2: research on user experience and research on scenario-based design. Bringing those two fields into relation seems promising, because the practice of user experience still lacks methodologies with similar characteristics as the methods used in scenario-based design (2.3). After exploring the intersection of the two fields, research gaps and research questions arising therefrom are formulated (2.4).

2.1 Relevant research fields

This thesis addresses the topic of methodological support in product development –specifically, when the focus of development lies in envisioning and representing user experiences. The objectives that this thesis addresses lie in the intersection of three broader fields: *product development*, *user experience* and *scenario-based design* (Figure 2-1). These fields build the research context, in which this research possibly contributes with original results.

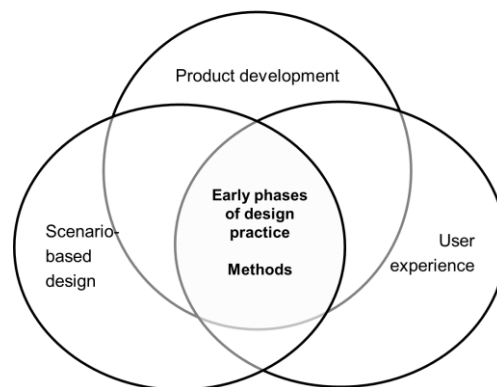


Figure 2-1: Research context of the thesis

Concerning the field of product development, the focus of the thesis lies in the *early phases* of design. Moreover, its major concern refers to the human component of product development, i.e. supporting individual developers to reach their goals with methods. Knowledge related to processes, existing methods and tools, and actors of product development is necessary to develop a feasible support. However, the focus on user experience implies that the broader context of the thesis also encompasses research conducted in disciplines other than product development (like interaction design and psychology). Secondly, it implies that product development processes are viewed in this thesis from a *user-centred design* perspective. Such approaches aim at putting prospective users into the centre of product development activities by analysing, understanding and even actively engaging them. The support developed in the thesis contains mainly scenario-based methods. Research on scenario-based design and individual methods is highly relevant, while the thesis adopts the view of *design as storytelling*.

2.2 Theoretical background

Having clarified the broader research context (2.1) and the focus of the thesis (1.3), this section gives a theoretical background on user experience and scenario-based design. User experience can be viewed as phenomenon and practice: both perspectives are examined in the next section. The focus of this thesis lies in the practice of user experience, which can only be understood if the special characteristics of user experience as phenomenon are clear. Scenario-based design is a promising approach to tackle challenges of user experience design. Single methods and their benefits are described at the end of the section.

2.2.1 User experience

This section provides a review of scientific work in the field of user experience. First, it describes the field of study of user experience; then, clarifies related terminology and defines “user experience” for the context this thesis; next, it describes the phenomenon of user experience and finally studies of its practice.

Roto et al. (2011) describe three perspectives on user experience: user experience as phenomenon, user experience as practice and user experience as field of study. The phenomenological perspective copes with defining user experience, its different types, circumstances and consequences. The practical perspective deals with the tasks of envisioning, representing and evaluating user experience, as well as delivering designs that enable certain user experiences. The field of study of user experience may concern studying the phenomenon or practice. Furthermore, it deals with finding means to mediate user experiences and, finally, with investigating and developing methods to design and assess user experience. The focus of this thesis lies on *the practice of envisioning and representing user experience* and *investigating and developing user experience design methods*. However, understanding the phenomenon is essential for improving practice.

2.2.1.1 User experience as field of study

In the mid-nineties, there was a shift in *psychology* research towards studying positive emotions. M. Seligman, at that time president of the American Psychological Association, invited his colleagues to focus on positive emotions and so opened the era of “positive psychology”. An indicator for the growing interest on this positive perspective is the number of publications on “happiness”, which grew from 50 to 4000 American books published in 2000 and 2008 respectively. B. Fredrickson is one of the scientists that proved empirically that positive emotions increase the problem-solving abilities (Fredrickson, 2001). Similar studies have been conducted by Alice Isen [cited in (Norman, 2005)]. Studies from cognitive psychology and studies on positive emotions have been adopted in many contemporary frameworks of user experience and have been applied for evaluating user experience.

The origins of user experience in design-related disciplines lie in the discipline of *Human-Computer Interaction*. In the mid-nineties, the interest on usability of interactive systems was broaden to a more holistic view, which included, next to functionality, the overall emotional response of users. In 1994, Logan discussed usability practices at Thomson Consumer

Electronics and concluded that “emotional usability” is not only relevant for entertainment products, but also for any other kind of tools. Moreover, he stated that companies making products that are enjoyable to use and “address the emotional elements of product use will differentiate themselves from the competition in the 1990s and beyond” (Logan, 1994). In 1995, Norman and his colleagues at Apple wrote about dealing with “user experience” in a holistic way, as it involves “all critical aspects of human interface research and application”. In 1996, Alben introduced the “aesthetic experience” as criterion for effective interaction design and opened up the view of usability towards holistic user experience. More specific definitions and frameworks of user experience were delivered in the early 2000s. Forlizzi and Ford (2000) introduced an early framework tailored for interaction designers. In the next years, the interest on user experience has grown rapidly. *Software and website design* quickly adopted a similar perspective establishing “joy of use” as major concern of software utilization (Hatscher, 2001).

From a *marketing and business* perspective, the implications of user experience for purchasing decisions seemed equally interesting. Oliver (1993) discussed the relationship between affect and post-purchase product evaluation and Creusen (1998) showed that affective responses to product appearance influence purchasing decisions [cited by (Desmet & Hekkert, 2007)]. In 1998, the Harvard *business review* “welcomes to the experience economy” (Pine & Gilmore, 2011), an economy building on the value of experiences instead of solely economic value of commodities, goods and services. Elaborating on that, Schmitt introduced “experiential *marketing*”, which (unlike the “traditional marketing”) views customer as “rational and emotional animal” and consumption as a holistic experience (Schmitt, 1999). Moreover, Cain stressed out that experiences are results of a process targeted to delivering experiences and introduced a framework for experience-based design (Cain, 1998). This framework emphasizes on problem framing and identification of opportunities before inventing solutions and their embodiment. Cagan and Vogel (2002) claimed that creating “breakthrough products” is not only a matter of functionality but also of emotions, impressions, hedonism and individuality.

The first extended work on user experience and emotions related to product use from the perspective of *Human factors* emerged in 1996-1997, when Jordan explored the meaning of pleasure and displeasure in product use (Jordan, 1998, 2002). His studies included not just software, like most related studies up to that point, but also tangible products. One of his main findings was that, although considered as major factor, usability does not guarantee pleasure in product use. Already in 1995, Kuroso and Kashimura had first findings supporting that “attractive things work better” [cited in (Norman, 2005)]. In the field of *product design*, some integrated approaches emerged in the mid 2000’s. The approaches vary in focus from approaches focusing on the user (like the work of Sanders) or the product (like the work of Desmet) to approaches focusing on the interaction (Forlizzi & Battarbee, 2004). From an *engineering* perspective, there have been attempts to link emotions to product attributes, with Kansei engineering (Nagamachi, 1997) being the best-known approach. Although there are debates on whether experience can be “engineered” (Sengers, 2003), its importance is meanwhile indisputable. In 2009, in a special issue of the Journal of Engineering Design on “Design and Emotion”, the engineering community acknowledged the “increasing awareness and value of emotions within the designing process for both the product developer and the consumer” and that “excellence in design [...] is about creating positive, rich and meaningful user experiences” (McDonagh et al., 2009).

Summing-up, the interest on user experience emerged in the late nineties from various disciplines and has been growing ever since. From 2010 and on we can observe attempts to formalize the concept (ISO, 2009) and bring clarity across-disciplines. The following sections summarize the two concerns of user experience as field of study: the phenomenon itself and the practice of user experience.

2.2.1.2 User experience as phenomenon

In this thesis, *user experience* is described as *a worthwhile episode related to an interaction between a user and a product, situated in context, and involves all subjective aspects the user thought, felt, did while expecting, experiencing and/or remembering the interaction.*

This definition combines aspects of literature-based aspects of user experience, as captured in definitions and frameworks. For understanding user experience, it is necessary to understand the nature of interactions and experiences. Therefore, the following sections summarize the theoretical background on user-product interaction, experience and user experience and conclude with the core characteristics of user experience that differentiates it from the related (but distinguished) concepts of usability and customer experience.

User-product interaction

In order to provide the reader with the essential background knowledge and terminology essential for the understanding of the next chapters, the section begins with an excursus on user-product interaction. The elements analysed in this section were identified as the main themes appearing in literature on user experience (Ariza & Maya, 2014). Their findings are adjusted and supplemented for the context of this thesis and will not be cited explicitly in the following paragraphs.

User and the process of understanding and giving meaning: The term “user” is selected as the most consistent in the literature on user experience to describe the human interacting with a product and actively contributes in creating value. Humans are biologically equipped with systems and skills that allow them to understand and interact with their environment and above that to give meaning. The sensory system enables them to perceive stimuli, the motor system enables them to act, while the cognitive system to make sense. The processing of the perceived information is a process of assessing how information relates to oneself and the own points of reference. The evaluation process of whether the perceived information matches or not is described as “appraisal”. The points of reference are described in the appraisal theory (Scherer, 1999) as “concerns” and include (among others) motivations, values, attitudes and individual experiences. The specific characteristics of a user influence the whole process. Besides the motor and cognitive abilities and previous knowledge, mood and motivation are decisive. Moods describe a valenced (i.e. subjectively perceived as pleasant or unpleasant) affective state and are typically elicited by no direct stimuli, but combinations of internal and external causes. Motivation involves needs, motives and goals that lead to certain activities, actions and operations (see: purpose of interaction). Designers of user experience should be aware of the capabilities and limitations of the human processing.

Product: A product is the object with which the user comes into contact through the interaction. Products serve utilitarian and non-utilitarian (e.g. aesthetic or social) functions. Products may

be tangible (“tools” or “toys”) or intangible (software or service) and have instrumental and non-instrumental aspects (Hassenzahl, 2003). This thesis focuses on tangible products.

Interaction: The term interaction describes the way people use, understand and experience the product. When experiencing the product, a user may have an active role (physical action) or a passive role (intangible interaction). Interactions can be classified in instrumental (using, operating, managing products) or non-instrumental (not directly serving a function) and intangible interactions (Desmet & Hekkert, 2007). Examples for intangible interactions are imaginary, anticipated or remembered interactions. Considering all types of interaction is important when designing user experiences.

Purpose of interaction: The purpose of interaction outlines the criteria against which the user evaluates the significance of stimuli for his/her well-being or a particular interest. Hassenzahl (2013) describes two types of purposes: purpose of action and purpose of being. The *purpose of action* depends on a current status and can vary easily. In this case, the product is only a means to an end and the purpose is linked to performance targets that are desirable and in line with expectations. The *purpose of being* is oriented to one self and linked to personal identity and values; is therefore more stable. The support proposed in this thesis focuses on the purpose of being and be-goals of interactions. The purpose of interaction is influenced by the individual *motivation*. Motivation describes all cognitive and emotional processes that lead to decisions and actions and can be intrinsic or extrinsic. The motivation is linked to needs, motives and goals. Hassenzahl et al. (2010) describe the hierarchical relations among them. Needs are the fundament of motivation; they describe the why behind an action. Needs are expressed in motives. The latter describe what a person wants to achieve through an action. Finally, motives result into goals through cognitive planning. Goals prescribe how to perform an action, which operations are needed. While needs are universal (Maslow et al., 1970; Sheldon et al., 2001), motives are expressed in specific situations and goals inspired by objects. Motives are expressions of needs in specific situations or contexts and are the reasons leading to an action. When an object is given, which can contribute in fulfilling the motive, the motive is concretized in goals. Goals can be divided into sub-goals, which lead to individual operations. The support developed in this thesis builds on the understanding of and aims at the satisfaction of users’ motives and needs.

Consequences of interaction: The term consequence refers here to the user’s response that is directly linked to the interaction. According to the appraisal theory, the consequences of interaction are results of cognitive assessment (appraisal) of stimuli against own concerns. When interactions are appraised as having beneficial or harmful consequences for individual concerns, emotions arise. Consequences of interaction affect most body subsystems and may trigger consciously or unconsciously, simultaneously or not, a variety of reactions (behavioural, multisensory, cognitive, and affective) and finally an evaluation of the interaction. This thesis refers primarily to the affective consequences of interaction. Those are instances of subjective (positive or negative) feelings, such as emotions and moods, accompanied by activation of a specific physiological response and expressive behaviour.

Finally, the aspects of user experience “*context*”, “*dynamics*” and “*total user experience*” are discussed in subsequent sections, because they constitute major differentiating characteristics of user experience opposed to other approaches.

Experience

One approach to study experience is to proceed in a *holistic* way. This holistic and constructive view links experience to storytelling and narrative structures, which are the fundamentals of the methodology proposed in this thesis.

Wright et al. (2003) adopt the point of view of the philosopher J. Dewey to conceptualize experience holistically: “Experience is the irreducible totality of people acting, sensing, thinking, feeling, and meaning-making in a setting, including their perception and sensation of their own actions”. McCarthy and Wright (2004) define the four inter-twined threads of experience, which would help analysing experiences. The *compositional thread* refers to the structure of an experience. Since interactions involve “self” and “other” in an unfolding of action possibilities (“*What will happen next? What if..?*”), actions, consequences and explanation of actions (“*What happened? Does it make sense?*”), it has an underlying narrative structure. The *sensual thread* involves the sense, feel and sensation involved in an experience. The *emotional thread* refers to the responses to a situation that lead to actions. Finally, the *spatio-temporal thread* refers to the time and place, in which the events unfold and the individual perception of them.

Another holistic definition of experience is composed by Hassenzahl (2013): “[experience is] an episode, a chunk of time that one went through [...] sights and sounds, feelings and thoughts, motives and actions [...] closely knitted together, stored in memory, labelled, relived and communicated to others [...] a story, emerging from the dialogue of a person with her or his world through action”.

Forlizzi and Ford (2000) present in their early framework (Figure 2-2) three perspectives for talking about experiences. *Experience* is the constant stream that happens during moments of consciousness; *An experience* has a beginning and an end and changes the user, and sometimes the context of experience, as result; *Experience as story* is a vehicle to condense, remember and communicate experiences in a variety of situations and audiences. The approach to study experience and user experience in this thesis is a holistic approach. Forlizzi and Battarbee (2004) refer additionally to “co-experience”, which adds the dimension of social context.

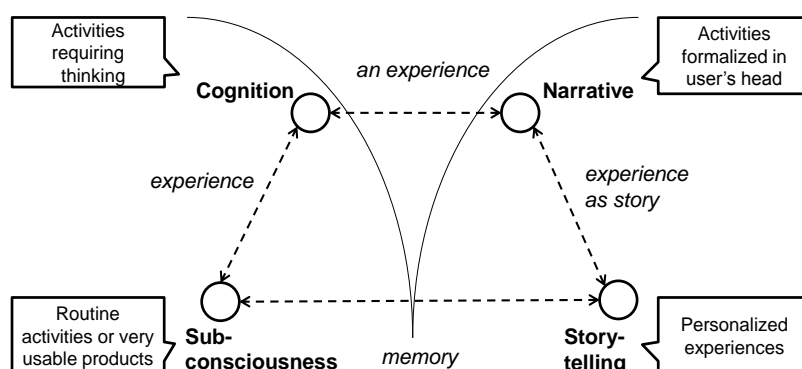


Figure 2-2 : Framework of experience (based on Forlizzi & Ford 2000)

Another perspective to look at experience is through cognitive approaches. Such approaches aim at identifying the individual components of experience and studying corresponding cognitive processes. Here, emotion and affect are central components of experience.

Norman (2005) suggests that experiencing is the result of affective processing. Human consciousness and the ability to reflect upon experiences are facilitated in three levels of processing: visceral, behavioural and reflective (Figure 2-3). The visceral level is the level in which the brain analyses the world and responds; the behavioural level is sub-conscious; the reflective level is responsible for conscious decisions and supports the learning. According to those three levels, Norman introduces ways to design and influence resulting reactions.

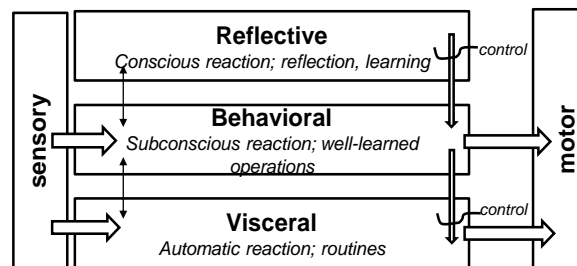


Figure 2-3: The levels of processing (based on Norman 2005)

Desmet and Hekkert (2007) adopt the perspective of the appraisal theory and study changes in core affect. They refer to experiences that are affective, which includes all types of subjective experiences that involve a certain level of perceived pleasantness or unpleasantness (valenced) and arousal. They build upon the core affect model (Russell, 2003), which combines the affect dimension with the dimension of physiological arousal (Figure 2-4). The distance from centre shows the level of core affect (neutral, moderate or extreme). Core affect can be experienced because of a stimulus or without relating to a particular stimulus. For affective responses relating to products, they have developed the framework of product experience, which is described in the next section.

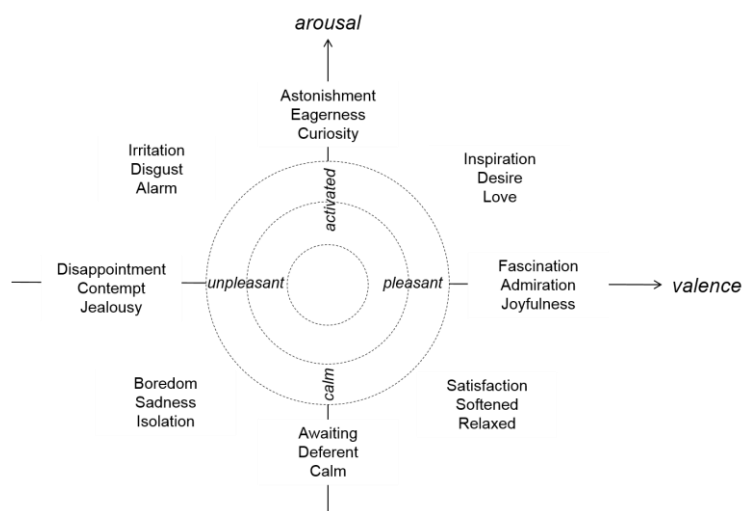


Figure 2-4 : Core affect model (based on Russell, 2003)

User experience – definitions, frameworks, characteristics

Unlike the generalized term “experience”, the term “user experience” refers explicitly to experiences that are related to the interaction of a user with a product. D. Norman coined the first use of the term user experience, when he tweeted²: “In 1993 apple’s UE team = Tom Erickson, Harry Sadler -1st use of ‘User experience’ (I think). We said UE. I don’t know who made it UX.”. Since 1993, many definitions have emerged from various disciplines and for various scopes. Appendix A2 gives an overview of important (frequently cited) definitions.

It is noticeable that most authors refer to certain *types* of user experience. For example, Desmet and Hekkert (2007) refer to “product experience” and its components, Forlizzi and Battarbee (2004) emphasize on the social dimension of experiences referring to “co-experience”, while Jordan (2002) distinguishes positive and negative user experience by writing about “pleasure and displeasure of product use”. Despite their different foci and terminologies, all those definitions present a similar concept, which evolved over the years and the perspective of each discipline. Therefore, it makes sense to summarize those common characteristics rather than list the definitions. To do so, the next paragraphs describe five *frameworks* that facilitate the identification of *characteristics* of user experience.

The understanding of user experience has been captured in: frameworks that describe its holistic nature around interaction [like (Forlizzi & Battarbee, 2004; McCarthy & Wright, 2004)]; frameworks that identify components of user experience [like (Hassenzahl, 2003; Mahlke, 2007; Saucken et al., 2012)]; and frameworks that focus on the desired positive result of interaction [like (Desmet & Hekkert, 2007; Fokkinga & Desmet, 2013; Jordan, 2002)]. The first category (described in the previous section) is most relevant for the thesis, which takes a holistic perspective. The latter categories (described in the following paragraphs) contribute to a better understanding of user experience.

Model of user experience (Hassenzahl, 2003): This model presents the core elements of user experience and their functional relations, differentiating between a designer’s and a user’s perspective (Figure 2-5). Designers “fabricate” an *intended product character* by manipulating *product features* in a way that, in their opinion, would evoke positive *consequences*. Users construct an *apparent product character* while interacting with the attributes of the product in a specific *situation* and experience the *consequences*. Product features are a designer’s medium to shape an intended product and include content, presentation, functionality and interaction. Users construct according to those features an apparent product character. This process of construction is subjective and may even vary for the same person over time or according to the environment. In any case, the product character represents pragmatic and hedonic product attributes. *Pragmatic attributes* are related to manipulation (utility and usability). Products with strong pragmatic attributes are so-called ACT-products. *Hedonic attributes* of products provide stimulation (i.e. product providing new impressions, opportunities and insights), identification (i.e. product communicating identity) and evocation (i.e. product provoking memories). Products with strong hedonic attributes are so-called SELF-products. The combination of

² Retrieved on 16 June 2016, from <https://twitter.com/jnd1er/status/360031085935075328>

pragmatic and hedonic attributes results to a desired (strong pragmatic and hedonic attributes) or unwanted (weak pragmatic and hedonic attributes) product character. Whether a user seeks rather for pragmatic or hedonic attributes is dependent on the situation and the momentary usage mode (goal mode or action mode). The interaction of a particular user with a particular product character in a situation always has emotional and behavioural consequences. If a product triggers positive emotional reactions, it is appealing. ACT-products address primarily the fulfilment of behavioural goals and *satisfaction* is experienced by an excellent goal achievement. SELF-products address primarily the fulfilment of psychological needs, so *pleasure* is experienced if an interaction leads to fulfilment of needs. The methodology developed in this thesis builds upon this claim and the overall understanding of this model.

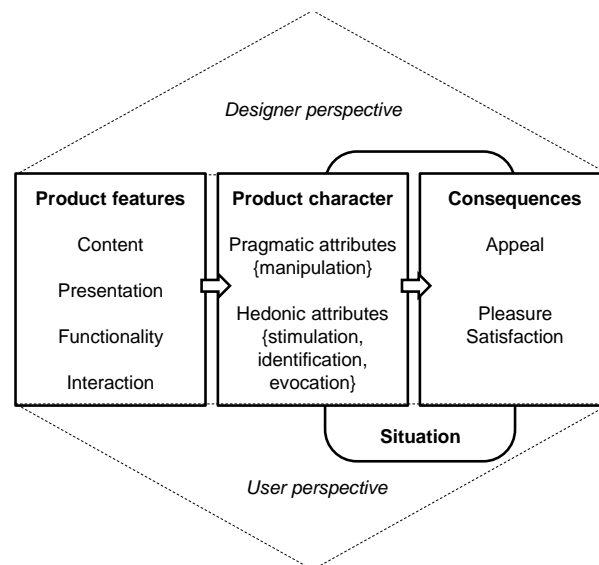


Figure 2-5: Model of user experience (based on Hassenzahl 2003)

Framework of product experience (Desmet & Hekkert, 2007): For affective responses relating to products, Desmet & Hekkert (2007) have developed the framework of product experience. A product experience is “the entire set of affects that is elicited by the interaction between a user and a product, including the degree to which all our senses are gratified (aesthetic experience), the meanings we attach to the product (experience of meaning) and the feelings and emotions that are elicited (emotional experience)”. Those three levels of experience, which are related to each other, build the framework of product experience (Figure 2-6). The level of aesthetic experience refers to the sensory modalities (compare to the visceral level in Norman 2004). The level of meaning refers to the assessment of personal or symbolic significance to products, as result of cognitive processes, like interpretation and memory retrieval (compare to the reflective level in Norman 2004). Finally, the emotional experience refers to the affective phenomena resulting from the interaction. The methodology developed in this thesis deals intensively with the elements of “concern” (how to elicit and capture users’ concerns) and the “experience of meaning” (how can a designer influence it, so that the interaction results into a positive experience). The aesthetic experience is not considered in this thesis.

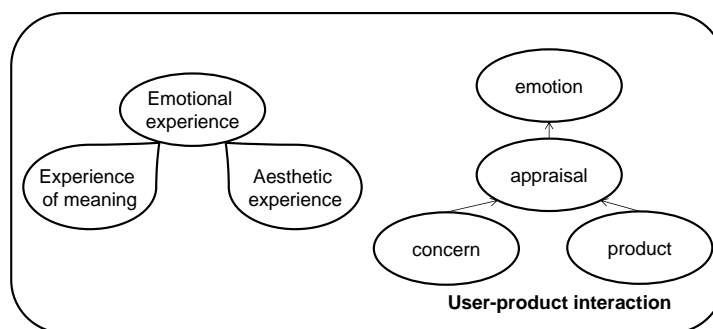


Figure 2-6: Framework of product experience (based on Desmet & Hekkert 2007)

Customer experience interaction model (Saucke, 2015, p. 47): This framework emphasizes on the relations among elements of user experience (user, usage, product, effect and context) and the importance of context. A *user* manipulates a *product* through active or passive *usage* (activity, possession, ability and habituation). The usage results into an *effect*, permitted by the *product* with its practical, aesthetic, symbolic and indication functions. The effect initiates the user's perception, with resulting cognitive and emotional responses leading to motivation for actions. The element of effect refers to the underlying process, its result, as well as a temporal situation. Finally, the *context* surrounds all the elements and influences them. The author distinguishes between the macro context, which involves social and cultural aspects, and the micro context, which refers to the physical environment. The importance of context is underlined through the methodology developed in this thesis.

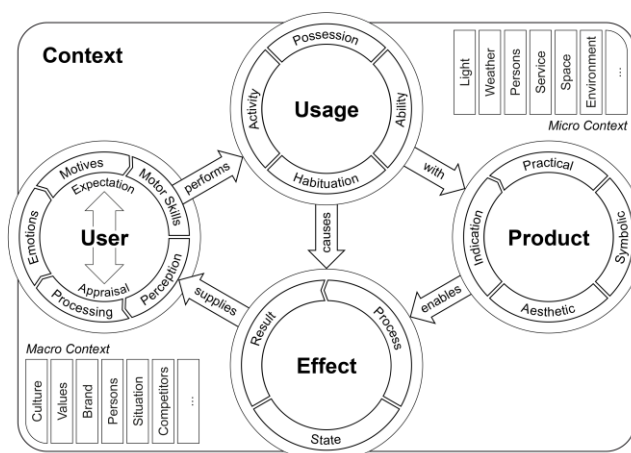


Figure 2-7: The customer experience interaction model (based on Saucke 2015)

The four pleasures (Jordan, 2000): In his early studies (1996-1998), Jordan distinguished the positive feelings related to product use in feelings of satisfaction and pleasure. Satisfaction is the result of interacting with a usable product. However, further pleasurable feelings (namely security, confidence, pride) result from product aesthetics, quality and features. He defined pleasure of product use as the emotional, hedonic and pragmatic benefits associated with products [compare to pragmatic and hedonic attributes in (Hassenzahl, 2003)]. *Emotional*

benefits pertain to how a product affects a person's mood. *Hedonic benefits* pertain to the sensory and aesthetic pleasure. *Practical benefits* occur from outcomes of tasks for which the product is used. The framework for considering pleasure with products describes four pleasures and helps analysts categorise the source of pleasure: *physio-pleasure*, *socio-pleasure*, *psycho-pleasure* and *ideo-pleasure*. However, pleasure should be seen holistically and not in separate categories. The methodology in this thesis emphasizes on emotional benefits of experience.

Types of life experiences (Fokkinga & Desmet, 2013): This framework describes various types of experiences involving not only positive but also negative emotions, which enrich a product experience. The authors distinguish between momentary experience and experience as whole [compare to experience vs. an experience in (Forlizzi & Battarbee, 2004)]. Emotional responses refer to the momentary experience. *Rich experiences* may include positive and negative momentary emotions (Figure 2-8). Rich experiences are atypical, *notable* and memorable and involve high levels of emotions –unlike *ordinary* experiences, which involve only mild, positive or negative emotions. Notable experiences can be distinguished in *unpleasant/unrewarding* experiences, which involve highly negative emotions, and *pleasant/beneficial* experiences. The latter may be related to only highly positive emotions (*favourable* experiences) or to both positive and negative emotions (*rich* experiences). According to the authors, this last type is promising for designing product experiences. The proposed methodology provides opportunities to explore and influence critical momentary experiences, especially through the method of creating a user experience story.

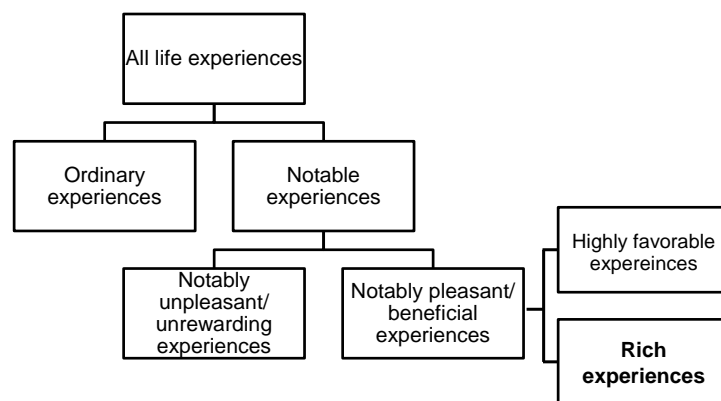


Figure 2-8: Types of experience (based on Fokkinga & Desmet, 2013)

The review of definitions and frameworks of user experience concludes to the six main *characteristics* of user experience.

(1) *Association of experience to products*: User experience refers to a user-product interaction. Various authors emphasize on this special focus:

- “focused on the interactions between people and products and the experience that results” (Forlizzi & Battarbee, 2004)
- “experience attributed to human-product interaction” (Desmet & Hekkert, 2007)
- “experience mediated by interactive products” (Roto, 2011).

(2) *Dependency of experience on user's perception (subjective)*: User experience is subjective, because it depends on the individual user. Most definitions and frameworks explicitly refer to the user, its characteristics, and active role in the sense-making process. This perspective is different than the consideration of human as actor in the approach of usability. In the foreword of the book "Funology", Jordan names as one of the differences of the user experience approach that they view the user in a more holistic way (values, tastes, image) (Blythe et al., 2004). It also differentiates the concept of user experience from the marketing-originated concept of customer experience (Meyer & Schwager, 2007). The latter refers not only to users, but also to all potential customers.

(3) *Context-dependant*: User experience considers not only the physical environment of interaction, but also further external factors as influential. Forlizzi and Battarbee (2004) refer explicitly to the social context, Chakrabarti and Gupta (2007) to the socio-cultural background and individual preferences, while Saucken (2015) defines extendedly factors of the "macro-context": culture, values, brand, milieu, other persons, other products. Furthermore, Johnson et al. [2002, cited in (Ariza & Maya, 2014)] names technological, cultural and economic factors as external influences on user experience. This is another distinguishing characteristic of user experience opposed to usability.

(4) *Holistic*: Experience is "the irreducible totality of people acting, sensing, thinking, feeling, and meaning-making in a setting, including their perception and sensation of their own actions" (McCarthy & Wright, 2004). Even frameworks, which decompose user experience in elements state that the decomposition aims only at better understanding and that a user experience exists in the relations of elements.

(5) *Dynamic*: User experience is dynamic as the person experiencing the system with its motivation, mood, its current mental and physical resources and expectations, is dynamic (compare to Hassenzahl 2003). The time span of actual interaction does not cover all relevant concerns, since indirect experiences can appear before or extend after usage. Jordan states that, unlike studies of usability, studying experience and emotions related to pleasure/displeasure should concern not only the period during, but also before and after use of products (Jordan, 1998). Roto et al. (2011) introduce four types of user experience according to the different time spans. Anticipated user experience emerges before the actual usage, when imagining the interaction. Momentary user experience emerges during usage. Episodic user experience refers to reflexions on a past usage. Finally, cumulative user experience refers to a recollection of multiple past usages [compare to change of experience over time (Karapanos et al., 2010)]. Moreover, user experience may change when the context changes, even if the system itself does not change; relevant can be social, physical, task, technical and information context.

(6) *Worthwhile*: User experience has an effect on the emotional/affective state of the user (as described in all presented frameworks) and/or the context (Forlizzi & Battarbee, 2004). Although most authors refer to *positive* effects, holistic views on experience incorporate all kinds of responses, positive and negative, which make the experience worthwhile and memorable. Goffman refers to *meaningful* experiences [cited in (Reed, 2003)]. The recent work of Fokkinga and Desmet (2013) emphasizes on *rich* experiences, which may include positive and negative emotions.

Summing-up, user experiences are *associated to products, subjective, context-dependant, holistic, dynamic and worthwhile*. Because of those distinguishing characteristics, user experience is a differentiated approach opposed other concepts, like usability. The support developed in this thesis embraces those special characteristics.

2.2.1.3 User experience as practice

This section gives an overview of the practice of user experience design. First, it clarifies the objectives of designing for user experience; then identifies relevant actors, who strive for user experience-related goals; finally, it summarizes existing methods and tools used for this scope.

Objectives of user experience design

In this thesis, the term “user experience design” (used synonymously to “design for user experience”) describes *the activities towards creating products whose use shapes and leads to worthwhile, positive user experiences*. Roto et al. (2011) summarize relevant activities in the practice of user experience: Envisioning user experience, representing user experience, evaluating user experience and delivering designs to enable a certain user experience.

Designing the user experience is hardly possible, because of the subjectivity and dynamics of user experience as phenomenon. However, it is possible “to design for an experience; and in order to do this, it is necessary to have an understanding of that experience” (Blythe & Hassenzahl, 2003). Engineering approaches, which aim at solving well-defined tasks, do not consider the cultural and social meaning that the system may take on and the ways in which users may choose to interact with it (Sengers, 2003). Shifting the focus of product development to user experience-related aspects results in a shift in its objectives.

From the frameworks describing user experience, it is possible to derive design objectives of each approach. Forlizzi and Ford (2000), for example, define a good product as “one that *offers a good or memorable narrative* that the user will engage with and pass on to others, either by sharing the artefact or by talking about it”. Hassenzahl (2003) describes the *fulfilment of psychological needs* through product interaction as a way to experience pleasure. Nielsen & Norman write that high-quality user experience means *meeting the exact needs of users, without fuss or bother, but with simplicity and elegance that result in a joy to own and to use products* (Jakob Nielsen & Norman, 2012).

It is obvious that the user experience factors -relating to affect, interpretation, meaning, social and aesthetic aspects- have an intangible nature and lead to challenging objectives. Those objectives require a differentiated and broader perspective than the traditional engineering design perspective, but even than the user-centred design perspective. Although user-centred design does not address contradictory objectives, the practice of user experience design requires a more mature implementation and significant additions, because user experience is difficult to measure, represent and manage on organisational level (Roto et al., 2011).

Actors

For dealing with the challenging objectives of user experience design, a multi-disciplinary practice is required. Even early works on user experience suggested an integrated practice (Jordan, 1998), a view confirmed in later and more formalized documentations [e.g. Jakob

Nielsen and Norman (2012) refer to a “seamless merging of disciplines”; (ISO, 2009; Roto, 2011)]. Specifically, the ISO standard for human-centred design for interactive systems states that the following points of view are required in a user-centred design team:

- Human factors, usability, accessibility, human-computer interaction, user research;
- Users and other interest groups (or those who can represent their views);
- Knowledge of the application domain, subject matter expertise;
- Marketing, branding, sales, technical support and maintenance, health, safety;
- User interface; visual design and product design;
- Technical documentation, training and user support;
- User management, service management and corporate governance;
- Business analysis, systems analysis;
- System engineering, hardware and software development, programming, production/manufacturing and maintenance;
- Personnel, sustainability and other stakeholders

It is worth mentioning that clients and users have a leading and active role in design. Not only are they the centre of design; experience design also embraces participatory techniques.

Approaches, methods and tools

A clear distinction of user experience methods is hard to make. On the one hand, the distinction from usability or general design methods is difficult, since some user experience methods build on existing, traditional methods. On the other hand, many methods are not formalized, while existing descriptions may have different levels of detail. In some cases, we deal with general approaches (e.g. user-centred design). Other researchers propose high-level rules or heuristics [like (Overbeeke et al., 2003)]. Principles of approaches and heuristics do not provide guidance for practitioners at an operational level. Heuristics are “high-level, abstract and aim to inspire rather than prescribe [...] do not provide specifics and therefore its success largely depends on the skill and experience of the people using it” (Anggreeni, 2010). Specific guidance is provided by methods. Methods describe a formal procedure, while tools support the execution of individual steps of such a procedure. Table 1 gives an overview of methods and tools used in user experience practice. Methods can be classified in *empirical* and *non-empirical* methods, to indicate whether the participation of end users is necessary or not. Furthermore, methods can be classified according to their scope in generative and evaluative methods. Generative methods aim at inspiring developers in the creation of new products and designs. Evaluation methods “help in choosing the best design (of existing concept ideas, design details, prototypes, or final product), to ensure that the development is on the right track, or to assess if the final product meets the original user experience targets” (Vermeeren et al., 2010). Sometimes the line between generative and evaluative methods is thin, since evaluation results feed and inspire the design. The focus of this thesis lies primarily on generative methods.

Approaches

Three approaches include basic principles that the methodology developed in this thesis incorporates: user-centeredness, empathy with users and positive design.

The approach of *user-centred design* aims at improving user satisfaction and productivity of users and bases on the active involvement of users, iteration of design solutions and multi-disciplinary design (ISO, 1999). ISO 13407 is the first international standard describing user-centred design at level of rationale, principles, planning and activities. The most recent standard (ISO, 2009) covers furthermore user experience-related aspects. It states that all design activities should take into consideration the total user experience. The aspect of planning emphasizes that project plans should reserve time for iterations and user feedback, while teamwork and communications are crucial. At activities level, the standard defines four main design activities: understanding and specifying the context of use; specifying the user and organisational requirements; producing design solutions and evaluating designs against requirements.

The approach of *empathic design* (Kouprie & Visser, 2009) aims at supporting designers to develop affective and cognitive empathy for users of the products they design. Affective empathy refers to an “immediate emotional response of the empathizers to the emotional state of the empathee”. Cognitive empathy refers to the understanding of the empathee’s feelings and the ability to imagine them. The “framework for empathic design” suggests four phases of empathy: discovery (designer approaches user); immersion (designer takes user’s point of view); connection (designer connects emotionally with user) and detachment (designer uses the increased understanding for design). The proposed methodology addresses the specific goals of each empathy phase.

Positive design is the approach focusing on how design can contribute to subjective happiness. The framework for positive design (Desmet & Pohlmeier, 2013) includes three ingredients of design for happiness: pleasure, personal significance and virtue. Although the outcomes of positive design may not always differ from other design approaches, it has distinguishing objectives and processes. In positive design, a positive effect resulting in pleasure, virtue and significance is the driver of the design process. It initiates the process and influences decision-making during the process, as well as in the assessment of the final design. Such design includes five characteristics: design is possibility-driven, strives for balance, accommodates a personal fit, promotes active user involvement, and offers the means for long-term impact.

Evaluative methods and tools

Most evaluative methods prerequisite the participation of end-users. An exception is the expert appraisal method (Jordan, 2002), in which user experience experts take the task of assessing designs. Empirical evaluation methods can be classified in *tracking*, *questioning* and *observation* methods. The methodology developed in this thesis proposes a structured questioning based on need fulfilment.

Tracking is the fundamental principle of psycho-physiological measurements of responses (Albert & Tullis, 2013), like eye movements, facial expressions or mental commands. The advantage of measurements is that they provide quantitative results. However, such methods have the disadvantage that reasons for a response are opaque and results might be misinterpreted.

A large number of evaluation methods base on questioning of subjects. *Open questioning* methods involve think-aloud (Janni Nielsen et al., 2002), private camera conversation, and co-

discovery (Jordan, 2002). In the first two methods, individuals are asked to verbalize their interactions, while the third method involves two or more users. The “UX Curve” is a method, which helps users and subsequently designers to retrospectively report and analyse their long-term experience with a product by sketching in a diagram how their user experience has changed over time (Kujala et al., 2011). A semi-structured questioning is incorporated in the “Repertory Grid Technique” (Fallman & Waterworth, 2005), which captures how users experience specific products and what their experience means to them. Open questioning is informative, but results in a time-consuming process.

A *structured questioning* takes place in experience diaries, reaction checklists and questionnaires, where an individual records his/her responses on predefined issues (Jordan, 2002). A questioning method to include more than one participant is the focus groups method (Jordan, 2002), in which more participants discuss on issues posed by a moderator. In the category of questionnaires, there are many scales especially developed for rating particular aspects of user experience. The “need questionnaire” (Hassenzahl 2010) explores the fulfilment of psychological needs. The “geneve emotional wheel” is a tool for rating the art and intensity of emotions (Bänziger et al., 2005). In the “AttrakDiff” questionnaire, subjects can rate the pragmatic and hedonic attributes of a product, as well as its attractivity (Hassenzahl 2003, compare to 2.2.2.1). In the “positive and negative affect schedule (PANAS)”, individuals can rate in a five-point scale their agreement with twenty adjectives describing ten positive and ten negative emotional states (Watson et al., 1988). The “self-assessment manikin” and the “product emotion measurement instrument (PrEmo)” depict visualisations of emotions and subjects are asked to select the human figure(s) depicting their own state. Structure questioning methods have the advantage of being standardized and can lead to qualitative data. On the other hand, they may not be as rich in insights as observations or interview-based methods.

Interview-based methods especially developed for user experience are the narrative episodic interview, the contextual inquiry and the valence method. Although those methods base on questioning and are appropriate for evaluating, they can partly be seen as generative methods, since they might inspire new user experience concepts. In a narrative episodic interview, users are asked to describe a past user experience (Knobel, 2013). Contextual inquiry is a semi-structured interview method to gather information about the use context. The participants are observed and questioned in their own environments. The results can be used to gain more realistic requirements compared to other interview methods, which take place in an artificial environment (Beyer & Holtzblatt, 1997, pp. 64-66). Finally, the valence method can be used for formative evaluation of user experience. The method helps analysts capture positive and negative feelings of users during the exploration of an interactive product. In general, interview-based methods provide rich insights, but require many resources.

Observation methods include field observation and controlled observation (Jordan, 2002). In the first case, subjects are observed in the natural context of interaction, while in controlled observations subjects take part in “in vitro” experiments. A method based on field observation is the experience clip method, in which one subject interacts in natural environment while a second subject observes, takes videos and notes. Observation methods require great amount of resources and are often challenging to plan –but may lead to new and valuable insights. A different kind of observation takes place during immersion (Jordan, 2002) and cognitive

walkthroughs (Polson et al., 1992). In those cases, the designer observes himself during a hypothetical interaction, in which he takes consciously the role of a user.

Generative methods and tools

A way to structure the generative methods used in user experience design is by mapping them to the phases of the design process, in which they can be applied. In that way, we can distinguish among methods supporting task clarification, conceptual or embodiment design. For this thesis, methods supporting the first two phases are relevant. Although the thesis recommends a scenario-based approach, it is possible to apply the methods enlisted here complementary to the scenario-based methods.

Context mapping (Visser et al., 2005) is a participatory design method that helps designers to collect information about the contexts of users' interactions. Context mapping typically involves five steps. First, designers formulate goals, select participants and plan the next steps. Sensitizing participants is about triggering and motivating them to think, reflect and explore aspects of their personal context in their own time and environment. During the group sessions, participants do generative exercises with expressive components. After the sessions, designers analyse the stories and anecdotes recorded. The final step is about bringing the results to the design process -ideally, in an interactive format (workshops, card sets or persona). Projective techniques like context mapping help to reveal future states of people by eliciting tacit knowledge and exposing latent needs (Sanders, 2001 cited in Visser et al. 2005). Tacit knowledge is knowledge that people can act upon, but cannot readily express in words (Polanyi, 1964 cited in Visser et al. 2005). Latent needs are those of that people are not yet aware and become realized in the future. Therefore, the insights are richer than insights gained by observations and interviews. However, putting these techniques in practice relies on experienced researchers.

The use of generative methods basing on storytelling is elaborated in 2.2.2. However, here is a short summary of such methods. The *co-constructing stories* method (Buskermolen, 2013) is a participatory generative method to be applied in early phases of design for eliciting in-depth user feedback and suggestions. The *experience story* method builds on analysed past experiences gathered from users and helps in creating new experiences of product interaction (Knobel, 2013). The *Storyply* (previously "*Storyfy*") tool (Atasoy & Martens, 2011b, 2016) guides designers concretely in the concept generation phase to create stories about envisioned user experiences.

The *Affinity Diagram* is a group method to analyse qualitative data from field study methods, in order to derive important points from the data and cluster similar findings (Courage & Baxter, 2015). It supports finding similarities among different users, illustrates the range of a problem and shows areas for further developments. Existing items and new items identified by the participants are written on cards, extended by further annotations such as quotes, hypotheses, or first design ideas. After the cards have been created, they are sorted into thematic groups of cards. The result can serve as a guideline for the design process. The affinity diagram works best in a team. Other methods to process the results of interviews and observations are by creating *customer journey maps* and *personas*, which are explained in section 2.2.2.

Kim et al. (2011) describe the importance of the fulfilment of users' needs and suggest addressing their fulfilment through product interaction. Evolving the work of Sheldon et al. (2001), they select six main and four sub psychological needs and suggest a five-step generative method, in which *experience patterns* are used to bridge the gap between a need and an activity or product to lead to ideas for enjoyable products. Experience patterns provide a minimum set of key findings explaining why people enjoy this type of experience. The method consists of the following steps: After determining the activity or product to enhance with experience and the users it aims at, a related need and an applicable experience pattern are chosen. A comparison between current and suggested experience should then provide designers with ideas for improvement of the selected product. Finally, designers determine ways to shape the experience as suggested by the pattern through a product's functionality, content, presentation, and interaction with users and other products. The human needs and the experience patterns capture important aspects of experience, which can spark and guide designer's creativity and the way of thinking. However, applying such a high-level method might require background knowledge on user experience (phenomenon and practice). Furthermore, experience patterns are not directly applicable to complex products, where the interaction with multiple functions in a context have to be addressed explicitly.

The framework of *Emotion driven design* of Desmet (2010) is based in the process that underlies emotional responses to products (compare to the section on user experience as phenomenon). In specific, three levels of appraisal and nine associated classes of product-evoked emotions are considered for inspiring designers. In emotion driven design, a designer first identifies a design theme (product functionality, user group and situation of usage). Then, she/he formulates a concern profile, which represents the intended user and is the point of reference for users' appraisals. Next, the designer specifies a product profile, which includes three qualities: the product's significance, intentions and character. Finally, a product that fits with the product statement is designed.

User experience principles can be used for inspiring the development of concepts in conceptual design. Saucken et al. (2013) derived underlying principles of user experience from users' reviews on various products. The principles are mapped to the elements of the customer experience interaction model (compare to the section on user experience as phenomenon). Designers can use the descriptions of principles corresponding to the element of the model in focus and get inspired by the suggested tricks and examples.

Methods of *affective engineering* like *Kansei Engineering* (Nagamachi, 1997), as well as the guideline for *designing the product impression* (2015) help developers manipulate product attributes in a way that evoke a particular product impression. They are useful in the concrete embodiment design stage of design.

Summing-up, there are few generative methods for early phases of design for user experience (less than ten methods were identified). A big part of such methods root in scenario-based approaches (persona, storytelling, customer journey maps) and will be further explored in this thesis.

Table 1 : Methods and tools for user experience design (reviewed in 2.2.1.3)

Method	Phase of design process	Empirical	Scope
Tracking	Embodiment design	✓	Evaluative
Expert appraisal	Conceptual design, Embodiment design	✗	Evaluative
Private camera conversation	Embodiment design	✓	Evaluative
Co-discovery	Embodiment design	✓	Evaluative
Think aloud	Embodiment design	✓	Evaluative
Focus groups	Task clarification, Conceptual design	✓	Evaluative
Experience diaries	Task clarification	✓	Evaluative
Reaction checklists	Embodiment design	✓	Evaluative
Questionnaires - Scales <ul style="list-style-type: none"> • Need questionnaire • Geneva emotion wheel • AttrakDiff • PANAS • PrEmo • ECHO • Self-assessment manikin • Affect grid 	All phases	✓	Evaluative
UX-curve	Task clarification	✓	Evaluative
Valence method	Embodiment design	✓	Evaluative
Repertory grid	Conceptual design, Embodiment design	✓/✗	Evaluative
Interviews <ul style="list-style-type: none"> • Narrative episodic interview • Contextual inquiry 	Task clarification	✓	Generative/ Evaluative
Laddering	Task clarification	✓	Generative/ Evaluative
Field observation	Task clarification	✓	Generative/ Evaluative
Controlled observation	Task clarification	✓	Generative/ Evaluative
Experience clip	Task clarification	✓	Generative/ Evaluative
Immersion, Cognitive walkthrough	Task clarification, Conceptual design	✗	Generative/ Evaluative
Context mapping	Task clarification, Conceptual design	✓	Generative
Affinity diagram, Customer journey map	Task clarification	✗	Generative
Personas	Task clarification, Conceptual design	✗	Generative
Stories <ul style="list-style-type: none"> • Experience story • Co-constructing stories • Storify 	Conceptual design	✓/✗	Generative
Experience patterns	Conceptual design	✗	Generative
User experience principles	Conceptual design	✗	Generative
Kansei engineering	Embodiment design	✗	Generative
Designing the product impression	Embodiment design	✗	Generative
Emotion driven design	Task clarification, Conceptual design	✗	Generative

Conclusions concerning user experience as practice

The interest on user experience emerged in the late nineties from various disciplines and has been growing ever since. Many definitions and frameworks have occurred to bring clarity across disciplines. The common denominator of many definitions are six unique characteristics of user experience: focus on products, subjectivity, context-dependency, as well as holistic, dynamic and worthwhile nature. A new paradigm in design practice is required to embrace those characteristics: shift in objectives, inclusion of diverse actors and end users, consideration of principles, like user-centeredness and methods that support the design of experiences as reproducible results.

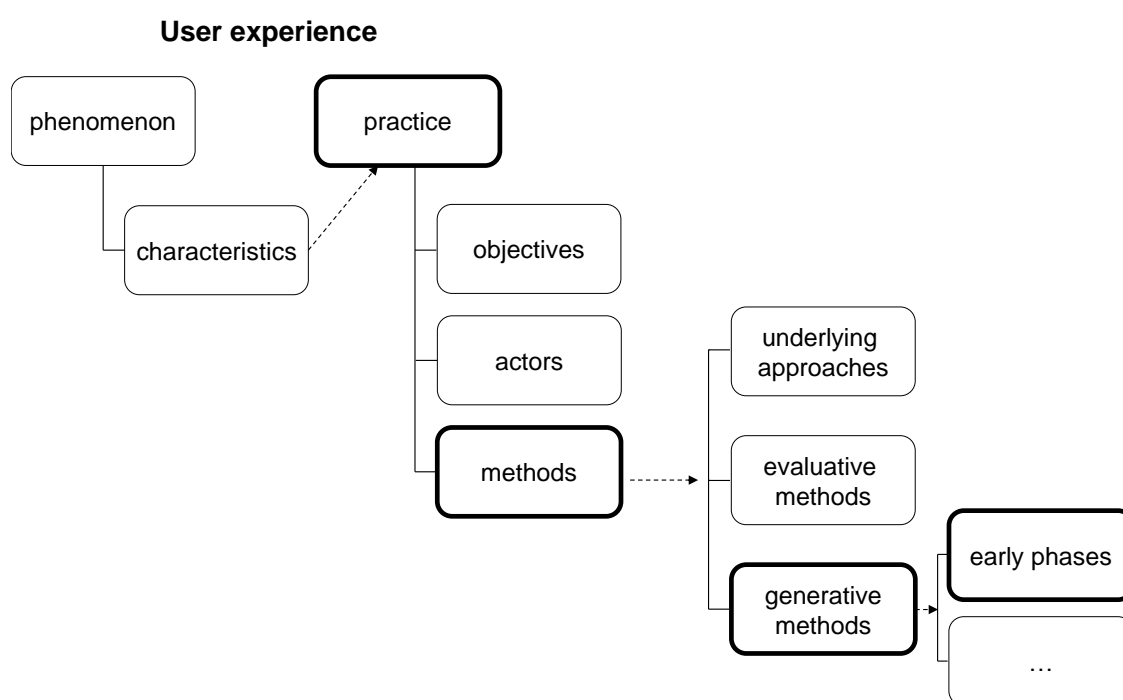


Figure 2-9: Issues of user experience practice addressed in this thesis (highlighted)

This thesis focuses particularly on generative methods for early design phases. Although there are various high-level frameworks and heuristics concerning the practice of user experience, methods that support practitioners at an operational level seemed rarer, with generative methods being significantly fewer. When considering the structured methods that are applicable in early phases of design, the amount is even smaller, since the approaches based on emotional design and Kansei engineering support the embodiment design phase. Furthermore, most approaches concern user experiences in “fragments” of product attributes and resulting affects rather than holistically. In addition, they do not deal with the issue of communicating the intended experiences, which is a crucial and challenging element of early design phases. An exception are the methods of storytelling, persona and customer journey mapping. Scenario-based methods are analysed in the next section and build the fundament of the future practice presented in chapter 4.

2.2.2 Scenario-based design

Scenario-based design makes a great contribution in effective communication, since the use of narratives and stories is a natural way of humans to express themselves and various studies demonstrate ways to apply them throughout the design process. At the same time, the phenomenon of user experience comprises a narrative structure [(Forlizzi & Ford, 2000, p. 420): “A product offers a story that invites controversy”]. Some scientists have explored how the use of narratives can contribute in envisioning and designing for user experience. This section reviews scenario-based design and methods. It begins with a clarification of relevant terminology, continued by a description of the origins and benefits of scenario-based design. Next, the section reviews scenario-based methods by describing their purposes, outputs and, whenever available, short method descriptions.

2.2.2.1 Terminology

As the terms used in this chapter may be used in differentiated ways by differentiated researches and practitioners, it is important to define central terms in the way they are used in this thesis (Table 2). Note that the definitions root in the specific context of the thesis and its focus on product design. For example, the term storytelling does not refer to general narratives or tales, but stories constructed especially for describing events related to an interaction of a user with a product. Subsequent sections will explain the background of the definitions and give broader descriptions. However, for understanding the definitions, it is helpful to distinguish between a *method* and its *outcome*, as well as between *content* (i.e. what elements are contained) and *form* (i.e. in which form is expressed) of the outcome.

Methods are prescriptions of ways to perform steps towards a goal. *Scenario-based methods* are methods that make use of scenarios. A *scenario* is an explicit description of events, which (in this thesis) are related to a product. So, the scenario, storytelling and storyboarding methods make use of explicit descriptions of events. *Scenario-based design* is an approach that recommends the use of scenario-based methods throughout the design process.

The outcomes of the referred scenario-based methods may vary in content and form. *Scenarios* include the elements: actor, goal, product, setting, action and event (Anggreeni, 2010). They may be expressed in form of narratives, structured text, diagrams/tables, or visualised frames. *Stories* include the same elements as scenarios. However, their elements have a different depth: events contribute to the development of drama and build a plot; the actors are fleshed-out characters with needs and motives; and the setting is described in a rich way. Stories are expressed as narrative. *Personas*, on the other hand, focus on the element of “actor”. Information on events, setting, product and action contributes to describing extensively the actor. Personas may have the form of narrative or [structured] textual description. Finally, *storyboards* are a form of expressing scenarios. Thus, they include the same elements as scenarios but furthermore visual elements. They have the form of visualised frames.

Table 2 : Definitions of terms related to scenario-based design

Scenario	An explicit description of hypothetical events concerning a product during a certain phase of its life cycle
Scenario-based method	Umbrella term for a method or technique that makes use of scenarios
Scenario-based design	A design approach that recommends the application of scenario-based methods
Story	A rich description of hypothetical events, experiences, or actions of a character concerning a product, tied together in a plot
Persona	An explicit description of a hypothetical user of a product, highlighted by typical events and contexts
Storyboard	A visual description of hypothetical events concerning the interaction of a user with a product
Narrative	A spoken or written account of connected events from a particular point of view

2.2.2.2 Historical review and benefits for design

Storytelling is a natural way of humans to communicate. From ancient years, stories have been shared in every culture as a means of entertainment, education, cultural preservation and instilling moral values³. The study of Propp (1968) on narrative structure in folklores has inspired many later studies in application of storytelling in various domains. Contemporary storytelling has applications fields varying from education (Connelly & Clandinin, 1990), organisational and knowledge management (Thier, 2005) to marketing (Woodside et al., 2008) and design (Erickson, 1996; Lloyd, 2000). Scenarios are explicit descriptions that support in designing and communicating activities. The original use of scenarios roots in writing of scripts for plays and films. However, scenarios have also been used as tool for strategic planning in military, business and policy management (Anggreeni, 2010). At the same time, scenarios have been used as tool for supporting design activities, primarily in the field of information technology, but also for the design of products. The latter works are relevant for this thesis.

Scenario-based design originates from the disciplines of *information technology* and *human-computer interaction*. In 1992, two significant works from the field of human-computer interaction sharpened the understanding on scenarios. Wright defined a scenario as a reference to a particular, contextualized episode, which can be seen by different perspectives; in his view, a scenario involves individuals, objects and actual or possible events (Wright, 1992). Nardi (1992) described her view on the definition of scenarios, as well as the scope of scenarios in the design of interactive systems. J. M. Carroll (1995) edited the book “Scenario-based design”, which explored extensively the use of scenarios for context-related and participatory design of information systems and resulting benefits and challenges. Erickson (1996) wrote about the use of storytelling as communication medium and informal design method in interaction design. In his experience, stories proved useful in user research and for linking its findings to new solutions, but mostly for communication throughout the process (“design as storytelling”). In another work, Rolland and his colleagues (1998) explored scenarios for eliciting and validating

³ Wikipedia. Storytelling. Retrieved on 21 June 2016, from <https://en.wikipedia.org/wiki/Storytelling>

requirements in the field computer science. Diaper (2002) viewed scenarios as part of the broader framework of task analysis in human-computer interaction. Bødker (2000) discussed the use of scenarios in user-centred design and supported their use not only for testing, but also throughout the design process (e.g. for summarizing field research or creating concepts) as basis for design, implementation, cooperation and decision-making. A distinction of scenarios and stories is made in the publication of Gruen et al. (2002), who described their reflexions on use of stories in user experience design at IBM, acknowledging their value. They highlighted characteristics of stories, which are not necessarily included in scenarios, but are critical in design: the development of plot, drama and character in a detailed setting. Having defined stories and their elements, they demonstrated the use and evolvement of stories in the four main phases of design process: research, design articulation, evaluation and execution. Blythe and Wright (2006) introduced “pastiche scenarios” as a way of using fiction as a resource for experience centred design. In their work, caricature characters are the medium for exploring user experience. Brooks and Quesenbery (2011) focused on improving the user experience. They describe why and how to use stories throughout the design process, including examples demonstrating many story types and how to create them.

The use of scenario-based methods in *product design* was proposed already in 1993 by Moggridge. He described a four-step process for designing products for the elderly, acknowledging the importance of storytelling and scenario building in envisioning new solutions. Fulton Suri and Marsh (2000) studied scenarios as tool for ergonomists. They claimed that scenarios are useful not only when evaluating products (tool for analysis), but also as a tool for synthesis. Furthermore, they emphasized on the value of scenarios in all phases of user experience design and as communication platform when working with various disciplines. The use of scenarios in single activities of product design has been analysed by more researchers. Lloyd (2000) characterized storytelling in ethnographic user research as the central mechanism in the development of common language in design teams. Wölfel (2014) explored narratives in elicitation of requirements and found out that they led to more user experience-centred requirements. However, most of these studies display examples of scenario-based design as a loosely defined approach. The PhD-thesis of I. Angreeni (2010) describes a more structured approach. With the overall goal of providing concrete support for creating, using and managing scenarios in the domain of product design, she developed and evaluated in industry context a concrete guide for scenario creation and use. Many results of her research, like the definition of scenario elements and the proposed way of applying scenarios in each phase of product design are elaborated in subsequent sections. Van den Hende (2010) studied the effect of early concept narratives (“really new stories”) on consumer understanding and attitudes in early phases of new product development. She concluded that narrative descriptions of a novel product evoked reactions that are more positive than those evoked by non-narrative descriptions of the same product. Stories facilitated imagery, feelings and attention, particularly when demonstrating an appropriate protagonist via an appropriate medium. Two recent studies have a special focus on user experience. First, Atasoy and Martens (2011b) developed Storify, a tool inspired from film and sequential arts, which guides designers through incorporating dramaturgical techniques in the concept generation phase of design. Their work is based on the common characteristics of stories and experiences. Second, (Knobel, 2013) proposed storytelling for user experience design in the automotive context. His approach starts with the

gathering and analysing of past stories, continues with the creation of stories for creation of new user experience concepts, while stories are one of the suggested ways to evaluate experiences (narrative episodic interviews). Finally, two studies demonstrate the application of stories in participatory product design. Dindler and Iversen (2007) proposed a participatory method making use of narratives in “fictional inquiry”, which helped end users immerse in a fictive situation and create new concepts. Buskermolen (2013) developed a workshop-based method for early design, in which users design and assess concepts by “co-constructing stories”.

Summing-up, scenario-based design has been since the early nineties a promising approach for supporting the communication, but also various design activities in the fields of information technology, human-computer interaction and product design. Some recent studies highlight the opportunities of using scenario-based methods in the context of user experience design.

2.2.2.3 Scenario-based methods

The term “*scenario-based methods*” refers in this thesis to methods and techniques that relate to scenarios. Related to scenarios and relevant for this research are stories, personas, use cases and storyboards, which are described in the following.

Scenario

“Scenarios are explicit descriptions of hypothetical events concerning a product during a certain phase of its life cycle”. This definition roots in the work of Anggreeni and van der Voort (2008-2010) on “scenario-based product design”, which argues for the use of scenarios during the whole product design process. Overall, the research on scenarios includes ways of classifying or deconstructing them into elements and focuses on the process of creating scenarios.

Concerning the *classification of scenarios*, an approach to classify is according to the purpose of a scenario [e.g. (Campbell, 1992; Jakob Nielsen, 1990)]. Other researchers classify scenarios according to their content [rich and narrow scenarios (Kuutti, 1995), plus-minus, open-closed and caricature-typical-critical scenarios in (Bødker, 2000)]. The classifications of Rolland et al. and Anggreeni are most relevant for this thesis: the first as a broad framework, covering most aspects addressed in other works; the latter as most relevant to product design.

The scenario classification framework of Rolland et al. (1998) proposes four views on scenarios, concerning their form, content, purpose and life cycle (Figure 2-10). The *form* view is related to the description of a scenario, i.e. their description via a specific medium and their art of presentation. Description media include narrative, tables, structured text, scripts, graphics, images, sketches, photographs and videos; while presentation may be interactive or not. Carroll (2000) recognizes prototypes, storyboards, videos and rapid prototyping tools as form of scenarios. The *content* view includes the facets of abstraction, context, argumentation and coverage. Abstraction indicates how concrete or abstract is a scenario. Context refers to system, environmental and organisational context. Argumentation describes positions and decisions demonstrated. Coverage indicates in how far events refer to functional or non-functional aspects and whether events are intended by users. The *purpose* view shows the aims of using a scenario, which may be descriptive, exploratory or explanatory. Finally, the *life-cycle* view includes the life span, i.e. the period of time in which a scenario is valid, as well as the operation facet, i.e. the operation of requirements engineering to which they refer.

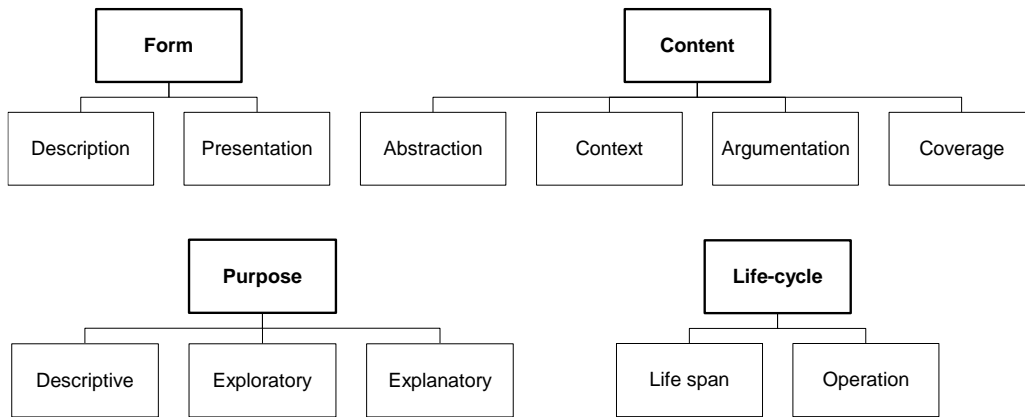


Figure 2-10: Four views on scenarios (based on Rolland et al. 1998)

The “scenario roadmap” classifies scenarios according to the phases of product design, in which they are used [Figure 2-11, (Anggreeni & Voort, 2008)]. During the first design phase, exploration and orientation, *exploratory scenarios* summarize findings of user research and complement actual *stakeholder stories*. In the phase of requirements capture, *actual practice scenarios* are used to elicit requirements, while *future practice scenarios* help in envisioning the new product. During the design phase, *possible problem scenarios* derived from actual practice scenarios support the selection/filtering out of ideas and concepts emerging in this phase. On the other hand, *interaction scenarios*, which are a result of elaboration of future practice scenarios, contribute in defining the created ideas and concepts and complete the product specification. Finally, in the validation phase, *validation scenarios* can support the process of usability testing or in general of validating products in specific use situations.

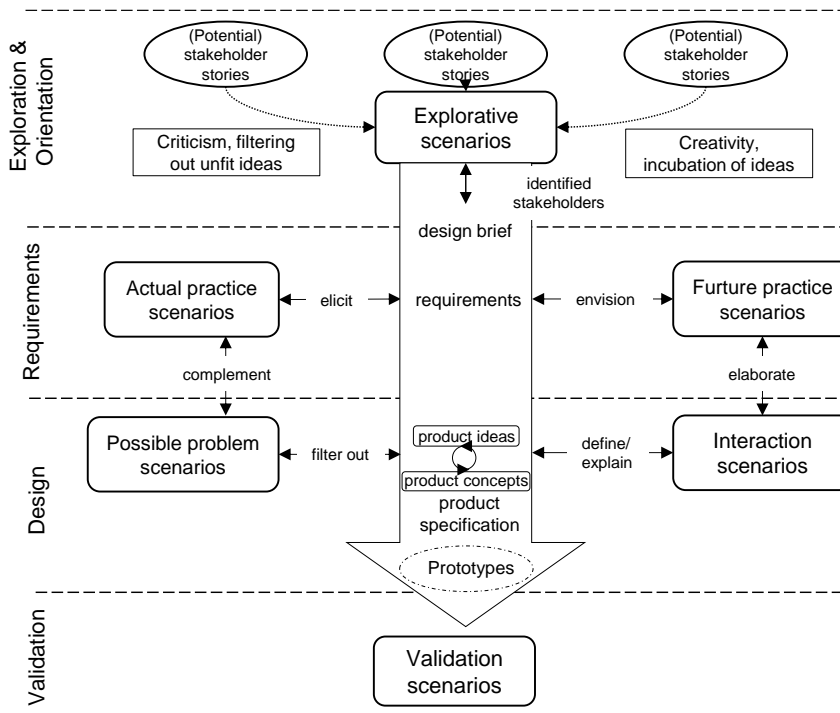


Figure 2-11: Scenario roadmap (based on Anggreeni & Voort, 2008)

As to studies on *defining scenario elements*: Nardi (1992) named user, work context, tasks and future technologies. Fulton Suri and Marsh (2000) adopted Nardi's definition, but referring not only to future scenarios, but also to ones addressing past and current activities. Wright (1992) also referred to actual or possible events, along with objects, individuals, and context. Anggreeni (2010) defined actor, goal, product, setting, action and event (Figure 2-12). One strength of the latter classification is that it is tailored to product design and furthermore takes relations among the elements into consideration.

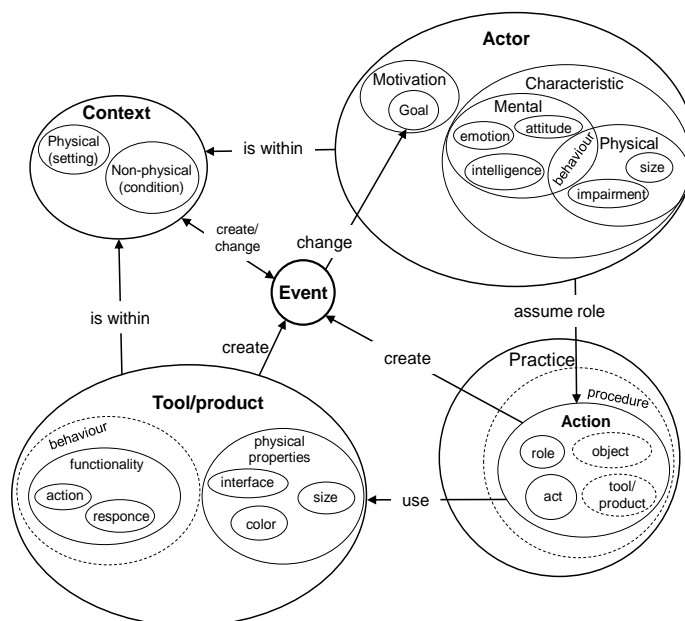


Figure 2-12: Scenario elements and influences (based on Anggreeni, 2010)

Finally, concerning the *process of creating scenarios*, three works are relevant for the focus of this research. J.M. Carroll (2000) proposed heuristic methods. Specifically, deriving scenarios from the involvement of target users through *ethnographic field study* and *participatory design*, the existing knowledge about a specific domain through *reuse of prior analyses*, *scenario typologies* and *existing theories*, the possibility of new technology by creating *technology-based scenarios*, and lastly, by applying the brainstorming-based technique of *transformations*. Those heuristics are valuable, because they demonstrate a holistic, yet loosely defined approach. The “*Design Information Framework*” (Lim & Sato, 2006) is a structured scenario generation mechanism, useful for organising user data, creating multiple aspects models and generating scenarios in narrative format. The analysis of multiple aspects of use by decomposing complex situations into chunks, structuring them, and representing their interconnection is particularly interesting in the context of complex products, which are the focus of this thesis. Finally, Anggreeni (2010) introduced a tool for semi-automatic scenario generation for product design in design teams. The proposed tool supports in gathering relevant design information; making relevant information for a specific purpose available; quick-and-dirty evaluating of concepts and communicating scenarios to various stakeholders. This tool does not offer explicit support for understanding and generating user experience; however, its structured nature and focus on product design make it a valuable foundation for this thesis.

Storytelling

Research on storytelling in the domain of design is not as structured as research on scenarios. Most works focus on the scope and advantages of storytelling rather than classification of stories or guides for their creation and usage. Storytelling is often viewed as an informal practice, a way of communicating. This section will first clarify the distinction between story and scenario; then review relevant studies.

Just like scenarios, stories in the context of design are models representing interactions between user and product. The scenario elements are apparent in stories. However, stories have distinguishing characteristics, which are optional or absent in scenarios, concerning their form, as well as the aspects of plot, character and context. Stories have a *narrative form*. Although the term “storytelling” initially referred to oral storytelling, it has a broader meaning and includes written narratives. The use of natural language is the reason for stories being understandable and memorable. Furthermore, the narrative form implies that “stories go beyond descriptions of a situation, because they have a plot, which enables the storyteller to reflect the interpretation on a certain subject” (Feldman et al., 2004). According to Feldman, a story is “a sequence of events, experiences, or actions with a plot that ties together different parts into a meaningful whole”. Gruen et al. (2002) referred to that as “causality”: events in stories are connected through causal relations. Unlike scenarios, stories embed a *drama development*. Gruen named possible dramatic elements (time locks, option locks, or stakes), which make stories compelling. Therefore, stories often refer to untypical situations; scenarios, on the contrary, demonstrate rather typical or prototypical situations and events in a specified order. Another distinguishing characteristic of stories is that they focus on *well-drawn characters* rather than actors. A story demonstrates motives and needs of the protagonist (character) and often involve a character development. A story implies the character’s values, fears/weaknesses and overall goals, in a way that allows the audience to understand and empathize with them. Gruen claimed that the role of a *product* in a story is to offer ways for characters to overcome obstacles and achieve their goals. Therefore, stories have a *personal nature*, since the character as well as the receiver are interested in the result, the ultimate goal achievement. Brooks and Quesenbery (2011) referred to interactivity of stories: the audience or receiver of a story becomes engaged in a process of making meaning, by interpreting subjectively its contents. Finally, stories include *rich descriptions of context*, which help the audience to situate themselves in the place and time the story takes place. Therefore, stories have a *specific nature*, describing a specific character in a specific situation. Summing-up, special characteristics of stories are: the narrative form with plot and drama development; the focus on untypical situations; the focus on a well-drawn character with known motives and needs rather than an “actor” and the personal nature; rich context; specific nature. It is apparent that story elements are similar to elements of scenarios used in product design, yet have a different depth. Gruen et al. (2002) classified stories in two major categories: fictional stories and customer (real) stories. Furthermore, they give examples of how to use stories throughout the design process (problem statement stories, solution story, detailed product design flow, product design specification).

Storytelling is the method making use of stories, mostly to support communication and share knowledge. Focusing on its application in design, we can find holistic approaches of design as storytelling in the field of human-computer interaction (Erickson, 1995, 1996; Gruen et al.,

2002), product design (Moggridge, 1993) and user experience design (Brooks & Quesenbery, 2011). As to specific methods for creating and using stories, the following works are relevant for this thesis: (Atasoy & Martens, 2011b, 2016; Brooks & Quesenbery, 2011; Buskermolen, 2013; Knobel, 2013).

Brooks and Quesenbery (2011) proposed ways to use stories throughout design: collecting real user stories as part of research; selecting stories as part of analysis; using stories for design ideas; evaluating with stories. Furthermore, they provided guides and examples on how to “craft” stories and communicate them in an appropriate way for the audience. They explored story elements (perspective, characters, context, imagery and language) and structural elements (plot lines) that are useful for creating stories. Their work is very valuable for this research; however, it lacks a special focus on designing complex, tangible objects.

Knobel (2013) presented a methodology for generating positive experiences in automobile, which makes use of storytelling in two stages: gathering of users’ past experiences and creation of an experience story describing a future experience. Gathering users’ stories is incorporated by the narrative interview method. More interesting is the method for creating a story. Knobel proposed the following elements of experience story: scenario, characters, psychological, need(s), system, motivation, conflict, conflict solving, and need fulfilment. The method is described at level of principles (Table 3), not at an operational level (inputs, outputs, anchoring in the process). A limitation of this research is the focus on the automobile domain. Moreover, the method refers to single experiences and does not explicitly support a system view.

Table 3 : Knobel’s process for creating an experience story (based on Knobel 2013)

Step	Description
Scenario depiction	A context, including time and place, is imagined
Introduction of characters	The plot begins by introducing the characters, and the story elaborates as to why the characters conceived the intended need in their specific context. Here, psychological need(s), which will later on motivate the use of the system, are addressed.
Introduction of system	A system is introduced without presenting any concrete technical solution -so that the focus of the story stays on the human experience
Introduction of conflict	A conflict is built up through the context and the characters. The psychological need(s) are again addressed here.
Climax of conflict	At the climax of the conflict, the system interaction takes place. To enable the audience empathize with the character during the interaction, focus is placed on one main character.
Need fulfilment	Finally, the conflict is solved through the interaction of the main character with the system, whereby the intended psychological need(s) are fulfilled.

Buskermolen (2013) developed a participatory design method based on storytelling, which is called “co-constructing stories”. Goal of applying the method is to elicit in-depth user feedback and suggestions in early design phases. The developed procedure bases on two claims: first, that designers consider stories valuable and useful sources of feedback; second, that users are prepared to envision future situations better, if they revive their past experiences first. Co-

constructing stories takes place in a workshop setting, consisting of the phases of sensitization and elaboration (Figure 2-13). Her method is well defined (in seven steps) and evaluated with practitioners. However, it has a participatory perspective –not suitable for all projects- and concerns only a certain stage of design.

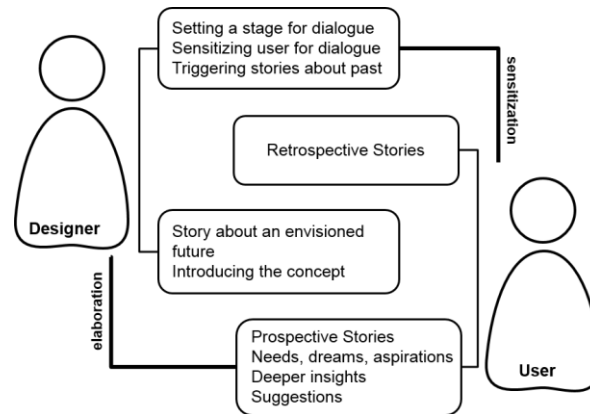


Figure 2-13: Co-constructing stories (based on Buskermolen, 2013)

Atasoy and Martens (2011b, 2016) developed *Storyply* (previously *Storify*), a tool that supports designers in the concept generation phase to create stories about envisioned user experiences. The tool is motivated by the similarities of user experience design and storytelling both on the level of their aims and on the level of common characteristics. User experience design and storytelling have a primer focus on influencing emotions. Furthermore, they share the characteristics of being subjective, dynamic and context-dependant and share a sequential structure, which can be influenced through design. The practice of experience design and film production is multi-disciplinary and makes use of common tools, like storyboards and personas, which need not be quick and inexpensive. Motivated by those similarities, Atasoy & Martens studied dramaturgical elements, extracted patterns and incorporated that knowledge into *Storyply*. *Storyply* assists designers in organising the elements of user experience (analogue to elements of stories) and in discussing strategies on how to shape them in an experience. The tool is structured in three layers. Although this research has a structured approach and same focus as the present research, it only supports the phase of conceptual design and in particular the creation of fictive stories. A link to data or results of previous phases or proposals on how to combine with other artefacts is missing.

Use case technique

Another scenario-based method is the use case technique originating from object-oriented software engineering (Jacobson, 1995). Content wise, they include the scenario elements of actor and action. Form wise, they may have a text or diagram (usually: UML diagram) form.

Use cases identify actors and their goals towards a system, which gives a graspable view of the system's capability and behaviour. Each use case is a complete series of events, described from the point of view of an actor (Jacobson et al., 1993). Use cases describe requirements on an abstract level and the way in which a user is related to a system (Moser, 2012, p. 92). Their focus lies on users' goals and how a system can address them. Therefore, they can be seen as

stakeholders' requirements for a system (Cockburn, 2001, p. 1). "Actors" refer to roles that interact with the system and may be individuals, groups of persons, representations of individuals (e.g. personas), or even other technical systems (Randolph, 2004). Use cases can be described at various detail levels. Cockburn (2001, p. 62) describes abstraction levels: the sea-level refers to user goals; more abstract goals referring to the organisation are at the cloud-level; the fish-level refers to sub-functions, while their parts are at the clamp-level and are rather too detailed. Each use case can be described in a template with: ID, title, primary actor, scope, level, precondition, main success scenario, extensions, frequency of use, secondary actors, status. Use cases are often used in combination with the critical incident (Flanagan, 1954) and the sequential incident techniques (Hughes et al., 2007). The critical incident technique is about documenting use cases that a customer perceives as exceptional (either in good or in bad). The sequential incident looks at entire processes and "all incidents customers perceive sequentially in the course of the consumption process". Typically, the critical incident technique results in a description of the entire customer life cycle, the flow of interactions and possible touch points. This result is called "customer journey". A part of the customer journey is the so-called "user journey", which concerns the use cases related to using the product.

Persona

The concept of personas originates in works of A. Cooper in interaction design (1999), where he defined persona as "a precise description of our user and what he wishes to accomplish". Later works define personas more accurately, like "fictional, detailed archetypical characters that represent distinct groupings of behaviours, goals and motivations observed and identified during the research phase" (Calde et al., 2002). Personas are "fictitious, specific, concrete representations of a customer of a real target group" (Adlin & Pruitt, 2010), based on behaviours and attitudes of observed real users and representing them throughout the development process (A. Cooper et al., 2014). Personas aim at studying and arranging different types of actual or potential users and their needs in a memorable way that turns designers' attention on satisfying them. The use of personas offers a time- and cost- effective way to involve potential users indirectly in the development process (Kozar, 2011). Working with personas offers ways for improving communication and for evaluating concepts. Personas are usually linked with scenarios and stories: they are rich descriptions of their protagonists. Although personas are fictitious representations, approaches to create them can be classified in (1) approaches, which do not make use of data and are loosely defined and (2) databased approaches. The works of Cooper fall into the first category: they do not describe in detail how the data for personas are collected and analysed, while he recommends using fictional details. Adlin and Pruitt (2010) claim for the second approach. They stated that despite its benefits, the persona technique could fail, when: personas appear implausible and are not associated with a methodological approach and use of real data; their use results into bias and stereotypes; the approach is not clear to the design team; the management does not accept personas; personas are communicated poorly. McGinn and Kotamraju (2008) recognized that data gathering is a time consuming process. However, it is still faster and cheaper than high quality ethnographic studies. They conclude that personas are not accepted if they do not base on real data or if the link to data can not be traced [also: (Blomquist & Arvola, 2002; Pruitt & Grudin, 2003)]. Personas are more readily accepted by clients when based on real data. Specifically, if data is gathered especially for creating personas, their traceability and thus acceptance are higher. This thesis takes a databased

approach. Goodwin (2001) and Nielsen (2004) proposed databased approaches for creating personas. For getting data about the users and creating behavioural patterns, they propose ethnographic field studies and contextual inquiry. Distinct personas are then created to cover the full range of behaviour patterns. Detailing each persona is the next step, followed by the optional final step of creating a visualisation. Goodwin (2001), for example, suggests creating a description about goals, skills, attitudes, environment and personal details to bring the persona to life.

Storyboard

A storyboard is “a short graphical depiction of a narrative” (Truong et al., 2006), typically consisting of multiple frames that describe important actors and actions (Branham, 2008). Storyboarding is a technique rooting in the movie and advertising industry, but used broadly in the domains of human computer interaction and design. It is used for demonstrating graphically interfaces and for illustrating “user’s interaction with the system over time through a series of graphical depictions and textual narrative” (Branham, 2008). In this context, storyboards can have benefits compared to textual narratives: while specific wording can influence the understanding of and reaction to a system, storyboards are a less biased visual depiction of the same information, by providing a common visual language (Van der Lelie, 2006). For product designers storyboarding is a powerful means to grasp context, time and interaction, while having the freedom to leave out details or aspects not yet explored (Van der Lelie, 2006). Readers can experience the visualised interactions by empathising with the user or the situation and can reflect on the visualised interactions from his/her own objective perspective (Van der Lelie, 2006). Furthermore, collaborative storyboarding (Branham et al., 2008), can be a helpful tool for a design team. Many studies recommend it as a useful and well-accepted by practitioners tool (Yang, 2007). Haesen et al. (2009) recommended storyboarding for derivation of requirements in multi-disciplinary teams. Wikström (2013) argued for the positive effect of storyboarding in the design activities of framing, communicating, understanding, compiling and visualising information, as well as innovating.

2.3 Support of user experience through scenario-based methods

Having clarified the main fields of interest, the following section illustrates why scenario-based methods are considered useful in user experience design. The argumentation is built around three themes: (1) importance of early phases of design of complex, tangible products; (2) challenges in the practice of user experience; (3) similarities of narrative structure of stories to structural elements of experiences. Scenario-based methods can be seen as catalysts to tackle the described challenges related to the first themes, while the third theme indicates how storytelling is appropriate for understanding, communicating and designing experiences. Parts of the described argumentation base on a previous publication (Michailidou et al., 2013a).

(1) Early phases of product development focus on creating a situational understanding of a market and its opportunities, defining the problem to be solved through the new design and first concepts fulfilling the requirements. The requirements list is the document representing the specification against which the success of the product development project can be judged throughout the development process. Therefore, it is important to reinforce the integration of non-technical requirements regarding user experience. Technical requirements and product

specifications usually describe what should be designed and how, and not the “why” behind the design or “be-goals” (Hassenzahl, 2010). The dynamic nature of experiences and temporal aspects of product usage are also difficult or impossible to capture in a requirements list. Furthermore, for complex products used in a complex environment it is essential to consider the relations among the system components. Such relations and their effect on the overall experience are difficult to capture in a requirements list. For all those reasons, new methods to elicit and artefacts to capture those aspects are essential in the task clarification phase of user experience design. The same applies to the next design phase. Conceptual design can be characterized as a creative phase of the design process, the result of which is further developed in embodiment design. Taking into account the findings of user research in conceptual design is essential for translating user needs into products. Later phases of design may facilitate user participation, but in most cases for evaluative and not generative purposes. Moreover, for the design of complex tangible products, defining restrictions and system boundaries is essential. Early phases involve ambiguity but bear the greatest potential to influence the subsequent phases and their results. Changes in early phases cost less than in late phases (Ehrlenspiel et al., 2007), so they can be considered more flexible. The need for methods for early phases of experience design has also been identified in previous studies [e.g. (Desmet & Pohlmeier, 2013; Vermeeren et al., 2010)].

(2) As to the practice of user experience, it bears many challenges. It is a user-centred practice that requires the involvement of experts of various backgrounds and the proactive, continuous participation of users for consideration of needs and context of use. Buskermolen (2013, p.32-33) presented a literature-based overview of barriers to user-centred design concerning four aspects: economic concerns, organisational obstacles, lack of motivation and difficulties in organising and facilitating sessions with users. The intangible nature of experiences makes communication an additional challenge. Difficulties in communication can occur in all stages of the process. For one, because experts from various disciplines and positions and even potential end users participate actively in the design process. On the other hand, non-tangible, subjective and dynamic aspects lie in the focus of communication. The challenge is to create a common communication platform for all stakeholders and eliminate the need for a continuous “translation” and subsequent information loss. Particularly, when designing complex tangible products, the relations among product components and, more importantly, their interplay and effect on the overall user experience have to be clear to the design teams working on different components. All stakeholders should have a common vision of the intended overall experience.

(3) The approach of using scenario-based methods to face these challenges and enhance user experience is not new. Carroll (2000) named five reasons why scenario-based design addresses successfully common design challenges. More authors agree on the value of scenario-based methods in communication and design, as well as their practical advantages (Anggreeni & van der Voort, 2008; Brooks & Quesenbery, 2011; Erickson, 1996; Fulton Suri & Marsh, 2000; Gruen et al., 2002). The following paragraphs summarize such benefits without citing separately the contribution of each publication. Scenario-based methods promote understanding of a system and its communication with two central characteristics: memorable and informal (well-suited to design ambiguity). Scenario-based methods enable the representation of intangible interactions and integration into physical and social context. More parts of a system are brought together. Furthermore, they offer a concrete platform for discussion and reflection.

Documentations are comprehensive and can take multiple formats, points of view and levels of detail. Scenario-based methods applied in the design process can help in building a common vision of design targets and serve as basis for decision-making. Again, these advantages help to overcome barriers connected with the practice of user-centred methods, like problems with documentation and difficulty in communicating results (Goodman-Deane et al., 2010). Another aspect concerns the (direct or indirect) participation of end-users in the design process. Scenario-based methods contribute in that direction by giving to designers the means to capture their findings from user research, but also communicate their ideas in an understandable for users way. Scenarios and stories can have many perspectives – particularly the perspective of users is enlightening for designers. The empathic design approach encourages the use of scenario-based methods in order to increase designers' affective and cognitive empathy to users and to communicate their findings. These advantages are crucial in the context of user experience design. Additionally, because of their use of natural language and lack of need for special equipment, scenario-based methods are understandable for all stakeholders; they enable design action and reflection without one blocking the other; are appropriate mediators for early testing; can be easily revised – and are for all those reasons cost-effective. These advantages are decisive for overcoming obstacles of user-centred design, where constraints in time and budget and designers' inexperience with complex, demanding methods have to be faced (Goodman-Deane et al., 2010; Rosenbaum et al., 2000).

Summing up, the need for low-cost and flexible ways of working in user-centred design is in theory ideally met by scenario-based methods. However, there are cases, in which scenario-based methods are not appropriate. Nardi (1992) describes in the “scenario life cycle” that scenarios are core artefacts in early design phases, but take a secondary role as the implementation of designs proceed in later phases. Aspects of detailed design, concerning form, material and the product character [*“Gestalt”*, compare to (Hassenzahl, 2003)] cannot be captured in words. Some authors also question the value of scenarios and stories that are purely fictive and do not relate on other results of design.

(3) Finally, the third reason why the study of scenario-based methods (and storytelling in particular) is highly relevant for user experience design is the structural similarity of experiences and stories, as well as the common aims of storytelling and user experience design. The phenomenon of user experience has an underlying narrative structure [compare to the compositional threat of experience in (McCarthy & Wright, 2004)]. Interactions unfold in a sequence of actions and consequences, but moreover in an inner cognitive process, a dialogue exploring action possibilities, explanations of actions and evaluating information according to own points of reference. This sense-making process as inner dialogue has a narrative, sequential structure that is apparent in stories. Comparing their content, both experiences and stories refer to memorable episodes. Moreover, experiences and stories, share the following common elements: users-characters and their motivations; rich context; dramaturgical elements. Furthermore, experiences and stories share the characteristics of being holistic, subjective, dynamic and context-dependant. For all those reasons, many authors use the meaning of story to define experience (Forlizzi & Battarbee, 2004; Forlizzi & Ford, 2000; Hassenzahl, 2013; McCarthy & Wright, 2004). As to their scope, user experience design and storytelling have a common primer focus on influencing emotions. As to their implementation, user experience design and storytelling (at professional level, e.g. in film production) in practice require diverse

competences and make use of common tools, like storyboards (Atasoy & Martens, 2011b). Because of those similarities, stories can be used for understanding experiences. Secondly, for communicating experiences, because the elements of stories and their narrative structure would make intangible experiences comprehensible. Thirdly, storytelling seems promising for creating meaningful experiences. Previous sections described a shift from usability towards user experience; an analogous shift appears in the usefulness of scenarios towards rich stories.

Despite their usefulness for user experience design, a tendency to improvised use of scenario-based methods and a lack of clear guidance for their use in the context of user experience motivates this research. The derived research questions are described in the next section.

2.4 Reframing of objectives and research questions

The literature review shows that there is a growing interest in studying user experience, while scenario-based methods and mostly storytelling seem to bear great potential for supporting the practice of user experience design. Particularly, some gaps in research have been identified, which this thesis is going to address. In short, the literature review indicates a lack of generative methods for the early phases of designing user experiences mediated through complex, tangible products; moreover, indicates a lack of a structured methodology, which makes use of various scenario-based methods and their elements, tailored to support user experience design.

Many studies on user experience focus on defining, modelling and explaining the phenomenon of user experience. This makes sense, since the complex phenomenon of user experience has been a relatively recent field of interest. Less works focus on user experience as practice and, specifically, on methods to guide practitioners through it. Although there are numerous high-level frameworks and heuristics [like (ISO, 1999; Overbeeke et al., 2003; Schmitt, 1999)], methods that support practitioners at an operational level seem rarer. Furthermore, compared to methods that support the evaluation of user experience, the methods supporting its communication and generation are significantly fewer. When considering the structured methods that are applicable in early phases of design, the amount is even smaller. The approaches of emotional design and Kansei engineering are valuable, but they support embodiment design, which deals with the form and attributes of products, rather than early design phases, which deal with the selection of product ideas and specifications. Furthermore, such approaches concern user experiences in “fragments” of product attributes and resulting affects rather than holistically. In addition, they do not deal with the issue of communicating the intended experiences, which is a crucial and challenging element of early design phases. The need-based approach [need-based design, experience patterns, AttrakDiff (Hassenzahl et al., 2003; Kim et al., 2011)] adopts a holistic point of view and addresses the communication issue –is therefore a very valuable ground for this research. However, it is questionable whether the approach is applicable in the design of complex, tangible products. Despite the broad literature review, it was not possible to identify case studies reporting the application of this approach in the design of complex, tangible products. A similar, need-based approach, which actually makes use of storytelling and furthermore reports case studies from the design of automobiles, is the approach of Knobel (2013). However, his studies are tailored to the automotive domain. Finally, Saucken (2015) developed in his thesis tools that support the design of experiences mediated through complex, tangible products, which have been evaluated

in cases of products from various domains. However, in his cases, the tools are independent from each other and do not relate to design artefacts or outputs of other methods. As explained in previous sections, methodologies have the advantage of describing how to make use of results that build on each other. To sum up, all reported works are valuable fundamentals for this thesis. However, this research goes beyond that and aims at delivering a structured *methodology to support unexperienced practitioners in communicating and generating user experiences mediated through complex, tangible products*.

As to scenario-based design, existing works that are relevant for this thesis can be classified in three groups: structured methods with focus on tangible products; structured methods with focus on user experience; structured methods with focus on user experience mediated through tangible products. The most relevant work representing the first category is the work of Anggreeni (2010). However, it does not focus on elements and particularities of user experience. As a result, scenario elements seem to lack the essential for user experience design depth (for example in concern to narrative structures, plots, and rich characters) and the findings are applicable only to some extent. On the other hand, the work of Brooks and Quesenbery (2011) emphasizes on user experience and makes use of storytelling elements. However, the reported applications refer to the design of intangible interactive systems, which do not necessarily bring along the challenges of design of complex, tangible products. Ways to integrate the new approaches (like storytelling) in existing product development processes are not addressed in that work. Finally, the works of Buskermolen (2013) and Atasoy and Martens (2011, 2016) focus on ways of making use of storytelling in user experience design and are applicable for tangible products. Both works address single design phases and do not provide guidance on how to use the created results in subsequent phases and in combination with other artefacts. The review of scenario-based methods showed that various methods make use of the same elements. However, the research clarification did not identify a structured methodology. Furthermore, the work of Buskermolen takes a participatory design perspective, which is not given in every case. On the other hand, Atasoy's work does not bring multiple scenario-based methods together. A structured approach with anchors in existing practices and well-defined inputs, results and responsibilities would be beneficial for a successful implementation.

This thesis addresses five research questions. The first two questions clarify the objectives of the thesis in actual design practice (chapter 3). The next four questions aim at developing and describing in detail a scenario-based experience design methodology (chapter 4). The final question aims at assessing the methods in corner cases (chapter 5).

- What is the view of design practitioners on the topics of understanding, implementation and assessment of user experience design and scenario-based methods?
- Which are requirements for a methodological support for communicating and generating user experiences mediated through complex, tangible products in early design phases?
- Which scenario-based methods are appropriate in each step of the design process? How to integrate the selected methods in a methodology?
- What are the objectives, necessary inputs, desired outputs and structured procedure for each method?
- How do design practitioners without prior knowledge in user experience design assess the ease of use, usefulness and suitability of the methods and the methodology?

3. Current practice of user experience design and goals for future practice

One of the conclusions of the literature review is that much effort has been invested in studying the phenomenon of user experience and its ideal practice. This makes sense, since a theoretical understanding of a new field of research, such as user experience a few decades ago, is essential for conducting any further studies. However, empirical studies on the actual practice of user experience (Kuutti, 2010; Laib et al., 2015; Law et al., 2014; Postma et al., 2012) are fewer, although practitioners would find operative guidance in empirical work and application cases. Motivated from that fact, this chapter addresses two research questions:

- What is the view of design practitioners on the topics of understanding, implementation and assessment of user experience design and scenario-based methods?
- Which are requirements for a methodological support for communicating and generating user experiences mediated through complex, tangible products in early design phases?

Two studies were conducted to explore the questions: an in-depth study within a research project in collaboration with an automobile company and a broad study with practitioners of various companies/domains. Given the variety of theoretical works on user experience from the academia, this chapter takes a practitioner’s perspective with the aim to trace theoretical work in actual practices and understand practitioners’ current situation and needs. The conclusions from both studies lead to a definition of development needs and requirements for future practice of user experience.

3.1 Study I: “CAR@TUM user experience” project

The first study on current practice of user experience took place within the research project “CAR@TUM user experience” (ff. CAR@TUM project), which was a collaboration of four university institutions⁴, BMW research and BMW development – quality management. Goal of the project was to explore user experience as current and future practice at BMW. Frequent communication and involvement in running development projects of BMW ensured that the participating researchers would have insights in the company’s practices. Such insights would enable the development of a suitable and useful support for designing and evaluating user experience. This section concerns the initial situation of the company (current practices). The results of understanding current practices presented in the following sections base on the participation in case studies and the analysis of project-related documentations. An important conclusion is that a methodological support for user experience design is desired. Moreover, the success of such support is highly dependent on its formality and ability to be integrated into existing processes. The next sections describe the research methodology and results of this

⁴ Institute of Human Factors of the Technical University of Munich, Institute of Industrial Design of the Technical University of Munich, Institute of Product Development of the Technical University of Munich and Institute of Human-Machine Interaction of the Ludwig Maximilian University of Munich.

study, as well as implications for the conceptualization of a desired, future practice of user experience.

3.1.1 Research methodology and limitations

The CAR@TUM project addressed various aspects of user experience. This section refers to the understanding and implementation of user experience design inside the company, as it was established by the beginning of CAR@TUM and as it was captured during the course of the project. Suggestions for an ideal future practice are described in chapter 4. The current section describes the research method and its limitations.

3.1.1.1 Research questions

The first study of current practice within the CAR@TUM project addressed the goals of creating a deep understanding regarding the implementation of user experience, as well as eliciting initial requirements for a support. The following research questions reflect those goals:

- How does the current user experience practice take place? Which aspects of the current practice motivate the development of a methodological support for user experience design?
- Which are requirements for a methodological support for user experience design?

3.1.1.2 Data gathering and analysis

To approach the research questions, the study incorporated the methods of participant observation, case study and document analysis. In *participant observation*, the role of the researcher is to both observe and participate in the process (Blessing & Chakrabarti, 2009, pp. 258-260). While participating, the researcher can gain familiarity with the observed phenomena. Therefore, it is possible to collect more in-depth data and interpret them better. For that reason, this method is appropriate for tackling the research questions. Participant observation studies can take place within *case studies* (Blessing & Chakrabarti, 2009, p. 262), since researchers usually would not have the resources to participate actively in all processes. Within the CAR@TUM project, it was possible to participate in ongoing development projects; namely parking assistant, motor start-stop automatic and lateral collision avoidance. Participant observation can be seen as a research strategy, which simultaneously combines several data-collection methods [(Denzin, 1978) cited in (Blessing & Chakrabarti, 2009)]. This was the case in this study: during participant observation, it was possible to collect data and proceed with a *document analysis* (Blessing & Chakrabarti, 2009, p. 269) of project documentation, meeting minutes and observational notes. Project documentation included annual project reports and material for interim presentations. Meeting minutes refer to weekly meetings among the project participants (researchers from five institutes and BMW participants) and quarter meetings in broad circle of participants (professors of the institutes and professor Don Norman as scientific advisors; BMW research, projects connected drive; BMW development, quality management). A limitation of document analysis is that sometimes it is not possible to trace the context in which the documentation was created. The combination with participant observation eliminates this risk.

3.1.1.3 Limitations

The CAR@TUM project took place in collaboration with one specific company, so the insights and results described are company-specific and based on objective opinions of the participants. Study II aims at addressing a wider spectrum of companies and complement in that way the results of study I. However, study I made it possible to gain deep insights, which would have been impossible to win in interviews, surveys, or (short/pure) observations. A limitation of the participant observation method is that the active participation brings the danger that researchers identify themselves with the subjects and lose their researcher perspective, a phenomenon known as “going native”. However, in the CAR@TUM project the researchers’ participation was limited to individual case studies, so that the aforementioned limitation is hardly applicable.

3.1.2 Results

This section summarizes the most important results of study I in reference to the research questions. The analysis of current user experience practice led to the elicitation of initial requirements for a future support.

3.1.2.1 Current user experience practice

While exploring the practice of user experience within the organisation, it was possible to identify differentiated views in different departments [described as “micro and macro experience” in Saucken et al. (2013)], as well as some challenges. The following paragraphs describe the most significant insights concerning the understanding of user experience, its implementation and perceived challenges and opportunities.

In the *research department*, we could identify a clear, need-based understanding (compare to works of Hassenzahl and Kim in section 2.2.1), which proposes focusing on user needs before the product mediating the intended experience. Such an approach enables the radical redesign of product concepts. Nevertheless, it demands related background knowledge and can only be implemented, if the development goal is chosen accordingly and if all stakeholders throughout the process consider it. Indeed, the research department worked with user experience experts [e.g. collaborations with Marc Hassenzahl, compare to (Knobel, 2013)] towards radical need-driven innovations. Applied methods involved the experience story and need questionnaire methods. However, a stated challenge was that the conceptualized story could “get lost during the process”. Moreover, ways to evaluate the experience potential of ideas in such early stages of design were missing.

The understanding of user experience in the *development departments* differed from that. For one, design for user experience was not clearly defined nor seen as a development goal achieved by following a certain process. User experience-related activities seemed more like attempts to improve the anticipated by developers experience in the later stage of embodiment design. Triggers for development projects were mostly market influences, technology innovations or legal regulations rather than users’ needs or motives. We could not track the application of user experience methods, but it can be said that the applied processes and methods were highly formalized. Approaches focused on problem solving (traditional engineering methods) and optimizing usability. Despite the successfully implemented usability methods, user experience

design in development departments seemed to focus on the avoidance of negative experiences and not on positive experiences. The observations indicated (1) challenges in the inter-departmental communication during development and in some cases the late involvement of departments; (2) lack of formal ways to derive and assess user needs; (3) “push innovation” and consequently late integration of user requirements; (4) late prototyping and evaluation. Those challenges were observed in projects related to the design of a parking assistant system, but were assessed as representative for further cases by the project participants.

Moreover, the observed practice implied two *overall challenges*. The first challenge refers to communication and information exchange. Not only seemed ways to communicate experience-related factors necessary, but also the consistent transfer of information across the borders of single departments or disciplines in a way that enforces the continuous consideration of users. That implies the need for global communication artefacts that are anchored in the process and linked to persons responsible for their deployment. The “*Lastenheft*” (customer demands) and “*Pflichtenheft*” (contractor demands) are such artefacts. However, they do not cover the special characteristics of user experience. Other artefacts, like needs, use cases and stories could play that role. However, their use was not formalized at the time of the observations. Needs and stories were used during research, but “got lost” in development, while use cases were applied only late in series development.

The second overall challenge refers to an early holistic view of the product. As current development follows the V-model (VDI, 2007), integration of the developed concepts happens only towards the end of the design process. This could have two negative consequences: it is possible that two concepts/functions evoke contradicting experiences; it is possible that the integration of too many concepts/functions increases the overall product complexity and thus have a negative impact on the overall experience. A system view and integration early on is beneficial especially in the case of a complex product like a car.

Having said that, the company seemed to recognize the *opportunities* of user experience design. They already develop great products, but look for ways to make experiences reproducible results. Possibilities for positive user experiences become increasingly important as they are seen as unique selling propositions; in some cases, they could be more relevant than products themselves. Offering differentiated experiences can distinguish brands and their variants in the global competitive market. At the same time, changes in the focus of automobile design motivate the adopting of new approaches. With the focus broadening from driver and driving experience to passengers and social experiences, user experience approaches seem relevant.

3.1.2.2 Initial requirements for a support for user experience design

Study I showed that methodological support for user experience design was desired in the collaborating company for two reasons. First, because existing processes and methods focus on problem solving and a shift of focus towards experience-related aspects and positive design [compare to (Desmet & Pohlmeier, 2013)] requires a systematic effort. On the other hand, the high level of process and organisational complexity would require the formality provided by methods. Ad-hoc and individual efforts are likely to disappear if they are not anchored in the process. However, to be useful, methods have to fit well to existing processes and ways of working. Furthermore, in this specific case of large company, many actors pursued various user

experience-related objectives. We could summarize the following: (1) *Define the experience potential* of a new or existing product, function or technology; (2) *Develop a new user experience* with a new product, function or interface; (3) *Improve an existing user experience* with an existing product, function, interface, or with an established technology; (4) *Evaluate the experience potential* of an idea or the experience with a prototype or with an existing product. Making these objectives, as well as relevant roles in user experience design explicit would help the company to organise resources and targets better. Summing-up, the derived initial requirements for a support are:

- The support should focus on experience-related aspects instead of problem-solving.
- The support should refer to a structured process and deliver results that are anchored in it.
- The support should be suitable for existing processes.
- The support should include methods with defined inputs, outputs and responsibilities.
- The support should refer to goals and competences of persons that apply it.
- The support should be applicable by persons without expertise in user experience design.

3.1.3 Implications for next research steps

The study of current practice within the CAR@TUM project led to initial results concerning the understanding, implementation and assessment of user experience in the collaborating company. At the same time, it led to a refinement of the research questions. Because of the aforementioned limitations, the validity of the gained results for further companies were addressed within (the broader) study II.

The practice of user experience is “young” and practitioners’ *understanding* might vary. This was our insight in the CAR@TUM project, where a unified view on user experience was evident only in individual departments. Therefore, exploring the understanding of user experience from a design practitioner’s point of view is worthwhile. A broader study (participants from a wide spectrum of companies) would indicate if this insight applies to further companies. Moreover, the first study led to the identification of various objectives and goals related to user experience design (four objectives summarized in the previous section). It would be worthwhile to see if they apply to goals and objectives of other practitioners.

As to *applied approaches*: The methods of use case and storytelling are already practiced in individual departments and are perceived positively. Therefore, they seem promising elements of a new support for user experience design. Nevertheless, their benefits can only be visible if they are formalized and anchored in the company process.

The company seemed to acknowledge *opportunities* arising from user experience design. An early and continuous consideration of users and their needs promises increased product value and the mediation of experiences that could be unique selling propositions. Understanding what motivates further companies to deal with user experience is a relevant aspect to be addressed in the second study. Concerning the *challenges* of implementing user experience design, the lack of background knowledge on user experience and of practical experience with specialized methods applied to many departments of the company. The three major overall challenges were difficulty in communicating experience-related aspects, ill-defined process and responsibilities, as well as a late integration of experience-related aspects into the product. The latter challenge

highlights an important dimension of this thesis: when dealing with the design of products of high complexity, system thinking and methods to support it early on are essential.

3.2 Study II: Survey on current practices in industry

The second study on current practice (ff. survey) was conducted online. 22 practitioners from companies of different sizes and domains shared their opinions on user experience and scenario-based methods. Their responses led to initial conclusions and requirements for a methodological support for user experience design. Furthermore, exploring the link of scenario-based methods to user experience confirmed their usefulness stated in literature, but also pinpointed challenges in their application. The number of participants of the survey does not allow a generalization of findings without further investigation. However, because of the broad (in terms of background) participants pool, strong indicators about global issues could be drawn. One such finding was the identified need for methodological support of user experience design and the appropriateness of scenario-based methods for this scope. Results of the survey have been published (Michailidou & Lindemann, 2016a) and will not be cited explicitly in this chapter.

3.2.1 Research methodology and limitations

To specify the scope of this study, research questions were formulated and broken down into concrete questions for practitioners. The questions root in literature findings (chapter 2) and findings of Study I (3.1). They refer to explicit wording, definitions and issues. Therefore, the survey was implemented via a questionnaire (Appendix A3) with an introductory (participants' demographics) and two main parts (on user experience and on scenario-based methods). The format of an online survey enabled access to a large pool of participants. The target group were practitioners with experience in the practice of user experience and/or scenario-based methods and were acquired from the networks of the Institutes of Product development (Technical University of Munich) and User-centred design (University of Twente). To overcome the risk of misinterpreting questions or not being able to express a representative answer as participant of an online survey, the survey was complemented with interviews, which took place (1) parallel to the online survey to clarify if questions were perceived as intended; (2) after analysing the responses, to explore in depth some issues worth further discussion.

3.2.1.1 Research questions

The overall issues explored in the survey concern the topics of user experience and scenario-based methods from three perspectives: understanding, implementation and assessment (Table 4). The exploring of those issues addresses the following research questions: *Does the understanding of user experience and scenario-based methods differ in literature and practice? What are current practices to implement user experience design? What do practitioners assess as opportunities and barriers of user experience design? Where do practitioners see benefits and challenges in the practice of scenario-based methods?*

Table 4 : Main issues explored in the survey study

	User experience	Scenario-based methods
Understanding	keywords, characteristics, high-level goals	characteristics, classification of methods
Implementation	procedure, approaches, targets, actors	procedure, targets, actors
Assessment	opportunities, challenges, willingness for future activities	opportunities, benefits, challenges

3.2.1.2 Data gathering and analysis

Participants of the survey were employees of German and Dutch companies of different sizes and domains. They intendedly covered a broad spectrum from companies with big company culture to companies with small company culture and companies with formal and informal structures. Regarding the domains, participating companies deal with the design of consumer products, working tools and interfaces. Only complete responses from participants with experience in user experience design were considered (Table 5). Data were analysed as whole and region-specific. However, a region-specific comparison would not be justified due to the limited amount of responses.

Table 5 : Participants of the survey

	Germany	Netherlands
Number of responses on user experience	15	7
Number of responses on scenario-based design	6	4
Number of different companies	13	6

Some of the questions requested the rating of relevance of predefined statements. The answers to such questions were rated with weighted scores. Responses signified as “relevant” received 9, 6, 3, 2, or 1 points, while responses signified as “irrelevant” received -1 point.

3.2.1.3 Limitations

The survey explores opinions of specific individuals and compares it with academic work. The main limitation of the survey is that the sample is not sufficient to influence design theory. Findings are implications rather than generalizable results, reflecting opinions of a limited number of persons with various backgrounds, so they should be concerned under this limitation. Despite the small sample size, some general conclusions could be drawn, because of the broad spectrum of participants. For example, because all 22 participants with different backgrounds mentioned “communication of soft aspects of interactions” as a challenge in user experience design, we have a clear indicator that this issue is relevant.

3.2.2 Results

The following sections summarize results of the survey. Interesting insights from analysing and reflecting on the responses as whole are further discussed in 3.2.3. The questionnaire can be found in the Appendix A3.

3.2.2.1 Understanding of user experience

The literature review exhibited a diversity of frameworks explaining the phenomenon of user experience. A lack of a common ground on user experience was also obvious in practice. Interestingly enough, this was even applicable when we investigated the understanding within a company. While most participants associated the notion of user experience with common keywords and many participants agreed on its features, a poor distinction of user experience goals contrasting usability was detected.

Keywords related to and characteristics of user experience

Keywords and characteristics were chosen from works reviewed in 2.2.1 to distinguish which are most characteristic for the user experience concept. *Momentary usage* and *anticipation* were most frequently selected. This aligns with the literature on temporal aspects of user experience. Additionally, *functionality*, *interactivity* and *active product usage* were greatly connected to user experience, implying that practitioners mainly look at product characteristics shaping interactions when designing for user experience. A general agreement amongst practitioners and literature was revealed in reference to characteristics of user experience (*subjective, context-related, worthwhile, dynamic and temporal*).

Goals and targets of user experience design

We distinguished high-level goals of user experience design from concrete targets of user experience projects. Inquiring about high-level goals, we planned to comprehend what stimulates practitioners to deal with user experience (Table 6). Feedback mirrored an uncertain distinction of goals related to user experience from usability goals. The items “*designing most effective, efficient and satisfactory product use*” and “*avoiding frustrations*” (which we considered goals related to usability) were highly rated, whereas “*fulfilling psychological needs and motives through product use*” (a primer goal of user experience design) was selected by 60% of the participants. An additional understanding is that *innovation* and *introduction of new functionalities* were highly rated, demonstrating that these goals are linked to user experience.

The question about goals (Table 7) depicted practitioners’ expectations from user experience projects. The CAR@TUM project (3.1) portrayed that user experience projects could have several goals. Due to the fact that at least three participants selected each of the named goals, it is clear that the survey confirmed that. User experience projects exhibit a correlation to existing products and their analysis, assessment or development. Improvements mostly refer to user interfaces.

Table 6 : High-level goals of user experience selected by more than the half of the participants

High level goals of user experience projects of your business area involve ...	Number of responses
Designing most effective, efficient and satisfactory product use	18
Creating innovations for the company	16
Fascinating customers	14
Avoiding negative experiences and frustrations	14
Developing new, add-on functionalities	13
Fulfilling psychological needs and motives through product usage	13
Including end-users in design	11
Achieve differentiation from competitors	11
...	
Other: create higher customer value through better usability	1

Table 7 : Targets of user experience design selected by most participants

Which targets have been addressed by previous user experience projects?	Number of responses
evaluating the experience with a function/product/technology	12
developing a comprehensive display- and operating concept	12
revising existing functions according to customer feedback	10
analysing the experience with an existing function/product/technology	9
define potential experience of new or existing products	9
creating market-/country- specific variants of functions	8
assessing the potential of new technologies from other fields	7
adapt and adopt features / products of competitors	6
defining value of existing features developed according to regulations	6
quantifying the success of a product	6
integrating existing display-and operating concepts in an new display	6
creating user manuals	4
comparing experience with various products	4
following a management request	4
creating a marketing concept	3

3.2.2.2 Implementation of user experience

The second block of questions focused on current practices. Mostly company-specific and informal practices were reflected through the responses. The “key players” of user experience design were identified, however the question about responsibility revealed significant divergence. Finally, participants generally agreed that they search for opportunities of user participation, usability in process application and helpfulness of results, when questioned about their requirements for a support.

User experience approaches

How does the application of user experience approaches take place? Most participants referred to company-internal processes, while only two participants mentioned consultancy. In most cases, the procedure is not standardized and in only three cases in accordance to a literature-based approach. Current approaches to shape user experience appear to be mostly product/technology-related, with “*increasing functionality*” or introducing “*interactive behaviour*”, “*technical innovations*”, and “*unique product characteristics*” being frequently named. The *need fulfilment* and *storytelling* approaches are also relevant.

Table 8 : User experience design approaches and number of responses

Which of the following approaches to shape user experience are you familiar with in your practice?	
increasing product functionality	17
increasing interactive product behaviour	14
fulfilment of needs through product use	14
introducing technical innovations	13
telling a story through a product	8
emotional design	7
introduction of unique product characteristics	7
introduction of surprise effects in the product behaviour	3

Stakeholders in user experience design

Working multi-disciplinary is suggested by literature on user experience. In study I, various actors were identified. The fact that typical actors do have various backgrounds was established by the survey (Table 9): *developer/engineer, designer, project controller, evaluation expert, manager, market and communication expert*. The fact that *end-users* are considered active actors is also an exciting addition. Moreover, the involvement of the project controller and high-level management is also witnessed. On the other hand, the responsible person for user experience projects was rarely agreed upon by participants. “*A company-internal expert*”, “*individuals from various departments within the company*” and “*cross-departmental, company-internal division*” were brought up equally often. In two cases, “*the whole company*” was mentioned. “*Project manager*” was mentioned once. All answers refer to a company internal entity, with only one exception.

Table 9 : Actors (left) and responsibility (right) of user experience design and number of responses

Typical actors of a user experience project		Responsibility for user experience design projects	
developer/engineer	17	company-internal expert	5
designer	15	project organisation with individuals from various departments within the company	5
project controller	14	specialized, cross-departmental division within company	5
user	12	other: entire company	2
evaluation expert	6	company external expert(s)/ consultant(s)	1
market and communication expert	6	other: different units due to company size	1
manager	5	other: product manager	1
technology scout	4		

Requirements for support

It is crucial to know what prospective users of the support find important, when developing a methodological support. A preliminary set of requirements was composed (3.1), in which

survey participants ranked according to relevance (Table 10). The most relevant requirement was found to be “*Good understandability of method*”. It is obvious that top-requirements relate to *user participation*, *usability of method*, *usefulness of results*, as well as *applicability from multiple actors*. The requirement for *fittingness to existing practices* (or similar) was added by three of the participants. This requirement did not receive a high relevance score as it was not predefined and visible to all participants. Nonetheless, it was considered an imperative requirement in study I (elaborated in the “implications” section).

Table 10 : Requirements for a methodological support of user experience, in descending order of relevance

good understandability of method
possibility of user participation
adequate communication of the results
concrete results
applicability of methods in multidisciplinary teams
great flexibility in the use of methods
comprehensible documentation of results
minor learning curve
re-use of results
complete documentation of results
low costs
minor need for special equipment /facilities
other: proper fit in the development process

3.2.2.3 Assessment of user experience

The assessment of user experience design was explored in the third question block. Because organisational efforts and costs are required for the application of user-centred methods, it is important to identify opportunities that contribute to applying such approaches. The amplified understanding of users and its constructive impact on the quality and success of the product is seemingly related to top-opportunities. Additionally, practitioners’ opinion on challenges of current practices was also inquired. The latter seem to differ from challenges rooting in the nature of user experience to challenges linked to the structure or even culture of businesses. Finally, a great willingness to expand user experience activities in the future was detected.

Opportunities and challenges of user experience

When asked about opportunities for a company through the application of user experience design approaches (Table 11), the *deeper understanding of users and context* was highlighted by a vast majority of participants. The *continuous consideration* and *greater involvement of users* were also brought up. An additional highly ranked group of opportunities relate to the positive impact of user experience design on the perceived and actual product value (“*increased product value*”, “*higher acceptance of products*”). A distinct advantage, which received a relatively high rating, is the *inclusion of emotional aspects in design*. Finally, some positive “side-effects” on procedural level were considered as opportunities by practitioners: *creativity*, *focusing*, as well as *interdepartmental and interdisciplinary collaboration* can profit from user experience approaches. Despite that, many of the participants’ expectations were not met when they were involved in user experience projects (72%). Which were the barriers holding back

from larger success? According to practitioners, challenges of user experience design could have various origins (Table 11). Many top-challenges relate to the *lack of experience* and suitable *methodological guidance*, but also to *corporate culture and mind-set*. Many known barriers to user-centred design are confirmed by the recorded challenges (Buskermolen, 2013, pp. 31-32). This concerns organisational hurdles, like opposition to change organisational structures, lack of resources and management disinterest. Additionally, the existence of complications in facilitating and organising sessions with users, particularly due to of lack of methods and/or expertise, was confirmed.

Table 11 : Opportunities (left) and challenges (right) of user experience in descending order

Opportunities of user experience	Challenges of user experience (UX)
deeper understanding of users	lack of experience with UX approaches
increased product value	lack of support of UX projects by management
continuous consideration of users	difficulty in communicating soft aspects of interaction
better understanding of use context	ill-defined roles and responsibilities in UX
experience as "unique selling proposition"	resistance against new approaches
higher acceptance of products or new technologies	late integration of UX-related aspects into the product
inclusion of emotional aspects	high product complexity
higher user involvement	lack of methodological guidance
enhancing creativity	limited resources for UX projects
better focus in selection of alternatives	insufficient cost-benefit ratio
better interdepartmental collaboration	high organisational complexity
better interdisciplinary collaboration	no anchoring of emotional targets in the process

Willingness for future activities

Finally, the participants were asked whether they are willing to extend the user experience-related activities and if so, would the new methods be applied. The increase of user experience activities were seen positively by a vast majority of participants (78%). Merely two of the total practitioners asked were not willing to try out new methods.

3.2.2.4 Understanding of scenario-based methods

Beginning with practitioners' understanding, scenario based methods were examined in the second part of the survey. The motivation in the survey is twofold, for including questions on scenario-based methods. Literature proposes scenario-based methods for analysis, conceptualization and co-creation steps of user experience design (2.3). Nevertheless, in the mechanical engineering context, their benefits compared to traditional, quantitative engineering methods seem to be not so often acknowledged. Their use can be amplified by pointing out benefits of scenario-based methods, while desired improvements could be indicated by pointing out relevant challenges.

An agreement between participants and literature is depicted among findings on understanding. Scenarios are understood as descriptions of real or (proto-) typical interactions and situations "as-is" or "to-be" [similar to (Bødker, 2000)]. Potential scenario contents are portrayed in Table

12 [similar to (Anggreeni, 2010; Bødker 2000)]. A remarkable insight is that scenarios do not classically portray emotional context. Furthermore, agreeing with the definition introduced in the preceding chapter, participants would allocate the following methods as related to scenario-based design: use case, scenario, storyboarding, storytelling and persona.

Table 12 : Possible contents of a scenario

Scenarios involve information about...	Number of responses
interaction between actor and product	10
motivation and goals of actors	9
events	8
properties of products	8
properties of actors (e.g. mental, physical)	7
physical context	7
time / sequence of the events	7
functionalities of products	7
emotional context	5

3.2.2.5 Implementation of scenario-based methods

It was stated by participants that 1/3 of all projects they participated in used scenario-based methods. In a parallel survey (Batzner, 2015), we distinguished that 40 from 150 design specialists were directly involved in user experience projects. *32 of the 40 user experience practitioners (80%) apply scenario-based methods in their practice.* Both the project types of *original design* and *adaptive design* were regarded relevant for scenario-based methods. Additionally, it was established that scenario-based methods are supportive in *co-creation projects*. Likewise, all development stages were considered significant for application of scenario-based methods. In descending order, the participants assessed: *prototyping*, *idea generation (conceptualization)*, *problem definition*, *need derivation*, *developing solutions*, *testing*, and *implementation*. This comes into alignment with the opinion of Nardi (1992) on the life cycle of scenarios: they are most important in the initial designing and less valuable, though still useful in later stages. The answers to both inquiries align with literature which suggests the application of scenario-based methods for various project types (including new developments and participatory design) and throughout the design process (Anggreeni, 2010; Fulton Suri & Marsh, 2000). The application of scenario-based methods is moderated in almost all cases by a *company-internal expert*. The application itself is in most cases based on a *company-internal* and *informal* procedure. Thus, confirming that the use of scenario-based methods is mostly ad-hoc (Anggreeni, 2010).

3.2.2.6 Assessment of scenario-based methods

What makes scenario-based methods useful? The importance of scenario-based methods are focused upon in much theoretical work. Our survey indicated that the theoretical view on scenario-based methods is in agreement with practitioners' insight. Top-advantages relate to *better results* (more *concrete*, *comprehensible*, and *complete*), *better understanding* of the method, *greater flexibility* and *lower costs* of scenario-based methods (Table 13). The similar

overall agreement applies to prospects for a corporation via application of scenario-based methods. Nonetheless, the ranking depicted in Table 13 is very interesting. Top-opportunities also relate to positive effects on the design process (e.g. “better interdepartmental communication”) and not only to amplified understanding and empathy as consequences of applying scenario-based methods.

Despite the positive assessment of scenario-based methods, or exactly because of it, all participants responded positively when inquired if they would implement new methods for a more effective usage of scenario-based methods. The inclination to apply new methodologies could be due to current challenges that practitioners experience in their existing practice. Few noted that they feel *uncertain* and *miss a methodological support*, in which inputs and outputs of scenario-based methods, responsibilities and form of results would be clear. More related to the corporate structure and culture seem to be the fact that *resistance* or even *lack of acceptance* of results of scenario-based methods from employees may exist. Another challenge is to have an “*overview of how established techniques of the company can be linked with scenario-based methods*”. Yet, the topic of *high product complexity* received a low score whereas the matters of *high organisational complexity* and *insufficient cost-benefit ratio* were explicitly rated as unrelated in the context of scenario-based methods. This might suggest that scenario-based methods seem to be applicable in spite of increasing complexity and restricted resources.

Table 13 : Opportunities (left) and challenges (right) through application of scenario-based methods

Opportunities of scenario-based methods	Challenges of scenario-based methods
better understanding of context of usage	lack of experience with scenario-based methods
better understanding of users	practitioners' uncertainty
increased empathy (different perspectives)	lack of methodological support
better interdepartmental communication	ill-defined inputs and outputs of the methods
improved communication	resistance against new approaches by employees
higher user involvement	no overview of how established techniques of a company can be linked with scenario-based methods
integration of ideas in physical and emotional context	poorly defined tasks and responsibilities/roles in the application
better understanding of the product	ill-defined levels of detail and media to display results
greater acceptance of products and market success	no acceptance of the results by employees
better representation of "soft" aspects	high product complexity
early/agile testing	existing methods / guidelines have no relevance to company-specific needs
better interdisciplinary collaboration	other: integration with technical requirements sometimes unclear

3.2.3 Implications for next research steps

Three high-level issues become noticeable when reflecting on the survey results. Firstly, most businesses treat user experience design in a company-specific and/or informal way. Second, responsibilities in user experience practice are ill-defined. Finally, some challenges of user

experience design are associated to corporate culture, while some to the lack of a methodological support. This thesis argues the suitability of scenario-based methods therefore.

Company-internal and unstructured processes

The practice of user experience and scenario-based methods seemed to be a “company-internal matter”. Subsequently, it is impervious to external observers. In most cases the processes are informal. Comparing, understanding and improving informal processes is challenging. The first step is to acknowledge this fact, while additional empirical work would be prised. Interviews with four of the survey participants were conducted, to achieve further insights on how the corporate-internal processes look like (if they do not follow a standardized process), which resulted in the following preliminary insights.

Benchmarking as source for user experience approaches: Participants were well educated about “hypes” in design (e.g. via taking part in seminars or merely via internet search) and specifically attracted by the approaches that competitors use. In some cases, elements of approaches or approaches modified to own practices are taken into consideration.

Existing knowledge and practices: The previous experiences and background of participants seem imperative for the choice of methods and the actual practice of user experience. Moreover, incorporation into current processes is vital. All interviews confirmed this.

Isolated, systematic and generalized attempts: Three levels of implementation of user experience design became obvious in discussions with practitioners. The first level involves companies with individual divisions or employees that conduct activities related to user experience, but the latter are not synchronized. The second level describes a company working according to a formal experience design process. The third level suggests that user experience design is part of the mind-set of employees and therefore the whole design practice embraces its principles, without explicitly stating it. Those three levels resemble the pyramid model of Sanders that describes the implementation of empathic design [cited in (Postma et al., 2012)].

Responsibilities in user experience design

The question about responsibilities in user experience design (Table 9) led to the most discrepant responses. Responses varied from a specialized person (“*company internal expert*”, “*project manager*”, “*external consultant*”) or group (“*specialized division of the company*”, “*individuals from various departments of the company*”) to a complete generalization (“*entire company*”). Assuming that big differences are legitimate, because of the variety of the participating companies is possible. However, “*ill-defined responsibilities*” was an explicitly named challenge of user experience design (Table 11). The interviews also confirmed that in different companies (regardless size and domain) it was vague who is responsible for user experience projects. Consequently, further research in this topic is relevant (compare to 4.3.1).

Issues linked to company culture and mind-set

When analysing the challenges of practicing user experience (Table 11) and scenario-based methods (Table 13), issues that are rather rooted in the company culture were evident. In cases of “*limited resources*”, “*underestimation of the importance of user experience*” and “*lack of support by management*”, we have examples of company strategies that do not support user experience design. When implementing user experience or scenario-based methods, it might be

possible to face “*resistance against new approaches/changes by employees*” or “*no acceptance of the results by employees*”. Postma et al. (2012) identified similar challenges in the implementation of empathic design. Moreover, the nature of user experience (“*difficulty in communicating soft aspects of interaction*” and “*poor measurability and controllability of user experience*”) poses further issues. Finally, in cases of “*high organisational complexity*” and “*high product complexity*” it is possible that the introduction of any process change is more challenging. However, it is exactly in those cases, where a systematic and formal approach is necessary. Finally, most issues could be addressed by methodological guidance.

Need for methodological support

Should user experience design be a general mind-set, a flexible process element or standardized process? The nature of experience makes it difficult to craft a standard. On the contrary, because the field of user experience is still fresh, a generalized, non-guided application would not likely be successful. A methodological support could be the golden mean. In the survey, “*lack of experience with user experience design approaches*” was the most significant obstacle in user experience design, whilst all participants explicitly specified “*lack of methodological guidance*” as a challenge (Table 11). Furthermore, additional procedural challenges were cited: “*difficulty in communicating soft aspects of interaction*”, “*late integration of experience-related aspects into the product*”, “*ill-defined roles and responsibilities in user experience design*”, “*no anchoring of emotional targets in the development process*”. A methodology could help in surpassing those hurdles. Such a support is defined in Chapter 4.

Scenario-based methods for user experience design

Chapter 2 exhibited why scenario-based methods can be beneficial for user experience design. Results that contribute to endorsing the hypothesis that scenario-based methods are a suitable foundation for a user experience methodology are also contained in the survey. Observing the necessities on a methodological support and the benefits of scenario-based methods, many links are obvious (Figure 3-1). Practitioners request a method easy comprehensible. Scenario-based methods have the benefit of being easier comprehensible compared to other methods. The involvement of end users and multidisciplinary teams in design is possible. Scenario-based methods are often used in co-creation projects [as described in the section on implementation of scenario-based methods and (Buskermolen & Terken, 2012)] and are suitable for practitioners with various backgrounds. The requirements related to results of method application match well to the benefits of results of scenario-based methods. Moreover, a long learning curve would not be required as the application of scenario-based methods is flexible. Nevertheless, scenario-based methods are not consistently applied in user experience design. Scenarios do not necessarily/normally comprise of emotional aspects (Table 12). Chapter 4 emphasises on adapting scenario-based methods for a more focused application in user experience design. The survey displayed that despite its advantages, the application of scenario-based methods could include obstacles for practitioners (Table 13). The approach defined in Chapter 4 targets to reduce practitioners’ ambiguity by defining inputs, outputs and format of results.

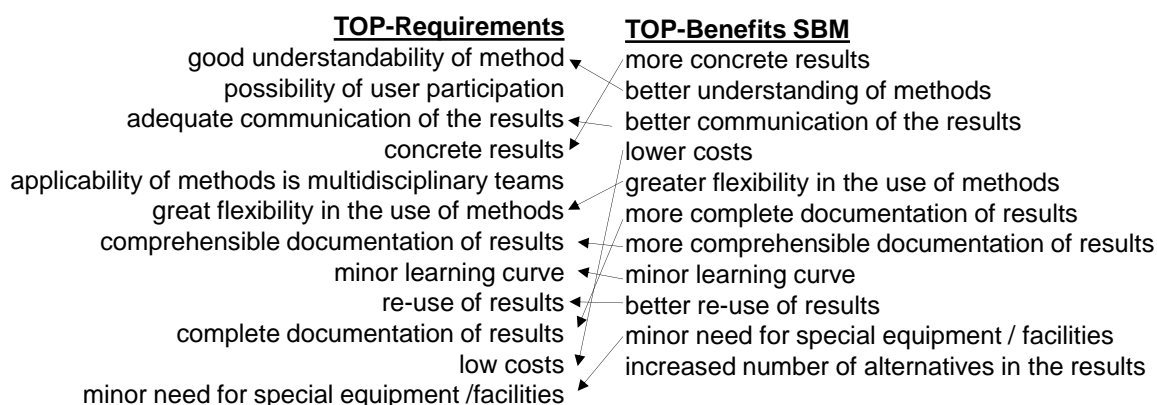


Figure 3-1: Requirements for a support opposed to benefits of scenario-based methods (SBM)

3.3 Conclusions on current practice of user experience

Theoretical and empirical research should be complementary; this applies also in the case of studying user experience. In an attempt to understand better the actual practice of user experience and scenario-based methods, two studies were conducted: an in-depth study (participating observations) within one company and a broad study (online survey) with participants from various companies. Although the limitations of the studies (particularly the limited number of participants) do not allow a generalization of results without further investigation, they provide interesting insights on how practitioners with different backgrounds (educational, professional, and corporate) understand, implement and assess user experience.

Similarly as in the scientific world, the practice that we explored seemed to lack a unified definition of user experience. This refers mostly to the opposition of user experience to usability. *Therefore, this thesis and the developed support stress the unique characteristics of user experience.* Furthermore, the studies on the actual implementation of user experience reflected a tendency to informal and company-specific approaches. Actors of user experience do have various backgrounds, while end users were considered active participants of design. *This thesis proposes a structured methodology making use of the diverse competences of the members of a user experience team and supports participation of end users.* In the described studies, the responsibilities in user experience practice were found to be unclear. *The roles in user experience design and the issue of management are studied further in the following chapter.* Both studies showed that practitioners see many opportunities in user experience design and seemed willing to try out new approaches. Methodological guidance seemed desired, since it would help in overcoming many of the stated challenges of user experience design. Some of challenges could be related to the company culture and mind-set towards user experience. This thesis proposes ways to influence that through management (4.3.1). A new support should not only address current challenges, but also meet practitioners' requirements. *The support proposed in this thesis builds on such requirements (3.4).*

The presented studies also explored the application of scenario-based methods, which are popular in practice and according to literature useful in user experience design. Both studies

implied a good understanding of scenario-based methods and many perceived benefits. Scenario-based methods were assessed as useful for understanding users and the context of interaction. Another benefit worth mentioning is the possibility of including end-users in design (even in early phases), when working with scenario-based methods. Finally, practitioners mentioned practical benefits of scenario-based methods. Those insights confirmed the benefits stated in literature (2.3). However, scenario-based methods can fail, when their application is not structured and anchored in existing processes. Furthermore, scenario-based methods do not typically focus on experience. *Therefore, scenario-based methods are used as basis for the new methodology, but in a structured and focused on experience-related aspects way.*

The results presented in this chapter could sensitize researchers on the importance of practitioners' needs and motivate them for the addressed topics. On the other hand, the studies could encourage readers with practical involvement in user experience design to reflect their own understanding and practices compared to that of other practitioners and theory. For instance, recognize common challenges, yet unexplored opportunities of user experience design, or new training areas for their company. That would be particularly interesting for companies that want to build expertise in user experience design. This applies to great extent to companies focusing primarily on problem-solving, technical approaches.

3.4 Requirements for future practice of experience design

Without underestimating the designers' need for flexibility in the application of methods and development of own strategies, structured guidance in the practice of user experience and the application of scenario-based methods can be beneficial. The findings described in previous sections indicate that such a support is desired. A methodology reduces practitioners' uncertainty, emphasizes the links among inputs and outputs of partial methods and thus enables their more sustainable and effective use. Results of individual activities contribute to an overall objective, while activities and collaboration are organised better. Moreover, in a structured process, responsibilities are clearly defined, results more visible and can be better evaluated.

Literature findings as well as the studies on current practices in this thesis indicate that a support for user experience design should embrace the special characteristics of experience as phenomenon. The support should enhance *system thinking* during design even in the early phases. This is essential, not only because the nature of experiences is holistic, but also because in the design of complex, tangible products, integration of individual features has a great impact on the final experience. Existing user experience approaches do not cover this aspect adequately. Furthermore, the support should bring experience-related aspects of interaction and particularly positive emotions into the centre of development. Therefore, we argue for a *possibility driven* [compare to (Desmet & Pohlmeier, 2013)] instead of problem-driven approach. Common problem-driven approaches aim to reduce or solve negative circumstances, behaviour, or features (Desmet & Pohlmeier, 2013). In contrast, a possibility-oriented approach focuses on supporting existing possibilities and creating new ones, rather than reducing or eliminating deficiencies. Another aspect concerned in this thesis is that a successful support addresses the situation and needs of its users, the design practitioners. To develop a *practitioner-centred* support [compare to (Saucken, 2015)], such requirements were elicited (Table 14). Furthermore, the analysis of characteristics and challenges of user experience

design opposed to benefits of *scenario-based* methods showed great possibilities. Therefore, scenario-based methods are the fundament of the new methodology. Finally, the term “methodology” implies a *structured* approach, which guides practitioners at an operational level. It was evident from the study that a clear definition of inputs, outputs, actors and process steps could be a catalyst for the successful adaptation of a new approach. To sum-up, characteristics of the new approach are *scenario-based, holistic, possibility-driven, practitioner-centred* and *structured*. The derived requirements concern *ease of use and learn, suitability* and *usefulness* of methods, as well as practitioners’ *satisfaction* with them. The requirements build the fundament for developing (chapter 4) and assessing (chapter 5) the proposed method in the next chapters.

Table 14: Requirements for a methodological support of user experience design

Category	Requirement	Criterion	
Ease of use & ease of learn	Understandability of method	The method description includes sufficient and understandable explanations	
	Prescriptive method description	The method provides operative guidance	
	Comprehensible documentation of results	The method prescribes ways for an intuitive documentation of results	
	Minor learning curve	After applying the method I know how the method works	
	No prior knowledge	It is possible to apply the method even without domain-specific prior knowledge	
Suitability	Proper fit in the development process	The method fits well in existing development processes	
	Possibility of user participation	The method provides ways for an active participation of users	
	Adequate communication of the results	The method provides results, which are easy to communicate	
	Applicability of methods in multidisciplinary teams	The method provides ways for application in multidisciplinary teams	
	Great flexibility in the use of methods	The method is scalable and provides flexibility in the application	
	Traceability of results	The method provides results, which are easy to argument	
	Low costs	The application of the method requires minor costs	
	Minor need for special equipment /facilities	The application of the method does not require special equipment/facilities	
Satisfaction	Recommendation	I would recommend the method to a colleague	
	Engagement in application	The method is engaging, not boring to use	
	Overall satisfaction	Overall I am satisfied with the way the method works	
	Effort-benefit ratio	The effort to apply the method is worth the benefits	
	Goal achievement	This method helped me to achieve my goal better than other methods I know	
Usefulness of results & impact of method	Concrete results	The method provides concrete results	
	Complete documentation of results	The method prescribes ways for a complete documentation of results	
	Reusability of results	I can apply the results of the method in subsequent design phases	
	Impact on understanding		The method results in increased understanding of users and their needs/emotions
			The method results in increased understanding of context of usage
	Impact on creativity	The method helps me to be creative	
	Impact on communication	The method supports my communication with other team members	

4. Proposal for future practice of user experience design

The previous chapters highlighted the importance of a methodological support for user experience design, particularly for communicating and generating experiences in early design phases. Furthermore, practitioners' needs and requirements for such a support have been captured. This chapter describes as starting point a prototypical process for user experience design with related objectives, participating actors and individual phases resulting in milestones. This process serves as frame for the application of a new methodology for user experience design. The methodology bases on a *scenario-based, holistic, possibility-driven, practitioner-centred* and *structured* approach. It aims at supporting developers of complex, tangible products without prior expertise in user experience design in the analysis and early concept phases of design. The methodology consists of individual methods, whose outcomes build on each other and can be further developed in subsequent design phases. The methods to *create user profiles, extract real users' motives, integrate experiences, create a user experience story* and *evaluate the user experience story* are described in this section. An overall conclusion concerning the described ideal future practice is that user experience design can be a reproducible result. Three features make the proposed approach unique. First, it is a formal approach based on storytelling, tailored for user experience design: the methods are described in a way that provides practical, operative guidance for collecting necessary (user experience-related) data and apply the methods. Individual results of methods built on each other. Second, by introducing the role of the storykeeper, it stresses the issue of responsibilities in user experience design. Finally, it is a holistic approach, which forces system thinking. The next chapter (5) will discuss lessons learned from application of the methods in three cases, as well as insights about the observed value of the methods (opposed to the expected/theoretical value described in the current chapter).

4.1 User experience design process

User experience processes should be user-centred, multidisciplinary and iterative. Moreover, an ideal process would embrace the special characteristics of user experience as phenomenon, like its holistic nature. The development of complex, tangible products calls for a high level of formalization and systematic integration of individual components. A review of existing processes under those considerations and the practitioner-driven requirements (3.4) showed that no existing process model addresses all those aspects adequately. Traditional engineering models, like the V-model (VDI, 2007) and the stage-gate model (R. Cooper, 1990) offer the essential structure, but do not emphasize on an early and extensive consideration of the holistic experience. Their focus lies on products and technologies rather than on interactions and experiences. Furthermore, they do not prescribe an involvement of end users. The design-thinking process (Brown, 2009), user-centred design process (ISO 9241-210:2010), the double diamond model (Council, 2005) and the framework of experience-based design (Cain, 1998) focus on the exploration of user needs and prescribe iterations. However, they do not describe the crucial step of integration, so their applicability for complex tangible products could be

limited. A result of the CAR@TUM project (Bengler et al., 2014) was a process model⁵ that overcomes the aforementioned limitations by adopting characteristics of both engineering and user-centred design approaches. This publication will not be cited separately in this chapter. Although the process model was initially developed in collaboration with an automobile manufacturer, further applications in the context of this thesis confirmed that this generic process model could be applied to other domains and its elements have been elaborated.

The process model describes the experience design process in a formal way. According to the general model theory (Stachowiak, 1973, pp. 128-133), models are representations of natural or artificial originals. In general, models do not capture all attributes of an original, but rather the relevant aspects for their creators (their purpose) and/or users. Therefore, models cannot per se be assigned to originals. They fulfil their replacement function for particular subjects, in particular time intervals and in particular operations. The scope of creating a model of user experience processes was to create a representation of crucial aspects of user experience design. The process is modelled in six generic *phases*; in each phase, activities, i.e. *steps*, take place iteratively until reaching a *milestone*, while *methods* and tools support the delegation of those activities. *Actors* in the experience design process are persons with different roles, i.e. competences, responsibilities and *goals*. Users of this model will be able to map their current practice and plan new activities according to their roles and objectives. The following sections give an overview of all process elements and finally set a frame of the aspects considered in this thesis. This provides a structured frame for the application of the scenario-based methodology. The description of the methodology (4.2) will refer to phases, steps, objectives and actors of the process model.

4.1.1 Goals

Previous parts of the thesis made clear that the practice of user experience could be motivated by various objectives and goals. As described in the (company-specific and cross-company) studies in chapter 3, it can be differentiated between overall objectives and specific goals. Objectives describe the motivation for dealing with user experience design (examples in 2.2.1 and 3.2.2). Goals are more directly linked to operations. The user experience design process addresses four goals: define, improve, develop and evaluate user experience. A practitioner using the proposed process model would focus on phases and steps that address his/her goals.

4.1.1.1 Define user experience

The goal to *define* (used synonymous to: represent, communicate) *user experience* underlies in every activity of user experience practice, which involves the communication between at least two persons. Defining an experience is about representing the real user benefit of a product and communicating it in a simple, precise and efficient way. Not only is defining a user experience

⁵ Available online: www.designingexperiences.org

relevant for the internal design-related communication and decision-making, but it is also crucial for the representation of a product towards users (e.g. marketing and operation manuals).

4.1.1.2 Improve user experience

The goal to *improve user experience* refers to adaptive design (Pahl et al., 2007, p. 64). In this case, adaptations of an existing product, function, interface, or an established technology are concerned, in order to achieve an improvement in the resulting user experience. Such improvements require a definition of the intended user experience (compare to previous goal), as well as the adaptation/redesign of the means to mediate the experience, e.g. by adding new elements or improving interfaces.

4.1.1.3 Develop user experience

The goal to *develop a new user experience* refers to new product development process. In this case, an original design (Pahl et al., 2007, p. 64), i.e. a new product, function or interface, is developed to mediate a new experience. For doing that, it is necessary to envision a new experience and create new means to mediate it.

4.1.1.4 Evaluate user experience

The goal to *evaluate a user experience* is relevant in all stages of the design process. According to the available artefacts, it may refer to the experience potential of an idea or the actual experience of interacting with a prototype or product. Evaluating user experience is about quantifying users' reactions, comparing experiences with different artefacts, as well as verifying whether the envisioned experience is mediated through a product.

4.1.2 Actors

The practice of user experience requires the participation of various actors. The literature review and the studies of current practices confirmed that multiple perspectives are necessary when dealing with user experience. However, the way in which those multiple perspectives are available in a company may differ in individual cases. The proposed process considers this aspect and describes important actors in a generic way as roles, rather than persons incorporating them. A role describes "what the holder of it will do in the process, what responsibilities he/she has, what skills and expertise are required, what the other project members can expect from him/her. The description is independent from the individual role holder" (Gulliksen et al., 2006). It is possible that one actor may take multiple roles, or that one role may require multiple actors to fulfil. For example, a product developer with a background in engineering, may find himself taking the role of a user expert when capturing users' requirements, the role of an experience designer when generating concepts to mediate a new experience, as well as the role of a developer when prototyping the concepts. In any case, the perspectives of human factors, design, development/engineering, user research, management and end users are represented in an ideal user experience design process.

4.1.2.1 Human factors expert

The *human factors expert* is responsible for analysing, measuring and evaluating experiences from early analysis over to the actual usage of a product. His/her tasks are to understand elements of experience and uncover “white spots” from a user’s point of view. Moreover, to identify the right target group and apply methods to evaluate user experience. A human factors expert may even develop new methods or tools to analyse and measure user experience. Required skills for a human factors expert are expertise in evaluation methods and usability, as well as analytical skills.

4.1.2.2 Experience designer

The *experience designer* brings creative skills to create a story describing the new experience and generate concept ideas about the mediation of the experience. It is the experience designer’s responsibility to understand the emotional values of an experience, translate experiences into concepts, think laterally and choose comprehensive approaches to communicate and implement concepts. Required skills are empathy, abductive thinking, visual thinking, visualisation skills, a good feeling for aesthetics and storytelling skills. It can be said that the experience designer brings in a “design thinker” mind-set.

4.1.2.3 Developer

The *developer* has knowledge about new technologies, manages requirements and implements concepts that translate the user experience story into a product. A developer’s responsibility is to elicit, capture and embody requirements: first to translate a story into technical specifications and specifications into hardware. Moreover, he/she is responsible for designing and realising the technical implementation of a product, as well as the integration of individual components into one complex product. The developer’s role includes aspects of a technology scout, a concept engineer and a requirements engineer. Besides the expertise in engineering and technological matters, communication skills for collaborating with the various stakeholders involved in requirements engineering (from engineers to end users) are essential.

4.1.2.4 User expert

The tasks of a *user expert* include the continuous communication with users to understand their needs and structure or even quantify their input. A user expert knows real users and delivers insights about them, while having a repertoire of methods to quantify user clusters and their motives. Moreover, he/she has detailed knowledge about the global market. It is the user expert’s responsibility to represent the users’ point of view in every design phase, from market research to marketing of the new experience. Furthermore, to communicate the user benefit in an appropriate for users way. Expertise in marketing, statistics and communication is required for this role. Analytical thinking and empathy are further desired skills.

4.1.2.5 User

A *user* is the expert of experience. As active participant of the design process, the user tells stories about previous, individual experiences; co-creates stories about new experiences; tests

and assesses the experience of interacting with new concepts. The role of user was not explicitly captured in the process model of Bengler et al. (2014). However, the results of study II (3.2.2.2) imply that users are essential actors.

4.1.2.6 Storykeeper

The *storykeeper* is the manager of the user experience design process. He/she accompanies the whole process while continuously putting experiences in its centre. It is the storykeeper's responsibility to ensure the success of user experience design. This means that the intended, conceptualized experience [story] is mediated through the new product and that users have an enjoyable, overall user experience. For achieving that, the storykeeper should manage resources and ensure that financial, personnel and methodological resources are available; monitor the process; implement the requirements management and achieve a coverage between technical specifications and story; influence decision-making in a positive towards user experience way. The role of a storykeeper incorporates more aspects than the role of a traditional manager. He/she is not just a project controller, but also a requirements manager, a consultant and the ambassador of user experience principles. This unique combination of tasks and skills is elaborated in section 4.3

4.1.3 Process phases and milestones

The proposed user experience design process consists of six phases, each of which includes various steps. The process is a structured, *stage-gate process* (Cooper, 1990). While iterations are possible and even desired within a single phase, at the end of each phase there is a “freeze” with a milestone (Kremer et al., 2014). Each subsequent phase builds on the results achieved by a defined milestone, which can no longer be modified. The proposed process prescribes an *extensive analysis* of the current situation and a detailed structuring of goals in the beginning of the process. Furthermore, it encourages *continuous user participation*, testing and *iterations*. Those characteristics are inspired by *user-centred* design processes (Brown, 2009; Cain, 1998; Council, 2005; ISO, 2009). Similar to the need-based approaches, in the proposed process, the experience comes before the product. We can talk about a *possibility-driven* (rather than problem-solving) approach. A unique characteristic of the proposed process is the early integration of experiences (*system approach*). By the end of the early concept phase, the design team has planned a later integration of individual components. Finally, the depth and duration of individual process steps is *scalable* and can be tailored to project-specific needs. All actors' perspectives are useful in each phase. However, depending on the project-specific goal, individual steps or actors may be primarily in focus. Table 15 and the following sections present the essence of each phase.

Table 15 : Phases of the user experience design process

Phase	Goals	Milestone
1. Analysis	Defining target user group(s); Understanding users and their motives; Identifying opportunities for new experiences	Framework with users' motives, user profiles
2. Early concept	Generating concepts for new, overall experiences	User experience story, integration concept
3. Latter concept	Creating detailed representations of concepts that mediate one or more experiences	Storyboard, rough prototypes
4. Implementation	Implementing single components that mediate experiences	Implemented components
5. Final implementation	Integrating components into a final, implemented product	Implemented product
6. Usage	Evaluating experience-related aspects of real users' interactions with the new product in real environment	Proof of concept

4.1.3.1 Analysis phase: Towards the experience framework

In the *analysis phase*, the design team creates an understanding of the context of usage and of potential users, aiming at generating a framework of possible experiences and representative user profiles by the end of the phase. The focus hereby lies on identifying opportunities for meaningful experiences rather than problems. After defining a user group, real users corresponding to it are analysed and data about them are collected. Final output of those activities are representative *user profiles*. In parallel, the design team conducts activities towards identifying and structuring design opportunities and experience potentials. Core of those activities is the identification of the needs and *motives* to be addressed by new designs. Finally, the team's interpretation of the design goals and vision of new user experiences is visualised in a *framework*. The framework includes clusters/themes of motives. This important document along with the user profiles constitute the basis for the design of user experiences during the next process phases.

4.1.3.2 Early concept phase: Towards the user experience story

The second phase in the design of user experiences (*early concept phase*) is about generating concepts for new experiences. The primer focus of idea generation is in this case the overall user experience and not yet the technologies or products that would mediate it. Therefore, this phase includes the creation and evaluation of a *user experience story*, i.e. a narrative describing a new, positive overall experience. Unlike the artefacts of traditional design processes, this milestone contains important experience-related aspects. The focus of a story lies on its characters' motives and emotions instead of a detailed description of technologies. It describes a specific, targeted interaction of a character with a system in a specific physical, temporal and emotional context. The process of creating a user experience story results in qualitative requirements for individual components of a product, as well as implications on how individual elements could be integrated into a meaningful whole. This systemic viewing results into an

integration concept that indicates in this early design phase, which elements are compatible with each other and may be integrated into a product and an overall experience.

4.1.3.3 Latter concept phase: Towards the experience storyboards

In the third phase towards experience creation (*latter concept phase*), the goal is to iteratively create experience prototypes and storyboards, which represent in detail concepts that mediate one or more experiences. While the focus of a story lies on the intended experience, the artefacts of the latter concept phase represent the product or feature mediating it. *Prototyping* is a helpful method for generating, exploring and evaluating design ideas, while the technique of *storyboarding* supports the design team in creating experience prototypes without neglecting emotional aspects. With those representations, the human factors expert can perform evaluations with users and find out, whether users' motives are fulfilled through the interaction. Insights from the process of prototyping and storyboarding along with user feedback lead to *quantitative specifications*. This phase results in a detailed representation of one or more experiences (rough prototypes and storyboard) with the evaluation results and the corresponding specifications.

4.1.3.4 Implementation phase: Towards the implemented components

The goal of the fourth phase of user experience design (*implementation phase*) is to implement and evaluate interactive *representations of components* mediating the designed experience. Representations base on the results created in the previous phases: story, storyboard and low-fidelity prototypes. However, the representations of components created in this phase are mature and incorporate aesthetic and material aspects. Furthermore, they should fulfil the qualitative, quantitative and integration requirements. An iterative development of prototypes is crucial. Evaluations with users would indicate whether the implemented components enable users to relive the intended experience. Furthermore, usability aspects and detailed design aspects are assessed. Each new version of an implemented component undergoes evaluations and improvements until the final components reach the desired level of maturity.

4.1.3.5 Final implementation phase: Towards the implemented product

In the *final implementation phase*, the focus lies on combining several components to enable a positive overall experience with the final product. The components developed in the previous phase incorporate the functionality of single components and mediate single intended experiences. However, the interplay of different components is crucial when experiencing an interaction with a complex product. In the final implementation phase, individual components are integrated into the *final product* under consideration of their interrelations. The integration builds upon the integration concept created in the early concept phase. Furthermore, product refinements regarding a homogenous sensual appearance and consistent usability of different components are now implemented. The evaluation with potential users provides important input for the final implementation. Ideally, evaluation results should indicate that the product embodies the story and enables positive experiences without any further explanation. Finally, a *marketing concept* is created to communicate the potential experiences. Having reached those milestones, the product is released for start of production.

4.1.3.6 Usage phase: Towards the proof of concept

The last phase of user experience design (*usage phase*) concerns the emergence of intended experiences, when real users interact with the new product in real environment. Traditionally, evaluation of final products concentrates on technical and usability aspects. On the contrary, the *proof of the experience concept* concerns primarily the evaluation of experience-related aspects. Building on tests with real users in a real usage context, structured experience reports determine if the real interaction corresponds to the anticipated experience described in the framework, story and storyboard. Minor product improvements should be implemented accordingly in the current product generation. Major recommendations should be used as input for following projects in order to consequently improve the user experience.

4.1.4 Focus of the thesis (actors, goals, phases)

The overall objective of this thesis is to create a methodological support for the early phases of designing experiences mediated by complex, tangible products. The support addresses developers without expertise in user experience design.

Taking the process model presented in the previous sections as reference, the methodology focuses on the *analysis* and *early concept* phases. As to actors and their goals, the support primarily focuses on *designers with no expertise in user experience design*, who are involved in the early phases of design and aim at *defining* and/or *developing user experiences*. Furthermore, the thesis elaborates on the role of the *storykeeper*, who is considered a catalyst for the successful application of the support.

4.2 Scenario-based methodology for user experience design

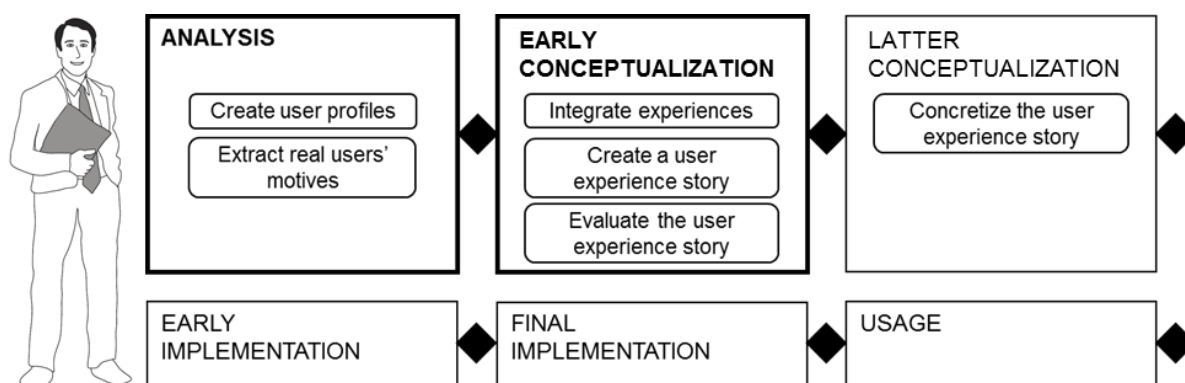


Figure 4-1: Overview of the proposed methodology (www.designingexperiences.org)

The developed support for early phases of user experience design is a structured, scenario-based methodology (ff. methodology). It consists of individual methods, which support relevant steps in the analysis and early concept phases of the user experience design process. The background and characteristics of the methodology had been elaborated in previous chapters. The following sections describe a prototypical application of the methodology throughout the user experience

design process, emphasizing on six methods that support the analysis and early concept phases (Figure 4-1). Core of the methodology, as depicted in the centre of Figure 4-2, is the method to *create a user experience story*, a special type of stories with experience-related story elements (Michailidou et al., 2013a). For creating it, preliminary work to collect the essential inputs is done in the initial steps of the methodology. Subsequent steps of the methodology aim at evaluating and concretizing the user experience story. Although this thesis focuses on the first two phases of design, the methodology includes one method in the latter concept phase to demonstrate how the results of the previous phases can be concretized. A key factor in the application of the proposed methodology is the role of a storykeeper. Since the outputs of individual methods build on each other, the person monitoring them has a critical task. In this case, the main object of focus is the intended experience captured in a user experience story.

A user experience story describes an interaction from a user's perspective. An interaction refers to a user, a product and a certain context (compare to 2.2.1). While the user experience story describes all aspects of interaction, its primary focus is to describe users' actions, thoughts, motivations and emotions. Products and features nor technical aspects are described in detail. Instead, the emphasis lies on the experience. For envisioning the experience from a user's perspective, it is essential to develop realistic and well-drawn story characters. With the help of the method to *create user profiles*, data about real users are summarized in archetypes (profiles) that appear in the story as characters. Besides the demographic, social and utilization characteristics of users, which are captured in the user profiles, it is essential to understand users' emotional behaviour. This could be achieved with the help of narrative analysis, i.e. by analysing real users' stories. The second proposed method supports the *extraction of motives*. Further story elements, namely use cases and functions, can be extracted from users' stories.

Once the story elements are collected, the methodology proposes an analysis of relations among them. Analysing the interplay of individual elements is essential for their meaningful combination and integration into a story. Such an analysis is considered in the *method to integrate experiences*. The user experience story can then be composed: momentary fragments of the interaction that are critical to the user experience are firstly analysed and then combined through a plot line in a narrative. The method to *create a user experience story* guides the process of combining user experience elements with narrative elements. To ensure that the intended experience is communicated, the story needs to be tested and adapted iteratively. The method to *evaluate the user experience story* proposes ways to collect feedback about the content and form of the story. Through this process, qualitative requirements can be derived and the new experience be tested with potential users. Figure 4-2 depicts the elements that a user experience story brings together. This collection roots in the literature review in chapter 2. In the latter concept phase, the creation of storyboards can be beneficial for *concretizing the user experience story* and translating it into physical representations.

As the focus of this thesis lies in early design phases, the proposed methods address the analysis and early concept phases. Subsequent phases of user experience design aim at bringing the story into life and implementing physical objects to mediate the experience. The user experience story inspires the creation of prototypes and its contents are detailed in storyboards. Again, user testing and derivation of requirements are parts of this iterative process. Finally, marketing concepts to communicate the intended experience can also be inspired by the story.

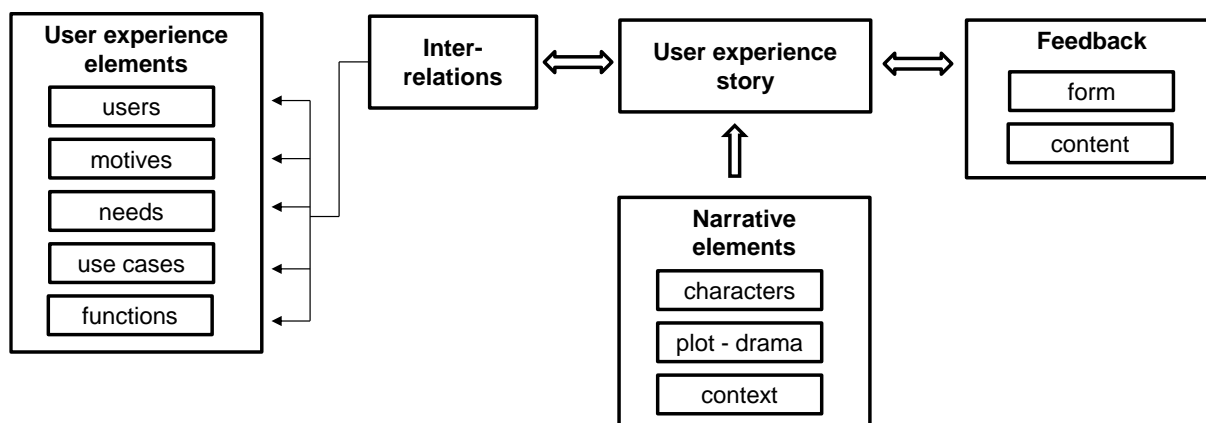


Figure 4-2: Aspects considered in a user experience story

4.2.1 Analysis phase: Collecting the story elements

The first phase towards designing experiences aims at understanding real users and setting development goals. Essential for that is to analyse users, existing products and the context of interactions. This section presents two scenario-based methods to reach those goals: the *method to create user profiles* is about understanding users through data analysis and summarizing important aspects in a comprehensible visualisation. The *method to extract real users' motives* describes a process to analyse user stories, extract and deeply understand the user experience. Alternative approaches for analysis include ethnographic and interview-based approaches, which bring along limitations (2.3, 2.4). In the scenario-based methodology, the understanding regarding users is summarized in user profiles, while users' motives set goals for the further design. At the end of the analysis phase, the storykeeper is responsible for passing on to the development team the approved by management user profiles along with development goals expressed as motives.

4.2.1.1 Method to create user profiles

The *method to create user profiles* (ff. method 1) describes a procedure for understanding users through data analysis and subsequently summarizing important aspects in a comprehensible visualisation. Contents of this section have already been published and will not be cited additionally in this section (Michailidou et al., 2016). Detailed instructions for applying the method can be found in the Appendix A8, while lessons learned from applying the method in three cases are described in chapter 6.

Background

Method 1 is a databased approach for understanding and creating representations of putative, potential or future users and results into user profiles and a record of evaluated user data. The method leans on the persona technique (2.2.2). As described in a previous section, the persona technique offers a time- and cost-effective way to involve potential users indirectly in the development process and brings along many benefits (Kozar, 2011). Personas are fictitious,

specific representations of a customer of a real target group, based on behaviours and attitudes of observed real users (A. Cooper et al., 2014). Persona is an excellent method to discuss and prioritize different types of users and their needs in a memorable way and to turn designers' attention on satisfying those users' needs, making the entire development process more user-oriented. However, critics of this approach mention that, despite its benefits, the personas can fail, (among others) when they are not associated with real data (Adlin & Pruitt, 2010).

Method 1 is *data-driven* and company-specific because personas are more likely accepted if they base on real data and the link to data can be traced (Blomquist & Arvola, 2002; Pruitt & Grudin, 2003). McGinn and Kotamraju (2008) conclude that personas are likely to be accepted by clients when based on real data. Specifically, if data is gathered especially for creating personas, their traceability and thus acceptance are even higher. Moreover, practitioners usually apply personas in ways that reflect their experiences and needs and not necessarily guidelines from literature, while they identify a need for more emphasis on actual practices (Chang et al., 2008). Method 1 addresses this issue, since it provides room for company-specific *adaptations* in many of its steps. Another limitation of existing approaches is that they do not include *social and emotional characteristics*, which are crucial when designing user experiences. Summing-up, if created in a formal procedure and based on real data, user profiles can indeed be a powerful means to create a better understanding of users' characteristics, needs and behaviour and thus lead to the creation of positive experiences. Method 1 has special characteristics (databased, adaptable, and experience-oriented) and its differentiated result is deliberately termed "user profile" (instead of "persona").

Method steps

The steps of method 1 (Figure 4-3) are conceptualized for creating representative visualisations of typical users of a certain product type corresponding to the main market segments. It is necessary to have decided for a specific product type and segmentation to apply the method. *Segmentation* strategies may include geographical, price-related or demographical approaches. Segmentation is important, because it would enable a differentiated treatment of users with similar characteristics opposed to other users. The classification is not only relevant for creating user profiles, but also for designing profile-specific product variants, meeting profile-specific decisions and selecting representative subjects for user tests. In the first phase of method application, all relevant data are collected and documented in a database. Possible sources of data are outcomes of marketing studies or user research, data loggers and production/sales data. This means that the storykeeper would have to facilitate the communication across the borders of single company departments during the phase of data gathering. The same applies to the final step of the method application, where he/she would ask for the approval of the final profiles. Besides *data on usage*, e.g. figures of system used in a specific market, and *utilization context*, e.g. climatic and geographic surroundings, findings about the *social context*, the *emotional behaviour* and needs that are important for experience design, are collected in a database. The database would enhance the perceived validity of the profiles and allow a more in-depth analysis for the technical design of functions in further stages.

In the next steps of method application, the most important data are summarized and compiled into a template, which can be used in following development activities. Those steps can be conducted within a workshop with involvement of various stakeholders (e.g. experience

designer, user expert, developer). Finally, a *vivid representation* of the profile is illustrated. This is relevant particularly for the “personal data” area in the middle of the template, which includes fields for inserting pictures. This is the only part of the method, in which fictive data, i.e. name and pictures, may be used to give to the profile a memorable human face.

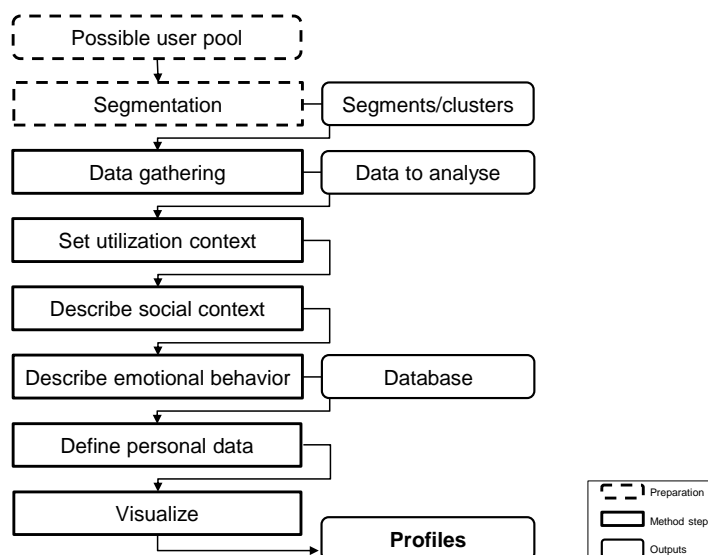


Figure 4-3: Method to create user profiles

Chapter 5 describes the application of method 1 in three different settings, with details on case-specific data sources and adaptations. In the following paragraphs, a general explanation describes the data types, which synthesize user profiles.

Data about *utilization context* refer to a representative country and city of the selected segment. For products used indoors, characteristics of domestic areas and impressions of rooms complete the utilization context data. For products used outdoors, climatic data of the selected area (average and extreme temperatures, sunshine hours, as well as humidity and precipitation values) are highly relevant. Gathering data about the utilization context would enable designers to gain a realistic impression of the physical context of interaction. This is important, because experiences are context-dependant and environmental aspects, which might influence the experience, should be taken into consideration when envisioning a new experience. To describe *product utilization* it first has to be examined which exact product variant is most popular in the selected market. A concrete selection would make the tracking of data more goal-oriented. Possible aspects of product utilization can be useful, if available: usage frequency per day, frequency on working days/weekends, daytime of usage, and number/duration of paused usage (if applicable). Again, that kind of information would provide a realistic frame of future interactions. In the real-life cases, in which the method was applied (5.2, 5.4) the data concerning utilization were tracked in company-specific data loggers. Another useful information source are qualitative statements on users’ perception towards the product, often available online. Making use of original statements would increase the perceived validity of data and would enable designers to get to know users through their representative statements.

Information about users' *social behaviour* include value orientations, goals, lifestyles and attitudes. Like the step of setting the utilization context, this step aims at raising designers' awareness about the context of a future experience. However, this step concerns socio-cultural aspects and therefore requires deeper insights in users' behaviour. In the real-life cases, in which the method was applied (5.2, 5.4), it was possible to identify relevant studies, which had been conducted by the cooperating companies. In the case of the automobile manufacturer, studies conducted by the SIGMA Institute classified users in milieus according to their social status and value orientation. Representatives of each milieu share common social characteristics, like goals, attitudes and lifestyles. The main characteristics of the corresponding milieus had been captured in the user profiles. In the case of the household appliance manufacturer, the marketing department of the company had conducted user studies, which included aspects on the users' social behaviour. Again, we captured a summary of values, goals, lifestyles and attitudes in the profiles. In the fictive case of applying the method (5.3), no resources for conducting special studies had been available. Therefore, we used the online available SIGMA studies as input. The designers involved in the application reviewed the milieu descriptions and identified the ones that matched to the characteristics of target users or real users they had observed. The recommendation for a company applying the method would ideally be to conduct a special study. Categorizing users according to behaviours bears the risk of leading to stereotypes. "Professional target group marketing" studies, like the SIGMA milieu study, ground on empirical data. Alternatively, existing studies like the SIGMA milieu study can be used as basis to align with empirical findings. Therefore, it definitely makes sense to involve in this method step stakeholders that had been involved in ethnographic studies.

The *emotional behaviour* is an important source for understanding users' needs that are relevant for user experience. Although there are fundamental human needs [e.g. (Maslow et al., 1970; Sheldon et al., 2001)], their prioritization may differ among individuals. The interpretations of needs is culture-dependant; that refers both to country-specific and to individual mind-set differences. For example, the need for security may refer to financial security for some individuals/cultures, whereas it may refer to the feeling of predictability for others. Additionally, if the fulfilment of needs is related to products and interactions, as it is the case in *user* experience, the meaning of needs and their importance depends on the product. For example, the need for security in the context of driving (e.g. "being safe") has a different meaning than security in the context of dish-washing (e.g. "being reliable"). The step of describing the emotional behaviour encourages designers to explore the definition and prioritization of needs related to the specific product and for the specific user segment(s) for which they design. That would enable designers to gain insights in the emotional world of users and the needs, which a future user experience could address. For conducting this step, designers could take a general description of needs as reference and then specify it according to the findings of user research. Again, the persons involved in empirical research would support. It is rather unlikely that a company applying the method has available user data relating exactly to the meaning and prioritization of needs. If resources are available, such studies could ideally be organised. Alternatively, the description and prioritization of needs could be conducted with the support of a user expert. In the case of applying the method with the automobile manufacturer, such special studies had been conducted. With the help of an expert, general needs had been defined for the automotive context (Hassenzahl, 2011), while their prioritization

for each segment was confirmed in a tailored study. In the case of the household appliance manufacturer, no special studies had been conducted nor could be organised. Therefore, this step was implemented within a workshop with user experts, using general need descriptions as fundament. Moreover, the emotional behaviour can be enriched by the results of the second method (method to derive real users' motives). For prioritizing the needs, analysts can apply a paired comparison (Lindemann, 2009) with the guiding question "is need A more important than need B for user X when interacting with the product Y".

Finally, *personal data* such as age, marital status, stage of life, annual income, profession and leisure activities would give a human face to the created profile. Data related to that category may be derived from buyer studies. If not available, personal data included in the profiles may be fictive, since their main purpose is to make profiles more vivid and memorable.

Expected value

Method 1 proposes a framework that brings together data from various sources (Figure 4-4). The resulting profiles and database compile information created during the analysis phase in a way that is traceable and understandable. Profiles can and should be used in subsequent process phases for creating and evaluating user experience stories, deriving and prioritizing requirements, or identifying representative evaluation subjects. User profiles can influence many decisions along the process (Table 16).

Unlike traditional persona approaches, the method to create user profiles includes the consideration of usage, behavioural and emotional patterns in a databased approach. A unique characteristic of the proposed method is the consideration of the emotional behaviour through a definition and prioritization of needs in the context of interacting with a specific product.

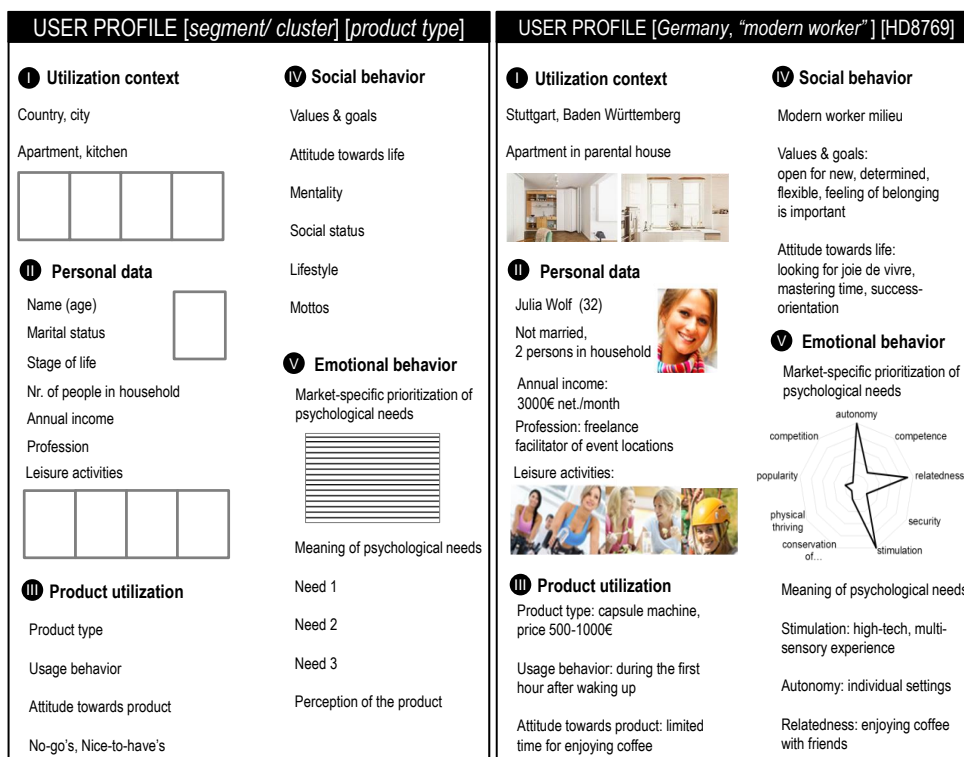


Figure 4-4 : Template for creating user profiles (left), exemplarily filled (right)

Limitations of this method concern obviously the availability of data and of resources for collecting them. The gathering of data requires effort and resources. However, it is essential for ensuring the validity and acceptance of user profiles, which build the basis for the next methods and many decisions. Compared to other methods for the task clarification phase (compare to Table 1), the method to create user profiles is still more efficient than many observation- or interview- based methods, which are purely empirical and require substantial amount of effort. The process towards creating user profiles enhances the understanding about users and prescribes a segment-differentiated, indirect participation of users in decision-making and concept generation. The focus of the method lies in compiling and communicating user-related information instead of gathering it. Empirical methods could be richer in insights and in some cases essential. In new product development, utilization data would not be available, like in an adaptive design project. Therefore, the proposed method should be used complementary to other methods and under those considerations.

Table 16 : Decisions influenced by user profiles (right) during the process steps (left)

Extraction of motives	Sources of stories are matched to profiles and further analysis for extraction of motives is conducted separately for each profile
Creation of user experience story	Profiles are sources for well-built characters; The profile database contains information for creating plausible contexts and selecting use cases; Emotional and social context helps to anticipate characters' reactions; Profiles demonstrate differentiation of segment-specific characteristics in interactions
Derivation of quality requirements	Profiles are used in requirements workshops as representatives for real users
Prioritization of requirements	Profiles influence the decisions for segment-specific variants of product features
(Primary) assessment of concepts	Profiles provide a user perspective
Evaluation of the user experience story	Profiles used as archetypes for selecting and clustering real users/subjects for testing
Creation of marketing strategies	Characteristics of profiles influence marketing strategies

4.2.1.2 Method to extract real users' motives

The *method to extract real users' motives* (ff. method 2) describes a procedure for analysing narratives related to interactions with the goal to extract the functions and use cases that are directly mentioned, but also latent information, like underlying needs and motives of users. This step is essential for setting the development goals of user experience design: the new experience should fulfil users' needs and motives. The outputs of the method serve as direct input in the creation of a user experience story. Moreover, the gained insights could complement the part on "emotional behaviour" in user profiles. Contents of this section have been published previously (Pucillo et al., 2014) and will not be cited separately in this section.

Background

Object of analysis in method 2 are users' narratives that relate to interactions and their context. Analysing such narratives is essential for collecting high quality data to use in the user experience story. Moreover, the process of analysis is important for increasing designers' understanding of and empathy with users. Why is a method based on narrative analysis more appropriate than other methods for understanding of veiled motives and needs? Interview-based methods (e.g. narrative episodic interview, laddering, contextual inquiry, compare to 2.2.1) are dependent from the interviewer's capabilities. Methods based on observation carry significant drawbacks related to costs, apprehensiveness of respondents, while they require skilled observers and the access to right events. On the other hand, projective techniques and narrative analysis in particular, seem promising for the stated goals. Projective techniques (e.g. association, completion, construction, choice ordering and expressive methods) are qualitative research methods that are "useful when a typical direct questionnaire is not appropriate in providing the information sought" [as quoted in (Nurkka et al., 2009)]. The subject responds to the related topics indirectly, by either using ambiguous stimuli or talking about other people's feelings, attitudes, and opinions, or about objects or situations. Projective techniques have the potential to convey tacit knowledge concerning user experiences. In particular, narrative inquiry (analysis) can uncover tacit user knowledge, like personal, unspoken needs, deeply rooted in a person's actions and experience (Helkkula & Pihlström, 2010). This exact information type is useful when designing new experiences. As to practical aspects, narrative analysis requires no expertise or special equipment and can indeed be more time- and cost-effective than other techniques. If possible, transcribed interviews may be used as input. A pragmatic alternative are narratives from customer feedback channels or product reviews (Lee et al., 2015).

Method steps

Method 2 consists of six steps (Appendix A8) and initially requires the gathering of narratives to analyse. The method delivers most relevant results when narratives of high quality are analysed. The term quality refers to the relevance of the narrative's content to the product to be designed and to the relevance of the data sources to predefined user profiles. Therefore, the analyst needs to ensure that the users' narratives refer to relevant interactions and that a person matching to the user profile had written them. In case of adaptive design, possible sources for real users' stories include after-sales feedback, product reviews or transcribed users' quotes, which refer to an initial ("predecessor") product. In case of original design, analysts can use quotes that refer to the situation addressed by the product to be designed. Clustering quotes according to the profiles matching their sources (using user profiles as archetypes) already in the beginning would facilitate the final analysis. Having gathered texts to analyse, the method application, ideally from two independent analysts, begins.

In the first step of the method, the analyst looks in the narrative for explicit information that is related to *use cases* and *functions*. Use cases describe events from the point of view of an actor. In general, a function describes "a solution-neutral, operational relationship between input and output variables of a system" (Lindemann, 2009). The proposed methodology takes into consideration only functions of the observed system are that are perceivable from a user's point of view. Such functions describe the "do-goals" (Hassenzahl, 2010) of an activity and are often phrased as "noun + verb"-sentences.

The subsequent steps of the method deal with the extraction of implicit information. To do so, the analyst first identifies the parts of each narrative that include descriptions of thoughts, feelings or sequences of actions. Quotes including technical details are irrelevant for the further analysis. The selected quotes constitute the stories to be further analysed. The analysis includes three steps: identification of *storylines* (arguments), identification of *oppositions* (meaning of arguments) and identification of *enthymemes* (implicit information). To identify a storyline, the analyst summarizes the main argument(s) described in a story. In order to identify oppositions, the analyst extracts the adjectives mentioned in a story and collects synonyms and antonyms for their meaning. This step would increase the analyst's understanding. Having built a good understanding of the story contents, the analyst identifies the so-called enthymemes. Enthymemes are parts of information that are not explicitly mentioned in the quote, but are indirectly implied. In this step, the analyst reads "between lines" and if necessary, adds words/sentences to the original quotes. The resulting enthymeme is a sentence that describes extendedly what the writer of the story wanted to communicate.

Final step of the method is that of describing motives. A motive describes the reason for acting; in the context of this analysis, a motive would specifically describe a user's reason for interacting with a product in a certain way, the "why" behind the interaction. Making explicit the interpretation of unknown users' thoughts is objective. However, the understanding built in the previous steps brings the analyst closer to the foreign mind-set.

To validate the objective interpretations of one analyst, a second person could analyse the same quotes. Comparing results of two independent analysts would highlight misinterpretations or convergence and improve the understanding. The final step includes clustering similar motives. This leads to a concise description of motives corresponding to a profile.

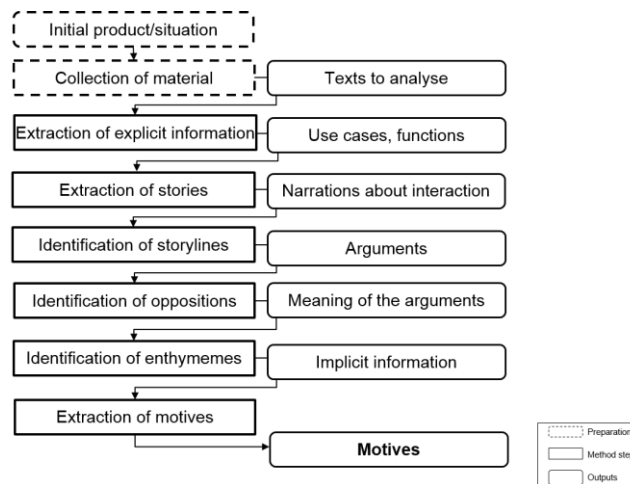


Figure 4-5: Method to extract users' motives

Expected value

Summing-up, the analysis of real users' stories provides a deep understanding of development goals and an appropriate way for their documentation. Not only are stories rich in insights about users and contexts of usage. The analysis process enforces designers' empathy with users and

their unspoken needs, as well. Moreover, making development goals explicit in form of motives instead of technical requirements increases the opportunity-driven and user-centred character of the design process. The motives express users' goals in natural language. Practical advantages of the proposed method, compared to interview- or observation-based methods, are its independency from the analysts' experience and the lack of necessity for direct participation of users. A *limitation* of the method lies in the many objective interpretations that are made during the analysis of quotes. However, this can be avoided by employing more independent analysts. Another limitation is that the quality of the output depends highly on the quality of the stories. A strong recommendation is to invest more effort in the preparation activities and select stories with rich content and from representative for the target group sources.

Table 17 lists further methods to gather the user experience elements [based on (Michailidou et al., 2014)]. Methods for data collection include qualitative methods (e.g. interviews, laddering, storytelling, experience sampling), modelling approaches (e.g. function modelling, morphological case) or even usage of existing company data (production, sales and marketing data, social media analysis, product manuals, data loggers) or literature-based data (e.g. literature-based sets of needs). Depending on availability of resources, practitioners could decide for conducting new studies/surveys, which would provide exact and detailed information, or for using available data, which is a less time-consuming variant. Regardless of the way collected, information concerning users, their needs and motives, components of the system to be (re)designed, context of use, use cases and key events, it is valuable to process and structure them in a coding scheme. Those are the story elements to be taken into further consideration in the early concept phase.

Table 17 : Exemplary methods to collect the user experience elements

Element	Method to collect data
Need	Literature-based sets of needs, laddering
Motive	Surveys, interviews, laddering, customer feedback, social media analysis, storytelling, experience sampling
Use case	Moderated workshops, cognitive walkthrough, journey mapping, field studies
Function	Function modelling, product manuals, data loggers
User	User profiles

4.2.2 Early concept phase: Bringing experience elements together into a user experience story

The early concept phase of user experience design aims at envisioning the user experience that would be mediated by the new product. The focus hereby lies on the experience and not yet on the product. Therefore, the design team would have to structure the findings and elements of the analysis phase and integrate them into one or more stories that describe the intended experience (user experience stories). The user experience stories are the first representations of the intended experience and inspire the creation of concepts and rough prototypes. Therefore, the form and content of stories have to be evaluated within the design team and with potential users, before the concepts are further developed and implemented.

This section presents three methods to reach those goals. The *method to integrate experiences* proposes a matrix-based approach to explore the relations among user experience elements. The method results in possible combinations of users, who have certain needs and motives, with the use cases and functions that are critical for them. The *method to create a user experience story* is about combining and communicating experience-related aspects, as well as generating new experiences. It describes a process to explore the interaction of a character with a new product in a certain context. During this process, the design team identifies and structures critical events of the interaction in a plot. Thereby, they explore the character's goals, emotions and actions during the events. By telling stories about the new experience, the design team generates ideas about concepts that would mediate a positive user experience in those situations. The final output of the method is a narrative that describes the intended user experience. Further outputs are qualitative requirements and concept ideas. The *method to evaluate the user experience story* has a twofold purpose. On the one hand, it aims at ensuring that the created story communicates the intended experience adequately. On the other hand, the method proposes ways to collect feedback on the content of the story by various stakeholders.

Existing generative methods for the conceptual design phase have been presented in Table 1. We can distinguish methods based on storytelling (works of Knobel, Buskermolen, Atasoy), methods based on context analysis (Visser et al., 2005) and methods that make use of experience patterns or principles [works of Saucken and (Kim et al., 2011)]. The scenario-based methodology adopts elements from all three categories. Obviously, it makes use of storytelling and narrative elements. Part of the storytelling is a consideration of the context of usage. Moreover, it is based on a need-driven approach and proposes the usage of high-level descriptions of needs. However, it has distinguishing differences from other methods. The methods focus on continuously putting user experience-related aspects into the centre of design. The methods are structured and offer operative guidance to designers. They reinforce collaboration among the members of a design team. Although they do consider users and their needs, they do not require the direct participation of users in every stage of design. Finally, they propose a systematic way to deal with the complexity of user experience by providing ways to capture elements, their relations and integrate them in a system. At the end of the early concept phase, the storykeeper is responsible for passing on to the development team the user experience story along with evaluation results and qualitative requirements.

4.2.2.1 Method to integrate experiences

This thesis studies the complex phenomenon of user experience mediated through tangible products of high complexity (1.3). Such products have a large amount of different elements, interrelations and states. Moreover, the tangible nature brings along limitations in products (like dimensioning, building space) and resulting constraints for design. Both studied aspects (phenomenon and nature of products) call for a systematic way to deal with complexity. A way to manage complexity is by analysing individual elements and their relations. This approach roots in research on system engineering and structural complexity management. Applying such an approach in the context of user experience design is promising, because a system view is essential when exploring a complex phenomenon and when designing a complex product. Chapter 2 reviewed studies, which defined elements of user experience. Although some researchers defined possible relations among elements, a method that supports the exploration

of such relations and mostly the drawing of indications for design could not be identified. An exception is the approach of “motive-oriented design” (Saucken, 2015; Saucken et al., 2014), which proposes a matrix-based method to explore functions related to a certain motive. The method presented here makes use of more experience elements than just motives. As to existing approaches for designing complex products, two weaknesses were evident. Firstly, most process models prescribe an integration of product elements/components only late in the process (compare to V-model). Second, existing approaches to combine components base on geometrical restrictions. No approach could be identified for supporting the combination of individual product components based on the user experience they would evoke.

The *method to integrate experiences* (ff. method 3) supports designers to explore the relations among the elements of experience and find meaningful combinations. The term “integrate” refers here to the approach of combining individual elements of user experience (user, motive, need, use case, function) by avoiding conflicts and redundancies. An analysis of relations and possible combinations would provide indications for design. Finally, a meaningful integration considering all experience elements would result to a positive overall user experience. To make this goal more tangible, this paragraph refers to the example of the driving mode interface in cars (described in the introduction section). This interface provides two modes, “sport” and “comfort”, which result in different experiences for the driver. Each mode addresses a different motive. For designing the product that mediates those experiences, it is necessary to consider the following aspects: Which driving situations are relevant for the new experience? In which driving situations can the motive of driving sporty be fulfilled? Which existing car functionalities have to be connected to the new interface? Answering those questions would lead to a deeper understanding of the new/intended user experience, but also to implications for design and requirements. Those exemplary questions deal with the analysis of relations among experience elements, e.g. the relation of a motive with use cases and with functions. The proposed method 3 supports exactly that kind of analysis. In later stages of design, traditional integration approaches are useful for exploring the exact place in the car, in which the new interface can be built. The following paragraphs describe shortly the background of the method (matrix-based approach) and the four steps of its procedure (overview in Figure 4-7). Contents of this section were presented in previous publications (Michailidou, Diergarten, et al., 2015; Michailidou et al., 2014; Saucken et al., 2014) and will not be cited explicitly in this section.

	User	Need	Motive	Use case	Function
User		<i>has</i>	<i>has</i>	<i>is affected by</i>	<i>controls</i>
Need				<i>is relevant in</i>	
Motive		<i>meets</i>	<i>Is related to/occurs simultaneously with</i>	<i>rises in</i>	
Use case		<i>stresses</i>	<i>stresses</i>	<i>occurs simultaneously with</i>	<i>influences</i>
Function		<i>fulfils</i>	<i>fulfils</i>	<i>is used in</i>	<i>is redundant with</i>

Figure 4-6: Elements of user experience and their relations (meta-model)

Background

Method 3 is a matrix-based method. Many researchers have proposed matrix-based approaches for system modelling and analysis to manage the complexity of engineering systems and design processes (Brady, 2002; Browning, 2001; Danilovic & Sandkull, 2002; Eppinger, 1991; Hauser & Clausing, 1988; Kusiak & Park, 1990; Yassine, 2004; Yassine et al., 2001). According to the quantity of the types of elements involved and executed computations, matrices can be classified in four types: “*Dependency Structure Matrices*” (DSM), “*Domain Mapping Matrices*” (DMM), *combined intra- and inter-domain matrices*, as well as “*Multiple-Domain Matrices*” (MDM) (Lindemann et al., 2009).

If relations within elements belonging to the same type are examined the related matrices can be defined as intra-domain. A DSM is a matrix with an equal number of rows and columns, in which elements (typically of only one system at a time) and their relationships are systematically mapped (Browning, 2001). A typical example is a matrix depicting dependencies between physical product components. The element names are placed down the side of the matrix as row headings and across the top as column headings in the same order. The diagonal elements of the matrix are normally not considered. Binary DSMs depict only the existence and the direction of the relationships, while numerical DSMs can describe values of attributes, such as importance ratings or the probability of repetition (Yassine et al., 2001), via the use of different marks in the cells, e.g., symbols, colours, or numerical rankings .

Matrices combining different elements belonging to different domains (e.g. customer requirements and product functions) are called inter-domain matrices or “*Domain Mapping Matrices*” (DMM) (Danilovic & Sandkull, 2002). DMMs link elements of two different domains and are widely used in design methodology, for example in studies on linkages between product architecture and organisation as well as between systems and organisation.

Some applications make use of combinations of intra- and inter- domain matrices for more complex analysis possibilities, for example to implement a systematic comparison. A *meta-model* depicts an overview of all considered domains and relations. If in addition to the combined use of intra- and inter-domain matrices, computations within the considered matrices are included, we refer to a Multiple-Domain Matrix (MDM).

Summing-up, matrix-based approaches are widely used for complexity management in many applications. DSMs have been applied in many types of system and design analysis in product development, project planning, project management, system engineering and organisation design (Brady, 2002). DMM approaches have been successfully implemented in the fields of: knowledge capturing, information transfer, understanding of products and processes, schedules and cost distributions, analysis of systems and products architectures (Yassine, 2004). MDMs have been used for managing different types of knowledge configuration and management of multi-project environments. These applications encourage the use of matrix-based approaches in the new application of managing the complexity of user experience design.

Method steps

The fundament of method 3 is an initial meta-model (Figure 4-6), which depicts an overview of the domains and relations that could be analysed in user experience design. The domains in this case are the user experience elements. For project-specific applications, this initial model

can be modified (e.g. add or remove domains, specify relations), depending on the project focus and the availability of data. In an ideal application of the methodology, necessary data would be available as outputs of the analysis phase. The method application begins with the entering of domain elements. This practically means that the designer creates the matrices, which would be filled in the next steps, by entering in a table the columns and rows defined in the adjusted meta-model. Once the tables are created, the designer invites domain-specific experts, who will help him/her to define the relations in the tables. The outcome of this process are the relations to be analysed. The final steps of the method concern the analysis of relations among the experience elements and their clustering. When clustering, the analyst decides for the meaningful combination(s) of elements that would be integrated in the new user experience. A cluster is at the same time a “story setting”, which will be used as input in the method to create a user experience story. Designers can then systematically select, for instance which user should be used as character of the story and which use cases are critical, when designing an experience that aims at addressing a particular motive and thus fulfilling the desired need.

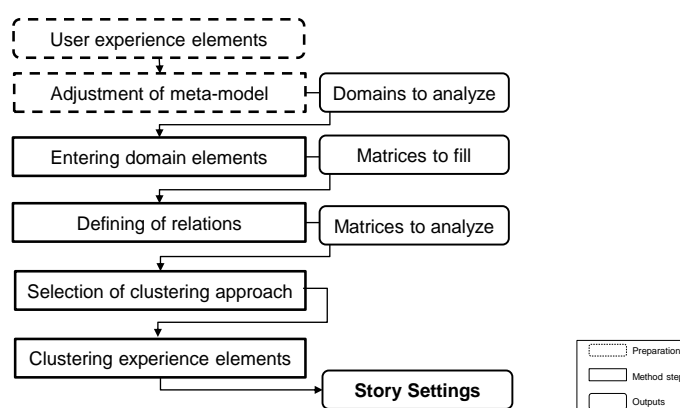


Figure 4-7: Method to integrate experiences

A fictive application of the method for designing the driving mode interface summarizes the method steps. The fictive task of the designer is to design the “sport mode” of the interface for drivers corresponding to user profile 1. To do so, the designer explores the relations of needs, use cases and functions with the motive “driving sporty”. First, he adjusts the meta-model according to his project-specific goal. In his modification, he eliminates the domain “user”, since he works with a predefined user profile. From the sixteen proposed relations of the meta-model, he decides to analyse the four most relevant to his goal: “motive addresses need”, “function fulfils motive”, “function is used in use case” and “use case stresses motive”. Next, he creates the four corresponding tables (matrices), e.g. a table for the relation “function is used in use case”. He collects the needed data (list of functions and use cases) and enters the functions in rows and use cases in columns. For identifying the relations, he invites an expert, a developer of driving assistant systems. They discuss every possible relation of the table. If the discussed function is used in the discussed use case, they note a relation. Having filled out all the matrices, the designer understands better the needs, functions and use cases that are related to the motive “driving sporty”. He now knows which functions he needs to integrate in the sport mode and in which use cases the sport mode will influence the driving behaviour. Moreover, he knows

that the underlying need he wants to address with the sport mode is the need for stimulation. A measure for the successful design of the user experience with the sport mode is the fulfilment of the stimulation need. With these findings, he proceeds with the creation of a user experience story and its evaluation. Real applications of the method are presented in chapter 4.3.4.

Expected value

In general, the method to integrate experiences suggests a formal, matrix-based procedure to examine how individual aspects of user experience can be combined. The analysis of experience elements with a systemic view raises the understanding about holistic experiences and inspires ideas and requirements for the next steps of design. Although this is a significant aspect for generating positive total experiences, it has not been addressed by existing methodologies. The proposed method leads to ideas about how to combine functions from user's perspective, instead of the conventional approaches of geometrical integration and 1:1 mapping of functions to interfaces. The resulting concepts are more likely to have a positive effect on overall experience and less perceived complexity. Furthermore, the suggested process reinforces collaboration within the design team. Data from many different sources are collected and experts of different backgrounds come together. Finally, the results are traceable (documented) and measurable (according to needs fulfilment). A *limitation* of the method is that it may require involvement of several stakeholders for a considerable amount of time, because the data needs to be collected from various company departments and actors. While applying the method, practitioners should make sure that the relations are not entered objectively, based on implicit knowledge, but based on data and documented decisions. Finally, traditional integration approaches basing on geometrical or other restrictions, still need to be considered in later stages of design (implementation).

4.2.2.2 Method to create a user experience story

Central step of the proposed methodology is that of creating of a user experience story, i.e. a narrative describing the intended user experience. A user experience story is a narrative about a specific, aimed interaction of a character with a system in physical and emotional context, focusing on the character's needs, motives and goals. Therefore, it enables a personal identification of the receiver with the story character. This definition describes a similar concept to that described by Knobel (2013). Moreover, it incorporates the special characteristics of stories described in 2.2.2. The use of dramaturgical elements differentiates this approach from approaches of scenario construction. Working towards a narrative at this stage of the process, instead e.g. of a storyboard, makes sense because of the special characteristics of stories. Stories have a narrative form, emphasizing the natural and memorable communication scope. They have a specific nature, describing a specific person in a specific situation. Moreover, they focus on a well-drawn character with known motives and needs rather than an "actor" and are personal, since the character as well as the receiver are interested in the result. Finally, a story often focuses on untypical (rather than typical or prototypical) situations. Consequently, the story will emphasize on the experience instead of a product. Although the concept of the user experience story is not new, a formal process for creating one could not be identified in existing studies. Such a process is proposed in this section. Parts of the method were presented in

previous publications (Michailidou, Haid, & Lindemann, 2015; Michailidou et al., 2013a, 2013b) and will not be cited separately in this section.

Method steps

The *method to create a user experience story* (ff. method 4) consists of eight main steps, which are schematically depicted in Figure 4-8, while a detailed description of the method and the corresponding templates is in Appendix A8.

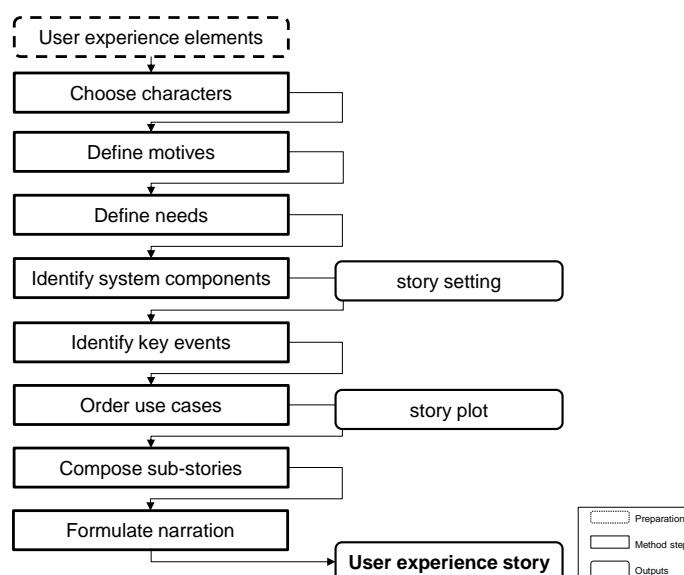


Figure 4-8 : Method to create a user experience story

The process includes main parts of *definition of the frame of the story* (setting and plot), *creation of sub-stories* and *formulating narrative*. The first and second parts are conceptualized for a workshop application. In particular, the second part may be open for participants outside of the design team, like end users. The user experience story consists of narrative descriptions of *key events* ordered in a plot from a character's perspective. The characters' perspective is analysed during the definition of the setting. Here it is essential to consider the user experience elements. The key events are identified and structured during the step of plot definition. Each substory describes in detail the user experience during a key event. Here is where the narrative elements come into application. Finally, the descriptions of substories are put together into a narrative.

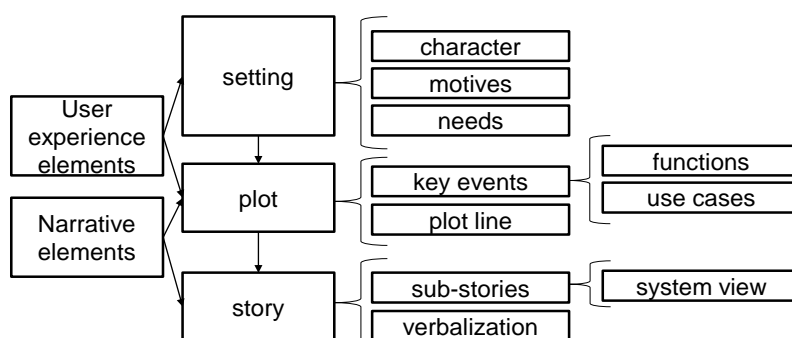


Figure 4-9: Main phases of the story creation process

Defining the frame of the story

Defining of the frame of the story means gathering the necessary data (inputs for storytelling), as well as meeting decisions about the exact goals of storytelling and concept generation. Those activities are complementary.

The *story setting* consists of a character with certain needs and motives. Therefore, it has to be decided which user profile is going to be the character in the story, as well as which of the user experience elements will appear in the story. In an ideal application of the methodology, the method to integrate experiences would provide this information. The decision for a certain user profile is a purely strategic decision and depends on the market segment, at which a specific development project aims. Once this decision is made, the information corresponding to the selected user profile is gathered. Then, the motives and needs of the profile are captured. The information about which motives and needs are representative for a certain user profile is based on the matrix analysis in method 3. Those three components (profile description, motives and needs) represent the character of the story.

The second aspect of a story frame is the *plot*. A plot gives structure to the story. For creating a plot, the design team has to decide for the events that will appear in the story (key events) and for the order in which they will appear (plot line).

The *key events* will be selected from the pool of gathered use cases created in the analysis phase. A key event is defined here as a use case, in which there are critical (positive or negative) influences on the characters' experience. In order to identify which use cases are critical for the character, the creator of the story can use the matrices from method 3. He/she would have to look for the use cases that stress the needs and motives defined in the story setting ("use case stresses motive", compare to the meta-model in Figure 4-6. Another way to identify key events is by finding out which are the use cases, in which the character uses functions that fulfil his/her motives. Again, this could be traced in the matrices from method 3. The designer would first identify the functions ("function fulfils motive") and then trace the use cases, in which those functions are used ("function is used in use case"). This second, indirect way for defining key events is applicable in the case of adaptive or variant design; the first approach is applicable also for original designs (Pahl et al., 2007, p. 64).

A *plot line* refers in this thesis to the way, in which the key events are presented to the audience of the story. A plot is "the sequential arrangement in which the events are revealed to the audience like what happens, in what order, with whom, and with what chain of causality" [cited in (Atasoy & Martens, 2011a)]. A plot can be used as a strategic guide to pull the audience emotionally and hold their attention. Appendix A8 provides a visual summary of various plot lines. They can be used for inspiring the storywriters to structure their story in such a way that the audience's attention is held and their emotions influenced as desired. The most important plots historically are: Aristoteles' "drama development" towards "resolution" (Sgouros, 1999), Freytag's "five-act plot", Field's "three act structure" and Campbell's "hero journey" [cited in (Atasoy & Martens, 2011a)]. Apart from those plots, which underlie classic plays and movies, there are some plots that have been explicitly recommended for stories describing interactions. Brooks and Quesenbery (2011) described five plots (plus the "hero journey") that can be applied in user experience stories: "prescriptive", "familiar to foreign", "framed", "layered" and "contextual interlude". The simple "prescriptive" plot, according to which the events are

presented in a chronological order, is the recommended plot line for inexperienced applicants of method 4. Furthermore, Knobel (2013) proposed a plot according to need fulfilment, which had been presented in Table 3. At an abstract level, the plot he proposed can be seen as a three-act plot with the acts of introduction (introduction of scenario, character and system), conflict (introduction of conflict and climax) and need fulfilment. Although usually a story can be told in many ways, it is a storyteller's art to find the most appropriate one and unfortunately, there is no recipe for that. Storywriters are advised to experiment with all plots and learn from the process how a story can influence emotions.

Creation of substories

Once this framework is set, each key event is analysed in depth with support of *substories*. The definition of substories refers to the scenario roadmap (Figure 2-11). A substory describes a vision of future practice and shows how the early product ideas would change the use practice and fulfil the user needs, without yet describing the product (compare to "future scenarios"). Alternative courses of each key event are explored in this step of the method. The creation of substories takes place by filling out templates for substories.

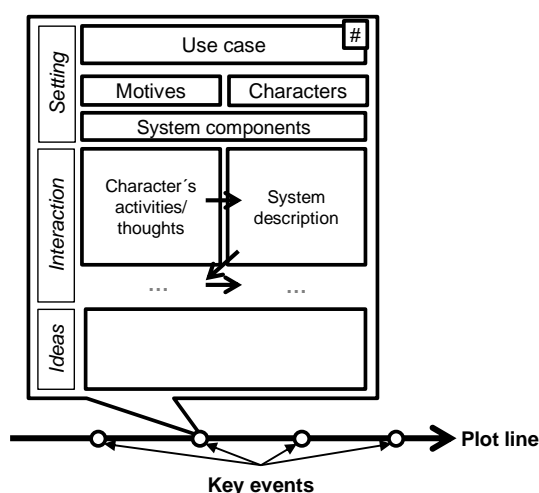


Figure 4-10: Structure of a substory

Each template is structured in three parts (Figure 4-10). The upper part includes the use case elaborated in the substory, the names of appearing characters, the character's situational motive, and system components that may influence the interaction during the specific event. Those components are similar to the general story setting defined in the previous step. However, it makes sense to concretize the setting when exploring a specific key event. It is possible that a second person (apart from the main character) influences the interaction in a specific situation. It is also possible that the character has an explicit situational motive. Finally, listing the system components would give the opportunity to gain a concrete picture of the context, in which the experience takes place. Rich context is one of the distinguishing characteristics of stories and at the same time a major influencing factor of experience. The middle part of the template includes a chart with two sides, which depict the characters' activities and thoughts on the left and a system description on the right. Participants of the method application fill out the flow

chart with short textual descriptions and explore the new interaction. The bottom part of the template is a blank space to document ideas and requirements that emerge during the process. This step of creating substories is a creative step, which can be implemented in a workshop with project participants or even project-external actors, such as end users. Some variations of application in teams are described in chapter 4.3.4.

Formulating narrative

The outputs of the previous step are substories describing the settings of and interactions during the key events. The descriptions are at that point only short and schematic. It is the goal of the current step to create narrative descriptions out of the substories. Those descriptions will build the user experience story, when arranged according to the plot line and combined. Hence, the content of the story is available and now the author of the narrative can focus on the formulation and application of narrative elements. For doing that, it is important to have the goals of creating a user experience story, as well as some criteria of a good story in mind. The goal of creating a user experience story is to communicate the user experience elements in a comprehensible way. The user experience story should describe a positive experience related to the interaction of a character with a product. As to the criteria for good stories, the author of the story can be inspired by a literature-based list (Table 18).

Table 18: Criteria for a good story (based on Michailidou et al. 2015)

CONTENT	
Honesty	Does the story base on real data? Does the content of the story portray user research accurately, without distorting the real data?
Uniqueness	Does the story reflect the feeling of the original events and the way in which the participants themselves might express it?
Richness in action detail	Does the story describe the way things happened thoroughly? Does the story provide more value than just a quote?
Relevance for user experience (UX) issue(-s)	Does the story identify a point-of-pain / a market gap / a new approach / a trend that is relevant for the UX issue? Does the story help in explaining something about the UX in a way that gets beyond facts?
Representativeness	Are the characters and situations representative?
Preciseness	Is the content of the story specific and tangible? Is the point of the story explicit enough for the audience to comprehend without further explanations or adjustments?
EXPRESSION	
Clarity	Does the story have a clear focus / a clear point?
Simplicity	Does the story use just enough details to help the audience to recognize its focus and authenticity, and no more? (...or does it involve many technical details / irrelevant information that might confuse the audience?)
Accurateness	Is the message of the story direct? (...or does it describe “a story about the story”?)
Richness in contextual detail	Does the story provide enough contextual detail to help the audience to relate to it? Does the story bring data to life by grounding it in a specific physical and emotional context?
Authenticity	Does the story use the characters’ language?
Vividness	Does the story use active descriptions?

STRUCTURE

Coverage	Does the story address all of the facts, even inconvenient details?
Coherence and plausibility	Do the facts and explanations delivered in the story make sense? Is the story believable?
Uniqueness	Is the explanation / solution delivered in the story convincing? (...or does it seem like there are many other explanations / solutions that would work equally well?)
Fittingness	Do the presented facts fit well in the story? (...or have they been forced into place?)
Length	Is the story as long as it needs to be, but no longer? Are the contents provided efficiently?

AUDIENCE-ORIENTATION

Resolution	Does the story provide an ending that suits the purpose of the story? Is the audience able to complete the “journey” in their minds? Is the audience able to relate and incorporate the contents of the story into their lives and design task?
Interactivity	Does the story evoke discussion and support participation? Is the story open-ended, so that it can be interpreted by the audience?
Suitability	Is the story told in a right way and right time for the right audience? Is it told from a perspective appropriate to the audience?
Understandability/ Introduction	Does the audience know enough about the context of the story? If not, does the story provide essential background information?

EFFECT

Reproducibility	Is the story memorable? Can others retell the story?
Identification / Immersion	Can the audience identify to / empathize with the characters of the story? Are the receivers interested in the result of the story?
Inspiration	Does the story inspire new ideas? Does it evoke reflection about design issues?

Expected value

The proposed method to create a user experience story includes the parts of defining a frame, creating substories and formulating narrative. When defining the frame, the design team brings together findings from the analysis phase to sketch and understand the character of the story. Moreover, they meet decisions about which functions to consider and which use cases to address and how. An important step is that of defining a plot, because the use of narrative elements can inspire ideas for new experiences. When creating substories, project-internal and (if desired) -external actors come together to explore and envision key events of the interaction. This happens with a system view and from a user’s perspective. Finally, when formulating the narrative, a designer has the opportunity to bring the individual user experience elements together and create (already in this early design phase) a concrete and understandable representation of the envisioned user experience.

Many advantages of a storytelling approach in user experience design have been mentioned in previous sections. Like storytelling in general, this method supports communication and collaboration across disciplines. Each member of the design team can contribute, generate new ideas and finally create a common vision about the user experience to be further designed in the subsequent phases. However, three specific aspects are worth mentioning here. The proposed method prescribes a way to generate ideas that build directly on results of previous phases. In that way, the results of storytelling are valid and information loss is prohibited.

Second, it gives a system view. Finally, it shifts the focus on user experience and narrative elements. A *limitation* of the proposed method is that storytelling raises discussions, which should be moderated properly. Many ideas may emerge during the process, which should be documented along with the outputs of individual steps. Although it is possible to emphasize on the quality of the story as narrative and even engage a professional author, it has to be clear that the main goal of this method step is to generate and communicate user experience concepts. Finally, because stories are captured in natural language, acceptance issues may appear. To make sure that the user experience story is a valid and significant document, it is important that (1) the storykeeper communicates that adequately and (2) the content and form of the story are evaluated. The second aspect is addressed in the next section about the method to evaluate a user experience story. Once the first story draft is ready it has to be proved that it does communicate the intended experience adequately. To achieve this, the drafts should be presented to non-design-team-members and necessary refinements follow.

4.2.2.3 Method to evaluate the user experience story

The user experience story is an important document in the design process: concepts and implementations will build upon this document and the experience captured in it. Therefore, it has to be ensured that (1) the user experience story communicates the intended experience adequately and (2) it addresses the defined needs and motives. In other words, evaluating the form and content of the story is necessary (i.e. the conceptualized user experience) before using it in subsequent design phases. In that sense, this step of the methodology has a twofold purpose: to assess the user experience story and to evaluate the conceptualized user experience. To achieve the first goal, the design team needs criteria, against which the story content and form may be assessed by project-internal or external stakeholders. To achieve the second goal, the design team may apply one of the evaluative user experience methods (compare to Table 1) after presenting the story to a certain audience. In this case, it is important to draw a representative sample (representative to the predefined target user group) to evaluate the experience. The *method to evaluate the user experience story* (ff. method 5) supports the design team to achieve both goals. Contents of this section have been published previously (Michailidou et al., 2015) and will not be cited explicitly in this section.

Method steps

The *method to evaluate the user experience story* consists of an initial evaluation, an assessment and a revision of the user experience story. Figure 4-11 gives an overview of the method steps, while a detailed description is in Appendix A8.

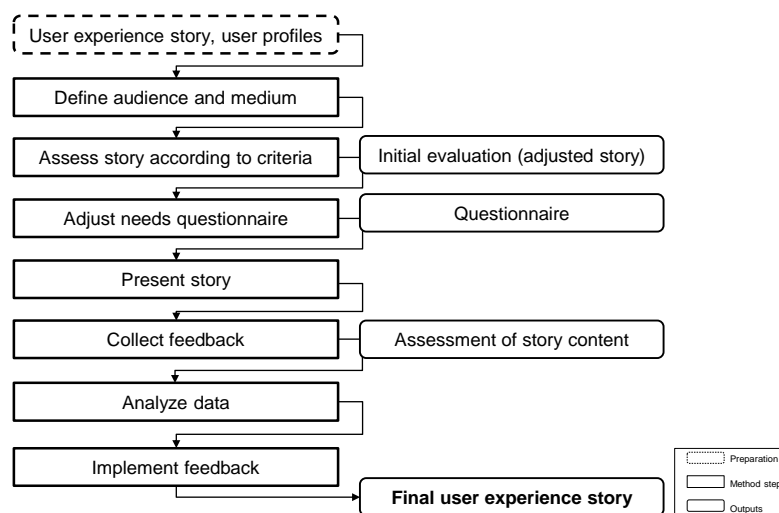


Figure 4-11: Method to evaluate the user experience story

An initial assessment of stories can be taken over by the creator of the story or other members of the design team. Before conducting any evaluation, however, it makes sense to consider who the audience of the story is (Brooks & Quesenbery, 2011). Depending on the previous knowledge of the audience about the project goals, the creator of the story decides for necessary introductions to make sure that the person assessing the story has adequate background information. The assessment itself takes place with the support of a checklist. The checklist could be the complete list of criteria for good stories (Table 18) or just the parts of the list, on which the story creator wants to receive feedback, i.e. content, expression, structure, audience-orientation and effect of stories. The criteria can be used to judge the quality of a story and improve it accordingly. However, the creator of the story and the design team have to find the right balance in levels of *representativeness* (representative vs. unexpected story), *detail* (detailed vs. interactive story) and *realism* (“rosy” vs. realistic story) in the story, so that it is suitable for the audience. Output of this step is an adjusted story that describes the intended experience adequately.

If the story describes the intended experience, the next and more interesting question is whether the experience described in the story is appealing to target users. The human factors expert is the member of the design team that has the necessary background to conduct this step of the method, while the story offers an excellent way to communicate the conceptualized user experience in such an early design stage. Two preparation activities are necessary before conducting the evaluation. First, the human factors expert draws a *representative sample* for the evaluation. User profiles serve as archetypes for selecting a sample with demographical, social and emotional characteristics similar to prospective users. Second, he/she decided for an appropriate *story presentation form*. The story has to be presented in a way that fits to the needs and expectations of the sample and to the evaluation setting. Depending on characteristics of audience, evaluation setting and availability of physical artefacts, the story could be presented in form of written text, storyboard or video. It is also possible to enact the storyline together with the participants. Figure 4-12 supports in identifying the most suitable option.

Form	Development phase			Presentation format			
	Analysis	Conceptualization	Implementation	Digital	Paper-based	Live	Offline
Oral narration	+	O	O	+	-	+	-
Textual narration	+	O	O	+	+	-	+
Text and pictures	+	+	+	+	+	+	+
Storyboard	O	+	+	+	+	+	+
Film	O	O	+	+	-	O	+
				+	:	appropriate	
				O	:	applicable	
				-	:	not applicable	

Figure 4-12: Support for selecting a proper story presentation form

Regardless from the way presented, the user experience story communicates the conceptualized experience in a comprehensive way. Due to their characteristics, such specific nature and integration in context, stories provide a great basis for user testing. Furthermore, they provide insights into the character's mind-set and motivation. Therefore, they enable an identification of the audience with the characters appearing in the story. Goal of the next step of method 5, *presentation of story*, is that participants project themselves into the role of the story characters and relive the presented experience. Therefore, they are able to evaluate their subjective experience in the next step.

There are various possibilities to proceed in the *assessment of story content*. The scenario-based methodology proposes the usage of questionnaires with scales, because of their practical advantages. Questionnaires are standardized and lead to qualitative data. Furthermore, the scenario-based methodology takes a need-based approach and proposes the use of the User Experience Need Questionnaire UXNQ (Körber & Bengler, 2013; Korber et al., 2013) to verify the needs defined in the analysis phase and elaborated in storytelling. A user experience story ideally describes a positive user experience and contributes to need fulfilment. When creating a story, designers emphasize on communicating needs and motives addressed by the new product. Potential users assess in the questionnaire whether they received the emphasis on those needs. Section 4.3.4 describes the application of such a questionnaire. Participants of the evaluation are invited to read (or hear, depending on the presentation form) the user experience story, identify themselves with the story character and finally fill out the questionnaire. In the need questionnaire, they assess the degree, to which their motives and needs would have been fulfilled, if they were the characters in the user experience story and lived the described experience. The resulting scales indicate each participant's subjective impression of the conceptualized user experience. In that way, need fulfilment is expressed quantitatively and experiences from different stories are comparable.

A limitation of an evaluation based solely on questionnaires with scales is that participants can only respond to predefined topics. Open questions, on the contrary, enable participants to express their overall impression without being restricted in answer options. A possible recommendation is to invite some of the evaluation participants to answer open questions referring, for instance, to the realism of stories and experiences described in them. Participants could also describe possible difficulties in comprehension. The evaluation cases demonstrate such a combined evaluation approach (scales and open questions).

Regardless of the exact method applied to assess the story, the output of this step is feedback about its form and content that indicates *necessary changes*. Comments on misunderstandings or difficulties in comprehensions are hints for making essential changes in the story before proceeding with its final evaluation. The responses in open-end questions will provide suggestions for possible improvements.

Expected value

During the process of creating, communicating and evaluating the story, a deeper understanding of the experience and the requirements for the interactive product to be designed is gained. As described by Wölfel (2014), the application of narratives leads to “a significantly greater number of requirements in the experience-relevant and human-subjective category [of requirements] [...] with focus clearly on experience-relevant requirements”. Moreover, the evaluation of potential users contributes to the elicitation of further requirements, which are important from a users’ perspective. The documentation of the gained knowledge takes place in our approach not only in the requirements list, but also in the refined story; that is the document that, once approved by the management, accompanies the product specification during the whole process under responsibility of the storykeeper. Evaluation results should raise the acceptance of story by management and designers who will implement the story into product in the subsequent phases. The proposed method helps inexperienced storywriters to focus on various aspects that would make the story as suitable for the audience as possible. As a result, traceability and acceptance of results is likely to increase.

A *limitation* of method 5 is that some aspects of user experience can only be evaluated in subsequent phases through actual interaction with prototypes. In a user experience story, many aspects concerning the product are vague and each receiver uses his/her imagination to fill in the missing information. Consequently, it is possible that a participant of the evaluation assesses an imaginary experience that might differ from the intended one. Therefore, further evaluations are required as soon as more artefacts are available. Moreover, the proposed method requires the engagement and participation of end-users, which might be challenging in terms of time and budget planning. The human factors expert can decide for the most suitable for the specific project evaluation method. However, it is still more efficient than other evaluative user experience methods in conceptual design, like expert appraisal, focus groups, questionnaires, repertory grid, immersion and cognitive walkthrough (compare to Table 1). Finally, it might take some time until a story creator gains the experience to find intuitively the right levels of detail, realism and representativeness in the story.

4.2.3 Latter concept phase: Concretizing the story

The aim of the latter concept phase of user experience design is to generate concrete ideas of the products that would mediate the conceptualized experience. The focus thereby lies on creating visual representations and prototypes, which demonstrate the conceptualized product and can be used for experiencing the interaction. In this phase of design, narratives and textual descriptions created in the previous phase are concretized [compare to the scenario lifecycle in (Nardi, 1992)]. During the process of replacing narratives of the user experience story with visualisations and physical representations, it is crucial that the experience-related factors and the core message of the story remain in focus. Of course, since rough prototypes cannot communicate all aspects of the intended experience yet, parts of the narrative are still used complimentary to other artefacts. Although this phase is not in focus of the thesis, this section describes a method supporting the shift of narratives to visual representations while keeping experience-related factors in focus; that is the *method to create an experience storyboard*. Furthermore, it proposes ways to use the user experience story complementary to other representations in user testing. Existing storyboarding and prototyping approaches may not fulfil the goal of transferring the intended user experience into a product, because they do not focus on experience-related aspects. The proposed method supports practitioners in facing this exact challenge. At the end of the latter concept phase, the storykeeper ensures that the generated product ideas represented in storyboards and prototypes are in line with the user experience story and evoke a positive user experience. Those outputs are the basis for the subsequent implementation phases.

4.2.3.1 Method to create an experience storyboard

Visualisations are essential for design. However, when designing experiences, envisioning and capturing experience-related aspects might be difficult during the process and in the result of visualisation. This section proposes the combination of two techniques for focusing on experience-related aspects in the process of creating visual representations of intended user experiences: storyboarding and analogy building.

Background

Storyboarding is a meaningful process in conceptual design, because it forces modularization and focus. Its result is a “globally” useful visual representation. On the other hand, analogy building can contribute to an easier envisioning of user experience. The transfer of emotional characteristics of a known positive *experience* to an analogous intended *user experience* can enable designers to imagine a future user experience and enforce them to focus on experience-related aspects of interaction. The proposed *method to create a storyboard* (ff. method 6) combines those approaches.

The substories created in the early concept phase offer an excellent way to start detailing concepts. However, they do not describe the product mediating the experience. Applying the technique of storyboarding would support the design team in creating or further developing those concepts. The output of the method is one storyboard corresponding to each substory. The created storyboards, when arranged according to the plot line, represent a more detailed version of the experience story. The following sections describe the necessary activities related to the application of the method (overview of the steps in Figure 4-13). The proposed method

is conceptualized for application within two workshops, in which members of the design team create storyboards in two stages. The proposed steps base on the analogy design (Kalogerakis, 2010) and storyboarding (Van der Lelie, 2006) processes. Contents of this section have been published previously (Michailidou et al., 2015) and will not be cited separately in this section.

Method steps

The method to create a storyboard is conceptualized for workshop applications in two stages.

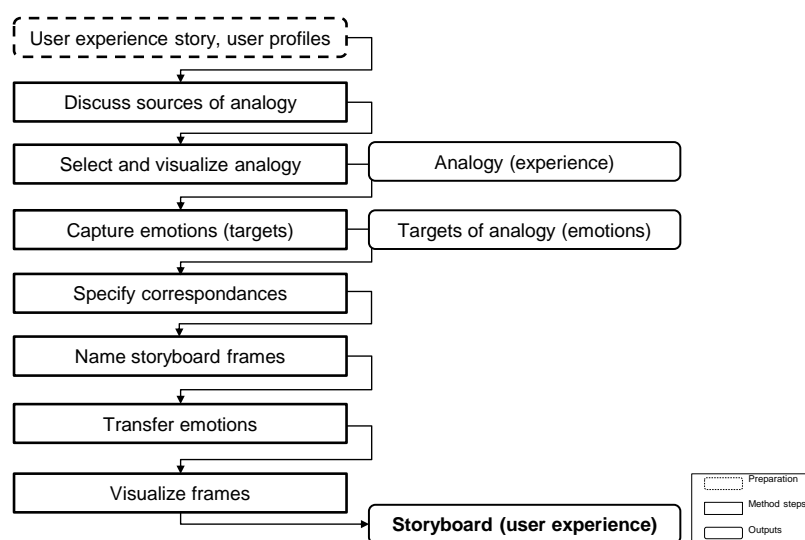


Figure 4-13 : Method to visualise the user experience story in a storyboard

During the first stage of the method, the design team creates an *analogy*. In an analogy, a *pattern* is transferred from a *source* to a *target*. The process of analogy design includes four steps. In the first step, the *retrieval*, access to analogy-related knowledge is required. In the next step, *mapping*, elements of the source are matched to corresponding elements of the target. The process of matching is structured and can be applied according to external or structural similarities. Then, knowledge that is related to the source of the analogy is *transferred* to the target. The transfer of meaningful conclusions leads to new insights. Finally, a *learning* process takes place, where generally applicable conclusions related to the analogy are documented. In this case, the target of the analogy is the intended user experience. Experience patterns are transferred from an experience (source of the analogy) to the intended user experience (Figure 4-14). The understanding of emotional patterns concerning a known experience is intuitive, while emotions that occur during the interaction with a (yet) unknown product can be challenging. Based on that claim, analogies can be very helpful for applying the knowledge about a known experience to draw conclusions about an unknown user experience.

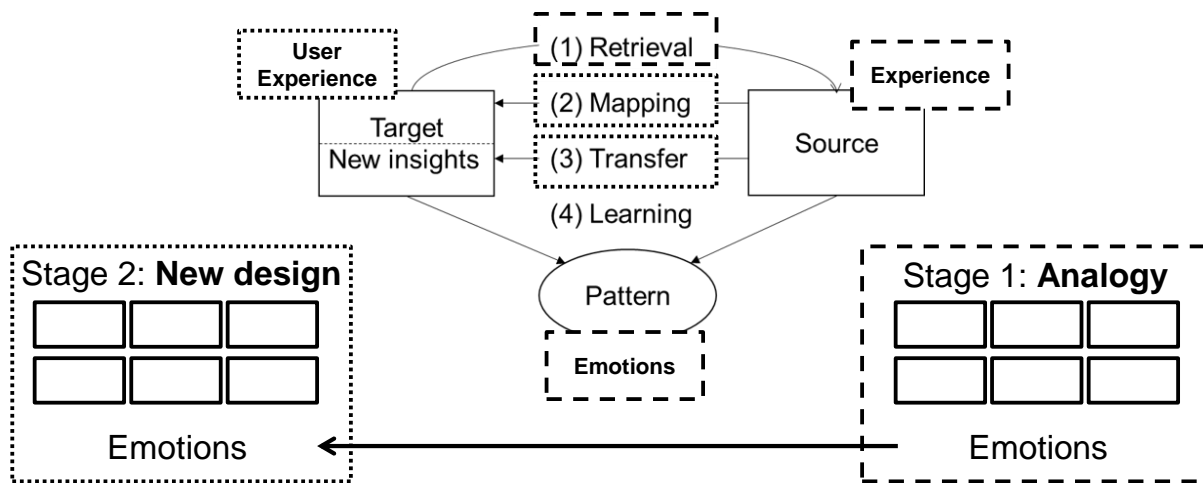


Figure 4-14 : Storyboarding for transferring emotions (patterns) of a known experience (source) to a new user experience (target)

For identifying and understanding the analogy source, the workshop facilitator brings together members of the design team with various competences. The participants first discuss possible sources for the analogy. To achieve that, they are first introduced to the user experience story. Then, they seek for known experiences that evoke a similar emotional response as the user experience story. A suitable analogy source describes a personal experience, which (1) evoked similar emotions as the ones described in the story; (2) fulfilled the need defined in the story setting; (3) fulfilled the motive defined in the story setting. The story setting (character, motive and needs) could help in identifying possible sources. Once a suitable analogy (i.e. an experience) is chosen, participants are asked to visualise the analogy in 3 to 7 frames [recommendation of (Van der Lelie, 2006)]. Finally, they document the emotions that come up in each frame. Those emotions are the *patterns* to be transferred to the target of the analogy, i.e. the intended user experience.

During the second stage of the proposed method, the concept is detailed and visualised, while the identified target emotions are transferred to the intended user experience. Again, the workshop facilitator brings together a multi-disciplinary team and presents the inputs upon which the method builds. Those are the user experience story and, particularly, the rough concepts/ideas and story setting it includes. If necessary, participants *specify the setting*, in which the events of the storyboard take place, and set a starting point (“initial situation”) and the goal (“desired situation”) of interaction. Next, the facilitator presents the analogy and discusses with the participants the *correspondences* of the analogous experience with the intended user experience. The next step is that of *naming the storyboard frames*. This step is crucial for focusing and framing the new concept. Each frame of the storyboard is linked to a frame of the analogy and an emotion. This linkage encourages the transfer of *patterns/emotions* of the *source*/analogous experience to the *target*/user experience and is the core of analogy design. Next, the *sketching of frames* begins. At this point, the facilitator can present storyboarding rules [which refer to inclusion of time, people and emotions, text, and the level of detail (Van der Lelie, 2006)]. Additionally, they could show some exemplary sketches to inspire the participants. Every frame could be visualised in many variations. One sketch per

frame is finally selected. During the process of sketching, the facilitator should make sure that requirements and to do's are documented. Once the first storyboard is created, its *validity for further characters/customer profiles and environments of usage* is tested and necessary changes are conducted. Finally, participants are asked to reflect the results from their department's perspective and, if necessary, document requirements and conflicts.

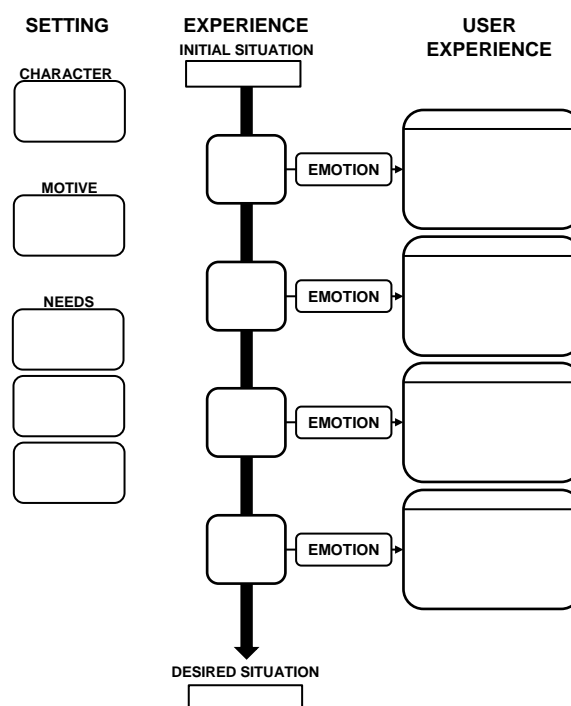


Figure 4-15: Schematic depiction of the outputs of the storyboarding method

Expected value

When applying the first stage of the method, *participants' understanding of emotional aspects is sharpened* while they refer to a known experience (analogy). This abstraction helps to identify and empathize with the evoked emotions. Using the analogy, the needs and emotions, the second stage of the method should facilitate the *transfer of this understanding into technical context*. In applications of traditional storyboarding (without the prior analogy-design stage), it can be difficult to accomplish an abstraction and relation to emotions. Both stages of the method are applied in *moderated, multi-disciplinary workshops*, in which a common understanding is built. During the second stage of the method, an increased consideration of emotions emerges when creating the storyboard frames. Participants frame the interaction, tell stories and create a common understanding. Therefore, the proposed method supports more effectively designers than methods based on experience patterns (compare to Table 1). Through their active participation in storyboarding, participants become more engaged.

Some *challenges* might come up, when applying the proposed method. Finding the right analogy is a crucial and probably difficult step. Therefore, the support of an expert and prior work are required. Choosing the right customer profile could also be challenging. It is easier to start with the most conventional/familiar profile and prove the suitability of the storyboard for

the other profiles next. Finally, some participants might face difficulties to sketch. Presenting specific rules and inspiring examples might increase their motivation.

4.2.3.2 Evaluate the user experience

During the shift of concepts from narratives towards visualisations and physical representations (technical drawing, CAD model, demonstrator or mock-up), it is important to verify that the intended user experience has been implemented. To achieve that, two aspects are important. First, the storykeeper should verify that the artefacts created in the latter concept phase are in line with the user experience story and other results of the previous design phases. Not only should individual concepts and their representations embody the content of the user experience story; all concepts have to be compatible to each other and possible to integrate into a meaningful experience, as well. Second, potential users representing the target user profile(s) should evaluate the user experience with the new representations (storyboards and prototypes). Using the user experience stories complementary to other representations is beneficial, because stories would provide a context for the interaction and provide a frame for bringing the individual concepts together (integration into an overall experience). A way to apply the user experience stories in concept evaluation is by organising *pluralistic walkthrough* (Bias, 1994) sessions or even organise *role-playing* sessions with users [as suggested by (Howard et al., 2002; Svanaes & Seland, 2004)]. The evaluation set-up could be similar to the story evaluation setting described previously, i.e. by incorporating questionnaires with scales.

4.2.4 Implementation and usage phases: Bringing the user experience story to life

As the focus of this thesis lies in the early design phases, this research does not propose any new methods for embodiment design and its release to market. However, results from the previous phases and, most importantly, the user experience story, can and should be used in the last phases of user experience design, the implementation and usage phases.

Aim of the implementation phases is to fill up the undetermined details of individual concepts to implement components (implementation phase) and finally integrate the components into a final product (final implementation phase). In an iterative process, concepts go through detailing into technical specification such as fabrication techniques, technologies and materials. The storykeeper should evaluate the concepts, their feasibility and their compatibility to the user experience story before all characteristics are determined. Furthermore, the implementation of the intended experience is not complete until all concepts/physical artefacts are combined into a total experience. The physical integration should embody the intended experience, as described in the user experience story.

The essence of the user experience story can be used as basis of the marketing concept. The same applies to the user profiles: they could be used to understand better prospective users and find out the right ways to address them with proper marketing strategies. Furthermore, the user experience story can serve as starting point for the writing of user manuals or promotional materials, since it illustrates a positive experience that can stimulate users' expectations. This

is important for influencing the anticipation towards novel products or features. At this stage, the story has usually the form of a visual narrative such as film.

Finally, the observation of real-world user experiences with the new product or feature and the collection of new stories during the usage phase is the starting point for new developments.

4.3 Discussion and conclusions

The current section summarizes three significant aspects concerning the future practice of user experience. First, it highlights that the proposed support makes it possible to design user experiences systematically. Second, it elaborates on how the individual methods focus on user experience-related aspects. Finally, it describes the importance of the storykeeper's role. The described "ideal" practice has limitations, which are described at the end of the section.

4.3.1 Importance of the methodology

Designing user experiences is not trivial. However, the proposed structured, methodological approach makes it possible to design user experiences as reproducible results (compare to 1.1.3). The proposed methodology supports designers at an operational level in organising, applying and documenting tasks that focus on user experience. The proposed methods are applicable individually. However, applying the proposed methods in a way that they build on each other would maximize the effect of the effort. Methods support in managing handy subtasks in a focused and goal-oriented way, while outputs of the methods build on each other and contribute to the overall objectives of user experience design. The methodology prescribes how to bring individual results together in a meaningful way. Another positive effect of applying the methodology is minimizing information loss. Subsequently, results can be considered more valid. Exactly because results build on each other, organising and controlling is essential. To address that, this thesis proposes that a storykeeper is responsible for implementing an effective management of individual actors and activities. Furthermore, chapter 4 described, besides the scenario-based methodology for user experience design, a frame for its application (i.e. the process model for user experience design). Such a high-level model is essential for planning design activities. In particular, the proposed methodology addresses the phases of analysis and early conceptualization of the process. Practitioners with no previous experience in user experience design are the main target of the support. The process model, the methodology as well as descriptions of exemplary applications (chapter 5) form a practical guide (Appendix A8, www.uxflrst.com) for managing the way towards the design of positive user experiences.

As discussed in chapter 3, an effective support for user experience design incorporates some special characteristics: namely scenario-based, possibility-driven, holistic, structured and practitioner-centred. The proposed methodology covers all those aspects, which make it unique compared to existing approaches (compare to 2.3).

- *Scenario-based*: The proposed methodology formalizes and makes use of the benefits of scenario-based methods, like storytelling and storyboarding. Existing scenario-based approaches have been modified to address the particularities of user experience.

- *Possibility-driven*: The core objective of all proposed activities is to understand motives of real users and find out ways to fulfil them through product interaction. Starting point for all developments are motives (not technologies or problems) and the ultimate development goal is to enable positive overall experiences.
- *Holistic*: Unlike existing approaches, which support the design of single features and resulting experiences, the proposed approach prescribes ways to deal systematically with the complexity of user experience. Particularly, it proposes ways to explore the integration of new features in a product in a way that the overall resulting experience is positive. Furthermore, the method of storytelling forces the integration of the new experience in physical and social context.
- *Structured*: The proposed methods are described as procedures with predefined steps, which take place at well-defined instants of the design process. This is because formalization is to some extent necessary when designing products of high complexity for the planning of activities and support of collaboration (synchronization of activities). The thesis introduced six methods that support designers to define (communicate) and develop (envision, design) user experience. Finally, the structured approach emphasizes on the importance of validity of results (databased approaches, frequent evaluations).
- *Practitioner-centred*: A special focus lies on practical advantages of the proposed methods, like resources-efficiency (no need for special equipment, not empirical in all stages) and scalability according to project-specific needs. The support was developed based on practitioners' requirements (3.4) and has been evaluated by practitioners (chapter 5).

4.3.2 Focus on user experience-related aspects

The proposed methodology is tailored to embrace the particularities of user experience as phenomenon and as practice. The following paragraphs will describe how individual methods and the proposed methodology as whole force the consideration of user experience-related aspects and the shift of the focus of development from products to experiences.

The special characteristics of *user experience as phenomenon* are subjectivity, context-dependency, as well as holistic, dynamic and positive nature (2.2.1). The method to create *user profiles* supports practitioners in reflecting the impact of design from a subjective user's perspective. User profiles provide insights related to the physical and social context of interaction, as well as to the emotional behaviour of representative users. Therefore, this method enables practitioners to understand deeper subjective experiences and behaviours and emerge in the contexts of interaction. The method to *extract motives* contributes to understanding deeper needs and motives and setting them as centre of development. The fulfilment of motives instead of solving problems or introducing technologies is the key to positive experiences. The method to *integrate experiences* is a unique method to analyse the interplay of experience elements and enables practitioners to deal with user experience design in a holistic way. *Storytelling* also forces system thinking, because it brings various elements of experience together. Stories are contextualized and subjective. Furthermore, the use of narrative elements can help practitioners to envision the interaction from user's perspective exploring the experience dynamics. Finally, the proposed *evaluation* gives the opportunity to reflect experiences from the subjective point of view and in the particular context of end-users.

The suggested practice incorporates the characteristics of *user experience as practice*, i.e. multi-disciplinary and user-centred. All proposed methods suggest ways for capturing and communicating user experience-related aspects in a way that is manageable for all persons involved in the design process. Moreover, the methodology suggests ways to incorporate different expertise in the method application. Users and their needs are the starting point and centre of all proposed design activities. Although their active participation is not advisable in every step of the methodology, because that would require tremendous resources and even hinder some design activities, users are considered in every step of the user experience process through the consideration of user profiles and user motives.

4.3.3 The role of a storykeeper

Ill-defined responsibilities in user experience design is an explicitly mentioned challenge in current practice (3.3). When designing complex products management is essential. However, the management of user experience design bears new challenges that should be explicitly addressed by a high-level manager. Those aspects are described here as the storykeeper's role. A previous publication (Michailidou & Lindemann, 2016b) will not be cited separately in this section.

The main responsibility of a storykeeper is guarding the project success. In the context of user experience design, this means that the new design mediates a positive user experience. In other words, it means that users (re)live a story when interacting with a product in a way that it evokes positive and memorable experiences. To achieve that, the storykeeper manages conflicts and makes decisions that are positive towards user experience. To achieve successful experience design, the storykeeper has to undertake many tasks and to be equipped with skills that would enable him/her to implement them. In short, the role of storykeeper is a unique combination of tasks and skills of high-level manager, requirements engineer and design thinker.

As *high-level manager*, the storykeeper influences the allocation of means that would make user experience design feasible. This refers to appropriate methods, personnel with various backgrounds, as well as involvement of end users. Moreover, he/she influences the company culture in a positive towards user experience way through the own attitude, through decision making and by rewarding positive results. Moreover, a storykeeper is responsible for the efficient and goal-oriented evolvement of projects. Analogue to a gatekeeper, the storykeeper overtakes the stage-gate controlling, which means he/she proofs and guards results of individual process steps. This is essential for applying successfully a methodology, where individual results build on each other. The role of storykeeper as high-level management is important, because from this position a storykeeper can influence mind-sets and decisions. Those are major drivers for the successful implementation of user-centred approaches (Van Kuijk, 2010).

As *requirements engineer*, the storykeeper has to make sure that users' needs and motives are elicited and captured. Particularly quality requirements must be captured and highly prioritized. In that sense, the storykeeper incorporates the role of a requirements manager, who is moreover sensitized about experience-related aspects. Furthermore, a storykeeper has the responsibility to guard the user experience story (prohibit that it becomes too technical, misinterpreted, lower

prioritized). Finally, he/she has to ensure that the focus of development remains on experience-related aspects and to proof the quality and fittings of developed concepts to design objectives.

As *design thinker*, the storykeeper (regardless educational background and applied practices) has some aspects shaping his/her mind-set. Human-centeredness is crucial to support human components of systems and selection of methods, which increase empathy. A storykeeper encourages iteration and experimental work, early process outputs and tolerates failure. Another characteristic is enthusiastic and positive attitude towards collaborations bringing diverse teams together. System thinking in problem understanding, solution creation and impact of new solutions would benefit user experience projects. Abductive thinking and a positive attitude towards “new”, as well as “visual” thinking are further valuable characteristics of a storykeeper. A design thinker is an integrator and orchestrator of functions; boundary creator and gatekeeper of initiatives; advocate of user and of human desire (Kleinsmann & Snelders, 2015). Those are all relevant personality aspects for a storykeeper.

4.3.4 Limitations of the methodology

Although the proposed future practice has been described in a generic way, it has to be stated that it might not be applicable in certain projects or organisations.

A first limitation is that the support was conceptualized for the design of complex, tangible products. In chapter 5, cases in the automobile and household appliance domains demonstrate its application. Consequently, individual methods or the methodology as whole might not be per se applicable for products of other domains or products with different characteristics. Tangible products of high complexity have special characteristics, so the applicability of the support for different kinds of products should be further explored. Furthermore, the proposed practice may not be suitable for all projects. Project-specific limitations concerning data availability, availability of resources or specific constraints (e.g. high confidentiality) may make the application of the methodology impossible. Practitioners, who are interested in applying the proposed support, should examine the extent to which it fits to project-specific needs. In any case, the methodology is to some extent scalable and adaptable.

Implementing a design process focusing on user experience is likely to require organisational changes, significant investment in resources and support from upper management. Upper management should make a conscious decision on aligning the organisation with user needs and establish a user-centred company culture (Van Kuijk, 2010). The proposed practice requires conviction about the importance of user experience. Establishing the proposed methods requires resources and effort (practice, resources and expenses). Therefore, it requires commitment. Moreover, implementing the proposed practice is a collective effort. For example, creating user profiles requires user-related data, integrating experiences requires the involvement of various stakeholders and evaluating the user experience story prerequisites the participation of end users. Although applicability was an explicit requirement of the support, conscious decisions and investments are necessary.

Finally, the proposed practice should not be seen as an exhaustive list of methods to communicate and generate user experiences. The proposed methods can (and in many cases should) be used complementary to other methods. Some examples have been given in the

descriptions of individual phases. For example, the creation of user profiles does not replace the deep insights that could be gained through field studies during the analysis phase. Similarly, a user experience story and a storyboard can not replace the direct interaction with physical prototypes in conceptualization. The methods proposed for the analysis phase focus on creating an understanding about users. Methods that contribute to understanding the context of use or desired product attributes can be used complementary. The methods proposed for the early conceptualization focus on experience-related aspects and can therefore be complemented by methods that focus on product-related aspects. Approaching later design phases, the need for other, different from the proposed methods increases. However, the proposed practice suggests ways to preserve the essence of the conceptualized experience in focus even beyond the implementation of a product.

5. Evaluation

The objective of this thesis is to introduce a support for designing positive user experiences systematically. The development of the support presented in chapter 4 was an iterative process of proposing, applying and refining methods. The groundwork for this iterative process were practitioners' requirements (3.4). The proposed practice of user experience was assessed according to those requirements in different cases. The current chapter will describe the evaluation of the support in the three corner cases with focus on the insights concerning the applicability of the support in each of them and the learnings for future applications. The chapter begins with a description of the research questions addressed in the evaluation and the research plan, highlighting the particularities of each evaluation case (5.1). Then, sections 5.2-5.4, describe the three case studies in terms of approach, results and learnings. Although this chapter focuses on evaluating the proposed methodology, it is at the same time an important part of the support for practitioners. The learnings from applying the methodology can serve as hints for practitioners. Therefore, significant insights concerning individual methods have been integrated into the method descriptions (Appendix A8). Finally, the end of the chapter describes cross-case conclusions and recommendations for future applications (5.5).

5.1 Research design of the evaluation

The overall objective of the evaluation was to find out how design practitioners without expertise in user experience design assess the ease of use, usefulness and suitability of the proposed methodology. Three studies contributed to this overall objective. The gained insights contributed to the development and the evaluation of the methodology. In particular, learnings from the first two cases (formative evaluation) influenced the further development of individual methods and the methodology as whole in intermediate stages. The third case (summative evaluation) was about evaluating the methodology in a real-life setting. It demonstrates an application of the methodology in its final stage, as it is presented in chapter 4. Although the current evaluation includes insights from specific cases, their differences (domains, companies, persons applying them) cover a relatively broad spectrum of design of complex, tangible consumer products.

An important matter when planning the evaluation was to identify settings that represent the focus of the thesis (compare to 1.3) and at the same time are realistic for future applications. Each case has special characteristics and addresses specific research questions (overview in Table 19). Executing more than one case study was important to cover a broad spectrum of possible applications and test the validity of the gained insights. Since the thesis focuses on user experiences mediated through *tangible consumer products of high complexity*, the products in all three cases incorporate those characteristics. Moreover, the thesis focuses on the *early design phases* and particularly on the activities that contribute to *envisioning and representing user experience*. The activities described in the case studies match to this focus. Furthermore, the developed support aims primarily at product developers without expertise in user experience design. Therefore, the applicants of the methods in all cases correspond to this profile. All cases represent realistic settings for application and address user experience-related objectives.

Criteria for the evaluation were the collected requirements (3.4, Table 14), which represent needs of possible applicants. In particular, the evaluation examined the *ease of use*, *suitability* and *usefulness* of the support, as well as the *satisfaction* of the persons applying it (compare to Table 14). In short, the requirement for ease of use describes the understandability and ease of learn of a method. The requirement for suitability indicates the degree to which the method fits into existing structures and processes. Usefulness is the measure for the impact of the method in terms of results. Finally, the user's satisfaction shows the subjective opinion of the person, who applied the method. The description of the case studies in the following sections refers to those requirements as "lessons learned" from each application and highlight opportunities, challenges and recommendations. The gained insights from all cases flowed into general recommendations for an ideal application, which are discussed at the end of the chapter.

The first case (ff. case "car") took place within the CAR@TUM project (details about the project background in 3.1). This case examined the methods to create user profiles, integrate experiences, create and evaluate a user experience story with the user experience process as frame for application. At the time the case "car" was implemented, the methodology was still in development. In that sense, this formative evaluation case contributed significantly to the development of the methodology. The research questions explored were:

- Which scenario-based methods are usable and useful for a multi-disciplinary team when envisioning and representing user experiences for the automobile domain?
- In which phases of the user experience design process are the methods applicable?

The case "car" demonstrates a *real industrial context* and a large company structure. The objects of design were products of the *automotive domain*. Cars are consumer products of high complexity. They consist of a large amount of components, which are of different arts (mechanical, electronic) and are geometrically and functionally linked. The existence of various user interfaces leads to a high number of possible states. Not only are the product states dynamic, but also the context of use, too, since the environment changes during driving. Finally, the driver is not the only user of a car: the user experience of passengers has to be considered, as well. For all those reasons, designing positive user experiences in cars is challenging in many ways. Concerning the application case itself, a characteristic of this case concerned the degree of novelty of designs: positive user experiences were supposed to be mediated through *original features*. Three of the experiences developed through the application of the methodology introduce three original features: the "heartbeat", the "periscope" and the "cocoon". Another particularity of this case was the *excellent availability of resources*. Within the frame of the CAR@TUM project, company data, a multi-disciplinary team, a team of product experts and user experience advisors, as well as real users were available.

By the end of the case "car", an initial description of the methodology and the individual methods was complete. However, it was unclear, whether the methodology is applicable in domains other than the automobile and whether it is possible to apply the methodology with limited resources. Moreover, the case "car" focused on original design projects, so the applicability of the methodology in adaptive design projects should be further examined. Those questions were explored in the second case.

The second case (ff. case “coffee machine”) was conducted through student projects and concerned the development of user experiences with automated coffee machines. This case focused primarily in the following research questions:

- Is the methodology applicable for a product of the household appliance domain?
- Is the methodology applicable in adaptive design projects?
- Are individual methods easy to use and useful?
- Is the methodology applicable with limited resources? Is it possible to apply only parts of the methodology? Is the methodology applicable with online data as primer source of information? Is the methodology applicable by individual designers instead of a team?

Although the “coffee machine” case *did not take place in direct cooperation with industry*, it demonstrates a realistic setting: it simulates a *limited* in term of time and *resources* project, i.e. situation that makes no exception in industry. The duration of the project was limited to maximum six months and no project-specific studies or data were available. Furthermore, the students involved in this case simulate adequately the target group of the support: product developers (with bachelor degree in mechanical engineering) without prior knowledge in user experience design. Because of the limited resources, *only punctual support by product experts or end users* was possible. Moreover, the study explored the extent to which it was possible to apply *only parts of the methodology*. The development goal concerning the degree of novelty was in this case *adaptive design*. As confirmed by the studies on current practice (chapter 3), this is the most common occasion in real industrial projects. The object of design in the “coffee machine” case was a product of the *household appliance domain*: an automated coffee machine. Although different from the object of the first case, the automated coffee machine is also a complex, tangible consumer product. It consists of many integrated mechanic and electronic parts, enables through a user interface the manipulation towards various states and may be used by multiple users. An intriguing aspect of redesigning a coffee machine is that the direct interaction lasts a few minutes in a static environment. However, coffee drinking is considered a ritual for many consumers and the coffee machine is a product with hedonic attributes. Most manufacturers of premium coffee machines offer a similar, broad spectrum of functionalities. Coming up with adaptations that improve the user experience would be an indicator for the usefulness of the methodology.

By the end of the “coffee machine” case, many insights about individual methods and the methodology as whole were gained, according to which their development and documentation were finalized. However, it remained unclear, whether the case-specific findings would be applicable in a real-life setting. In a real-life setting, it would also be possible to assess the suitability of the methodology. Those issues were explored in the final case.

The third case (ff. case “dish care”) took place within the “Innovative Dish Care Solutions” project. It demonstrates a *real industrial context* and a *large company structure*. The constraint of *limited resources* was applicable in this case, too. The product duration was limited to six months and only punctual support by experts or end users was possible. However, *real company data* were available. Applicants of the support were both mechanical engineering students and employees of the company without expertise in user experience design. The project type was in this case not limited: both *original and adaptive designs* (features) were welcome, as long as existing products of the company would be taken as reference. The product of reference was

another complex product of the *household appliance domain*: a dishwasher. The intriguing aspect of this product is that it is, unlike cars and coffee machines, a product with a predominantly pragmatic character. Finding hedonic attributes and creating pleasure in the interaction, which goes beyond functionality, was the challenge addressed in this case. The research questions explored in the “dish care” case were:

- Is the methodology useful and suitable for a real-life project of the household appliance domain?
- How do practitioners assess the ease of use of the methodology and their satisfaction?

By the end of the “dish care” case, a summative evaluation of the methodology was completed. Moreover, a cross-case analysis of the results from all three cases made it possible to provide general recommendations about the applicability of the methodology.

Table 19 : Case studies of the evaluation

Case	Domain	Objective	Focus	Setting, Project type	Applicant	Data source
Car	Automobile, dynamic product	Formative evaluation	Usefulness and suitability of methods	Real-life, Original design	Multi-disciplinary team, experts	Company data, project-specific studies
Automated coffee machine	Home appliances, hedonic product	Formative evaluation	Applicability of methodology - in further domain - in adaptive design projects - with limited resources	Realistic, Adaptive design	Individual product developers, experts	Online data
Dish care	Home appliances, pragmatic project	Summative evaluation	Ease of use, usefulness, suitability of and satisfaction with methodology	Real-life, Original and adaptive design	Team of product developers, experts	Company data

5.2 Formative evaluation: Case “CAR@TUM user experience”

The first case study (ff. case “car”) describes the application of the scenario-based methodology by an interdisciplinary team in the exemplary design of user experiences with an electric vehicle. The research goal in this case was to find out which scenario-based methods are useful and usable, as well as to define the steps in the user experience process in which the method applications should be anchored. The following research questions summarize those aspects: *Which scenario-based methods are usable and useful for a multi-disciplinary team when*

developing experiences for the automobile domain? In which phases of the user experience design process are the methods applicable?

The “car” case took place in collaboration with industry. Members of the design team were the participants of the CAR@TUM project, i.e. scientific assistants with *various backgrounds* (engineering, psychology, design, informatics), who had at the beginning of the project no prior user experience-related knowledge (*non-experts*). They applied the proposed *methodology* in team, bringing in their domain-specific expertise. When necessary, they were supported by employees of the company (product experts) and user experience experts (“mentors”) from the broader circle of project participants. Main source of information were *company data*, studies, as well as feedback from experts and potential users. The object of design were novel features that would mediate positive user experiences for drivers and passengers of an *electric car*. The application of the methodology has indeed resulted into the development of three features named “heartbeat”, “periscope” and “cocoon”. The development of the three concepts (and method application) took place in a sequential order. Cars are challenging products in terms of user experience, because of their high level of complexity. Users of cars, which may be drivers or passengers, experience dynamic situations. Finally, cars have a strong *hedonic* character.

5.2.1 Approach

To approach the research questions, the first evaluation study incorporated the methods of participant observation and document analysis during the design process. The advantages and limitations of this approach are described in section 3.1.1. While section 3.1 concerns the established company practice, the current sections refer to the application of the same approach for drawing conclusions about a new practice. In short, the methodology was applied by the project participants⁶, while observing and documenting their behaviour and difficulties. The main advantage of participant observation is that it provides deep insights concerning the research questions. Furthermore, methods and their outputs were discussed in several (formal and informal) project meetings with the broad circle of project participants (company employees, professors, mentors). Minutes and notes from those meetings were analysed to draw the conclusions presented in the next sections. A limitation of this case is that the setting of the CAR@TUM project provided excellent resources for the method application in terms of expertise, data availability, contact to various stakeholders and time. This is unfortunately not the most common setting for real-life applications, where resources are usually more limited. Another limitation of the “car” case is that at the time of its execution, no concrete descriptions of the methodology existed. The formalization of the methods happened in parallel to their application. Subsequently, the method descriptions could not be evaluated. Both limitation aspects have been considered in the next evaluation studies (5.3 and 5.4).

⁶ In the subsequent sections, the terms “project team”, “design team” or “we” will refer to the core team of project participants (i.e. the scientific assistants from the four cooperating institutions).

5.2.2 Results

During the course of the CAR@TUM project, the application of the user experience design process (4.1) resulted to the development of three features mediating new experiences: the “heartbeat” (Loehmann, Landau, Koerber, & Butz, 2014), the “periscope” (Loehmann, Landau, Koerber, Hausen, et al., 2014) and the “cocoon”. Following sections will describe only the results that are relevant for the focus of this thesis, i.e. results that emerged in the analysis and early concept design phases through the application of scenario-based methods. Subsequently, the results of applying other methods (like experience prototyping) or results that emerged in later design phases will not be discussed. Table 20 shows the relevant applications.

Table 20 : Method application in the “car” case

	“Heartbeat”	“Periscope”	“Cocoons”
Create user profiles	✓	✓	✓
Extract real users’ motives	✓		
Integrate experiences	✓		
Create a user experience story	✓	✓	✓
Evaluate the user experience story	✓	✓	✓

Because the project team had put most emphasis on the design of the “heartbeat” and the result is the most complete one, the evaluation refers primarily to it to demonstrate the method application. The “heartbeat” concept is described in detail in works of Loehmann (Landau et al., 2014; Loehmann, 2015; Loehmann, Landau, Koerber, & Butz, 2014), who was the project participant responsible for the implementation of ideas into prototypes. The “heartbeat” is a feature for electric cars, which informs drivers about the momentary energy state via haptic feedback and the stage of charge via visual feedback. Analog to a human heartbeat, it lets the driver explore the energy flow of the electric car, it provides the opportunity for a stimulating user experience. By providing subtle information about the energy state, it helps the driver to gain control of current and upcoming situations; thus provides the opportunity for an experience addressing the need for competence. The following sections describe the results of applying scenario-based methods in the development of the “heartbeat”. Individual results have been slightly adapted or are not depicted in this thesis due to confidentiality reasons.

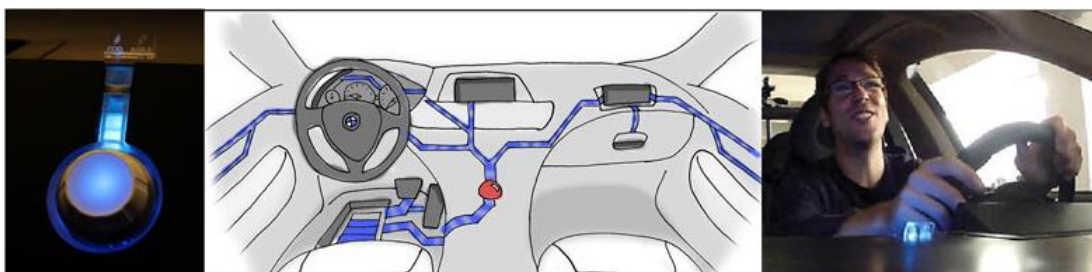


Figure 5-1 : The “heartbeat” prototype ⁷

⁷ www.designingexperiences.org

5.2.2.1 Create user profiles

In the analysis phase of the user experience process, we searched for ways to compile and represent information concerning potential users of the new designs. As described in 4.2.1, this is crucial, because a deep understanding of prospective users' characteristics and needs is the prerequisite for the design of experiences. In the "car" case, the objects of design were novel features mediating positive experiences in electric cars, so our target users were electric car drivers. Having gathered information about demographics and social characteristics of drivers of electric cars, we created a fictive persona incorporating those characteristics. The persona based on open-access studies and statistics concerning drivers of electric cars of various manufacturers globally. Although the compiling of information in a persona was useful, we identified some challenges and limitations related to it. One aspect concerns the little differentiation of brands and markets. The gathered data did not include such a differentiation, so the resulting persona did not either. Another drawback of a fictive persona is that acceptance issues may raise. Acceptance is a key issue when applying the method, because a persona is a core result of the analysis phase to be used in the next steps/phases: If not grounded in reliable data, the subsequent results building on it may be false.

A databased procedure would overcome those challenges. Therefore, we decided for creating *databased user profiles* to assess the validity of the fictive persona. It was possible to identify many studies/data sources in the company, which would contribute to the creation of a databased persona. To begin with, it was possible to differentiate brands, markets and product types. Results of method application are in Appendix A4.1 and in a previous publication (Michailidou et al., 2016). An exemplary profile is depicted in Figure 5-2.



Figure 5-2 : User profile in the case "car"

Following the procedure depicted in Figure 4-5, we gathered retail data for car type T1, in years 1-3, in regions R1-R6. Car type T1 represents in this case the existing car type of the manufacturer with the greatest similarities to an electric car. We selected region R1 as the most representative for buyers of T1. Those restrictions helped us to focus on data about buyers of T1 in R1. Not only could we identify statistics about demographics of such buyers, but also it was possible to retrieve from data loggers insights about their usage (driving) behaviour. Examples for demographic and utilization data can be found in the description of the method for creating user profiles in 4.2.1. Another limitation of the traditional persona approach is that it does not include user experience-related aspects, like information on the physical and social context of the interaction, as well as information about the emotional behaviour of typical users. We integrated those exact aspects in the user profiles. From online sources, it was possible to collect information about the physical context, like characteristics of representative cities in region R1 and typical weather conditions. To specify the social context, we used the SIGMA milieu studies, which had been broadly used by the collaborating company. Having matched typical buyers of T1 in R1 to a milieu, we could draw representative values, mentalities and lifestyles. Finally, we concentrated in the inclusion of the emotional behaviour. We found out that the research department of the collaborating company had conducted a study about the meaning and prioritization of psychological needs in various regions. The needs defined by Sheldon et al. (2001) were the basis of the study. Buyers from various markets were asked about their interpretation and assessment of importance of those needs. The main result of the study is a region-specific definition (interpretation) of needs and their region-specific prioritization. We adopted those results for the user profiles and created a radar chart depicting the prioritization of needs in region R1. Discussing the meaning and prioritization of needs in the team helped us to gain a deep understanding of the emotional behaviour of drivers of T1 in R1. In total, we have created five profiles corresponding to car type T1 represented in regions R1-5 and three profiles corresponding to car type T2 represented in regions R1-R3. Although no data relating explicitly to electric cars were available, the created profiles represent adequately possible drivers of electric cars.

Opportunities

The opportunities we have identified in applying the method to create user profiles can be summarized in three aspects. *First*, the databased approach is the key to create representative, traceable profiles that are highly likely to be accepted and used in the design process. The format of results of the method application is also important. Big companies, like our partner in the “car” case, have qualitative and quantitative data concerning needs and behaviours of customers. However, the results of individual studies could “disappear”, if they do not have a useful format or if they are not brought in relation to other information. The proposed method provides a structure to include data from and synchronize activities of various departments and stakeholders. The format of the profiles (database with relevant user data and profile visualisation) was perceived usable and reliable. *Second*, the inclusion of user experience related aspects substantially contributed to a better understanding of the context of interaction and emotional characteristics of users, which are crucial when designing experiences. In the “car” case, we observed a positive impact when the profiles were used for inspiring the elicitation of requirements. Realistic usage situations and particularities of different markets have been taken into account. This considered aspects of usage context (location, climatic

surroundings), identification of critical situations, but also personal characteristics and psychological aspects in particular. The identified requirements were more reliable (ground on the database) and rich in emotional aspects. *Third*, the creation of segment-specific profiles makes it possible to differentiate product variants according to the characteristics and needs of users from different segments. In the “car” case, the segmentation was based on geographical regions, so a possible outcome are differentiated requirements for region-specific car variants.

Challenges

The main challenge of the method is the *availability of data and resources*. A prerequisite for application is to have data on utilization, context and prospective users. In the case of adaptive design and given that the company tracks retail and buyer data, this is easy to implement. In the “car” case, sufficient data about electric cars were not available. Instead, we have used data of car types with significant similarities. Furthermore, data on product utilization can easily be traced in automotive, but less likely in other domains. We worked with a company, which supported the execution of marketing studies and the inclusion of machinery, like many automobile manufacturers do. What if few or different data are available? This case focuses in the automobile domain. If willing to apply the method in another domain, it may be necessary to adapt the *data on utilization context and product utilization*, which are relevant and traceable in automobile but probably not in other domains. Another case-specific decision was the one concerning the *segmentation*. Possible segmentation strategies include regional-, market-, brand- or need- specific segmentations. The decision for a strategy could be made according to data availability and company practices. *Availability of resources* can also be an issue. The data gathering and analysing processes are the most time-consuming ones, but at the same time the ones that are the key to a successful method application. A way to tackle this challenge is by eliminating the number of profiles. All mentioned challenges are explored in cases 2 and 3.

Recommendations

Investing resources in the creation of solid user profiles is worthwhile, if they find application in subsequent design phases and influence the decision-making process (compare to Table 16). Therefore, it is highly recommended to invest the resources in the creation and benefit from the application of profiles. Another recommendation concerns the number of profiles created. Depending on that, a company can invest or save up resources. Our recommendation is to create at least one profile per significant market (region). In critical cases, it might be useful to create an additional “extreme” profile. Extreme profiles can be useful for deriving and assessing specifications. Profiles can be used in an analogous to anthropometrics data (percentiles) manner: if the feature/product fits to average and extreme profiles, it will fit to the majority of customers. Finally, databased user profiles represent real users. Because often there are differences between marketing personas (“ideal users”) and real users, it is advisable to clarify the difference.

5.2.2.2 Extract real users’ motives

Parallel to the creation of user profiles, the design team conducted empirical studies to understand behaviours, wishes and problems of drivers of electric cars. The studies were implemented by the human factors and the design expert, while results were shared, discussed and further processed by all team members. The empirical studies included observations and

semi-structured interviews with drivers of electric cars. They primarily focused on the usage of driver assistance systems and the issue of charging the electric car. Complementary to the empirical studies, the team has collected relevant information (e.g. studies, articles) from online sources and press. All those efforts contributed to the goal of understanding real users and extracting opportunities for the design of new experiences. Therefore, we focused on positive experiences instead of problems or technologies (compare to “opportunity driven design”).

Table 21: Exemplary motives in the case “car”

swim harmonously in traffic
delegate tasks with a good feeling
be able to concentrate on passengers
avoid collisions with other cars
reach destination with my energy resources
feel the driving conditions with all senses
experience dynamic agility
feel the energy flow
communicate with my car directly
know and feel the status of my car

At least two analysts, who read the statements and divided them into text modules, executed the qualitative content analysis of the interview results. They organised the interview responses into the syntactic units of *goals*, *problems*, *situations* and *activities* and in the next step created a list of codes according to the interview responses. The text modules were then assigned to overall categories, each of which represented a motive. The motives were not predefined; instead, they were the result of content analysis. As described in 2.2.1, motives are expressions of fundamental human needs in specific situations and the reasons leading to an action. The findings of the analysis of press reports and open source studies were processed in a similar way. Key findings were summarized into text chunks, which were then assigned to the described categories. The output of this step is a summary of experience reports of users in form of an overview of their goals, problems, motives and needs. A major outcome of this step related to the development of the “heartbeat” was the derived motive “*I want to understand the energy flow of my electric car in a comprehensible way*” (Appendix A4.2). This motive was evident in interview statements, as well as in the gathered material. Furthermore, it provided the fundament for the conceptualization and evaluation of the “heartbeat”, since the “heartbeat” concept primarily aims at fulfilling this motive and thus providing a positive experience.

Opportunities of the described approach is that the confrontation with real users increases significantly the team members’ understanding of user experience-related factors and empathy with users. Focusing on motives and needs (instead of problems and technologies) is the initial step towards designing new, positive experiences. However, the described process bears *challenges*. First, empirical studies require many resources from the side of the design team and a demanding recruiting of appropriate participants. Experienced interviewers and analysts took the leading role in this process step. Another challenging part of the process concerned the analysis: assigning information to the category of “motives” prerequisites a good understanding of the meaning of motives, as well as a good abstraction ability from the side of the analyst.

Having on board team members with background in psychology was crucial at that stage, because, the definition of motives turned out to be difficult to grasp for most team members. *Recommendations* for next applications are related to the resources and the demanding data analysis. Although empirical studies definitely contribute to a deep understanding, non-empirical ways to derive motives will be explored in the next cases. Particularly, the analysis of user stories found in open sources seems very promising. The “car” case showed that they are rich in insights, while the effort for collecting and analysing them was significantly less compared to the empirical studies. The “coffee machine” case demonstrates a systematic way for extracting motives through narrative analysis (compare also to 4.2.1). As to the matter of understanding the meaning of motives and choosing the right level of detail to express them, it is certainly recommended to provide many examples.

5.2.2.3 Integrate experiences

At the end of the analysis phase, we have defined a target user group represented in a user profile and a relevant motive to address through new concepts. However, before initiating the idea creation, it was important to examine all user experience aspects relating to the system to be designed. This step is crucial in the design of complex, tangible products. Any new concept would have to fit into the existing product (here: electric car) and the experiences emerging through the driver’s interaction with it would have to match to the overall driving experience, particularly in the driving situations, in which it would be used. Therefore, it was necessary to approach systematically the integration of a new experience. To do so, we have applied the matrix-based method described in 4.2.2. In the implementation of the method, the role of developers was the leading one (moderating the method application). However, all team members brought in their expertise and contributed to the filling of matrices.

The procedure of method application took the following steps (Michailidou et al., 2014). Representative examples are in Appendix A4.3. First, we identified the experience-related aspects (domains) to be examined: motives, needs, use cases and functions. Then, we have collected the elements for the selected domains and created the matrices “*motive can occur at the same time with motive*”, “*motive meets need*”, “*function fulfils motive*” and “*function is used in use case*”. The motives entered were the ones derived in the previous step. The needs entered were the needs tested by Sheldon et al. (2001). As to use cases, the cooperating company provided ca. 20 relevant use cases to be considered. Finally, to identify functions we created a hierarchical function model. We identified about 60 different functions and selected the 20 ones according to their relevance to electric mobility, their potential for positive experience creation and project restrictions (e.g. focus on car interior, no primer driving functions). In the next step, we identified relations in each of the selected matrices. Each matrix was filled out within moderated workshops with the developers as moderators and project participants with expertise in the topic discussed in each matrix as contributors. To identify relations between motives or motives and needs, for instance, we involved psychologists, while matrices involving functions required the attendance of engineering experts. The results were documented in tables.

Since the starting point of development was the motive of feeling the energy status of the car, the matrix analysis was organised around this motive. Therefore, we first looked for further motives associated to it. In the matrix exploring the relations among motives we identified, for

example, the related motives for “reaching destination with energy resources”, “feeling the energy flow in different driving situations” and “getting a feeling of electric energy consumption”. The matrix combining motives and needs showed that primarily addressed are the needs for physical thriving, competence and stimulation. The fulfilment of those needs was set as criterion for the success of the new design. Analysing the relations among functions and motives, we identified the functions which address the relevant motives: e.g. “provide energy information”, “control driving mode”, “start/stop motor”. The matrix combining use cases and functions provided additional information regarding the situations in which the functions and consequently the new device are likely to be used, like “driving energy efficiently” or “start driving”. Having a selection of functions and clearly set criteria and use situations, the team proceeded to step of creating and evaluating concepts. The identified relations served as direct input for the subsequent phases, particularly for storytelling. In its final implementation, the “heartbeat” replaced five buttons/indicators, making their use more intuitive. With the help of the matrices, it was possible to identify the critical use cases and the needs to be addressed.



Figure 5-3 : The “heartbeat” prototype (left: first prototype; right: integrated prototype) ⁸

Applying the matrix-based method to integrate experiences opened up many *opportunities*. The method provided a structured way to collaborate within the design team. The consideration of user experience-related domains definitely contributed in anticipating the impact of a new experience. Furthermore, the method provided a structured way to deal with the complexity of experiences: it supported the team to avoid redundancies and achieve compatibility or even synergies when integrating a new feature into an existing complex, tangible product. The method provided traceable results and gave the opportunity to consider indirect relations of user experience elements by computations. For example, the links of needs to functions were indirect and challenging to define. However, through the indirect relation of needs to motives and motives to functions it was possible to find out links between needs and functions.

The main *challenge* in the method application was the communication of the complicated procedure of matrix analysis. Since various stakeholders were involved in the method application, the benefits and procedure of the method had to be explained many times and in a comprehensible manner. Therefore, it is highly *recommended* to proceed with a simplification

⁸ www.designingexperiences.org

of the procedure or at least its communication in next applications. Moreover, it was challenging to determine the appropriate order, in which to fill out the matrices. Next applications will explore this issue. A further challenge concerns the implicit entering relations. Ideally, decisions should base on facts and not just implicit decisions of the workshop participants. Furthermore, when combining functions, restrictions (e.g. geometrical constraints, safety constraints) and limitations (e.g. not combining too many functions) definitely have to be taken in consideration. Finally, we found that the steps of integrating experiences and creating user experience stories are complementary and should ideally be conducted iteratively.

5.2.2.4 Create a user experience story

The core of early conceptualization is the step of creating a user experience story (ff.: method 4). The user experience story describes the experience mediated through new concepts from a user's perspective. The process of creating the user experience story is a process of bringing together the results of all previous steps, exploring experiences and ideating. It takes places within the multi-disciplinary team. During the development of the "heartbeat", we applied method 4 in workshops with all team members. The procedure was based on the steps depicted in Figure 4-8. We have implemented the steps in two workshop sessions: the first including the definition of settings and plot and the second the composition of substories. The formulation of narration and its visualisation happened afterwards. Exemplary results are in Appendix A4.4.

All team members participated in the workshops. Prior to the first session, the two developers had prepared a proposal for the story setting and a description of the storytelling method. During the first session, all team members discussed the appropriate settings and the story plot. We worked with a user profile as character of our story. It was helpful that all team members were aware of characteristics of the user profile, because it was easy to understand the character's perspective. The storytelling workshop was focused on conceptualizing the "heartbeat", so the setting and the plot were built around the motive of "feeling the energy flow" and the needs, functions and use cases related to it. The relations depicted in the matrices of method 3 are direct inputs for defining settings. For arranging the relevant use cases in a plot line, we discussed in team various possible orders. Finally, we came up with a chronological arrangement of use cases concerning the periods before, during and after the interaction with the heartbeat. Such arrangement is simple ("straight-forward"), but at the same time allows the consideration of all time spans of experience and provides the opportunity to create highlights (compare to: "climax" of plot) of the experience at various times. The output of the first session was a plot line and predefined settings for the five selected use cases. Those served as direct input for the second session, during which the team was divided into two groups. By making use of the same setting, each group created an own version of each of the five substories representing the five selected use cases. For creating the substories, all participants used the corresponding template (Figure 4-10). Each substory was discussed in plenum after the group work and the team finally decided for one variant of each substory. This procedure gave us the opportunity to create many ideas, which were discussed in two team constellations. Moreover, the presentation of substories in plenum gave to each of us the opportunity to practice actively the telling of stories. At the end of the second workshop session, the output were the five selected substories ordered according to the plot line. The next step was the formulation of narrations. We implemented that step iteratively: the first narration created by one team member

was reviewed and adapted by all other team members until we have reached a satisfying result. The visualisation of the story took place towards the end of the early concept phase. At that point, first rough prototypes of the “heartbeat” concept were available. Taking these as reference, the designer of our team created sketches, which complemented the textual story.

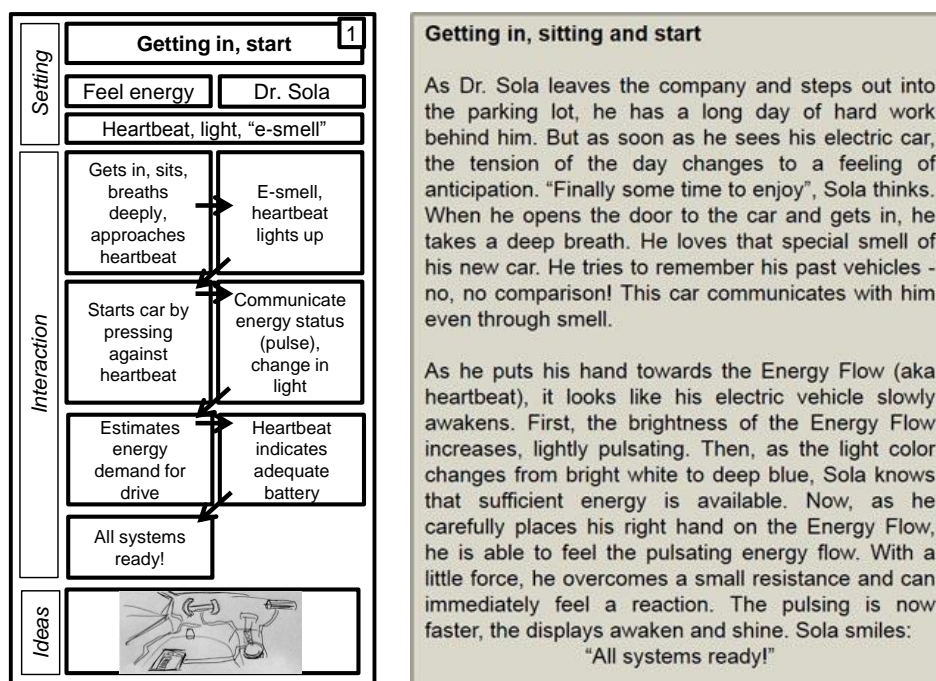


Figure 5-4 : Exemplary results of the user experience story in the “car” case

Many *opportunities* emerged in the application of method 4. The main advantage is that it became possible to explore a non-existing interaction in a holistic way and from the point of view of a representative user in a realistic interaction context. We came up with many new ideas, which grounded on data gathered in previous steps. All team members could contribute, while the result (user experience story) compiled various information in an understandable way. It was surprisingly easy to apply the method in workshop, since storytelling is a natural way of communicating. The documentation in narration was rather intuitive, since all participants had the opportunity to practice storytelling in the workshop and use the substory templates as basis.

The main *challenge* when applying the method was to focus exclusively on experiences and not solutions. The focus of story lies in a positive user experience and not the technology mediating it. However, describing a positive experience that is meanwhile realistic proved to be challenging. Indeed, the user experience story describes an ideal interaction, which however has to come across realistic and not too euphoric. A support concerning the expression and quality of the narrative with concrete examples is helpful. Another aspect to be considered is that of traceability. “The weakest link in the chain is the database from which storytelling starts. One must not describe users who will never exist, or situations that will never occur that way”, was the feedback of a company representative. Artificial situations would lead to disapproval of results by designers and end users. In that sense, it is advisable to involve those key stakeholders in the process of creating the story and ensure that they accept, understand and

remember it. Finally, we identified the risk that the story might get “lost” (too technical, misinterpreted, low prioritized) in the process. Therefore, it is essential to name a storykeeper.

Some best practices/*recommendations* derived from applying method 4 in the “car” case are the following. It definitely makes sense to introduce the character of the story in the beginning of the workshop, especially if the participants are not familiar with it. The user profiles can be highly useful for doing that. Only if participants are aware of the character’s personality, they can anticipate his/her reaction in the situations emerging in the story. Moreover, we found the use of templates for documenting the substories highly useful, because they enabled a comparable and consistent documentation. Finally, we came up with a rather simple plot line in our non-expert storytellers’ team. It was easier to understand and cope with this structure. However, it is advisable to consider plot lines that include all time spans of experience (before, during and after interaction) and, when familiar with the process, to make use of more complex narrative structures. The visualisation of the story as text with complementary sketches/pictures is advisable, because a purely textual description might seem too long/ “dry”.

5.2.2.5 Evaluate the user experience story

With the user experience story, we had a first comprehensible communication medium representing the intended experience mediated through the “heartbeat”. Furthermore, the results of the matrix-based method to integrate experiences indicated the criteria for evaluating the experience (fulfilment of motives and needs) in relevant use cases. On the other hand, the user profiles from the analysis phase provide a description of archetypical users. With those inputs, we proceeded to an initial evaluation of the content of user experience story. The process of evaluating the story consisted of the following steps. First, we defined the criteria for evaluation. These were the fulfilment of the needs for physical thriving, competence and stimulation. To assess those criteria, the human factors expert in our team adjusted a need-based questionnaire (compare to section on evaluation methods in 2.2.1) and created the UXNQ questionnaire (Körber & Bengler, 2013). Goal of the next step was drawing a sample and recruiting participants for the evaluation. The evaluation itself consisted of two parts: in the first part, participants received the user experience story and were asked to identify themselves with the protagonist. In the second part, they filled out the questionnaire. Finally, the human factors expert analysed the collected feedback. It turned out that the target needs were fulfilled, which is an indicator that the “heartbeat” would be the mediator for positive experiences.

Because the focus of the thesis lies on the scenario-based methodology and not on evaluation methods, this section emphasizes on the role of scenario-based methods in the evaluation process. More details on the evaluation can be found in the works of Moritz Körber. The user profiles are useful in the evaluation process for two reasons: they are the fundament for creating realistic protagonists for the story, with which receivers of the story can identify themselves; at the same time, they serve as archetypes for selecting evaluation participants, which correspond to target users. The identified motives (output of method 2) are the aspects to be assessed within the evaluation. As to the results of the method to integrate experiences, they are in many ways useful for the evaluation: based on the relations identified in the matrices, it is possible to find out which needs and in which situations are relevant for the new experience. Based on that, the human factors expert sets the evaluation criteria and invites the participants to emerge in certain

driving situations. Finally, the user experience story is an excellent way to communicate a new experience in an understandable for users way, because it provides a concrete context and a user’s point of view.

The main *opportunity* of this process step is the possibility to assess a conceptualized experience in such an early development phase. The evaluation provides a quantitative result that indicates the success of user experience design. Particularly, if the sample is representative and adequate, the results provide a solid basis for decision-making.

The main *challenge* of this step is linked to the effort for recruiting participants and investing the necessary resources to plan, conduct and process the evaluation results. However, the use of a questionnaire and the user experience story makes it possible to find ways to eliminate to some extent the necessary resources: for example, it is possible to conduct an online evaluation, in which the participants receive the story and the questionnaire via a hyperlink and submit their responses online. This is a sufficient alternative compared to an empirical evaluation study. This variant will be discussed in subsequent sections (cases 2 and 3). Another challenge we have identified in the “car” case was the clear separation of the assessment of the story and the assessment of the experience described in it. It is possible that a participant finds the concepts and experiences described in the story interesting but the story itself inadequate, or vice versa. Therefore, in the next cases we make a separate evaluation of the story itself (opposed to the experience described in it) with the procedure described in Figure 4-11. A final challenge worth discussing is how to cope with negative evaluation results (concerning the content of the story). The process of creating (adjusting) and evaluating the story is iterative. However, if the evaluation clearly indicates that representative users do not see benefits in the described experience, the storykeeper should even consider the option of terminating a project. This is still a more efficient option than making changes or quitting in a later stage of design [compare to (Ehrlenspiel et al., 2007)].

Further *recommendations* concerning the evaluation are the following. A major factor for the success of the evaluation lies in the preparation. Building on results of the previous steps would increase the opportunity that the experience is presented in an adequate way to a representative sample. A further aspect to consider is the selection of appropriate media for presenting the story and conducting the evaluation. Finally, it is advisable to collect qualitative feedback (from open-end questions) besides the questionnaire results. In the “car” case, we conducted such interviews with few of the evaluation participants and found their qualitative feedback useful and informative for the design process for understanding the reasons for a certain assessment or collecting further ideas.

5.2.3 Lessons learned

The application of the user experience process and the scenario-based methodology in the “car” case showed that they are useful for the systematic design of experiences. The usability of the methods was not assured in all cases, because formal descriptions of some methods were not available at the time of the application. However, it was possible to apply the methods in the multi-disciplinary team without prior experience with user experience methods and create new features mediating positive experiences. Furthermore, we developed a proposal for the

anchoring of the methods in phases and steps of the design process. The key for achieving that was the compatibility to existing processes and practices of the company. In that sense, the direct cooperation with company employees was essential.

The following sections describe important insights gained through the application of each method. Moreover, the “car” case provided some *general lessons learned*. A first learning is that it is important to focus constantly on positive experiences instead of deficits or specific technologies. This required a shift in the mind-set of all project participants. The proposed methods contribute to that. Second, we found out that many theoretical concepts related to user experience might be challenging to grasp, like the concept of motives. The multidisciplinary team had to develop a common language and understanding of those abstract concepts, but meanwhile proceed quickly with “doing” and gaining hands-on experience. The proposed methods offer operative guidance, which would help practitioners to overcome quickly the challenging familiarization with user experience practice. Finally, we found out that it makes sense to apply the methodology as whole to benefit the most from its advantages. Outputs of single methods served as direct inputs for subsequent steps, in a way that raises the quality of results in total. That makes it essential to establish the role of a storykeeper (4.3.3).

5.2.3.1 Create user profiles

In the “car” case, we created with a databased approach nine user profiles that cover a broad spectrum of potential users in various regions. A significant aspect of our approach is the inclusion of contextual and emotional aspects next to retail, utilization and demographic data. The data were gathered by various entities of the company and represented in a twofold format consisting of a database and a profile visualisation. This approach is significantly different compared to the traditional persona approach and contributed to a better understanding of user experience related aspects.

Concerning the first research question “*is method 1 useful and useable*”, the “car” case showed:

- Method 1 is useful for user experience design, because it provides concrete and reusable in the next steps results, which raise practitioners’ understanding of crucial user experience aspects (users and their emotions, context of use). Furthermore, it has a positive impact on communication, because it encourages the involvement of various stakeholders. Next applications will explore the application of the method within workshops to emphasize this effect. Finally, although method 1 does not primarily aim at increasing creativity, it has inspired some ideas.
- We found method 1 and the suggested databased procedure usable. The applications showed that, once the data sources are identified, the procedure is easy to implement. This should be explored in further cases, where a formal method description is applied. No domain-specific knowledge is required for the application. However, defining the emotional behaviour is a step where expert involvement could be beneficial.

Regarding the research question “*in which stage of the process should method 1 be anchored*”:

- Method 1 is one of the first (fundamental) steps to complete in user experience design and is therefore anchored in the analysis phase. However, profiles can and should be used in

subsequent design phases. In the “car” case, method 1 fitted well in existing processes, since it prescribes a way to bring together results from various existing process steps. Although method 1 does not prescribe ways to involve end users directly, it encourages their indirect participation (as representatives) throughout the process. It is possible to apply method 1 in multidisciplinary teams. A workshop format will be discussed in the next cases. Finally, although method 1 requires resources, it results to traceable and solid results.

5.2.3.2 Extract real users’ motives

Real users’ motives are the main input for conceptualizing new, positive user experiences. The process of extracting them can be a time-consuming but worthwhile process, because it increases substantially the design team’s understanding of experience-related aspects. In the “car” case, we applied empirical (semi-structured interviews) and non-empirical (text analysis) approaches to extract motives. The contribution of the human factors expert in this process step was significant, since the other team members found it challenging to cope with the abstract concept of motives. Therefore, alternative ways for non-experienced practitioners with limited resources for completing this step are explored in the “coffee machine” case.

Concerning the question “*is method 2 useful and useable*”, the “car” case showed:

- Method 2 is useful, because it has a significant impact on the understanding of user experience-related aspects. Furthermore, it results to a concrete result (i.e. motives), which is essential for the subsequent phases of user experience design. As to the ease of use, method 2 required in the “car” case the significant contribution of an expert, since difficulties in understanding and executing empirical studies and processing their results seemed challenging. However, the non-empirical approach (text analysis) seemed more promising in this regard and will be examined in the next case.

Regarding the research question “*in which stage of the process should method 2 be anchored*”:

- Method 2 is an essential part of the analysis stage of the user experience process. The output of the method is crucial for the subsequent phases. Nevertheless, the approach suggested in the “car” case was resource-consuming through the participation of end users and method experts, so it is advisable to explore alternative ways to implement the extraction of motives in next applications.

5.2.3.3 Integrate experiences

The matrix-based method to integrate experiences is a unique approach to deal systematically with the complexity of user experience aspects. In the “car” case, we applied the method to integrate experiences (method 3) when developing the “heartbeat” for identifying needs, functions and use cases relevant for the new concept. It provided a framework for collaboration and a useful result, although the procedure itself was perceived as rather complicated.

Concerning the question “*is method 3 useful and useable*”, the “car” case indicated:

- Method 3 is useful for user experience design, because it results in increased understanding of user experience-related factors. The method supports the communication among members of the design team making use of various competences and data into concrete

results that serve as direct inputs for subsequent steps. In the “car” case we emphasized much on the importance of dealing with the integration of a new feature in an already complex product. New features should not add to the overall perceived complexity or be incompatible to the existing product. A positive experience can only be mediated if the combination of individual elements is enjoyable, so it should be challenged if a new idea fits to the overall product.

- Method 3 is useable to some extent. Participants expressed their understandability issues and the learning curve was rather high (i.e. participants were not able to apply the method after participating once). The next cases address the issue of simplifying the procedure and effectively communicating it.

Regarding the research question “*in which stage of the process should method 3 be anchored*”:

- According to the V-model (VDI, 2007), integration is considered only after the design of individual components. As augmented in 4.1, in the case of designing experiences integration should be considered earlier on in the process. Therefore, we propose method 3 to be the intersection between the analysis and the conceptualization phases. It is essential to explore the integration of a new concept before proceeding to detail conceptualization and implementation. It is useful to apply method 3 iteratively to the method for creating a user experience story. Outputs of method 3 can serve as direct and solid input for storytelling. On the other hand, the exploration of ideas via storytelling might add new insights concerning the integration of experiences. Finally, finding out the relation of basic needs to functions and use cases is the key for a solid assessment of experiences. Therefore, method 3 builds the fundament for the evaluation of concepts.

5.2.3.4 Create a user experience story

Creating a user experience story gave the means to the design team to compile information from all previous steps, explore a new (unknown) experience, ideate and communicate the results in a comprehensible way. When applying method 4 in the multi-disciplinary team for the development of the “heartbeat” in the “car” case, we have experienced all those positive effects.

Concerning the question “*is method 4 useful and useable*”, the “car” case showed:

- Method 4 is useful for designing experiences. It results in a better understanding of users and the context of interaction, while it invites participants to be creative. The method supported the communication with other members of the design team and resulted in a concrete and reusable output.
- Method 4 was applicable by all team members. After applying the method once, it was possible to apply it again without further explanations (which happened in the development of the “periscope” and the “cocoon”). Using templates made the process more efficient.

Regarding the research question “*in which stage of the process should method 4 be anchored*”;

- Method 4 is new to traditional design processes. However, it could be integrated in early conceptualization because of its great benefits, since it seems to be applicable with low costs and by making use of results of existing process steps. The user experience story can

be used in an analogous to the requirements list way. The role of the storykeeper is essential for the use, prioritization and interpretation of the story in the following phases.

5.2.3.5 Evaluate the user experience story

The method to evaluate the user experience story is a method that prescribes ways to engage end users in design. As soon as the intended experience is described in a story, it is possible to assess the experience by letting representative users relive the experience through the story and evaluate it via a questionnaire. The evaluation results give a quantitative measure concerning the potential of a new design, while the incorporation of stories in the evaluation process raises the chance that participants understand, contextualize and emerge in the experience.

Concerning the question “*is method 5 useful and useable*”, the “car” case showed:

- Method 5 is (quite) useful, because it leads to concrete results that can be used in further design steps and impact the understanding of experience-related aspects. In particular, it makes it possible to reflect the intended experience from the point of view of a representative user. Unlike other evaluation methods, method 5 enables the assessment of experiences in a very early development phase. However, when applying method 5 in the “car” case, we identified a difference in assessing the story and the experience described in the story. We found out that it is essential to propose a procedure for evaluating the quality of the story separately from the experience. Moreover, we would find useful a support for selecting appropriate media for presenting the story. Those aspects have been implemented in the next cases and the resulting procedure is presented in section 4.2.2 and Figure 4-11.
- Method 5 is usable to a great extent. It provides ways to create useful results and document them. Like in other empirical methods, it might be challenging to recruit an adequate number of representative participants and find the necessary resources to plan and execute the evaluation. The suggested procedure with stories and questionnaires could be, however, more efficient compared to other evaluation methods. An application with limited resources will be examined in this case. Finally, a possible challenge is to work with the needs questionnaire (and particularly modifying in) without any prior related knowledge.

Regarding the research question “*in which stage of the process should method 5 be anchored*”, the application of method 5 is recommended at the end of the concept phase complementary to other evaluation methods (e.g. evaluation of prototypes). With method 5, it is possible to assess the potential of conceptualized experiences early on in the process, as soon as the team has created a user experience story describing the intended experience.

5.3 Formative evaluation: Case “automated coffee machine”

The second case study describes the application of scenario-based methods by three students in the exemplary design of user experiences with an automated coffee machine. Research goal was to assess in how far the proposed methods are applicable for products of a domain different from the automobile. Secondly, if it is possible and with which costs/effects to the final result to reduce the resources during the application by employing single developers (instead of a team), using online data (instead of conducting special studies) or applying only essential parts

of the methodology. The following research questions summarize those aspects: *Is the methodology applicable for a product of the household appliance domain? Is the methodology applicable in adaptive design projects? Are individual methods easy to use and useful? Is the methodology applicable with limited resources? Is it possible to apply only parts of the methodology? Is the methodology applicable with online data as primer source of information? Is the methodology applicable by individual designers instead of a team?*

Unit of analysis in the three embedded cases is the application of methods in analysis and early concept phases of experience design. Three persons took the role of designer, collected necessary data, applied methods and documented insights. In particular, three students with mechanical engineering background i.e. *non-experts in user experience design* applied the methods. They worked *individually* and guided by the author, *with punctual support of experts* with specific domain- or product related knowledge and/or possible end users. There was *no direct collaboration with industry*, so instead of real company data, main source of information were online sources and user feedback. Each student applied *parts of the methodology in different scale*. In a cross-case comparison, it was possible to find out in which cases the extra effort was necessary, as well as if it is possible to skip a method without significant difference to final results. *Automated coffee machines*, products from the household appliance domain, were the object of design. Such coffee machines consist of mechanical and electronic parts, while users can manipulate various settings through interfaces and can thus be described as complex products. Secondly, coffee consumption is often perceived a social, positive event and coffee machines could be emotional products. There are many types of automated coffee machines from various household appliance manufacturers, so possible improvements in terms of user experience would implicate a benefit of applying the method.



Figure 5-5 : A new user experience is mediated through the interface of “coffee chips” (Fluhr, 2015)

5.3.1 Approach

The case study approach includes the steps of *study plan and design, evidence preparation, collection, analysis and report* (Yin, 2013). For addressing the research questions, this approach was applied within the student theses of Abram (2014), Fluhr (2015) and Ihlenfeld (2015). The case study approach suits the research question, because it puts the methodology into practical examination. Furthermore, the methodology can be improved and tested in slightly different variants along the process. Implementing the methodology in three “micro”-cases conducted by three independent individuals prevents the common pitfall of the case study method and allows generalizing the results on other product types and individuals. Section 5.3.3 describes lessons learnt from a cross-case comparison of key findings.

Table 22 : Study plan of the “coffee machine” case

Method	Abram (2014)	Fluhr (2015)	Ihlenfeld (2015)	Variables explored across cases
Create user profiles	Applied by the student, using statistics on coffee consumption	Applied by the student, using statistics on personal/social data	Not applied	Applicability with online sources? Possibility of eliminating the method?
Extract real users' motives	Applied by the student, using online user reviews	Applied by the student, using online user reviews and a survey in an online platform	Applied by the student, using online user reviews	Applicability with online sources?
Integrate experiences	Applied by student and supervisor, a product expert and a psychology expert	Applied by the student	Applied by student, supervisor, psychology experts and users	Possibility of eliminating expert involvement?
Create a user experience story	Applied by the student in moderated workshops with participation of six users	Applied by the student	Not applied	Possibility of eliminating expert involvement? Possibility of eliminating the method?
Evaluate the user experience story	Not applied	Applied by student and supervisor, as well as in online survey with 35 users	Applied by the student in cognitive walkthrough sessions with three users	Possibility of eliminating the method?

Study plan and design were conducted from the author of this thesis. The students, guided by the author, conducted the steps of *evidence preparation, collection, analysis and report*. The documentation of each thesis includes a retrospective analysis of method application, detailed protocols, results, reflection and suggested improvements. Table 21 gives an overview of the methods applied in each thesis. The study plan was based on the variables described in the right

column. The variables indicate which aspects related to the research questions were examined via a cross-case comparison. For example, Ihlenfeld did not create user profiles in her thesis, whereas the other two students did. A cross-case comparison examined whether it would be possible to eliminate this method and proceed to the application of the rest of the methodology and which impact that had. In the application of method 2, one student worked individually, whereas the other two with support of experts. Again, the cross-case comparison led to indications about the possibility of eliminating the involvement of experts. The reason behind those “eliminations” and the replacement of empirical studies through online sources is the particularity of limited resources that characterizes the “coffee machine” case. As to the applicants of the support, the participating students already held a bachelor’s degree in mechanical engineering and had no expertise in user experience. In that sense, they simulated possible users of the support (compare to 1.3). The method application in academic context has differences from industrial application, but learnings from the student projects provided implications for the application of the support for teaching/training purposes and contributed to preparing the descriptive study II.

5.3.2 Results

The application methods by the three students resulted in concrete outputs (concepts mediating new user experiences), as well as reflections on usability and usefulness of methods. Exemplary results from the thesis of Fluhr (2015) are in Appendix A5 (Figure 5-6). All students received the method descriptions available at that time (the thesis includes the final descriptions including implemented recommendations from all cases) and relevant material retrieved from the “car” case (5.2) and publications (Michailidou et al., 2013; Michailidou et al., 2014, Pucillo et al., 2014, Michailidou et al., 2015). The following section describes opportunities, challenges and recommendations identified by each student when applying the methods.



Figure 5-6 : Results of user experience design in the thesis of Fluhr (2015)

5.3.2.1 Create user profiles

Both Abram (2014) and Fluhr (2015) applied the method for creating user profiles to understand characteristics of potential users of automated coffee machines. Both used data from online sources concerning users from Germany. Each student created three profiles. The choice of German market and the limited number of profiles created was due to availability of resources.

Abram created three profiles representing users of coffee machines in the three top German markets. Her segmentation was based on geographical markets, like recommended in the “car” case. The data that profiles based upon were online available statistics about coffee consumption in Germany. Orienting on the characteristics included in drivers’ profiles (Figure 4-4), Abram looked up for statistics about the three top German cities in coffee consumption, about demographics of coffee consumers (gender, age, annual income, marital status, profession, leisure activities), about coffee consumption-related behaviour (environment, frequency), as well as values of coffee consumers. Finally, she identified two main opportunities and two main challenges of creating user profiles. *Opportunities* of representing users with user profiles are (1) align the product to users’ needs; (2) have a basis for further communication. Abram used the created profiles as characters in storytelling and recognized those opportunities. The main *challenge* she identified was in creating a reasonable mix of scientific data and fictive assumptions in the profiles. Profiles are mostly databased, but additional fictive elements about personal details (e.g. name, photo) improve the understanding. However, when this ratio of data and fiction varies significantly, it affects the quality of profiles. Another challenge with fictive characteristics is that they might lead to stereotypes. Her *recommendation* is to include only facts based on scientific data and limit fictive assumptions to a name and picture of the profile.

Fluhr created three profiles representing users of three social milieus in Germany. His segmentation was based on socio-economical clusters (sigma milieus). This choice is different from the previous applications. The reason for proceeding with this segmentation was the hypothesis that, for products used in interior, the big difference of climatic conditions in different geographical regions are irrelevant. Therefore, he decided to proceed with a segmentation based on social similarity of users. By doing that, he recognized the *opportunity* of having a clear separation of user groups when using data about milieus. Furthermore, descriptions of milieus include information on social and emotional behaviour, which is valuable for understanding users deeply. However, Fluhr recognized the *challenge* of gaining publicly accessible information about milieus or even deriving similar information through own studies. Fluhr created one profile per milieu and the extreme characteristics of each profile helped him to consider their individuality in future experiences. It is explored in the “dish care” case, whether creating one profile per segment is adequate or if multiple profiles per segment are essential to represent a larger spectrum of users. Another challenge he identified concerned the information loss, when compiling information in a short profile. For the “dish care” case, it will be explored how to structure the essential information. Fluhr concluded with some *recommendations*. He suggested including detailed information in the method description about the number of necessary profiles, criteria for making a meaningful segmentation and a recommendation on the level of detail of profiles. The final method descriptions included in this thesis provide such a guide. Finally, because he recognized the opportunities of working

with information on users' behaviour, he recommends as possible extension of the method to describe behaviour, thoughts, emotions, and typical character traits in everyday situations, not directly connected to a product.



Figure 5-7 : Exemplary user profile in the "coffee machine" case

5.3.2.2 Extract real users' motives

All three students applied the method to extract real users' motives through narrative analysis by using product reviews derived from online accessible sources. Fluhr (2015) analysed the greatest extent of reviews and conducted a complementary, product-specific online survey to gather specific data. In all cases, the method resulted to a list of motives and an increased understanding of users.

Abram identified as *opportunity* of the method the use of rich descriptions obtained with minor effort, since they are already available. Furthermore, she recognized that the structured procedure forces the analyst to understand deeply users and their underlying motives. Although not directly involved, users take part in development in this way. A *challenge* she mentioned, is that of selecting appropriate reviews to analyse. Most reviews are rather descriptions than stories. She also faced difficulty in understanding the meaning of "enthymemes", while she concluded that this method requires practice. Her *recommendations* to improve understanding of the method are (1) to include more examples in the method description and (2) to provide a

template for documenting results. Furthermore, she suggested involving more than one analyst in the interpretation of results. Another possibility would be to ask representative users about the perceived validity of the extracted motives. That would have the advantage they might have a mind-set that is closer to that of the authors of the reviews. On the other hand, there is the risk of self-confirmation. The inclusion of end users for that purpose could be examined in future works.

Fluhr saw great *opportunities* even for inexperienced designers to understand users’ motives in a cost- and time-effective way by applying the narrative analysis. He characterized the output of the method as essential for all subsequent phases of design. However, he recognized two major *challenges*. In his opinion, there are limitations in using online product reviews, mostly concerning their representativeness and traceability. His approach to overcome this issue was by creating an online platform, in which registered users upload their reviews. Second, he recognized the ambiguity of interpretations. His *recommendation* to overcome that is by involving multiple analysts, even method experts. Moreover, when applying the method, he missed a clear explanation of the meaning of enthymemes. He recommended the inclusion of examples both for appropriate texts to be analysed and for the steps of analysis. Finally, he recommended an evaluation of relevance and importance of the extracted motives (e.g. by representative users) to ensure their validity before their usage in subsequent phases. This could be a matter for future research.

Ihlenfeld acknowledged the *opportunity* of applying the method to derive valuable information for experience design. Not only could she identify and understand users’ motives, but also detect the most relevant use cases and functions. Her main *challenge* was in grasping the meaning of syllogisms and enthymemes. Building on the other students’ recommendation to involve more analysts, she compared her results with those of an independent analyst and found convergence of over 70%. Ihlenfeld concludes that the method is applicable and useful, but her *recommendation* is to provide a more extended method description that includes examples.

5.3.2.3 Integrate experiences

All three students applied the matrix-based method to integrate experiences. In all cases, online available product reviews and product manuals built the inputs for applying the method. The order of filling out matrices and the inclusion of experts varied in each thesis. Furthermore, the approach for integrating experiences also varied: Abram (2014) suggested to integrate (combine) experiences that address certain motives; Fluhr suggested integrating experiences that address the same need; Ihlenfeld (2015) suggested to group experiences according to the use case, in which they occur. Although the results are not directly comparable, it can be said that all approaches seemed fruitful and inspiring for the designers. In that sense, the method was flexible in application. Moreover, all integration approaches led to meaningful concepts.

To integrate experiences that address certain motives, Abram selected four relevant matrices from the initial meta-model and filled all of them out with the support of experts. For filling the first two matrices, “*motive is related to motive*” and “*motive meets need*”, she involved a researcher with background in psychology. For filling out the next two matrices, “*function fulfils motive*” and “*function is used in use case*”, she involved a product expert: a researcher, who has participated in the development of an automated coffee machine. Abram recognized

the *opportunity* of having an increased understanding of user experience elements and their relations through the stepwise analysis procedure. Furthermore, the results are clearly documented in matrices. The main *challenge* she faced was that of handling large amounts of matrix elements in workshops with experts. Abram gave some *recommendations* to address this challenge. Generally, a structured procedure is essential for a fast and complete filling of the matrices. Therefore, the matrices should be filled row by row. If an expert is involved, an assistant or the workshop facilitator should document the input into the matrices. Otherwise, switching between both tasks could irritate the expert. Additionally, a list of the matrix elements helps the expert to think about their connection without the matrix layout. The complete amount of elements might be necessary. When filling out “*motive is related to motive*”, similar motives could be listed in an order according to similarity to speed up the process of recognizing relations. In all cases, a list of elements (instead of matrices) with short explanations or examples was helpful for the experts. Once clusters are identified, they could be used in subsequent matrices and replace the longer list of elements. For example, Abram recommended using motive clusters instead of individual motives when filling out subsequent matrices including the motive domain. In her case, that would reduce the 35 elements to 14. Another alternative would be that of selecting carefully the order of filling out matrices: Abram could have begun with the matrix “*motive meets need*”. Motives addressing the same need could then be presented sequentially when filling out “*motive is related to motive*”. Finally, an observation she made when discussing with the product expert was that in some cases the understanding of functions and use cases differed. Therefore, it is essential to clarify basic terms in the beginning of the workshop.

To integrate experiences that address the same need, Fluhr selected the matrices “*motive is related to motive*”, “*motive meets need*” and “*function fulfils motive*”, which he filled individually. Following Abram’s recommendation, he created motive clusters by analysing the first matrix, and proceeded with the clusters instead of single motives to the analysis of the second matrix. This reduced a great amount of effort: the 35 initially collected motives were compressed into 13 motive clusters. In the analysis of “*motive meets need*”, Fluhr concluded that most relevant were the needs for relatedness, autonomy and stimulation. Those needs are indeed highly relevant for users corresponding to the user profile in focus. All his conclusions show the *opportunity* for focusing on experience design goals when applying the method to integrate experiences. However, when filling out the matrix “*function fulfils motive*”, Fluhr faced a *challenge*: existing coffee makers and their functions did not seem to fulfil the identified motives. The matrix provided a systematic way to show the potential for creating new concepts. On the other hand, proceeding with the matrix-based approach, which concerns a product as-is, would not be purposeful. Therefore, Fluhr proceeded with an integration via stories, in which he considered only new features (ideas created by himself, instead of features of existing products) addressing the needs for relatedness, autonomy and stimulation. The next section about the method to create a user experience story describes the process he followed. An interesting *recommendation* is to consider restrictions resulting from the utilization context of the product before finalizing the integration concept. Fluhr considered geometrical restrictions concerning physical characteristics of kitchen surfaces that have an influence on the design of coffee makers. Those restrictions provide an overview of the context in which to integrate the new experience. This recommendation addresses the limitation of the method to integrate

experiences that is stated in 4.2.2: geometrical and safety restrictions still need to be considered in later stages of design (implementation).

To group experiences according to the use case, in which they occur, Ihlenfeld began her integration of experiences by selecting relevant matrices. In her case, the major concern was to identify relations among use cases and needs. This relation seems indirect and challenging to anticipate without a systematic procedure. However, the matrix-based method makes it possible to identify direct relations and subsequently calculate the indirect ones. Therefore, Ihlenfeld selected the following proceeding: first she filled out the matrices “*use case stresses motive*” and “*motive meets need*”. Based on that, she could calculate the indirect relations by multiplying the two matrices. Then, she analysed the matrix “*function is used in use case*” for the use cases she found out to be relevant for the needs in focus. An *opportunity* arising from the matrix-based method is that it becomes possible to identify and understand indirect relations among experience related elements, although it seemed impossible at first to detect those indirect relations. Moreover, Ihlenfeld made an extensive research of functions and use cases. A resulting *challenge* was to cope with the large matrices. Her approach (and *recommendation* for future application) was to work with clusters of functions and use cases: she started by filling out the matrices “*function is redundant with function*” and “*use case arises simultaneously as use case*” and managed to reduce the number of functions and use cases significantly. This conclusion is similar to that made by the other two applicants: working with clusters instead of single elements clearly reduced the effort. As to involvement of experts, she involved external stakeholders only in cases with a clear benefit. She and the thesis supervisor filled each matrix separately and compared the results. Although in all other cases there was a high convergence, the matrix “*motive meets need*” raised many discussions. Therefore, three psychology students were involved. Because the discussions with the external stakeholders provided new insights, Ihlenfeld also involved two users of coffee machines in the completion of “*use case stresses motive*”. Ihlenfeld recommends such cooperation, but gives the hint to document discussions and not only capture the relations in matrices. Finally, because Ihlenfeld identified minor mistakes in the matrices, she recommends a double check of their contents. Specifically, by questioning every given relation and its reasoning.

5.3.2.4 Create a user experience story

Abram (2014) and Fluhr (2015) applied the method to create user experience stories. While Fluhr’s work was individual, Abram conducted a workshop for constructing substories, in which she involved prospective users. Fluhr involved prospective users only after creating the story. In his case, users did not co-create but only evaluated the experience.

Abram took the *opportunity* to involve end users (as experts of experience) in the conceptualization of new experiences. Following the method steps, she built on results of previous methods (user profiles, motives and matrices) to identify the most relevant use cases and define the respective settings. In the beginning of the workshop, Abram presented the method and the selected profile. During the workshop, she presented for each use case a motive and the corresponding quote from user reviews, as well as the setting. Then, participants were asked to create a substory, before moving on the next use case. Participants of the storytelling workshop were six users of existing automated coffee machines with different levels of

experience in methodological product development: four scientific assistants with at least two years' experience and two mechanical engineering students with minor experience. Participants worked in two groups (two assistants and one student) under supervision of two moderators. Each group created a substory with thoughts and actions of the protagonist (corresponding to the preselected user profile) for each of the five use cases. Substories for each use case were presented in plenum. Participants enjoyed the group work and Abram concluded that many of the created ideas were original. However, the involvement of end users caused *challenges*. From a moderation perspective, it was challenging to communicate the knowledge gained in the previous steps in a way that they “flow” into the story. Abram presented the user profile in the beginning of the workshop and in some cases it was evident that the profile influenced the storytelling. However, Abram had a deeper understanding of needs and motives through her involvement in the project so far. The active involvement of such “user experts” in storytelling would probably lead to better results. Another way to encourage deeper reflection is by including corresponding hints in the substory template. Moreover, Abram tried to communicate previous findings by showing desired attributes of the future product. Unfortunately, the transfer did not succeed. Abram chose to present quotes about the current situation to provide anchors for new ideas. In some cases, participants focused too much on given problems. From a participants' perspective, it was difficult to understand tasks at the beginning of the workshop. Some participants expressed their uncertainty about the level of detail in the story, levels of freedom and system boundaries in idea creation. Moreover, some ideas required too many changes in the product structure or utilization context. Those aspects should be better defined in the assignment. *Recommendations* to overcome this issue include presenting adequate examples and providing a clear representation of changeable and unchangeable product parts (system boundaries). In future applications of the method in workshops, it would be helpful to involve at least one method expert, as well as a user expert: Abram observed that participants asked questions about the method and the content of input data. Finally, it is important to provide space for participants' sketches and notes on templates. All recommendations were implemented in the final case study.

Fluhr applied the method to create a user experience story individually. In his previous attempt to integrate experiences, he had realized that existing coffee machines offer few features and use cases that address the motives, which are relevant for the new experience. Storytelling gave him the *opportunity* to conceptualize new features and use cases, which contribute to fulfilment of those motives. The steps towards creating a setting helped him to bring together results from the previous steps (i.e. user profiles, motives, insights from the matrix-based analysis). The method to create a user experience story forced him to focus on a theme, which represents the essence of the new user experience. The steps towards defining a plot inspired him to identify new use cases, which highlight the theme over the temporal dimension. The creation of substories led to crystalizing and concretizing of ideas. Another opportunity through storytelling was the reflection of the experience from the perspective of two characters interacting with the coffee machine and with each other.

A *challenge* he faced concerned the risk of “overloading” the story. At first, Fluhr did not pay attention to the amount of components included in settings and the level of detail in the description of substories. The result was a long story, which was modified in an iteration. Being aware of positive examples and criteria for good stories before writing would have helped.

Another *recommendation* is to highlight mainly critical/key events. Fluhr also emphasized the importance of visualisations complementary to textual descriptions, especially when introducing new ideas.

Jonas knows Julia’s coffee machine and its features. The coffee chips offer him a way to select the depicted drink and order it from the coffee machine without having to manipulate any other settings. In his search for a light coffee flavor, Jonas is fascinated from the great variety of drinks. “Café noisette, interesting”, he thinks, as he grasps the chip. It feels lighter than the espresso ristretto chips he usually prefers -just like café noisette itself!



Figure 5-8 : Excerpt of the user experience story in the “coffee machine” case

5.3.2.5 Evaluate the user experience story

Fluhr (2015) created a user experience story individually, so it was necessary to collect feedback from independent users. Two aspects of the story were assessed: syntax (expression, structure, audience-orientation and effect) and content (*does audience relive the intended experience through the story*). The first aspect was assessed with the help of the checklist with criteria for good stories (Table 18). As suggested in the checklist, Fluhr and the thesis supervisor reflected upon various aspects of the story critically and derived directly improvement suggestions. Fluhr even *recommends* using the checklist during the creation of stories. After that first iteration, external stakeholders (i.e. prospective users of coffee machines) assessed the story content. Basis for that was the user experience story in form of text and complementary pictures. This medium was found to be the most appropriate (compare to: Figure 4-12). Then, Fluhr created a questionnaire based on the UXNQ (Körber & Bengler, 2013). He used items from the UXNQ, which concerned the target needs (stimulation, relatedness and autonomy) and control items corresponding to other needs. The hypothesis was that, if a representative sample of participants rate the items corresponding to the three target needs significantly high, the user experience story makes it possible to relive the intended experience. To address a wide audience efficiently, Fluhr decided for distributing the questionnaire online. He posted the improved story in an online platform (google forms), in which he invited users to read the experience story and submit their answers to a questionnaire, as well as open comments. Fluhr faced two *challenges* when preparing the evaluation. First, he needed a proper presentation format for communicating the story online and thus created visual material. This process required some extra effort, but proved to be worthwhile. Secondly, he considered only responses of participants fitting to the user profile. Therefore, he included a part with questions on demographics that would allow to match participants to user profiles. Finally, he analysed the collected responses (in total $n=35$ and for target group $n=18$). He found out that the needs for stimulation and relatedness were significantly met for the target group. Although the limited sample does not ensure the result, Fluhr achieved with limited resources to have a quantitative

evaluation result, which indicated that the user experience story makes it possible to relive the intended experience.

5.3.3 Lessons learned

The “coffee machine” case examined the application of scenario-based methods with *limited resources* in the exemplary design of user experiences mediated through premium, fully automated coffee machines, which are complex products of the *household appliance domain*. To examine the aspect of limited resources, the impact of (1) *applying parts of the (instead of the whole) methodology*, (2) *applying methods with online sources as primer source of information* and (3) *applying methods without the involvement of experts or end users, via a cross-case comparison of three applications* was analysed.

All methods were found to be applicable with limited resources (single developer with punctual support). However, in two cases (method to create user profiles and method to evaluate the user experience story), the investment of additional resources is advisable. When applied with limited resources, the method for creating user profiles provided poor results compared to those achieved in the databased application in the “car” case. The method for evaluating the user experience story prerequisites the participation of external stakeholders. The effort can, however, be eliminated through the suggested recommendations. As to elimination of single methods, it was evident that, while single methods do provide useful outputs, results are better justifiable when all methods are applied.

The application of scenario-based methods in the design of experiences mediated through automated coffee machines indicated that all methods are applicable for products from the household appliance domain. The method for creating user profiles was the one that required slight adaptations compared to the application in the “car” case, which were all easy to implement. All methods seemed useful for adaptive design projects. When designing novel features, the method for integrating experiences was only limited applicable.

5.3.3.1 Create user profiles

Two students created user profiles following the same framework, but with variation in segmentation approach, data sources and visualisations. Following a *segmentation* based on users’ characteristics (like Fluhr) seems, at least for the case of household appliances, more appropriate than a geographical segmentation (like Abram). This is a point worth mentioning in a revised method description. Both students faced the challenge of *data availability*. Abram states that results seem stereotypical, if the ratio of scientific to fictive data is not appropriately defined. Fluhr confirms that a rich description of users would help developers to consider each profile’s individuality rather than just creating stereotypes. In the “coffee machine” case, scientific data was drawn from external sources with limited access and applicability. Furthermore, the most valuable parts of profiles, i.e. on social and emotional behaviour, could not be filled with reliable data, because online available sources provide too general descriptions. Therefore, it is recommended to use company/scientific data about users in a next application. The greater value would pay back for investing the necessary resources. Profile *visualisations* created by Abram are brief and contain few data, whereas Fluhr created

comprehensive profiles with attached data. In future applications, it makes sense to work with a template for visualisation formats. Finally, certain parts of drivers’ profiles were not applicable in the case of a *household appliance*. Coffee machines are used indoors, so climatic data are not relevant. Data on product utilization are essential, but compared to the automobile example, less detailed. The elimination of method 1 (like in the case of Ihlenfeld) is inadvisable. The user profiles provided in the thesis of Abram and Fluhr useful inputs for the subsequent phases. That was most evident in the prioritization of needs, which are the criteria of the success of user experience design. Without the user profiles, such prioritization may be invalid.

In regard to the research questions “*Is the method to create user profiles (ff. method 1) applicable for products of the household appliance domain? Is the method applicable in adaptive design projects? Is the method easy to use and useful? Is the method applicable with limited resources?*”, the described cases showed that:

- Method 1 is with minor adjustments useful for products from the household appliance domain. Necessary adjustments concern the fields of utilization context (interior vs. exterior environment and climate) and product utilization (less data available), which were implemented in the “dish care” case. The provided results are vital for subsequent phases.
- Method 1 has a positive impact in analysing and conceptualizing improved user experiences. It was evident that profiles facilitated the communication of user-related data in following phases of storytelling and conceptualization.
- Method 1 is usable for single, inexperienced designers. The method descriptions were understandable. However, a more concrete support for selecting an appropriate segmentation approach and tracking relevant sources was necessary. As to the documentation of results, it is recommended to include both a profile and a database in the final output. Both aspects were implemented in the “dish care” case.
- Method 1 is limited applicable with online sources as main information source. Both theses confirmed that finding relevant data, especially for the crucial parts of social and emotional behaviour, was difficult or impossible, but had an impact on the quality of profiles. In future application, it is advisable to invest the resources to collect data.

5.3.3.2 Extract real users’ motives

Applying the method to extract users’ motives provided in all three theses congruent results. All students delivered a list of motives and recognized the method to be effective and easy to use, even for first time application. This is a strong indication that it is possible to replace the costly empirical methods of the “car” case with an adequate result from method 2. However, the applicants of method 2 in the “coffee machine” case found that enthymemes, syllogisms and the level of interpretation need further explanation and examples, because engineers are usually neither familiar nor trained for such text analyses. In the first application, Abram suggested to document the analysis in a table, which Fluhr and Ihlenfeld used and perceived as helpful. Abram and Fluhr stated that results of the method are highly subjective unless multiple researchers perform the analysis separately. Ihlenfeld implemented this recommendation and confirmed its value.

In regard to the research question “*Is the method to extract motives (ff. method 2) applicable for products of the household appliance domain? Is the method applicable in adaptive design projects? Is the method easy to use and useful? Is the method applicable with limited resources?*”, conclusions from the described cases are:

- Method 2 is useful for products from the household appliance domain. It was possible in all three applications to extract motives related to utilization of automated coffee machines. Motives were concrete results, used as direct inputs for the other methods.
- Method 2 has a positive impact in analysing and conceptualizing improved user experiences. All three applicants reported that the understanding of users’ motives was improved and experience-related information (use cases, critical functions) was extracted.
- Method 2 is with minor adjustments usable for single, inexperienced designers. Describing the method steps with more details and examples would improve the understanding of abstract concepts like “syllogisms” and “enthymemes”. Such descriptions are included in the final method descriptions, but their effect should be explored in further case studies. Furthermore, involving an independent analyst would ensure the validity of interpretations.
- Method 2 is under circumstances applicable with online data as main information source. Applicants should be aware of limitations of such sources concerning their representativeness and traceability. Selecting appropriate reviews is a precondition for successful application. Finally, future research can examine ways to evaluate the relevance and importance of the extracted motives. That would be useful for ensuring their validity before usage in subsequent phases.

5.3.3.3 Integrate experiences

The three applications in the “coffee machine” case show various ways for applying the method to integrate experiences. The choice of matrices and order is project specific. All applications showed that it makes sense to choose an order that reduces the effort of filling out matrices, e.g. by creating clusters. Still, all applications confirmed that it was to include external stakeholders. In each application, the need for inclusion of experts or even end users varied. A recommendation when involving experts is to work with a list of elements and questions instead of matrices and to document comments instead of just relations. Otherwise, the matrix form could lead to errors. Another way to clarify different interpretations is to allow participants to discuss their results after they filled the matrices, which proved to avoid subjectivity in Ihlenfeld’s application. In all theses, matrices depicted “as-is” products and relations. When creating novel designs, an integration of experiences via a storytelling approach is meaningful.

Concerning the research question “*Is the method to create integrate experiences (ff. method 3) applicable for products of the household appliance domain? Is the method applicable in adaptive design projects? Is the method easy to use and useful? Is the method applicable with limited resources?*”, the described cases showed that:

- Method 3 is useful for products from the household appliance domain, if predecessor products exist. In new product development, the method seems to highlight promising

areas, but is only limited applicable. Concepts for such identified areas could be created in storytelling.

- Method 3 has a positive impact in analysing and conceptualizing improved user experiences. All three theses reported that their understanding of user experience elements and their relations among each other was increased. Abram and Fluhr used the gained insights directly in storytelling. Ihlenfeld created new interface concepts inspired from the results of the method.
- Method 3 is usable for single, inexperienced designers. However, it is advisable to involve experts (with product-related experience or domain-specific knowledge) in case of divergence of results of independent analysts to increase quality of results.
- Method 3 is applicable with online sources as main information source. It was possible in all three theses to gather and prioritize user experience elements, analyse their relations and found out clusters that create a meaningful integrated experience.

5.3.3.4 Create a user experience story

The two applications of the method to create a user experience story showed that it is possible to work with or without involvement of external stakeholders. While a workshop application requires more effort in communicating and transferring information, it could lead to original ideas. The workshop facilitator should complete carefully all necessary preparations. Individual application facilitates a more effective use of previously gained data, but requires iterations according to external feedback. Eliminating the method is not purposeful, because the project will miss a central artefact for communicating ideas.

In regard to the research question “*Is the method to create a user experience story (ff. method 4) applicable for products of the household appliance domain? Is the method applicable in adaptive design projects? Is the method easy to use and useful? Is the method applicable with limited resources?*”, the “coffee machine” case indicated that:

- Method 4 is useful for products from the household appliance domain. It provided an increased understanding of user experience-related factors and led to many ideas. A precognition for successful application is the clear definition of system boundaries.
- Method 4 has a positive impact in analysing and conceptualizing improved user experiences. Both students reflected the new experience from a user’s point of view, in the interaction context, over a temporal dimension. New experiences and requirements were derived during this process.
- Method 4 is usable for single, inexperienced designers. Both students were able to apply the steps for creating a story. The involvement of external stakeholders in the step of creating substories seems promising for ideation. Compared to the application in the “car” case, where product and user experts were involved, the applications in the “coffee machine” case showed limitations. The involvement of end users was possible, but without the experts the results may require intensive reworking. Individual application is possible, but the result was not as rich. This was considered in the final case study.

- Method 4 is applicable with online sources as main information source. Storytelling gives the opportunity to bring results of previous steps together. However, if the persons applying the method had not been involved in previous steps, they should be encouraged to review and include input data.

5.3.3.5 Evaluate the user experience story

In regard to the research question “*Is the method to evaluate the user experience story (ff. method 5) applicable for products of the household appliance domain? Is the method applicable in adaptive design projects? Is the method easy to use and useful? Is the method applicable with limited resources?*”, the described cases showed:

- Evaluation requires the involvement of external stakeholders. However, all preparation activities of method 5 are usable for single, inexperienced designers. Moreover, it is possible to replace a costly empirical study with an online survey.
- Method 5 is useful for products from the household appliance domain. The need questionnaire was applicable for assessing the fulfilment of needs. For a better analysis of results, it is advisable to create questions on demographics and match results to profiles.
- Method 5 is only applicable with results from methods 1, 2 and 4 as main information sources.
- Method 5 has a positive impact in analysing and conceptualizing improved user experiences. Users’ feedback provokes reflection of the experience from another perspective. The evaluation results confirm the addressing of needs or indicate which should be stressed out more. Finally, open-ended questions might lead to users’ contributions, like new ideas.

5.4 Summative evaluation: Case “dish care”

The third case study (ff. “dish care” case) describes the application of the scenario-based methodology in a real-life project concerning the development of dishwashers. The research goal in the “dish care” case was to assess the usefulness of the methodology in a further product of the household appliance domain, as well as its usability and suitability in a real-life setting. Moreover, project participants, who applied the methodology, assessed the perceived usefulness and satisfaction with the methodology. Following research questions will be discussed in this section: *Is the methodology useful and suitable for real-life projects of the household appliance domain? How do practitioners without prior user experience-related knowledge assess the ease of use of the methodology and their satisfaction?* The “dish care” case covers all evaluation aspects (compare to Table 14), which could not be studied in the previous cases: the ease of use could be evaluated, because methods descriptions had a high level of maturity by the start of the “dish care” case, while the real-life setting made it possible to evaluate the suitability, as well. Compared to the “car” case, the “dish care” case took place in a more limited in terms of resources project, which demonstrates a realistic setting for future applications. The persons applying the methods match to the profile of target users of the methodology and their assessment of satisfaction with the methodology is therefore

representative. A clear indicator from the previous cases was that the methodology provides best results when applied as whole, which was the case in this summative evaluation.

The “dish care” case took place in collaboration with B/S/H/, a major manufacturer of household appliances. A team consisting of scientific assistants and master students⁹ worked with the employees of the technical product management of the product division “dish care” of B/S/H/. The project aimed at developing innovative dish care concepts and was divided in the analysis and synthesis phases, which correspond to the analysis and early conceptualization phases of design. A major focus of the project was the design for user experience. Two students and two employees *without expertise in user experience* applied with the guidance of the author of the thesis the proposed *methodology in whole*. Main source of information were *company data*. The object of design were novel and adaptive designs that would mediate positive user experiences for differentiated users of dishwashers. *Dishwashers* are challenging products in terms of user experience design, not only because they are tangible products of high complexity, but also because they are perceived as products with purely *pragmatic* character.

5.4.1 Approach

To approach the research questions in the “dish care” case, the research methods of case study with participant observation and expert evaluation were incorporated. Project participants applied the methodology with the support of a method expert and company experts. My role as “method expert” was to provide the method descriptions, clarify questions, participate actively in the first application of each method and, finally, collect and document the feedback of the participants. The role of participants was to get familiar with the methodology by studying the method descriptions and to apply it. Therefore, they collected necessary inputs, documented outputs, communicated the results and provided structured and open-ended feedback related to the application (Appendix A7). The role of company experts, who were high-level employees of the cooperating company with no direct involvement in the project, was to provide (open-ended) feedback related to methods and their outputs in status meetings. The criteria for the evaluation were the requirements of Table 14. Advantages and limitations of the selected research methods had been discussed in previous sections. In short, the selected approach offers deep insights; grounds, however, in the subjective opinions of a limited number of participants acting in a specific setting. Unlike the previous cases, the “dish care” case incorporates the final method descriptions for all methods and takes place in a real-life setting.

5.4.2 Results

Project participants applied the methods for creating user profiles, creating a user experience story and evaluating the user experience story in total four times (one time for each of the

⁹ Scientific assistants and master students of the Institute of Product Development brought in their expertise and specific goals. The topics of the project, besides user experience, were user acceptance, digitalization and servitization, as well as inventive problem solving.

defined user profiles). The method to integrate experiences was applied once and its outputs were used in all subsequent method applications. The only one of the proposed methods that was not applied in the “dish care” case is the method to extract real users’ motives. The reason is that the cooperating company had conducted studies that provided representative motives of the four user profiles prior to the beginning of the project. Two further aspects are worth mentioning: First, during the application of the methodology many activities took place iteratively (e.g. storytelling and integration of experiences). The definition of use cases, which was a necessary part for integrating experiences and storytelling, was a major step and for incorporating it, we created user journeys. Second, a particularity of the “dish care” case is that a large group of participants created ideas to address different topics (e.g. mechanical components, services) by applying various methods and only a part of the group focused on user experience. The method to create a user experience story brought all results together. Results related to the user experience topic are documented in the theses of Reckordt (2016) and Martinez Garcia (2016) and will not be cited explicitly in this chapter. Exemplary results are in Appendix A6.

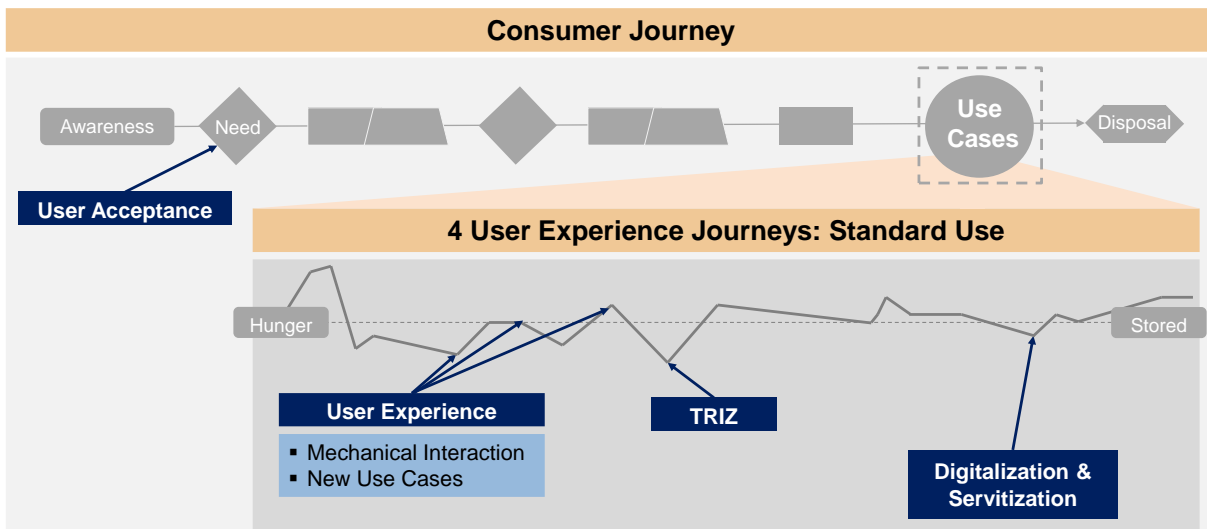


Figure 5-9 : Schematic project overview (dark blue boxes: topics of individual theses)

5.4.2.1 Create user profiles

The first step of the analysis phase aimed at creating user profiles (method 1). This proved to be a great starting point for the team to build a deep and differentiated understanding about users of dishwashers from various segments.

As indicated in the description of method 1, it is necessary to identify relevant *data sources* prior to the method application. The main source of input data for method 1 in the “dish care” case was an ethnographic segmentation study of the cooperating company. The study was conducted in eight countries representing mature markets for dishwashers and explored personality, lifestyle, goals and values of users, as well as the role of brands, kitchen and cooking. Finally, information about dishwasher purchase and satisfaction, current dishwasher

and routines and relevance of features were included. Results of the study were documented in various reports and videos.

This study quickly indicated the good availability of data within the company, as well as a set *segmentation*. In particular, mature markets were split in four homogenous segments of users, who have differentiated needs (ff. need clusters). Furthermore, we found out that the company is interested in addressing each need cluster with a differentiated product of a brand. Making use of the existing segmentation would raise the acceptance of the user profiles resulting from application of method 1 within the company. This was confirmed by our industry partners. Therefore, we created four user profiles; each representing one need cluster using the product of the target brand in the most representative (for this cluster) country.



Figure 5-10 : Exemplary parts of the user profiles created in the “dish care” case

The project participants studied the method description and information provided by the company with the goal to identify data corresponding to the fields included in the user profiles. After that, we created each user profile within a workshop that followed the steps depicted in Figure 4-3. Each participant contributed with useful suggestions about the information to include in each profile. The template from the “coffee machine” case was to greatest extent applicable. The need for minor modifications was identified in the first workshop (listed below). Then, we applied the same steps in three subsequent workshops to create profiles representing the other need clusters.

- Environment: we included extra information about adjectives describing kitchens
- Personal data: no data on income were available, so we discarded this field
- Product utilization: we included information about frequency of use, usage behaviour concerning particularly loading and program choice; we replaced the field of “attitude” through “preferences for dishwasher features”
- Social behaviour: we found information about all fields in special company studies (instead of milieu-studies used in previous cases)
- Emotional behaviour: it was necessary to redefine basic needs (Sheldon et al., 2001) in the dish care context

After each workshop, a participant visualised the results and created a summary of the reference data. The profiles were reviewed in iterations to reach an agreement among all product participants, the marketing department and brand representatives of B/S/H/. After reaching

agreement, we proceeded with the subsequent methodology steps, in all of which we used the four profiles.

Many *opportunities* were identified in the process and the result of the method. According to the B/S/H/ employees, the main value of method 1 lies in the identification of the emotional behaviour. Method 1 provides the opportunity to focus on needs. In future, it would be possible to order existing features according to the needs they address; design new features to address specific needs; use the identified needs as criteria for user tests. All those opportunities are relevant for the analysis phase of design, in which user needs (instead of technologies and features) should be in focus. A tendency in current practices is to proceed quickly with generation of ideas. On the other hand, profiles provide the opportunity to support a differentiation of brands and a cluster/user profile-specific design. In the current practice of the company, there is no structured process to achieve cluster/brand-specific selection of features nor a support for the reasoning of such differentiated decisions. User profiles could play that role. Moreover, a matching of real users to user profiles could be useful for structuring user feedback from marketing studies, after-sales feedback and user tests. Such structuring does not take place currently. However, it is valuable for making profile-specific decisions.

Further advantages regarding the form of profiles were obvious. Profiles are clear and tangible representations that are easier to pass on and communicate than detailed study results (in form of reports). The fact that project-external stakeholders could give feedback by just reviewing the short profiles demonstrates their communication value. The form of profiles makes it easier to compare different profiles, find out their distinguishing characteristics and memorize them. In the dish care case, we used the four cluster-specific user profiles in all further steps of design.

One identified *challenge* in the “dish care” case was that, in our short-term project, the definition of the emotional behaviour could not be justified by studies. Our interpretation and prioritization of needs was based on intensive discussions among members of the project team. During the first application of the method, this step required much effort. In future projects, we recommend the inclusion of an extra preparation step before the method application in workshop. Here is an exemplary order of steps (compare to: Figure 4-3): define need cluster (segment); define elements of template; *define product-specific needs*; collect data; fill out template; *validate emotional behaviour with expert*; validate and communicate profiles. Furthermore, future projects would benefit from new studies on the emotional behaviour of real users (e.g. product-specific definition of needs, prioritization of needs for each need cluster).

Finally, we created only one profile corresponding to each need cluster (typical user in most representative region). We found this number to be adequate for the needs of our project. Again, due to the focus of the project on mature markets, we had excellent data availability. In future work, it would be interesting to explore the method application with focus on emerging markets or less representative regions.

5.4.2.2 Integrate experiences

The “dish care” case examines the design of experiences mediated through dishwashers of differentiated brands. Having a predecessor/reference product makes it essential to study the integration of the new ideas to this existing frame. Moreover, the project incorporated many topics and ideas of various persons. Also because of this reason, it was essential to study the

meaningful combination of ideas from different sources. We implemented that by applying the method to integrate experiences and the method to create a user experience story iteratively. This section describes the integration of experiences. However, many of the described steps complemented storytelling and vice versa.

In the application of method 3, we followed the steps described in Figure 4-7. First, we gathered the user experience elements and identified the relevant for our project domains and relations. During this preparation, we reframed our goals. Our main goal was to “fulfil the relevant *needs* of a *user* (corresponding to each of four user profiles) in specific *use cases* through a new *dishwasher concept*”. Consequently, a central question we wanted to address was which of the generated ideas to integrate into a dishwasher for a specific user profile. This question refers to the relation between a concept and a user profile. To approach this indirect relation, we broke it down into more direct and manageable relations: “*need* is highly relevant for *user profile*”, “*use case* stresses *need*”, “*mechanical component* is used in *use case*”, “*concept* is mechanically compatible to *concept*”. Focusing on one user profile means focusing on certain needs, which are stressed in specific use cases. In those use cases, we could provide simultaneously only concepts that are mechanically compatible to each other. This reframing of goals was extremely important for the further method application in this case. We adapted the initial meta-model (Figure 4-6) and created a plan for approaching our project-specific questions. The method to integrate experiences offers the necessary flexibility to make such adaptations.

Collecting the needed data has led to another important step: the definition of use cases. While information on user profiles, needs, concepts and mechanical components was already available from the project work conducted so far, we had no structured information concerning use cases. To deal with this deficit, we created a user journey (process described in the next section).

Having gathered all necessary data, we proceeded with the matrix analysis. Each matrix was filled out by two independent analysts and results were compared. In the few cases of divergence, we asked for the help of a product or user expert.

The knowledge gained through the matrix analysis enabled us to proceed with the clustering of experience elements. At the end of this step, we had for each user profile a description of relevant needs, use cases and (compatible to each other) concepts. Those clusters were used as settings in storytelling. Through the process of creating user experience stories, we could grasp better the impact of concepts on our users’ needs in certain use cases. In some cases, we proceeded with necessary changes/refinements in the matrices.

Applying the method to integrate experiences in the “dish care” case opened up many *opportunities*. First, the method built a solid and traceable link among the results of the analysis phase and the ideas created by all project participants. The results were complemented and reused until the end of the concept phase. Second, the method supported a differentiated access to differentiated users. We were able to identify the situations and new features that would fulfil the needs of each user profile. The method description offered operative guidance through the steps, but also the necessary flexibility to address the project-specific questions. For example, we replaced the domain of “functions” with “mechanical components”, because the project goal was to develop solutions that are compatible to the existing product architecture. Moreover, the process led to a deep understanding of user experience-related aspects and their interplay. The intensive analysis of use cases (in user journeys) is a clear indicator for that. Furthermore, the

method inspired many ideas. In particular, eight ideas about how mechanical components can address target needs emerged while applying the method. Our industrial partners assessed even the well-documented intermediate results (e.g. use cases) as very valuable.

Two *challenges* became obvious during the application of the method. First, the reframing of objectives and making goals explicit required intensive discussions. Those discussions were fruitful, because they led to the team analysing user experience aspects. They also led to the creation of a plan for the matrix analysis, which proved to be very successful. Future applications may require explicitly the step of formulating the objectives of the method, because it was the key to a successful plan. A second challenge was the establishment of relations among profiles and needs. Those exact relations are depicted in the “emotional behaviour” part of user profiles. However, the intensive analysis of the relations during the matrix analysis has led to a slight refinement. This emphasizes the recommendation to explore the emotional behaviour within a specialized study.

We applied the method to integrate experiences after the user profiles were finalized and first concepts had emerged. Moreover, we reflected upon some results while creating the user experience story. A *recommendation* regarding this order is that it definitely makes sense to apply the method iteratively to storytelling and after some ideas have emerged. However, exploring the relations among user profiles and needs before finalizing the user profiles is advisable, if those relations are not established through studies (like in the “dish care” case). Furthermore, participants should make their analysis goals explicit. One way to do that is by formulating explicitly the questions that are analysed in each matrix. Finally, it turned out in the “dish care” case that the selection of clustering approach was one of the first steps in method application. Exploring the different approaches when selecting the relevant domains is advisable for future applications.

User journeys

For gathering and structuring use cases, we explored the current use of dishwashers with the help of user journeys (Nenonen et al., 2008). For our particular application, we considered the following aspects: phases of interaction of end user with product, temporal sequence of phases, relations among phases, user’s thoughts and feelings. The creation of user journeys was a team effort, during which the project participants gathered possible touchpoints of an end user with the dishwasher along the whole life cycle. We depicted those touchpoints in a “consumer journey”. A major touchpoint of the consumer journey is the “user journey”, which refers only to the experience of a user of a dishwasher. We focused on the user journey describing a “daily use” to collect use cases. Cognitive walkthroughs, observations and video material demonstrating interactions with dishwashers, were the sources for the four user journeys that we created (one for each user profile). Although the use cases depicted in all four journeys were identical, we documented profile-specific actions and a profile-specific “emotional experience curve”, which is a qualitative depiction of the interaction experience. The user journeys were an excellent way to collect and structure use cases and even explore their importance and impact for each user profile. In that sense, the process of creating them complemented the matrix analysis of the method to integrate experiences and it certainly facilitated the definition of “key events” in story creation. Compared to the collection of use cases via user manuals and product reviews in the “coffee machine” case, the creation of user journeys is definitely advisable,

because it provides deeper insights about the interaction. The collection of use cases in the “coffee machine” case resulted in a list of use cases before, during and after the usage of a product. A user journey shows moreover the sequence and the relations among use cases. Although the participants had some difficulties in defining the desirable level of detail in the journeys, the result is valuable and reveals starting points for the (re)design of user experience.

5.4.2.3 Create a user experience story

The user experience story played in the “dish care” case the role of a prototype, which brought together ideas from various sources and described four new experiences. We created four stories, each of which described the experience of a user (representing one user profile) when interacting with a new dishwasher, which incorporated features developed by the project participants. We applied the method for creating a user experience story in total four times, in a sequential order and according to the phases depicted in Figure 4-8.

For *defining the setting*, we gathered the outputs of the previously conducted methods, as well as a list of the ideas created by the project participants up to that point.

The *definition of plot* and the *creation of substories* took place within workshops. Each workshop had 3-4 participants. We included in every application one project participant with great knowledge of user profiles (“user expert”), one participant with excellent product knowledge (usually company employee) and a method expert. The workshop began with an introduction to the method and the story setting by the method expert. In each case, one user profile was in focus as protagonist of the story. We paid great attention in describing the special characteristics of the profile. Then, the workshop participants were asked to define the key events and order them in a plot line.

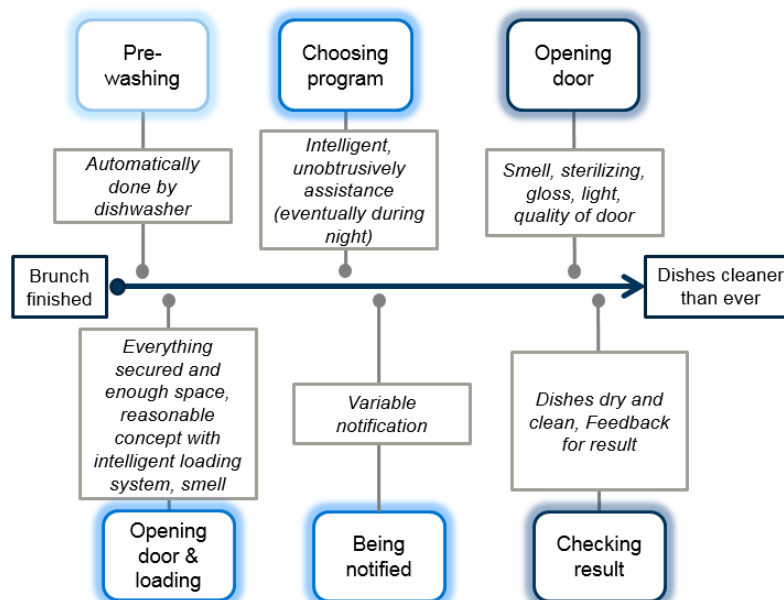


Figure 5-11 : Exemplary plot of a user experience story in the “dish care” case

For doing that, we discussed all collected use cases and selected the most critical (for the protagonist) ones. We paid particular attention in selecting use cases concerning the periods before, during, as well as after usage. Then, participants were asked to create a plot line that links the selected key events in a meaningful way. After a short break, during which the workshop moderator prepared the templates for substories (Figure 4-10), participants were asked to describe each key event in a substory. We watched out that participants focus on the experience and not on technical solutions. However, we used the list of created ideas, when it made sense, and also documented new ideas that emerged. Finally, the moderator wrapped up the results, by “telling” the story composed in the substories. Last step of each workshop was a reflexion on method application.

The *verbalization of stories* happened after the workshop by one project participant, who used the criteria for good stories (Table 18) as support. The focus hereby was the communication of the character’s thoughts, feelings and actions and the impact of the new features on that. Other participants reviewed the story (based upon the criteria) and necessary changes were made. The reviews concerned the syntax of the story and not the experience described in it. The latter is the focus of the next step of the methodology.

The project participants recognized many *opportunities* in the method to create a user experience story. The method made possible in short time to gain a deep understanding of the experience of a specific user in a specific context and during critical situations. Moreover, they could explore ideas and their interplay and envision the future experience. The industry partners explicitly commented the idea generation process that took place within the workshops. Unlike their familiar practices for idea generation, storytelling forced them to focus on a particular user and specific situations. Through the focus on a user profile, it was possible to relate to the user. Through the discussion, selection and focus on use cases, it was easy to consider the interaction step by step and provide meaningful solutions. Moreover, it was not necessary to have a large group of participants to come up with new ideas. The workshop structure was perceived as easy and smooth. As to the result, it certainly made it possible to bring together various ideas and communicate a new experience from a particular user’s perspective. The inputs for storytelling and thus the result were traceable and easy to argument.

A *challenge* when creating user experience stories in the “dish care” case was the inclusion of the already developed ideas. For one, because we had a very large amount of ideas, with which not all workshop participants were familiar. An explicit presentation of the ideas during the workshop would shift the focus from the experience to technology/product. A compromise we came up with was to add suitable to the story ideas after the workshop, in case they were forgotten. Another challenge was the definition of motives during the definition of settings. In this case, we had identified motives of the user profiles in the ethnographic studies of the company. However, it might take some practice to be able to formulate “the one” motive of focus within the story. Finally, in one case the story became too long, which is something to watch when verbalizing it. If it is not possible to reduce the information described in the story, it makes sense to complement or replace some of its parts with visualisations or sketches.

Recommendations derived from the “dish care” case refer to the part of the method conducted in workshop. First, the constellation and number of workshop participants were great. In the workshop applications we worked primarily with “hard” (vs. digital) material, which is

advisable for emphasizing a hands-on character. For a most complete documentation of results and emerging ideas or arguments, it makes sense to engage a secretary. Finally, when defining the setting, we have proposed a context, in which the story takes place (e.g. dinner with friends, regular morning use). A context can be derived from the touchpoint journey and will help the workshop participants to have a more concrete interpretation of the individual use cases.

5.4.2.4 Evaluate the user experience story

The initial evaluation of the user experience story via a checklist was implemented as part of the previous step of the methodology was proved very meaningful. To assess the potential of the conceptualized ideas and the intended experience as whole, we conducted a small-scale evaluation of the created user experience stories. Each user experience story addressed one user profile, so our evaluation considered this differentiation of prospective users. The research question behind the evaluation was: “are the relevant needs of a user profile adequately met by representative users corresponding to the user profile, when reliving the user experience story?”. Due to confidentiality reasons, we distributed the questionnaire only among project participants. The steps we followed to conduct the evaluation lean on the procedure depicted in Figure 4-11.

Having defined the evaluation goals and the audience of the story, we decided for an appropriate story medium. Specifically, we selected a textual narration, because (1) at the time of the evaluation no other visualisation was available and (2) because we did not want the audience of the story to focus on the implementation of ideas instead of the experience. Moreover, we decided for a questioning via a printed questionnaire, a form that fitted best to the setting of the evaluation, i.e. a project meeting.

Next, we adapted the need questionnaire. Using the User Experience Need Questionnaire UXNQ (Körber & Bengler, 2013) as reference, we isolated the suggested items corresponding to the target needs. For example, for the first user profile, the needs for security and competition were the most significant ones. Therefore, we selected three items of UXNQ that express each of those two target needs. Moreover, we created one new item per target need. The new items described the significant motive of each user profile. The description of motives was one of the first steps of creating the user experience story. Those items (motives) would help us to assess the relevance of product-specific needs. Furthermore, we have selected “control” questions, i.e. items that describe needs that are not highly relevant for the user profile. Finally, the selected questions were listed in a random order.

In the next step, we created the complete questionnaire (Appendix A6.4). It consisted of three main parts: (1) questions about profile; (2) questions about needs and (3) questions about story. The first part is used for matching a respondent to a user profile. To achieve that, we created a multiple choice question with four answering options, each of which depicted a representative for one profile kitchen and loading order in the dishwasher with a very short textual description. Participants were asked to characterize themselves as “type A-D” according to those descriptions. Depending on their choice, they would continue with part (2), which corresponded to the questions for their matching user profile. The second part included 10 questions about need fulfilment (see: previous step), in which participants had to indicate their level of agreement in a 5-point Likert scale. The third part of the questionnaire included three questions

about the understandability of the story. The items were selected from the checklist in Table 18 and participants could indicate their level of agreement in a 5-point scale. Finally, we included one open question, where participants could add their comments or ideas.

We distributed the printed questionnaire in a project meeting. Project participants filled out the questionnaire. The analysis of the responses showed that it is possible to communicate and evaluate the intended experience and indicated that the majority of participants found the described experiences positive (i.e. significantly fulfilled their needs). Unfortunately, the number of responses does not allow any generalization concerning the assessment.

The method to evaluate the user experience story opens up the *opportunity* to collect feedback about the experience in a very early stage of design and with very limited resources. Including a filter-question about the user profile a participant corresponds to, it is possible to differentiate the needs in question according to participants' profiles and receive representative results.

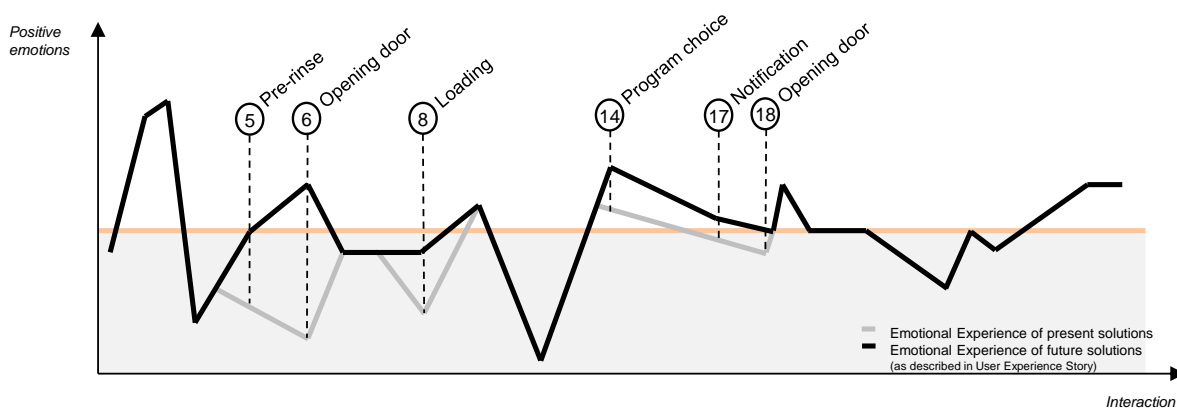


Figure 5-12 : Expected emotional experience depicted in emotion curves

However, we faced the *challenge* of confidentiality, because of which we did not include external stakeholders in our evaluation. The very limited number of responses could be increased by inviting more company-internal stakeholders to participate. That would be easy to implement by distributing the questionnaire via the company intra-net. We did not implement this step, because of time issues. Regarding the procedure, only the step of adapting the need questionnaire provoked questions. The method description seemed to be inadequate in guiding practitioners to select appropriate items and include them in the questionnaire. This issue is addressed in the final method description. During the analysis, the 5-point scale raised some discussions. In the given scale, there is no possibility to select a “neutral answer”, so participants could only agree or disagree with a statement. In our case, this polarization was useful for the analysis, but confused some participants (feedback received in open-ended question). When adapting the questionnaire, it makes sense to reflect in the team, whether the evaluation goal is to receive only polarised responses or even neutral ones.

A strong *recommendation* is to include in the questionnaire a short part assessing the understandability of the story. In that way, analysts can track if the assessment corresponds to a participant who has the feeling that he/she understood well the contents of the story. If not,

the response can be filtered out. We can also recommend the way we asked the filter-question about the profiles. Giving a number of choices with visual and textual description resulted in a good matching of participants to profiles. Finally, we used the profile-specific motive as item in the questionnaire. This is advisable for including a question, which is directly linked to the usage of a specific product opposed to basic needs.

5.4.3 Lessons learned

The research goal in the “dish care” case was to assess the usefulness of the methodology in a further product application (dishwasher), as well as its usability and fittingness in a real-life setting. The “dish care” case showed that it is possible to apply the methodology to analyse and conceptualize user experiences mediated by dishwashers. We achieved this goal by making use of company data and the product-related expertise of employees of the company. Several project members participated actively in the method application. We found the methodology very useful for even creating differentiated experiences that address the specific needs of four user profiles. Dishwashers of different brands could mediate the differentiated experiences, which we captured in user experience stories. The four user profiles created by the application of the proposed method was the basis for this distinction and the subsequent steps in the methodology. Applying the methodology as whole did not only allow to use the user profiles in the next steps, but also apply the methods to integrate experiences and create a user experience story iteratively. In that way, we could explore the integration of experiences through matrix analyses, but also the impact of a possible integration through storytelling. Moreover, the user experience stories were the means to bring together results and ideas of various project participants. Finally, the user experience story was evaluated and the results could be used as basis for planning the latter conceptualization phase of design. Necessary adaptations and particularities in the application of individual methods have been described in previous sections. Overall, all evaluation dimensions (usefulness, ease of use, satisfaction and suitability; compare to Table 14) were found to be positively rated by the project participants.

5.4.3.1 Ease of use and satisfaction with methodology and its results

In the “dish care” case, the active participants of method application, i.e. students and B/S/H/ employees, assessed positively the ease of use of the methodology and their satisfaction with its results during feedback sessions, in which structured and open feedback was collected. The conclusions regarding the research question, “*How do practitioners without prior user experience-related knowledge assess the ease of use of the methodology and their satisfaction?*”:

- For the active applicants of the methodology, who were practitioners without prior expertise in user experience, the method descriptions seemed to be very useful. They characterized the provided *explanations sufficient and understandable* and were able to apply the methods without prior knowledge. In particular, the methods to create user profiles and a user experience story were assessed with excellent understandability. The method to integrate experiences required in the beginning (reframing of goals) a more intensive clarification. Once the analysis strategy was clear, the further steps were easily

implemented. The method to evaluate the story was applied with punctual difficulties due to the short description of the procedure to create the questionnaires. Further explanations were provided and added in the final descriptions of the corresponding methods.

- Through the method descriptions, participants received *operative guidance* for applying the steps of the methodology and documenting results. However, some planning aspects had to be specified according to the project-specific frame. For example, tracing and gathering the necessary data was a company-internal matter, which was not supported by the general method descriptions.
- In the “dish care” case, we applied many methods in total four times to cover the spectrum of the different user profiles. The fact that it was possible to apply the method without support after one application indicates that the methodology has a *minor learning curve*.
- As to satisfaction with the methodology, the participants agreed that it enabled them to *achieve* their *goals* in an *engaging* manner. The B/S/H/ employees confirmed that they would *recommend* the methods further and can imagine applying them in future projects.
- Finally, the perceived *effort* to apply the methods was worth the *benefits*. The team has achieved in a short time frame to create a deep understanding of current experiences and conceptualize future experiences. From the side of the company, the engagement in the project was also perceived as very worthwhile.

5.4.3.2 Usefulness of the methodology and suitability for real-life setting

The “dish care” case took place in direct cooperation with industry. Having a given reference product (dishwasher), it was possible to evaluate the usefulness of the methodology for it. Furthermore, the real-life setting made possible to assess the degree in which the methodology is applicable by using company data, achieving goals efficiently and with the available expertise and resources. It was important for the methodology to be adaptable according to project-specific needs and provide ways to anchor the new steps in the existing process. All those goals were achieved in the “dish care” case. Conclusions regarding the research question, “*Is the methodology useful and suitable for real-life projects of the household appliance domain?*” are:

- The application of the methodology in the “dish care” case provided results that *improve the understanding about users and their needs*. In particular, the method to create user profiles had a major impact on the understanding of representative users and their differentiated needs. The method to integrate experiences forced practitioners to think about the interplay of user experience-related elements. A result that was extremely useful was the collection and depiction of use cases in user journeys. Practitioners gained a deep understanding of the current experience of interacting with dishwashers from the perspective of each user profile. While creating user experience stories, practitioners focused on those key events and explored a contextualised future experience. Finally, the evaluation of stories provided insights about the value of ideas for representative users.

- Practitioners found the *results* of individual methods *complete and reusable*. The user profiles, the user journeys and the user experience stories were the main artefacts created, while the results of the matrix analyses and the evaluation flowed into the design.
- As to the *impact on creativity*: during the application of the methodology, many ideas for concepts to mediate new experiences emerged. For example, creating and working with user profiles inspired ideas for addressing the differentiated needs. The method for integrating experiences led to the creation of many concepts for mechanical components. The user journeys indicated which are the key events of interaction, while the participants found new ideas to improve the experience during those events through storytelling. Although we did not make use of the evaluation results due to time limitations, the method to evaluate the story also led to ideas inspired by the participants of the evaluation.
- The methodology *supported the communication* within the project team and across borders of departments. The user profiles and steps of user journey gave an overall structure to the project and were communicated by the B/S/H/ employees in many meetings with project-external stakeholders. On the other hand, the user experience stories brought together the results/ideas of individual project participants. They played the role of demonstrators and were the major presentation medium to communicate the project results.
- The methodology *fitted well in the structure of existing processes*. In the beginning of the project, the discussion about the project plan quickly showed a convergence of the company process to the process phases of “analysis” and “early conceptualization”. Moreover, the company data that we derived were complete and we could immediately proceed with the methodology steps. The application of the methodology does not require special equipment and the costs are limited to the invested human resources.
- We found the methodology to be *scalable and adaptable* according to project-specific needs. For example, for the segmentation in user profiles we proceeded with the company segmentation and modified slightly some profile elements. In the method to integrate experiences, we created a plan tailored to project-specific goals, explored extensively use cases and dealt with the domain of “mechanical components”.
- According to the B/S/H/ employees, the main added value of the methodology is that it provides an *excellent traceability* of results and opportunities for their *adequate communication*.
- The methodology was *applicable in multidisciplinary teams* (in this case: involvement of participants with background in engineering, marketing, business administration). Although single methods enable the involvement of end users (methods to create and evaluate story), we did not use this opportunity in the “dish care” case. However, the user profiles as representations of real users accompanied every step of the design process.

5.5 Discussion: Applicability of methodology and recommendations

Having applied the methodology proposed in this thesis in three different settings, it was possible to derive best practices regarding its applicability. The recommendations aim at helping practitioners, who are interested in applying the methodology, to answer the following questions. *Do the products I deal with and my company make a good setting for the application of the methodology? Which methods to apply? How to set an application plan? Who should be involved in and who is responsible for the application? How to apply the methodology?*

This thesis focuses in the development of *tangible products of high complexity* and so did the three evaluation cases. However, while developing the methodology we have applied the methodology in student projects (Appendix A1) dealing with digital products or with low-complexity products [e.g. running shoes in (Simson, 2014)]. It became obvious that applying the methodology makes rather sense in the cases dealing complex tangible products. Although single methods were applicable in different cases, the effort-benefit ratio was not satisfactory. For example, the user experience story did not provide many new insights about the interaction with running shoes, while the method to integrate experiences was hardly applicable. On the other hand, the “car” and “dish care” cases showed that two major manufacturers of complex, tangible products see benefits in all individual methods and a sustainable way of designing user experiences in the methodology in total. The two product domains explored in this thesis (automobile and household appliances) seem to be appropriate objects of design.

The three evaluation cases dealt with different *available resources*. Resources refer to the available expertise, time and data. The “car” case dealt with the (rare) scenario of excellent resources. The “coffee machine” case demonstrated the other extreme: no availability of company data and limited resources. Those two corner cases explored the scalability and adaptability of methods. Many of the methods seemed applicable with online sources as primer information source, while it was possible to reduce the involvement of external stakeholders. Finally, the “dish care” case demonstrated a resource-efficient application, which was possible partly because of the great availability of company data. To conclude, there is unfortunately not a direct answer to the question about the minimum resources. However, the methodology provides a great flexibility to scale the effort in a suitable for each project way.

Furthermore, it was examined whether it makes sense to apply the *whole methodology* opposed to individual methods. The cases showed that it is definitely advisable to invest the resources to apply the complete methodology. As stated by the industry partners in the “dish care” case, the systematic process and the outputs that build on each other make results valid and traceable.

As to the degree of novelty, the method was applied in *original design* and *adaptable design* cases. The applications showed that it was easier to apply the methodology in cases, in which there was a predecessor/reference product. This is applicable also for the cases that deal with the development of an original feature that is part of a reference product. The main reason for that limitation is that some of the methods (methods to create profiles, extract motives and integrate experiences) build on data, which can only be found if a reference product exists. In cases of complete novel designs, like the design of a device to track frequently lost items in the

thesis of Haid (2014) we still found the methodology to be useful. Most of all, the method to create a user experience story was very valuable for exploring and communicating novel ideas.

As to the creation of a *project plan*, the process model (4.1) proved very useful. Reflecting on the objective of a user experience project and mapping the activities to phases and steps of the design process was helpful for planning. In future application, it is advisable for practitioners to link their practice to the proposed process model and make their objectives explicit. This match and general project conditions (e.g. time frame, budget) will shape the project plan.

During the development of the methodology, it was examined which *stakeholders* can and should be involved in its application. In every case, it is possible to apply the method in a multi-disciplinary team without prior expertise in user experience design. The perspectives of engineering, design, human factors and marketing enrich a user experience project. It is advisable to assign those roles to members of the design team. For example, one of the design team members may take to role of the “user expert” and represent user and their special characteristics and needs. The corresponding company departments (like marketing or development) can review outputs of single methods. The method descriptions give recommendations about which roles to include in the application of individual methods. Participation of end users is also possible in the frame of the methodology. In particular, it is easily facilitated in the creation of user experience story and necessary for evaluating the story. Because the involvement of end users requires additional effort, it is advisable to examine in each individual case with which goal and under which conditions to engage end users. As to the issue of *responsibility* for a user experience project, the thesis proposes the role a storykeeper (4.1.2, 4.3.3) as necessary and vital for the success of the project.

To be guided through the application of the methodology, practitioners can lean on the method descriptions. However, the best way to get familiar with the methodology is by gaining hands-on experience. For a *first-time application*, it is advisable to apply the methodology in a pilot project with duration 3-6 months and draw learnings for further, more extended applications.

Finally, some best practices that concern the individual methods were extracted.

The *method to create user profiles* is most useful when it grounds on valid and real data. The segmentation strategy may vary depending on company practices, as long as a segment refers to a homogenous user group with distinguishing characteristics compared to other groups. For products used outdoors like cars, a geographical segmentation, which considers the differences in the physical environment, seemed useful. For products used indoors, like households appliances, building user clusters with similar values and needs seemed useful. As to the number of the profiles to create, at least one profile per segment is valuable.

The *method to extract motives* can be applied in different scales, varying from ethnographic studies to the narrative analysis of user stories. The latter variant can be adequate, if it is possible to track relevant data, i.e. stories of traceable and representative users describing interactions. A question needing further investigation in future studies is how to verify the extracted motives.

The *method to integrate experiences* is highly adaptable. Practitioners should make their analysis goal explicit and create an analysis plan. In any case, the collection of data related to user experience elements can be very rich in insights. Particularly, we found the collection of use cases via a user journey to provide a deep understanding of current interactions. In the case

of original design, we found the method most useful in combination with storytelling. For defining relations among experience-related elements, it is advisable to involve more than one independent analysts, and domain-specific experts. Particularly, for analysing the domains of needs and motives it makes sense to involve someone with background in psychology.

The *method to create a user experience story* proved to work best when applied within team workshops. Particularly valuable is the participation of a method expert, a user expert and a product expert. Moreover, it is worthwhile to invest time to introduce results from previous steps. Finally, a good preparation of the sessions is a catalyst for a successful application. When verbalizing the story (narrative) narrative elements and the criteria for a good story is advisable.

The *method to evaluate the user experience story* requires the participation of end users and, in some cases, of a human factors expert. There are ways to implement the evaluation efficiently, for example by conducting it online. A careful choice of story communication media and the media for implementing the questionnaire is advisable. Moreover, it is important to match the characteristics of participants to user profiles, in order to make an optimal use of results.

6. Conclusions and outlook

The overall objective of this thesis was to provide scientists and design practitioners with practical support for the systematic design of user experiences mediated through complex, tangible products, specifically in early design phases.

The research was motivated from the fact that, while the topic of user experience has a growing importance for customers and industry, a lack of formal ways to design experiences as reproducible results is evident in literature and current practices. In particular, there are only few methods supporting the generation of experiences in the critical, early phases of design of complex, tangible products. The persons involved in related activities would benefit greatly from a methodological support in their multi-disciplinary and user-centred (and therefore challenging) practice. A methodology herein supports in planning, collaborating, executing and documenting, but also focusing activities on experience-related aspects. Moreover, a theoretical review of user experience as phenomenon showed that the distinguishing characteristics of user experience (subjective, context-dependant, holistic, dynamic and worthwhile) seek for new practices that embrace those characteristics and facilitate the communication and envisioning of experiences. A way to address those issues is offered in scenario-based design, i.e. a process-accompanying approach making use of scenario-based methods (like scenario, storytelling, storyboarding) to communicate, design and evaluate. Literature states that such methods offer a feasible way to overcome design challenges, like communication, system thinking and user integration. Additionally, the structural similarity of stories to experience (underlying narrative structure) and their common characteristics (narrative form with plot and drama development, specific nature with focus on untypical situations, rich descriptions of character and context) make them particularly useful in user experience design. However, at the start of this research, there was no formal methodology focused on user experiences mediated through complex, tangible products and the desired characteristics: scenario-based, holistic, possibility-driven, practitioner-centred and structured.

In order to develop a support for such systematic practice, an initial step of this research concerned the collection of practitioners' requirements. Based on that, a methodology was conceptualized, applied, refined and evaluated in three cases. The proposed methodology consists of five methods for early design phases and has three distinguishing characteristics. First, it is a *formal* approach based on storytelling, tailored for user experience design. The proposed method descriptions provide practical, operative guidance for collecting necessary (user experience-related) data and applying the methods. Results of individual methods built on each other. Second, the methodology refers to roles and goals that are *specific for user experience design*, while the introduction of the role of storykeeper (i.e. user experience manager) stresses the issue of responsibility. A review of literature and current practices showed that user experience design has special characteristics, which require the involvement of various stakeholders and a demanding management for reaching user experience related goals. Those aspects were not adequately stressed in the literature and practices analysed during the research clarification and first descriptive study. Finally, the proposed methodology is a *holistic* approach, which forces system thinking. The methodology was applied in three cases. Although the cases concern specific applications, due to their differences (domains, companies,

resources, applicants) they cover a broad spectrum of design of complex, tangible products. The first two cases contributed to the development and refinement of the methodology. The final case was a summative evaluation, which indicated that the methodology fulfils the derived requirements concerning ease of use and learn, suitability and usefulness, as well as applicants' satisfaction with it. Finally, a cross-case analysis led to recommendations for successful future applications, as well as a practical guide for future applications.

6.1 General discussion

The following sections describe reflections on the special focus and the research methodology of this research, as well as the limitations of the proposed support.

6.1.1 Focus of the thesis

This thesis focuses on the design of experiences mediated through *tangible consumer products of high complexity*. Such products have a large number of components, level of dynamics and bring along restrictions. That results in challenges for the design practice. A structured system view differentiates this research. Furthermore, this thesis takes the *perspective of product development*. For the field of product development, the focus on experience and intangible aspects of interactions is relatively new. Other disciplines, like psychology or interaction design, have a longer history in dealing with “soft” aspects. Product developers without expertise in user experience design, who are the target of the support, need guidance through a new practice. The developed support embraces the special characteristics of user experience, but at the same time provides the essential structure for the development of complex products. Finally, the thesis focuses on *early phases of design* and specifically the challenging activities of communicating and envisioning experiences. The proposed scenario-based methods focus on experience-related aspects and provide a communication platform, while the methodology is holistic and focused on possibilities for positive experiences (rather than deficits).

6.1.2 Research methodology and collaboration with industry

The research methodology applied in this thesis includes both theoretical and empirical parts. *Overall*, the research methodology facilitated a clear industrial relevance in the development and evaluation of the methodology. The *research clarification*, during which the research questions were identified, was literature-based. The literature review made it possible to cover a broad spectrum of current works. A challenge in the research clarification phase was to distinguish works relevant to the focus of the thesis. The main reason was that some user experience methods are not formalized and most are not strictly classified. As a result, distinguishing user experience from usability or common design methods, as well as defining their scope (generative or evaluative) was challenging. The *descriptive study I* had the aim of understanding the current practice and retrieving requirements for a future practice. It was implemented within two studies, an in-depth participant observation and a broader, questionnaire-based study. The chosen methods were useful for gaining deep insights in a specific situation and for exploring the relevance of the insights in a broader study. Although

the sample was too small to derive results that influence design theory, it was intendedly broad, so that it was possible to identify relevant issues. The *prescriptive study*, which contributed to the iterative development of the support, was implemented within multiple case studies in real and realistic settings. Individual methods were conceptualized based on the findings of research clarification, while the hands-on experience gained within the application cases contributed majorly to their further development. Due to the iterative process of applying and developing the methodology, it was not possible to evaluate all aspects in that stage. Therefore, the *descriptive study II* aimed at a summative evaluation of the methodology, which took place within a case study in real setting. The conducted case studies, with their distinguishing characteristics (domains, applicants, setting), enabled to observe the applicability of the support in a broad spectrum of design of tangible, complex products.

6.1.3 Limitations of the proposed support

Although the proposed support is described in a generic way, there are cases, in which it may not be applicable. The case studies showed that the methodology is useful for complex, tangible, consumer products, like products of the automobile and home appliance domains. The applicability of the support for different products or specific project types should be further explored. Furthermore, there are some precognitions for applying the methodology, like making the necessary resources available or like meeting required strategic decisions. In general, the implementation of user experience design requires conviction about the importance of user experience, commitment, conscious decisions and investment of resources to implement necessary changes. Management can influence many of those aspects, so to some extent it is required for a successful implementation that the upper management supports the implementation of the new methodology. Another characteristic of the proposed methodology is that it stresses the use of data related to product utilization and prospective users, in order to result in valid outcomes. Limitations like data availability or specific constraints (e.g. confidentiality) may make it difficult or impossible to apply the support. Moreover, the methodology suggests the involvement of actors with various backgrounds and in that sense prerequisites a good availability of resources.

The thesis proposes the application of the methodology within a stage-gate process. In the stage-gate process, the project success is assessed by the end of each process stage, when a milestone is reached. The proposed user experience process foresees multiple development iterations until reaching a milestone, while the storykeeper guards the project success and the reached milestones with respect to user experience. At the same time, the storykeeper has the decision power to break a project, if the goals are not achieved. In the proposed user experience practice, goals are represented by the fulfilment of users' needs. By the end of the early concept phase, the evaluation of the user experience story provides a first quantitative result, which demonstrates if the intended experience fulfils users' needs. According to this result, the storykeeper may decide whether the project is successful, whether an iteration (refinement of story or more extended evaluation) is necessary, or even whether the project must be terminated. It is still more cost-effective to make changes or break a project at this early stage of design than in later stages. The proposed methodology offers systematic ways and artefacts to make well-founded decisions.

6.2 Conclusions

The overall objective of this thesis was to provide practical support for the systematic design of user experiences mediated through complex, tangible products. The output of the research clarification was a reframing of research objectives and the formulation of research question. The following sections describe the resulting conclusions.

Why was further research in the field of user experience necessary?

Positive user experiences influence directly the user satisfaction, which is the major factor contributing to product success. Despite the growing interest on user experiences in the past decades, there is still a need for systematics to design positive user experiences as reproducible results. The literature review showed that many studies focus on understanding the phenomenon of user experience, while fewer works aim at studying and supporting its practice. Because of the special characteristics of user experience as phenomenon, a shift of focus in current practices (objectives, actors, methods) is required. Nevertheless, many of the methods identified in literature have an evaluative scope, whereas generative methods for the early design phases are few. Limitations of such generative methods are that they consider fragments of experience and not the experience as whole; may require expertise; or do not address the characteristics of complex-tangible products. Meanwhile, the practice of user experience bears many challenges, in terms of communication, collaboration and management. A structured, methodological support for the early phases in the practice of user experience would bring along many benefits. From a product development perspective, a methodology would open up the opportunity to work beyond disciplines, with new methods and conceptualize products with positive impact on users' life. The latter benefit is important in today's global, complex and post-materialistic era. From a design practitioner's perspective, a methodology would provide the necessary guidance to manage and act, prescribe ways to collaborate and document. Finally, a methodology makes it possible that results of individual efforts contribute to an overall objective. Summing-up, the development of a support for designing positive user experiences mediated by complex, tangible products systematically is relevant.

What makes scenario-based methods relevant in user experience design?

In early phases of design, it is essential to produce artefacts that capture and communicate experience-related aspects. Scenario-based methods offer a promising communication platform, because they relate to the natural way of communicating. Particularly the storytelling method is relevant in the context of user experience design, as stories share with user experience the same narrative structure and common characteristics. Moreover, the review of scenario-based methods showed that they are suitable for various design phases, while different methods make use of the same elements. Consequently, it is possible to combine methods in a process-accompanying methodology. Finally, scenario-based methods are not new to design practice and have many practical advantages. For example, they do not require expert knowledge or special equipment. For all those reasons, the introduction of scenario-based design in user experience design is promising. However, the research clarification showed that additional research was needed for the application of scenario-based methods in user experience design. Existing scenario-based methods are either loosely defined, not focused on user experience, or

address only single design activities. The scenario-based methodology developed in this thesis is formal, holistic and focused on user experience aspects.

What is the view of design practitioners on the topics of understanding, implementation and assessment of user experience design and scenario-based methods?

To capture the current practice of user experience, this research incorporated an in-depth study (observations) and a broad study (survey). The explored practice seemed to lack a unified *understanding* of user experience. This refers mostly to the opposition of user experience to usability. The studies of the actual *implementation* of user experience design reflected a tendency to informal and company-specific approaches. It was confirmed that actors of user experience design have various backgrounds, while end users were considered active participants of the design process. In the described studies, the responsibilities in user experience practice were found to be ill-defined. Both studies showed that practitioners see many *opportunities* in user experience design and seemed willing to try out new approaches. Positive user experiences seemed associated with increased product value, innovation and unique selling propositions, as well as with positive “side effects” in the design process (like integration of users, collaboration across single departments). The identified *challenges* related to the nature of user experience (namely: communication of experience-related aspects, ill-defined process and responsibilities, late consideration and integration of experience-related aspects), to the lack of experience with user experience methods and to company culture and mind-set towards user experience. As to *scenario-based methods*, we found a good understanding and broad use. However, the current application of scenario-based methods is not always formalized and not necessarily involving experience aspects. Finally, it was possible to identify obvious links between benefits of scenario-based methods and practitioners’ requirements for a support for user experience design. An overall conclusion from the studies of current practices is that the relevance of the research and the appropriateness of scenario-based methods were confirmed.

Which are the requirements for a methodological support for communicating and generating positive user experiences mediated through complex, tangible products in early design phases?

After a literature review and the descriptive study, it was possible to capture the requirements for a methodological support. Desired characteristics of the support are scenario-based, holistic, possibility-driven, practitioner-centred and structured. In the survey conducted as part of the first descriptive study, design practitioners expressed their requirements for a support. They can be assigned to the overall aspects of ease of use, usefulness, satisfaction and suitability. *Ease of use* refers to understandable and prescriptive method descriptions, which are applicable without prior knowledge and are easy to learn. The requirement for *usefulness of results* describes the need for concrete, complete and reusable results, which have a positive impact on understanding, creativity and communication. The aspect of *satisfaction* refers to the engagement of practitioners in application, as well as to a positive subjective impression of the effort-benefit ratio and goal achievement. Finally, the requirement for *suitability* describes the

fit in existing processes, applicability in diverse teams and with end users, minor costs and need for equipment, as well as traceability of results.

Which scenario-based methods are appropriate in each step of the experience design process?

The usefulness and suitability of scenario-based methods in the design process was studied in a real-life application. Similar to the view presented in literature, the application showed that scenario-based methods are useful in early phases of design and particularly in the analysis and early concept phases. The *analysis phase* aims at defining opportunities for meaningful experiences. Required for that is a deep understanding of prospective users and their needs. Useful for addressing these goals are the methods of persona and narrative analysis. The developed methodology proposes an application of those methods (in adapted form) in the analysis phase. In particular, the first step of the methodology is the creation of user profiles, a method that roots in databased personas, but is extended with experience-related aspects. The databased approach increases the validity and traceability of profiles, while the process towards creating the user profiles increases the understanding about users. The second step of the methodology is about extracting users' motives through a method based on narrative analysis. The narrative analysis offers an efficient way to identify latent needs of users. The *early concept phase* is about generating concepts for new experiences. Storytelling is valuable for this purpose. In particular, the method to create a user experience story offers a structured way to bring experience-related elements together, communicate them and come up with new ideas by using narrative elements. The result is a comprehensive representation of the intended experience. Storytelling in combination with structured questioning (like the need questionnaire) is also useful for evaluating experiences. The *latter concept phase* signifies the shift towards physical representations and concretization. The scenario-based method of storyboarding is useful in this phase. The proposed methodology suggests a procedure based on storyboarding to include experience-related aspects in visualisations. In the subsequent phases of design, scenario-based methods are not as useful as prototyping methods. The methodology does not include a further scenario-based method for later design phases. It proposes, however, the use of the created artefacts (profiles, motives, stories, storyboards) for ensuring that the physical representations incorporate the intended experience. Moreover, the user experience story can be a useful basis for marketing concepts. The proposed methodology consists of scenario-based methods, which include scenario elements (i.e. actor, goal, product, setting, action and event) and additional user experience elements (i.e. need, motive). Those common elements are the connecting components of methods in a methodology. Moreover, the need for a method to explore systematically the relations among experience-related elements was identified in the context of designing complex products. This is important even in early design phases (intersection of the analysis and early concept phases). Therefore, the scenario-based methods were supplemented by a method to integrate experiences, whose aim is to find out meaningful combinations of experience elements. Finally, a research outcome of this thesis was that the management of user experience design throughout all phases of the design process is a key aspect. Therefore, the role of a special user experience manager, a "storykeeper" was introduced.

What are the objectives, necessary inputs, desired outputs and structured procedure for each method?

To provide an operative guidance to practitioners, individual methods and a frame for their application in early phases of the design process were developed. A research outcome of the thesis is a practical guide for method application. The guide comprises of method descriptions, which are structured documents that include information about the objectives, necessary inputs, desired outputs and structured procedure for each method. Moreover, the descriptions include templates and additional material that facilitate the application. The practical guide can be found in Appendix A8, as well as in the web (www.uxfirst.com).

How do design practitioners without expertise in user experience assess the ease of use, usefulness and suitability of the methods and the methodology?

The evaluation of the developed methods and the methodology was implemented in case studies. Each of the three cases had different characteristics (domain, product, resources, applicants), due to which they cover a broad spectrum of design processes of complex, tangible products. Overall, the ease of use, usefulness and suitability of the methodology, as well as practitioners' satisfaction with results were assessed positively. A cross-case analysis showed that, although the application of individual methods is useful, it is advisable to apply the whole methodology to benefit most. The methodology was assessed as useful for experiences mediated through complex, tangible products of the automobile and the household appliance domain. Moreover, the method revealed to be scalable according to the available resources in each case. It was possible to apply the methodology in design cases dealing with original and adaptive design. However, the methods were found to work best when there is a reference product because of the data availability. Finally, it was found beneficial to include different perspectives (roles) and a responsible storykeeper.

Practitioners assessed the methodology and individual methods in various case studies. The practitioners' requirements for a support, which had been derived in the descriptive study, served as criteria for the assessment. The requirements related to *understandability* were positively assessed for all methods, with the method to integrate experiences being the most complicated one to understand. A minor *learning curve* was evident for all methods, since in most cases one application was sufficient for learning the procedure. All methods were *applicable without prior knowledge*. The application in real-life cases (design of cars and dish washers) showed that the methodology *fits properly in existing processes* of the collaborating companies. The requirements related to the *involvement of various actors* were also found to be fulfilled. The methods to create and evaluate the user experience story provide the possibility to involve end users, while all methods can be applied in team. The three different cases demonstrated the *flexibility* of methods according to project-specific needs. All methods provided *concrete, complete and reusable results*. The major benefit of the methodology was the excellent *traceability* of results. As to the impact, all methods contributed to a *deep understanding of users and their needs*, as well as *improved communication* of experience-related aspects. Particularly the methods to create user profiles, integrate experiences and create a user experience story led to new ideas. In total, applicants were *satisfied with the application* of the methodology, its results and the effort-benefit ratio.

6.3 Research contributions

The main contribution of this research is that it provides a systematic, practitioner-centred support for designing positive user experiences as reproducible results. The unique focus of this thesis on complex, tangible consumer products and early phases of design, as well as its holistic approach differentiate it from previous research.

This research showed that the study and support of the user experience practice are highly relevant. The successful implementation of user experience design requires a change in practice (objectives, actors, methods) and mind-sets. The research outcomes of this thesis are beneficial towards the aforementioned directions. From a *research perspective*, this thesis is unique because it combines the fields of user experience and scenario-based design from a product development perspective. From an *industrial perspective*, the developed support is valuable, because it provides a formal way to design experiences as reproducible results. Moreover, the provided guidelines and recommendations are expected to be useful for practitioners, since they root in the real application of the support in various design cases.

A main contribution lies in formalizing scenario-based methods with a special focus on user experience. Although user experience design deals with intangible, soft aspects of interaction and requires a holistic view, informal practices were found inadequate for its successful implementation in the context of complex, tangible products. In this case, design processes are formal and new approaches have to be anchored to the existing process. Moreover, user experience design calls for collaborations with various actors, which needs to be managed in a structured way. For all these reasons, a methodology is valuable for structuring, managing and executing design activities. The proposed methods result in formal artefacts (milestone results) and provide a frame to collaborate. At the same time, scenario-based methods will inspire practitioners to think and work with scenarios in an informal way in their overall practice. This would be beneficial for the communication and envisioning of user experiences. Finally, this thesis contributes with practical guidance in the implementation of the proposed support. It introduces the role of storykeeper for managing user experience design from an organization perspective, while an interactive guideline has been implemented to support the introduction of the methodology in the organization.

6.4 Anchors for future work

This thesis studied the practice of user experience from a product development perspective. It delivered a support for the early phases of design of complex, tangible consumer products. The support aims at designers without expertise in user experience design. This unique focus limits the spectrum of the research, but reveals further valuable areas for future studies.

This research focused on the practice of user experience rather than the phenomenon itself. Specifically, the phenomenon of user experience was viewed in a holistic way, based on existing works. Subsequently, it did not provide a new framework for analysing experiences nor did it study single aspects of experience. The aspect of aesthetic experience, for example, was not studied. In the study of practice, the focus lied on generative methods for early phases of product development, while the study of methods concerned primarily scenario-based methods. Future studies could broaden the scope of this research. Incorporating methods that

deal with physical artefacts, like prototyping methods, would make the methodology even more valuable for all facets of experience, including the aesthetics.

The study of current practices included only a limited number of cases. In the frame of this thesis, this was adequate to identify some global issues. However, it is highly relevant to conduct more empirical work on current practices of user experience design. The questionnaire developed in this thesis (Appendix A3) could be used to extend the survey and even analyse domain- or company- specific differences. The derived requirements for a support represent the view of product developers without expertise in user experience design. It is a relevant topic for future studies to derive the requirements of other actors of user experience design, since user experience design is a multi-disciplinary concern.

The proposed support focuses on early phases and specific steps of the design process. It could be elaborated with further methods supporting other steps or later phases of design. The combination of the proposed methods with other approaches, like prototyping, might lead to a more comprehensive support. It would even be interesting to explore the application of the methods in later phases, for example study the use of stories in the implementation phase. Furthermore, there are remarkable future research directions concerning the individual methods. It would be valuable to study how to link the method to create user profiles to empirical studies and find out which exact activities are necessary to collect the data for the profiles. That would make the guidance of practitioners more complete. The method to extract motives could be elaborated by a final step for validating the derived motives. The method to integrate experiences could be supported with a software tool, in order to make the complicated process of filling out matrices more efficient. The method to create a user experience story opens up the opportunity for direct participation of end users in design. Its application in the increasingly important context of co-creation could be further explored. Finally, modifications of the method to evaluate the user experience story could be examined in individual cases to substantiate its value: for example, by using different scales (instead of the need questionnaire) or evaluation settings (for example by acting out instead of reading the story).

In the descriptive studies, the issue of management of user experience design was found to be highly relevant. In current practices, the role of a user experience manager is ill-defined, though crucial for the successful implementation of user experience design. It is worthwhile to study this role from a managerial/organisational perspective and create a support for user experience managers. Moreover, the impact of the storykeeper's role could be examined further in real-life cases. In particular, it would be valuable to study reasons for interventions by the storykeeper. For example, investigate the cases, in which it is necessary to influence decisions or even terminate a project.

The evaluation of the proposed methodology took place within specific cases and concerned products of the automobile and household appliance domains. Further cases would be necessary to reach a generalizable result. On the other hand, further studies are necessary to explore the application of the support in projects or settings that are not in scope of this research, for example in co-creation projects. Finally, the implementation of user experience design in other product domains, like in healthcare, or development of working tools might reveal different challenges. Studies in this area would be valuable, since the impact of positive experiences mediated through products of those domains has a promising social value.

This research delivered a practical guide for the application of the proposed support in form of method descriptions. The interactive guide (www.uxfirst.com) would be even more useful for practitioners, if it would be tested and fine-tuned from a web-design perspective. Finally, the goal of the support was to provide operative guidance in design practice. However, the practical guide could be used for teaching or training purposes. As the design practice is expected to broaden its objectives in future, it would be valuable to provide students and practitioners with new methods, focused on experience.

In the near future, researchers and practitioners are expected to join a new design paradigm, which will allow them to satisfy the customers' growing demand for experience value in products. Equipped with appropriate methods, they will collaborate to envision and realize user experiences that will make users' lives more gratifying.

7. References

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Appendix

- A1. Student theses supervised and guided by the author
- A2. Definitions of user experience
- A3. Survey on current practices in industry (Questionnaire)
- A4. Results from case study “car”
 - A4.1 Create user profiles
 - A4.2 Extract real users’ motives
 - A4.3 Integrate experiences
 - A4.4 Create a user experience story
 - A4.5 Evaluate the user experience story
- A5. Results from case study “coffee machine”
 - A5.1 Create user profiles
 - A5.2 Extract real users’ motives
 - A5.3 Integrate experiences
 - A5.4 Create a user experience story
 - A5.5 Evaluate the user experience story
- A6. Results from case study “dish care”
 - A6.1 Create user profiles
 - A6.2 Integrate experiences
 - A6.3 Create a user experience story
 - A6.4 Evaluate the user experience story
- A7. Questions for method evaluation
- A8. Method descriptions (Practical guide)

A1. Student theses supervised and guided by the author

Table 1 : Theses including process and methods analysis

Thesis	Title	Content	Insights
Finn Angel, 2013	Documentation in development processes and their verification with regard to user experience	Analysis of early phases of engineering design and their resulting artefacts.	User experience design requires a deep understanding of user and use context, which is not the focus of current engineering design methods and their resulting documentations. However, user experience methods (generative and evaluative) can be integrated in early design phases to support those aspects. Scenario-based methods are the most promising generative methods.
Dominik Gast, 2015	Methods to support user experience design in early phases of product development	Collecting and analysing user experience methods supporting early design phases.	The greatest difference between engineering and user experience methods is that the first result into quantitative and the latter into qualitative results. The methods of persona, storytelling and storyboarding are promising methods to combine results of both approaches.

Table 2 : Theses including interviews with design practitioners

Thesis	Title	Content
Benedikt Dechamps, 2014	Implementing design thinking in existing product development structures	Interviews at Siemens Corporate Technology about existing process and approaches for user-centred design.
Tobias Vollmann, 2015	Interview-based study on user experience processes	Interviews at various companies dealing with user experience. Insights on the understanding, implementation and assessment of user experience and scenario-based methods.
Veronique Buchta, 2015	Methods to support the systematically and user-centred definition of development goals in the case study of acoustical experiences in cars	Interviews at BMW about existing process and approaches for user-centeredness in early design phases (task clarification).

Table 3: Thesis including exemplary applications of methods (1: create user profiles, 2: extract users' motives, 3: integrate experiences, 4: create story, 5: evaluate story, 6: create storyboard)

Thesis	Title	Methods	Product	Partner	Insights
Daniel Fluhr, 2012	Opportunity-oriented approaches for generating User Experience and their application for a bicycle infotainment system	4	Bicycle		Storytelling is applicable for generating experiences for a bicycle. In comparison to the approaches of Kim and Jordan, storytelling seems to guide better practitioners without prior related experience.
Liana Kroll, 2012	Narrative approaches as innovation methods based on stimuli from the entertainment area on the example of a bicycle infotainment system	4	Bicycle		Four stimuli (negative story, positive story, images and science fiction) were used to generate user experiences. Positive stories led to most ideas. The two latter sources could be used complementary.
Johann Wolferstetter, 2012	Development of a narrative procedure for creating market-specific customer experiences in cars	1, 4	Car	BMW	The methods of use case, user profile and storytelling are applicable for generating user experiences in automobile. Data-based user profiles improve acceptance of results.
Damian Schockenhoff, 2013	Chances of electro mobility: Systematic development of a new customer experience and prototypical implementation	1, 4	Car		User profiles and storytelling are useful for new product development.
Cornelia Gebauer, 2013	Application of narrative methods to support UX design in automotive context	1, 4, 6	Car	BMW	Structuring and formalizing the methods of user profiles and storytelling increases their usefulness for the industry partner. Storyboards are perceived as the most useful form of stories.
Walter Simson, 2013	Evaluation of tools and methods for user experience analysis and design	2, 3, 4	Sneaker, tablet, adaptive cruise control		The methods were applicable in all cases, but rated as more valuable when designing a complex product.
Laura Abram, 2014	Systematic use of scenario-based methods for customer-oriented product development	1, 2, 3, 4	Coffee machine		Operative descriptions of methods improve applicability. Methods were applicable and useful. Results of single methods build on each other.
Charlotte Haid, 2014	Application of scenario-based methods for deriving user-oriented requirements	1, 4, 5, 6	Device to track lost items		Methodology was useful for new product development. Method to assess a story is essential.

(contin.)

Lorenz Diergarten, 2014	Matrix-based method for connecting technologies and users' needs	3	Train driver advisory system		Matrix-based method was useful for reducing the perceived complexity and designing new interfaces in the case of digital system.
Mira Ihlenfeld, 2015	Matrix-based methods for connecting technologies and users' needs in the case study of a coffee machine	2, 3	Coffee machine		Matrix-based method was useful for reducing the perceived complexity and designing new interfaces in the case of a mechatronic product.
Daniel Fluhr, 2015	Applying scenario-based methods to improve user experience of an automated coffee machine	1, 2, 3, 4, 5	Coffee machine		Methodology was applicable and useful in the case of adaptive design. Single methods were fine-tuned.
Heiko Knörzer, 2015	Methodological support for the design of positive user experiences	2, 3	Swimming goggles	Start-up	Matrix-based method was useful for designing a new product (goggles).
Veronique Buchta, 2015	Methods to support the systematic and user-centred definition of development goals in the case study of acoustical experiences in cars	2, 4	Car (BMW)		The application of user profiles, use cases and storytelling was useful for defining experience-related goals and was perceived as applicable by the industry partner-
David Hübner, 2016	Applying and improving the user experience method "product persona" in the case study of a superbike	4	Motorcycle		The storytelling method can be enriched by defining a product persona.
Tim Reckordt, 2016	Identification of new use cases for dish car based on an analysis of current consumer behaviour	1, 4, 5	Dish washer	BSH	The methodology was assessed as applicable and useful in the case of new development dish washers
Ana Martinez, 2016	Development of new dish washer concepts for improved mechanical interactions	1, 3, 6	Dish washer	BSH	The methodology was assessed as applicable and useful in the case of adaptive design of dish washers
Marcus Stavrakakis, 2016	Systematic design and prototypical implementation of a drinking aid in the context of user experience design	1, 4	Drinking support	Start-up	The methods of user profiles and storytelling were applicable and useful for designing a healthcare product

A2. Definitions of user experience

Table 3 : Definitions of user experience

Year	Author	Definition
1995	Norman et al.	User experience: Umbrella concept to fully describe “critical aspects of human interface research and application”
1996	Alben	Quality experience: The way [a product] feels in their hands, how good they understand it works, how they feel about it while they are using it, how well it serves its purpose and how well it fits to the entire context in which they are using it. Aesthetic experience: Using the product is aesthetically pleasing and sensually satisfying
1997; 2000	Jordan	Pleasure in product use: the emotional and hedonic benefits associated with product use. Displeasure in product use: the emotional and hedonic penalties associated with product use.
2003	Hassenzahl	User experience encompasses all aspects of interacting with a product.
2004	Forlizzi & Battarbee	Experience: constant stream of self-talk that happens when we interact with products An experience: can be articulated/named; has a beginning and an end; inspires behavioral and emotional change Co-experience: creating meaning and emotion together through product use
2006	Hassenzahl & Tractinsky	User experience: User experience is about technology that fulfils more than just instrumental needs in a way that acknowledges its use as a subjective, situated, complex and dynamic encounter. User experience is a consequence of a user’s internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (for the environment) within which the interaction occurs (organizational/ social settings, meaningfulness of the activity, voluntariness of use, etc.).
2007	Desmet & Hekkert	Product experience: The entire set of affects that is elicited by the interaction between a user and a product, including the degree to which all our senses are gratified (aesthetic experience), the meaning we attach to the product (experience of meaning) and the feelings and emotions that are elicited (emotional experience)
2010	ISO 9241	User experience: A person’s perceptions and responses that result from the use and/or anticipated use of a product, system or service. User Experience includes all the user’s emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviours and accomplishments that occur before, during and after use. User Experience is a consequence of: brand image, presentation, functionality, system performance, interactive behaviour and assistive capabilities of the interactive system, the user’s internal state resulting from prior experiences, attitudes, skills and personality, and the context of use. Usability, when interpreted from the perspective of the user’s personal goals, can include the kind of perceptual and emotional aspects typically associated with user experience. Usability criteria can be used to assess aspects of user experience.
2011	Nielsen & Norman	Customer experience: All aspects of the end-user’s interaction. All persons’ experiences with a specific system, including design, interface, and the actual physical interaction

A3. Survey on current practices in industry (Questionnaire)

We thank you in advance for completing this questionnaire and for enriching our research project with your experience. Before you start filling out the questionnaire, we would like to point out that this survey is about your personal opinion and experience on the subjects user experience and scenario-based methods. Through your answers, we want to understand the significance, as well as the opportunities and challenges of both subjects from an industrial perspective. There are no right and wrong answers and, in many questions, you will be able to select multiple answers to reflect your opinion. The questionnaire takes approximately 20 minutes to complete. Thank you for your time!

A1 In the following section, please fill the information about your company and your position in it.

Q1.1 How would you describe the culture of your company?

- big company culture
- small company culture
- formal
- informal

Q1.2 In which business area are you involved?

Q1.3 What is the position / function that you have in this business area?

Q1.4 How would you classify the products of your business area?

- physical product
- service
- product-service-system
- product service / assistance
- Please enter here the product sector: _____

Q1.5 Are you / Have you been involved through your role within the company in the planning and / or execution of user experience design projects?

- planning
- execution
- no involvement

A2 In the following section, please select the statement (s) regarding the understanding of user experience that you, from your current position in your business area, consider applicable.

Q2.1 Which of the following keywords do you relate to the concept of user experience?

- emotions
- interactivity
- functionality
- users' psychology
- users' physical condition
- motives / motivation
- active product usage
- subjectivity
- anticipation
- momentary experience / "experiencing"
- retrospective experience / remembering
- product design
- interaction design
- multi-disciplinarity
- usability

Q2.2 User experience is...

- subjective
- dynamic
- temporal
- worthwhile
- context-related
- other: _____

Q2.3 High-level goals of user experience design projects of your business area involve ...

- avoiding negative experiences and frustrations during product use.
- designing most effective, efficient and satisfactory product use.
- creating innovations for the company.
- developing new, add-on functionalities.
- fulfilling psychological needs and motives through product usage.
- influencing/harmonizing the expectations on product usage, product usage and the memory of product usage.
- including end-users in design.
- enhancing marketing strategies.
- other: _____

Q2.4 Role of users in product development process Potential users...

- are indirectly involved in the development process through their input in form of feedback.
- are actively involved/taking part in the development process.

A3 The following questions relate to the implementation of user experience design activities in your company.

Q3.1a For how many years have projects with application user experience design approaches been carried out in your business area?

- 0-3 years
- 3-5 years
- 5-10 years
- more than 10 years

Q3.1b What percentage of the total number of projects of your business area take projects with application of user experience design approaches?

_____ number of projects with application of user experience design approaches / total number of projects (percentage)

Q3.2 How does the application of experience design approaches take place?

- external consulting
- informal proceeding
- fixed proceeding / prescribed operating steps
- company-internal proceeding
- proceeding according to literature (please enter the author's name) _____
- (other) _____

Q3.3 Which of the following approaches to shape user experiences are you familiar with in your current practice?

- telling / reliving a story through a product
- emotional design
- interactive product behaviour
- introduction of technological innovations
- introduction of surprise effects in the product behaviour
- introduction of unique product characteristics
- increasing product functionality
- fulfilment of needs through product use
- other: _____

Q3.4 Which phase of the product development process has been addressed by previous user experience design projects?

- problem definition
- need derivation
- idea generation (conceptualization)
- prototyping
- developing solutions
- implementation
- testing
- evaluation
- other: _____

Q3.5 Which targets have been addressed by previous user experience design projects?

- Defining the experience potential of a new or existing function/product/technology.
- Analysing the experience with an existing function/product/technology.
- Evaluating the experience with a function/product/technology.
- Defining customer value of existing features that have been developed according to regulations.
- Assessing the potential of new technologies from other fields.
- Creating user manuals.
- Creating a marketing concept.
- Adopting and adapting features/products of competitors.
- Creating market-/country-specific variants of functions.
- Developing a comprehensive display- and operating concept.
- Integrating existing display- and operating concepts in a new display- and operating concept consistently.
- Revising existing functions accordingly to customer feedback.
- Following a management request.
- Comparing experiences with various products.
- Quantifying the success of a product.
- other: _____

Q3.6 Which are typical actors in a user experience design project?

- manager
- project controller
- developer/engineer
- evaluation expert
- technology scout
- market- and communication expert
- designer
- user
- other: _____

Q3.7 Who is responsible for the coordination of user experience design projects in your company?

- specialized, cross-departmental division within company
- project organization with individuals from various departments within the company
- company-internal expert
- company external expert(s) / consultant(s)
- other: _____

Q3.8 Which are, in your opinion, important requirements on a methodological support for user experience design? Please drag the items listed as requirements either to the box "relevant" or to the box "not relevant". Please also rank the relevant requirements in descending order from top to bottom of the box. If important, in your opinion, requirements are missing, please add them in the text field "other".

relevant	irrelevant
_____ low costs	_____ low costs
_____ minor learning curve	_____ minor learning curve
_____ good understandability of method	_____ good understandability of method
_____ complete documentation of results	_____ complete documentation of results
_____ adequate communication of the results	_____ adequate communication of the results
_____ great flexibility in the use of methods	_____ great flexibility in the use of methods
_____ re-use of results	_____ re-use of results
_____ minor need for special equipment / facilities	_____ minor need for special equipment / facilities
_____ comprehensible documentation of results	_____ comprehensible documentation of results
_____ no need for processing of results	_____ no need for processing of results
_____ concrete results	_____ concrete results
_____ increased number of alternatives in the results	_____ increased number of alternatives in the results
_____ applicability of methods is multidisciplinary teams	_____ applicability of methods is multidisciplinary teams
_____ possibility of user participation	_____ possibility of user participation
_____ other:	_____ other:
_____ other:	_____ other:
_____ other:	_____ other:

A4 The following questions relate to the assessment of user experience in your company.

Q4.1 What are opportunities for a company through the targeted application of user experience design approaches? Please drag the items listed as opportunities either to the box "relevant" or to the box "not relevant". Please also rank the relevant opportunities in descending order from top to bottom of the box. If important, in your opinion, opportunities are missing, please add them in the text field "other".

relevant	irrelevant
<input type="checkbox"/> inclusion of emotional aspects	<input type="checkbox"/> inclusion of emotional aspects
<input type="checkbox"/> continuous consideration of users	<input type="checkbox"/> continuous consideration of users
<input type="checkbox"/> deeper understanding of users	<input type="checkbox"/> deeper understanding of users
<input type="checkbox"/> better understanding of use context	<input type="checkbox"/> better understanding of use context
<input type="checkbox"/> higher acceptance of products or new technologies	<input type="checkbox"/> higher acceptance of products or new technologies
<input type="checkbox"/> experience as "unique selling proposition"	<input type="checkbox"/> experience as "unique selling proposition"
<input type="checkbox"/> enhancing creativity	<input type="checkbox"/> enhancing creativity
<input type="checkbox"/> better interdepartmental collaboration within the company	<input type="checkbox"/> better interdepartmental collaboration within the company
<input type="checkbox"/> higher user involvement	<input type="checkbox"/> higher user involvement
<input type="checkbox"/> better interdisciplinary collaboration	<input type="checkbox"/> better interdisciplinary collaboration
<input type="checkbox"/> other:	<input type="checkbox"/> other:

Q4.2 Would you be willing to extend the user experience design activities of your business division?

- yes
 no

Q4.3 Would you be willing to apply new methods to make experience design more effectively?

- yes
 no

Q4.4 Are there user experience design projects of your business division that, in your opinion, did not meet expectations?

- yes
 no

Q4.5 Which barriers can you identify in the context of user experience? Please drag the items listed as barriers either to the box "relevant" or to the box "not relevant". Please also rank the relevant barriers in descending order from top to bottom of the box. If important, in your opinion, barriers are missing, please add them in the text field "other".

relevant	irrelevant
<input type="checkbox"/> lack of experience with user experience design approaches	<input type="checkbox"/> lack of experience with user experience design approaches
<input type="checkbox"/> lack of methodological guidance	<input type="checkbox"/> lack of methodological guidance
<input type="checkbox"/> ill-defined roles and responsibilities in user experience design	<input type="checkbox"/> ill-defined roles and responsibilities in user experience design
<input type="checkbox"/> high product complexity	<input type="checkbox"/> high product complexity
<input type="checkbox"/> high organizational complexity	<input type="checkbox"/> high organizational complexity
<input type="checkbox"/> difficulty in communicating soft aspects of interaction (e.g. emotions, needs)	<input type="checkbox"/> difficulty in communicating soft aspects of interaction (e.g. emotions, needs)
<input type="checkbox"/> late integration of experience-related aspects into the product	<input type="checkbox"/> late integration of experience-related aspects into the product
<input type="checkbox"/> no anchoring of emotional targets in the development process	<input type="checkbox"/> no anchoring of emotional targets in the development process
<input type="checkbox"/> lack of support of user experience projects by the management	<input type="checkbox"/> lack of support of user experience projects by the management
<input type="checkbox"/> insufficient cost-benefit ratio (e.g. by applying user-centred methods)	<input type="checkbox"/> insufficient cost-benefit ratio (e.g. by applying user-centred methods)
<input type="checkbox"/> limited resources for user experience projects	<input type="checkbox"/> limited resources for user experience projects
<input type="checkbox"/> resistance against new approaches/changes by employees	<input type="checkbox"/> resistance against new approaches/changes by employees
<input type="checkbox"/> underestimation of the importance of user experience design	<input type="checkbox"/> underestimation of the importance of user experience design
<input type="checkbox"/> other:	<input type="checkbox"/> other:

A5 At this point, the first section of the survey (part on user experience) is completed. We would appreciate it if you continued with the second part of the questionnaire on scenario-based methods.

Q5.1 Are you involved through your role within the company in the application of scenario-based methods?

- planning / moderating
- applying / executing
- no involvement

A6 In the following section, please select the statement(s) for each dimension that apply to the understanding of scenario-based methods in your business area.

Q6.1 Scenarios are...

- specific
- personal
- fictional
- narrative
- other: _____

Q6.2 Scenarios can describe...

- a (proto)typical interaction
- a real interaction
- a situation "as-is"
- a situation "as-should"

Q6.3 Scenarios can involve information about...

- physical context
- emotional context
- motivation and goals of actors
- properties of actors (e.g. mental, physical)
- events
- time / sequence of the events
- functionalities of products
- properties of products
- interaction between actor and product
- other: _____

Q6.4 Which of the following methods/techniques would you assign to the umbrella-term "scenario-based methods"?

- scenario technique
- storytelling
- persona technique
- storyboarding
- use case technique
- other: _____

A7 The following questions relate to the implementation of scenario-based methods in your business area.

Q7.1 For how many years have scenario-based methods been applied in projects of your business area?

- 0-3 years
- 3-5 years
- 5-10 years
- more than 10 years

Q7.2 What percentage of the total number of projects of your business area take the projects with application of scenario-based methods?

_____ number of projects with application of scenario-based methods / total number of projects (percentage)

Q7.3 Which are the percentages of projects of the following types that have been supported by applying scenario-based methods?

_____ new product development / original design

_____ adaptive design / configuration

_____ co-creation project

Q7.4 Which phase of the product development process has been addressed by the application of scenario-based methods?

- problem definition
- need derivation
- idea generation (conceptualization)
- prototyping
- developing solutions
- implementation
- testing
- evaluation
- other: _____

Q7.5 Which are typical stakeholders in the application of scenario-based methods?

	creator	receiver
developer/engineer	<input type="checkbox"/>	<input type="checkbox"/>
designer	<input type="checkbox"/>	<input type="checkbox"/>
project controller	<input type="checkbox"/>	<input type="checkbox"/>
manager	<input type="checkbox"/>	<input type="checkbox"/>
evaluation expert	<input type="checkbox"/>	<input type="checkbox"/>
market- and communication expert	<input type="checkbox"/>	<input type="checkbox"/>
user	<input type="checkbox"/>	<input type="checkbox"/>
other:	<input type="checkbox"/>	<input type="checkbox"/>

Q7.6 Which scenario-based method or technique is, in your opinion, the most useful for each of the following targets?

	persona	storytelling	scenario	storyboarding
analysing information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
synthesizing / combining / compiling information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
detecting problems / needs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
creating ideas for new potential products	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
deriving qualitative requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
deriving quantitative requirements	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
creating product concepts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
developing solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
deriving detailed specifications	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
testing concepts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
creating marketing concepts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
analysing a user group	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
describing a vision	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q7.7 How does the creation of scenarios take place?

- external consulting
- informal proceeding
- fixed prescribed operating steps / proceeding
- company-internal proceeding
- proceeding according to literature / author: _____

Q7.8 How does the documentation of scenarios take place?

- paper-based, text
- paper-based, sketches
- digital, text
- digital, multimedia
- tool: _____

Q7.9 What are typical settings and media when presenting scenarios to the audiences described in the first column?

	setting		medium			
	meeting room	context of prospective product usage	slides (e.g. power-point)	video	visual images	paper
users	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
design team	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
experts from other fields	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
controlling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q7.10 Who is responsible for the coordination/moderation of scenario-based methods in your company?

- specialized, cross-departmental division within company
- project organization with individuals from various departments within the company
- company-internal expert
- company external expert(s) / consultant(s)
- other: _____

A8 The following questions relate to the assessment of scenario-based methods in your company.

Q8.1 What are opportunities for a company through the targeted application of scenario-based methods? Please drag the items listed as opportunities either to the box "relevant" or to the box "irrelevant". Please also rank the relevant opportunities in descending order from top to bottom of the box. If important, in your opinion, opportunities are missing, please add them in the text field "other".

relevant	irrelevant
_____ better understanding of users	_____ better understanding of users
_____ better understanding of context of usage	_____ better understanding of context of usage
_____ better understanding of the product	_____ better understanding of the product
_____ greater acceptance of products and market success	_____ greater acceptance of products and market success
_____ better interdepartmental communication within the company	_____ better interdepartmental communication within the company
_____ higher user involvement	_____ higher user involvement
_____ better interdisciplinary collaboration	_____ better interdisciplinary collaboration
_____ better representation of "soft" aspects	_____ better representation of "soft" aspects
_____ integration of ideas in physical and emotional context	_____ integration of ideas in physical and emotional context
_____ increased empathy (different perspectives)	_____ increased empathy (different perspectives)
_____ improved communication	_____ improved communication
_____ promotion of action and reflection	_____ promotion of action and reflection
_____ early/agile testing	_____ early/agile testing

_____ other.	_____ other.
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Q8.2 What are, in your opinion, benefits of scenario-based methods in comparison to other methods? Please drag the items listed as benefits either to the box "relevant" or to the box "irrelevant". Please also rank the relevant benefits in descending order from top to bottom of the box. If important, in your opinion, benefits are missing, please add them in the text field "other".

relevant	irrelevant
_____ lower costs	_____ lower costs
_____ minor learning curve	_____ minor learning curve
_____ better understanding of methods	_____ better understanding of methods
_____ more complete documentation of results	_____ more complete documentation of results
_____ better communication of the results	_____ better communication of the results
_____ greater flexibility in the use of methods	_____ greater flexibility in the use of methods
_____ better re-use of results	_____ better re-use of results
_____ minor need for special equipment / facilities	_____ minor need for special equipment / facilities
_____ more comprehensible documentation of results	_____ more comprehensible documentation of results
_____ less need for processing of results	_____ less need for processing of results
_____ more concrete results	_____ more concrete results
_____ increased number of alternatives in the results	_____ increased number of alternatives in the results
_____ other:	_____ other:

Q8.3 Would you be willing to enhance the application of scenario-based methods in your business division?

- yes
- no

Q8.4 Would you be willing to apply new approaches for a more effective usage of scenario-based methods in your division?

- yes
- no

Q8.5 Are there in your business division cases of failed application of scenario-based methods?

- yes
- no (-please describe shortly the reason:) _____

Q8.6 What are barriers in the application of scenario-based methods? Please drag the items listed as barriers either to the box "relevant" or to the box "irrelevant". Please also rank the relevant barriers in descending order from top to bottom of the box. If important, in your opinion, barriers are missing, please add them in the text field "other".

relevant	irrelevant
_____ lack of experience with scenario-based methods by practitioners	_____ lack of experience with scenario-based methods by practitioners

<p>_____ lack of methodological support</p> <p>_____ existing methods / guidelines have no relevance to company-specific needs</p> <p>_____ poorly defined tasks and responsibilities / roles in the application</p> <p>_____ high product complexity</p> <p>_____ high organizational complexity</p> <p>_____ no clear representation of the relationships between individual scenario-based methods</p> <p>_____ no overview of how established techniques of the company can be linked with scenario-based methods</p> <p>_____ practitioners' uncertainty</p> <p>_____ insufficient cost-benefit ratio</p> <p>_____ resistance against new approaches / changes by employees</p> <p>_____ ill-defined inputs and outputs of the methods</p> <p>_____ ill-defined levels of detail and media to display results</p> <p>_____ no acceptance of the results by employees</p> <p>_____ other:</p>	<p>_____ lack of methodological support</p> <p>_____ existing methods / guidelines have no relevance to company-specific needs</p> <p>_____ poorly defined tasks and responsibilities / roles in the application</p> <p>_____ high product complexity</p> <p>_____ high organizational complexity</p> <p>_____ no clear representation of the relationships between individual scenario-based methods</p> <p>_____ no overview of how established techniques of the company can be linked with scenario-based methods</p> <p>_____ practitioners' uncertainty</p> <p>_____ insufficient cost-benefit ratio</p> <p>_____ resistance against new approaches / changes by employees</p> <p>_____ ill-defined inputs and outputs of the methods</p> <p>_____ ill-defined levels of detail and media to display results</p> <p>_____ no acceptance of the results by employees</p> <p>_____ other:</p>
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A9 Thank you for your time and interest! If you have further questions about this research, do not hesitate to contact us.

A4. Results from case study “car”

Appendix A4 depicts exemplary results created through the application of the scenario-based methodology for user experience in the case study of designing the “heartbeat” within the CAR@TUM project¹. Individual results have been slightly adapted due to confidentiality reasons. Moreover, at the time, in which the case study took place, the methods were in a premature stage compared to the final stage reached by the end of the final case study.

A4.1 Create user profiles

Following exemplary data were used for creating a user profile for product type T1 in the geographical region R1 in the “car” case.



Figure 1: Exemplary visualization of a user profile

¹ Results at www.designingexperiences.org

To define the most representative regions, retail data were analysed. Regions R1, R2 and R6 are based on that the most representative regions.

Region	Year 1		Year 2		Year 3	
R1	48477	33%	79999	30,5%	71294	28%
R2	29345	20%	55667	21,5%	62000	24%
R3	20223	14%	38867	15%	39001	15%
R4	9880	6,5%	15001	5,5%	14997	6%
R5	9654	7%	18002	6,5%	20987	8%
R6	27223	19,5%	55111	21%	47999	19%
Total retail	131008	100%	296548	100%	267211	100%

Figure 2: Retail data for car type T1, in years 1-3, in regions R1-R6

To describe further the utilization context, climatic data in region R1 were analysed. The profile includes the most representative (highlighted) values.

Ø T	< 5 °C	5,1 - 10 °C 100%	10,1 - 15 °C	15,1 - 20 °C	20,1 - 25 °C	> 25 °C
Ø T_max	< 5 °C 25,00%	5,1 - 10 °C 16,50%	10,1 - 15 °C 16,50%	15,1 - 20 °C 16,50%	20,1 - 25 °C 25,00%	> 25 °C
T_max	< 15 °C 8,50%	15,1 - 20 °C 16,50%	20,1 - 25 °C 16,50%	25,1 - 30 °C 16,50%	30,1 - 35 °C 33,50%	35,1 - 40 °C 8,50%
Ø T_min	< 0 °C 33,00%	0,1 - 5 °C 25%	5,1 - 10 °C 17,00%	10,1 - 15 °C 25,00%	15,1 - 20 °C	> 20 °C
T_min	< -20°C 16%	-19,9 - 15 °C 17%	-14,9 - 10,0 °C 8%	-9,9 - 5,0 °C 17,00%	-4,9 - 0,0 °C 17%	0-5 °C 25,00%
Ø rel. humidity	40 - 50 %	50,1 - 60 %	60 - 70 %	70,1 - 80 % 59,00%	80,1 - 90 % 41,00%	
Ø sunshine hours/day	0 - 2 17,00%	2,1 - 24,50%	4,1 - 25,00%	6,1 - 8 33,50%	8,1 - 10	10,1 - 12
rainy days/ year	< 40	40 - 80	81 - 120	121 - 160 100%		
precipitation/ year	300 - 500 mm	501-700mm	701-900mm 100%	901-1100mm	1100-1300 mm	1300 - 1700 mm

Figure 3: Climatic data for region R1

Before deriving data on product utilization, the product model was specified. Retail data showed that the model M1 is the most representative model of car type T1 in region R1.

Model	%	Total
M1	65,50%	8975
M2	16,20%	1803
M3	10,30%	1093
...
	100%	10438

Figure 4: Retail data for models M1-M3 of T1 in region R1

In the next step, utilization data could be derived from data loggers.

Trips per week	3,3	average velocity	59km/h
Driving under 15 min / day	1,1	Velocity distribution (time share)	
middle distance / driven day	97km	0-40km / h	29,50%
average annual kilometers	27600km	40-70km / h	21,50%
Vacation trips km / year	2030km	70-110km / h	18%
Private weekend trips > 50km / year	21	110-150km / h	14,50%
Highway (time share)	3210km	> 150km / h	4,50%
Country road (time share)	37%	Duration of the trip	19,5min
Urban Transport (time share)	19%	Stops / hour	19
Times of the day (start of trip)	45%	Stops / 100km	28
18h- 6h	12,50%	average duration of parking	6,7h
6h 9h-15h-18h & 9-15h	27,90%	average duration of parking / driving day	19,5h
	33,50%		

Figure 5: Utilization data for T1, M1 in R1

To describe the social context of interaction, we took the descriptions of sigma milieus as reference. Representative for car buyers of cars T1, M1 in R1 correspond to the upper conservative segment.

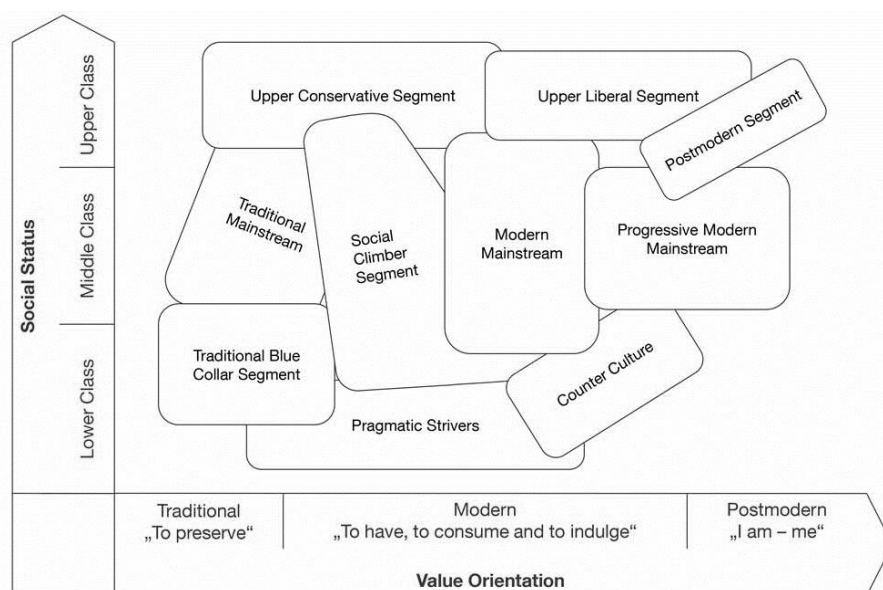


Figure 6: Sigma milieus in Germany

Finally, the following personal data were retrieved from customer databases.

Ø age	49,3	entrepreneur	35%
60+	29%	academic	25%
50-59	39%	public service	13%
40-49	19%	independent	4%
30-39	5%	pre-family	1%
<30	1%	young family	3%
male	95,10%	family with young children	20%
married / in partnership	91,30%	family with adult children	30%
nr. persons in household	3,1	family with grandchildren	40%
nr. cars in household	1,8	commuting home-work	65%
Ø annual income	77000	business	70%

Figure 7: Personal data of buyers of T1, M1 in R1.

A4.2 Extract real users' motives

The starting point for the development of the heartbeat was the motive “feel the energy status of my electric vehicle”. Here is an exemplary statement demonstrating this motive:

[...] Without the vibration of the car, the roar from the exhaust, the clacking of the transmission, the electric frenzy feels somehow synthetic [...] As long as [the vehicle] is not moving, you could think it is a driving simulator. [...] The revolution counter tachometer, an otherwise central cockpit instrument, is missing. [...] There are only a few toggle- and rotary switches [...]

An analysis of this statement shows that, due to the absence of a combustion engine, there is no acoustic or any feedback related to the energy status in important situations. The vehicle does not feel real for the driver. Indicators seem unimportant and drivers wish for another way to feel the energy status. Seeking for alternative ways for feeling the energy is the starting point for designing a new, positive experience.

A4.3 Integrate experiences

In the design of the “heartbeat”, the matrix analysis aimed at identifying a motive cluster related to the motive “feel the energy”, as well as the relevant needs, use cases and functions.

Table 4: Adjusted meta-model

	Function	Motive	Need	Use case
Function		fulfills		is used in
Motive		can occur at the same time with	meets	
Need				
Use case				

The method moderators collected the elements corresponding to the domains of the adjusted meta-model.

Table 5: Exemplary elements of the selected domains

Function	Motive	Need	Use case
play music and radio	swim harmonously in traffic	competence	get into the car
show pictures/videos	delegate tasks with a good feeling	stimulation	start driving
control navigation	be able to concentrate on passengers	security	drive energy efficiently
connect with devices	avoid collisions with other cars	preservation of something meaningful	drive in traffic, city
start and stop motor	reach destination with my energy resources	popularity	drive in traffic, highway
control driving mode	feel the driving conditions with all senses	relatedness	drive with high speed, highway
provide energy information	experience dynamic agility	physical thriving	stop car
provide speed information	feel the energy flow	autonomy	park car
provide route information	communicate with my car directly	competition	drive in bad conditions
provide range information	know and feel the status of my car	...	get out of the car
...

The analysis of the first matrix (motive-motive) led to the identification of a motive cluster consisting of the highlighted motives.

	swim harmoniously in traffic together with others	delegate tasks with a good feeling	feel the driving conditions with all senses	know and feel the status of my car	feel the energy flow	reach my destination with my energy resources	get a feeling for electric energy consumption	...
swim harmoniously in traffic together with others								
delegate tasks with a good feeling								
feel the driving conditions with all senses				x				
know and feel the status of my car			x	x				
feel the energy flow				x	x			
reach my destination with my energy resources					x	x		
get a feeling for electric energy consumption						x	x	
...								

Figure 8: Relations “Motive can occur at the same time with motive”

The relevant motives meet primarily the needs for competence, stimulation and physical thriving. The fulfilment of those needs was explored in the evaluation studies.

	competence	stimulation	security	preservation	popularity	relatedness	physical thriving	autonomy	competition
swim harmoniously in traffic together with others	x						x		
delegate tasks with a good feeling	x		x						
feel the driving conditions with all senses		x					x		
know and feel the status of my car	x						x		
feel the energy flow		x					x		
reach my destination with my energy resources	x		x					x	x
get a feeling for electric energy consumption	x	x	x				x	x	
...									

Figure 9: Relation “Motive meets need”

The main conclusion from the analysis of the third matrix is that the highlighted functions contribute to a positive experience. Most of them are controlled through the “heartbeat” interface in its final design.

	swim harmonously in traffic...	delegate tasks...	feel the driving conditions with all senses	know and feel the status of my car	feel the energy flow	reach destination with my energy ressources	get a feeling for electric energy consumption	...
show pictures/ videos								
start/ stop motor				x	x			
control driving mode	x	x	x	x	x	x		
provide energy information				x	x	x	x	
provide speed information	x			x	x	x		
provide route information						x	x	
provide range information	x			x	x	x	x	
...								

Figure 10: Relation “Function fulfils motive”

Finally, it was possible to identify the use cases, which are relevant for the new experience. Those use cases were further explored when creating the user experience story.

	..	start driving	..	driving in the city, traffic	driving in the city, less traffic	..	driving with high speed	driving in highway	..	driving ecologically	..	Stop and park	getting out of car	..
...	0	4	0	8	7	8	8	7	6	2	3	1	2	0
...	0	5	0	6	7	7	6	7	4	1	2	1	2	1
...	1	6	1	7	7	4	5	6	4	3	3	2	4	1
....	1	7	2	10	11	6	9	10	6	5	3	2	5	2
start/ stop motor	2	2	2	4	3	2	4	3	3	3	1	1	3	0
control driving mode	0	4	1	9	7	1	7	6	5	7	2	3	7	0
provide energy information	2	4	2	11	9	3	10	9	7	8	5	0	8	2
provide speed information	2	3	2	8	6	1	7	6	5	6	2	0	4	0
...	1	4	1	6	6	4	5	6	4	4	4	1	5	2
provide range information	1	4	2	8	8	3	7	8	6	7	2	1	7	2
...	0	1	0	1	1	1	1	1	1	0	0	0	0	0

Figure 11: Relation “Function is used in use case”

A4.4 Create a user experience story

The story setting brings together the elements explored in the previous methodology steps.

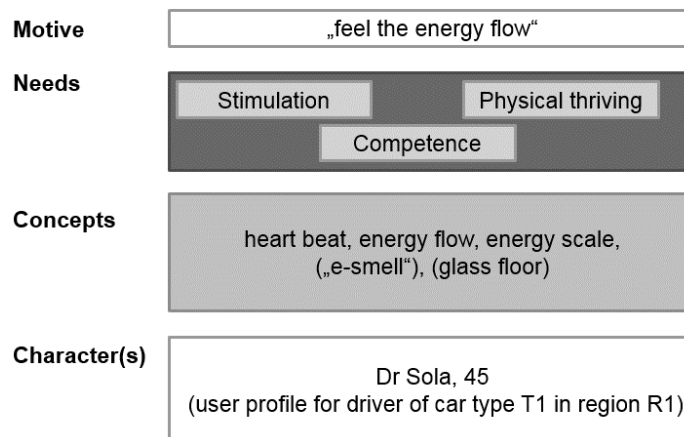


Figure 12: Story setting

The story plot shows a chronological arrangement of the relevant use cases.

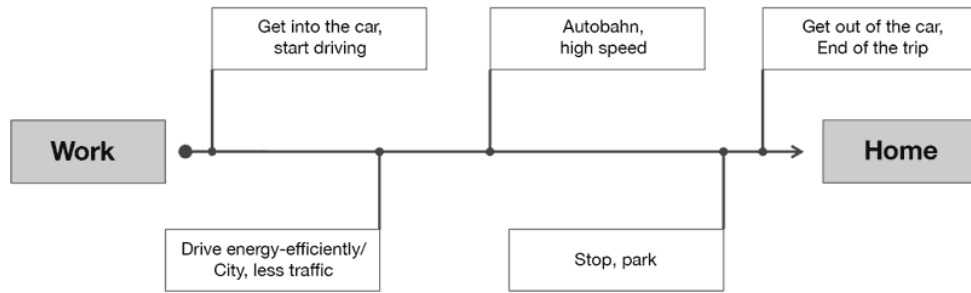


Figure 13: Story plot

To create substories, the team used the template in a previous version.

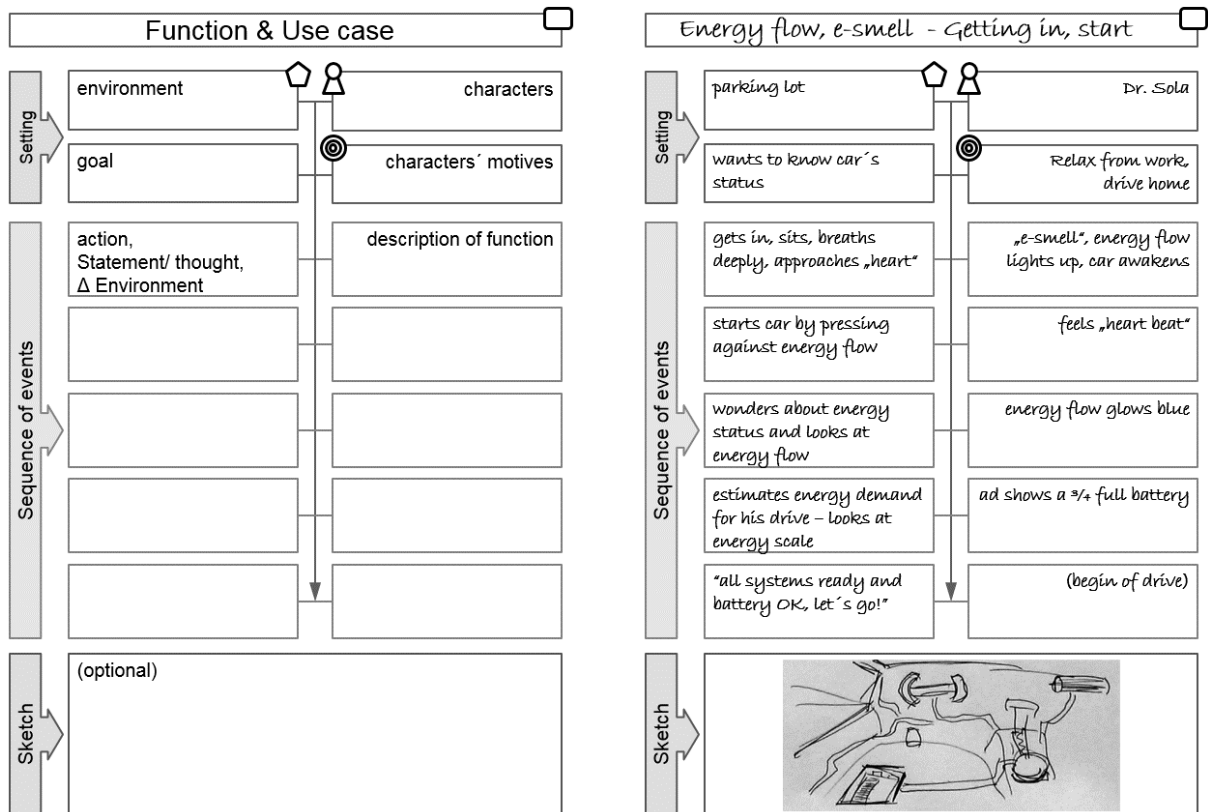


Figure 14: Exemplary substory

Finally, the user experience story was formulated and visualized.

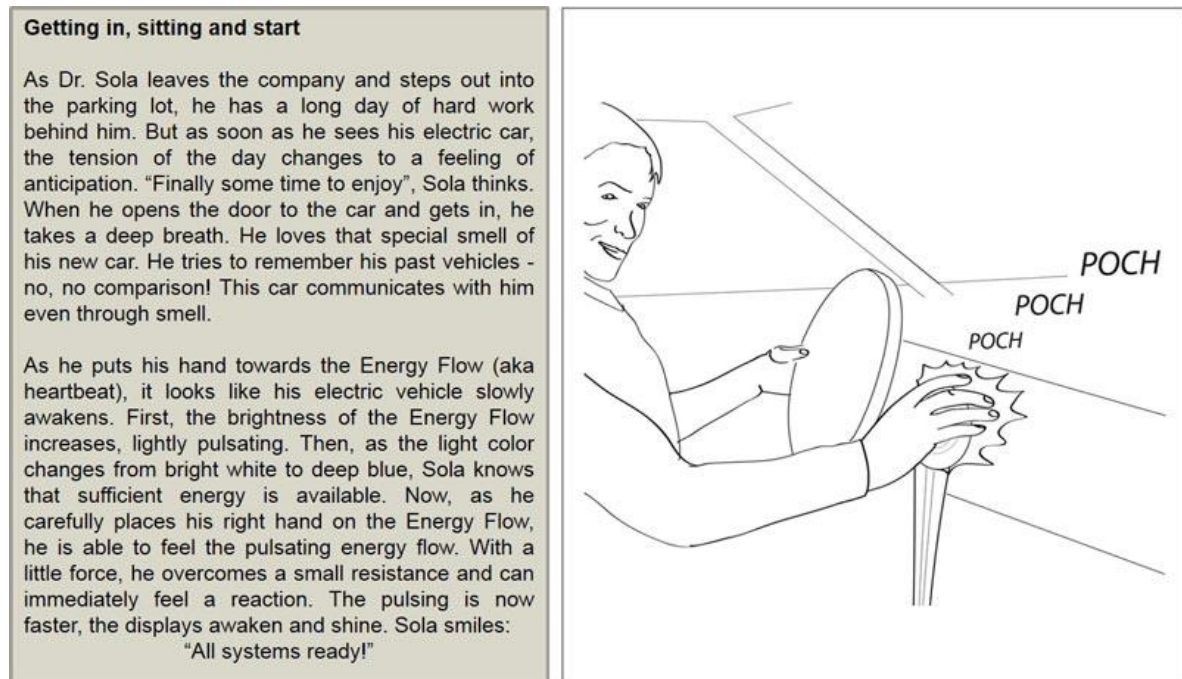


Figure 15: Excerpt from the user experience story

A4.5 Evaluate the user experience story

At the time the case study "car" took place, there was no method to evaluate the story. We only evaluated the experience presented through the story instead. This process is not a focus of this thesis. Details can be found in the works of Moritz Koerber.

When using the system, ...							
		Fully disagree	Somewhat disagree	Agree in part	Somewhat agree	Fully agree	Not applicable
1	...I was in full control of the situation.	1	2	3	4	5	0
2	...the situation was completely predictable and not threatening.	1	2	3	4	5	0
3	...my action was efficient and effective.	1	2	3	4	5	0

Figure 16: Example of the questionnaire to measure the fulfilment of needs

A5. Results from case study “coffee machine”

This part demonstrates exemplary results from the application of the methodology by Fluhr (2015) in the design of new experiences mediated through fully automated coffee machines. The application resulted to the design of a new experience addressing relatedness and stimulation. The new experience is mediated through a new interface concept for coffee machine, the so-called “coffee chips”.

A5.1 Create user profiles

The analysis of online statistics showed that a major group of coffee machine owners (represented here by Julia Wolf) prioritize highly a multi-sensory experience (need for stimulation), individual settings (need for autonomy) and enjoying coffee as a social experience (need for relatedness).



Figure 17: Exemplary user profile representing coffee machine owners from the “modern workers” segment in Germany

A5.2 Extract real users' motives

The analysis of reviews written by owners of coffee machines corresponding to the selected profile showed that major motives are “fascinating contacts”, “attracting contacts” and “being stimulated through new taste”. The experience mediated by “coffee chips” addresses those.

Table 6: Exemplary results of applying the method to extract real users' motives

Quote	Story	Storyline	Oppositions	Enthymemes	Motive	Cluster
<p>Personally, I always find the look of glasses and cups really elegant. [...] Meanwhile, I was even able to impress some friends who visited me. Two of them are considering seriously even the purchase of an automatic coffee machine.</p>	<p>Personally, I find looks [...] elegant. I was able to impress friends who visited.</p>	<p>The user, who finds an elegant look important, could impress and influence his visitors with an optical and qualitatively good result.</p>	<p>elegant look <-> unattractive look meanwhile <-> before [purchasing machine] visiting, being close <-> being distant some friends <-> few impress <-> be neglected</p>	<p>I could impress friends with my elegant coffee machine. These friends came over for a visit. Possessing the coffee machine increased my popularity and makes visits more interesting.</p>	<p><i>Making an impression through my coffee machine</i></p>	<p>fascinating contacts, attracting contacts</p>
<p>In the first few days, as proud owner of the machine, I enjoyed the whole thing with the perfect milk foam. Then, the powder was out and I came up with the idea to try once if adding cocoa powder and a little sugar possibly improves the taste of cappuccino. And behold, just my first attempt with a coffee measure cocoa powder and a teaspoon of sugar worked.</p>	<p>[...] The powder was out and I came up with the idea to try once if adding cocoa and sugar improves the taste of cappuccino. [...] My first attempt worked.</p>	<p>The user added cocoa and sugar in his machine and received easily a better tasting cappuccino.</p>	<p>[...] try, experiment, explore <-> bore, neglect [...] first attempt <-> many attempts</p>	<p>Triggered through the great machine foam and a coincidence (not enough coffee powder), I experimented with the taste. I am fascinated that this first experiment worked.</p>	<p><i>Easily exploring better taste</i></p>	<p>Stimulated through new taste</p>

A5.3 Integrate experiences


In order to integrate experiences, we took as starting point the two most relevant needs (relatedness and stimulation). First, we explored which motives meet those two needs. For an efficient matrix analysis, we considered clusters of motives instead of individual motives in a random order. The motive clusters were built as result of the matrix “motive is related to motive”. As depicted in Table 6, the new product (coffee chips) addresses most motives.

Table 7: Representative results of the analyses of the relations among motives and needs

Need	Motive cluster	Motive	Coffee chips
relatedness	fascinating contacts	making an impression through my coffee machine	
		coffee machine enriching visit	x
		fascinate friends with great coffee	
		being able to offer the coffee that my contacts want	x
		possessing a machine that my friends like	
	attracting contacts	attracting contacts through the coffee machine	x
		influencing contacts through the coffee machine	
		being able to easily invite friends for coffee	x
...	...		
stimulation	stimulated through new taste	easily exploring better taste	x
		being supported through my search for the ideal taste	x
		receiving taste benefits	
		being able to create different coffee tastes	x
		tasting and smelling great coffee	x
	

To find out, which functions fulfil the three relevant motive clusters, we analysed their relations in a matrix. The identified functions (highlighted) are the ones influenced by the coffee chips.

Table 8: Representative results of the matrix “function fulfils motive”

Function fulfils motive 	fascinating contacts	attracting contacts	being stimulated through taste	...
Activate machine				
...				
Take coffee selection request	x		x	
Manipulate settings	x		x	
Make coffee		x	x	
Boil water				
Dispense coffee	x		x	
Foaming milk	x		x	
Manage energy consumption				
...				

A5.4 Create a user experience story

For creating the user experience story, we first defined the story setting, using as inputs the user profile, the derived motives and the identified as relevant needs.

Table 9: Story setting

Character(s)	Julia (32), owner of the coffee machine → user profile “comforts” in Germany Jonas (33), Julia’s guest/friend
Motives	Fascinating contacts Attracting contacts Exploring new taste directions Being stimulated through new taste
Needs	Relatedness, stimulation

The method to integrate experiences indicated which use cases are most critical. We ordered them in a prescriptive plot line.

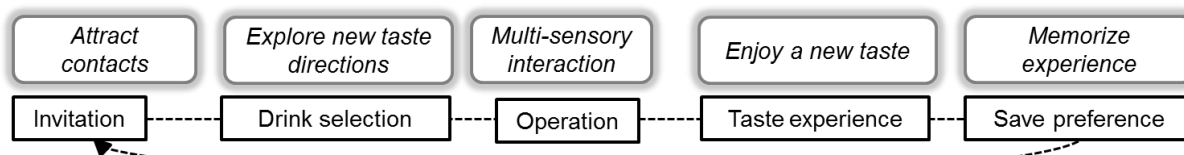


Figure 18: Story plot

Then, we created one substory per use case.

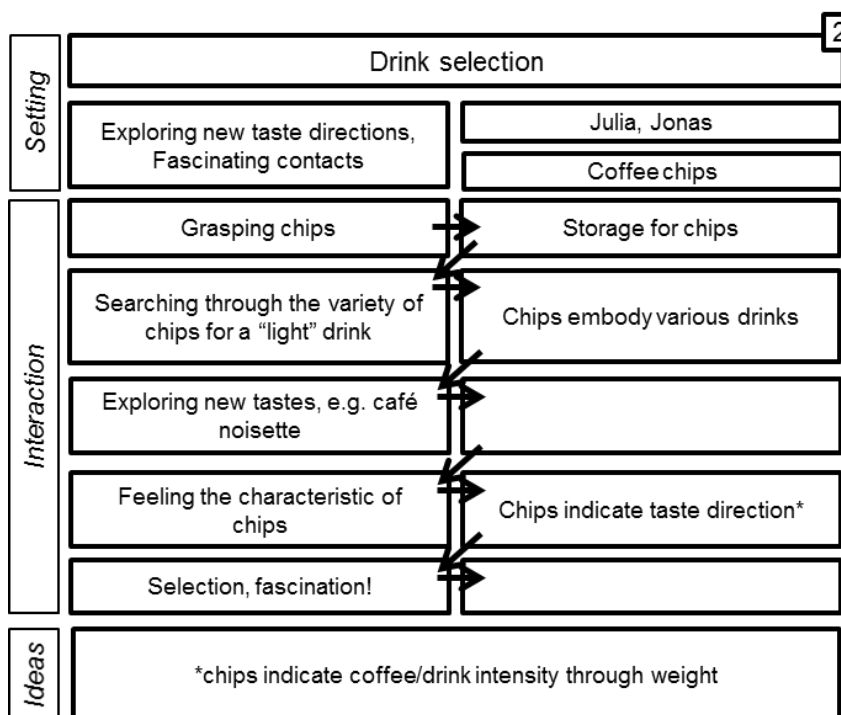


Figure 19: Exemplary substory

Each use case was formulated in narrative form, resulting into the user experience story:

It is evening, as Julia closes the refrigerator and discovers a note from Jonas at her coffee machine. She had not seen Jonas for weeks, so she decides to invite him for a cup of coffee. On her way to work next morning, Julia stops by Jonas’ house. She brought one of their magnetic coffee chips with an invitation message. Hoping that her friend discovers the invitation soon, she throws the chip into Jonas’ mailbox. At the same evening, Julia’s phone rings. It is Jonas, who had discovered the chip. “Hey Julia, thanks for the invitation”, says Jonas. Julia is happy that the invitation worked!

A few days later, Jonas visits Julia. “Nice to see you, Jonas, come in! Feel yourself at home and make a coffee... I must go to the basement for a second to check the washing machine”, says Julia. Jonas knows Julia’s coffee machine and its features. The coffee chips offer him a way to select the depicted drink and order it from the coffee machine without having to manipulate any other settings. In his search for a light coffee flavour, Jonas is fascinated from the great variety of drinks. “Café noisette, interesting”, he thinks as he grasps the chip. It feels lighter than the espresso ristretto chips he usually prefers –just like café noisette itself! Julia had shown him last time how easy it is to prepare the selected beverage. He approaches the machine with the chip in this hand. As if by itself, the chip gets attached to the special position in the machine. By slightly turning it, the coffee starts brewing. “A new taste with just a single movement”, thinks Jonas. His coffee is ready, when Julia returns. She operates the coffee machine through the conventional interface, as she wants to set a custom amount of coffee. With the freshly brewed coffee, both go the living room to enjoy their beverages and catch up. It is already dark outside, when they go back to the kitchen with their empty cups. Julia reminds Jonas of the dashboard with favourite drinks. Once a chip is attached on the magnetic board, it can be instantly found. While Jonas places the coffee chip, he notices that several people had left messages. One of them is from Tom, who suggests a camping weekend. Jonas likes the idea and adds a new note with his intention to join. Julia, observing from the background, is pleased that her coffee machine has become in short time a true inspiration for activities among friends. Recalling her cosy afternoon with Jonas, she decides to spend more time with their friends. Thereby, her gaze wanders towards the coffee machine...

Finally, we complemented the narration with pictures.

Jonas knows Julia’s coffee machine and its features. The coffee chips offer him a way to select the depicted drink and order it from the coffee machine without having to manipulate any other settings. In his search for a light coffee flavor, Jonas is fascinated from the great variety of drinks. “Café noisette, interesting”, he thinks, as he grasps the chip. It feels lighter than the espresso ristretto chips he usually prefers -just like café noisette itself!



Figure 20: Except of the visualised user experience story

A5.5 Evaluate the user experience story

For evaluating the experience, we used a questionnaire with selected items from the UXNQ.

Table 10: Items from the UXNQ used to evaluate the story

Need	Item (While using the system...)	Comment
Relatedness	... I rather acted alone than with others.	Invert item
Relatedness	... that I belonged to a group of other persons.	
Stimulation	... I experienced something great.	
Stimulation	... I was fascinated by making new experiences.	
Popularity	... I was able to improve my social image.	Adapted item
Conservation of something meaningful	... I could preserve something that is meaningful to me.	
Physical thriving	... I felt alive und vital.	Control item
Autonomy	... I was free in my decisions.	Control item

A6. Results from case study “dish care”

This part includes representative results from the project “Innovative Dish Care Solutions” and the thesis of Martinez (2016) and Reckordt (2016).

A6.1 Create user profiles

Each of the user profiles created in the “dish care” case represented one of four “need clusters”. Figure 22 shows the representation of users, who appreciate high tech products, which deliver great results (need cluster “high tech & result”).

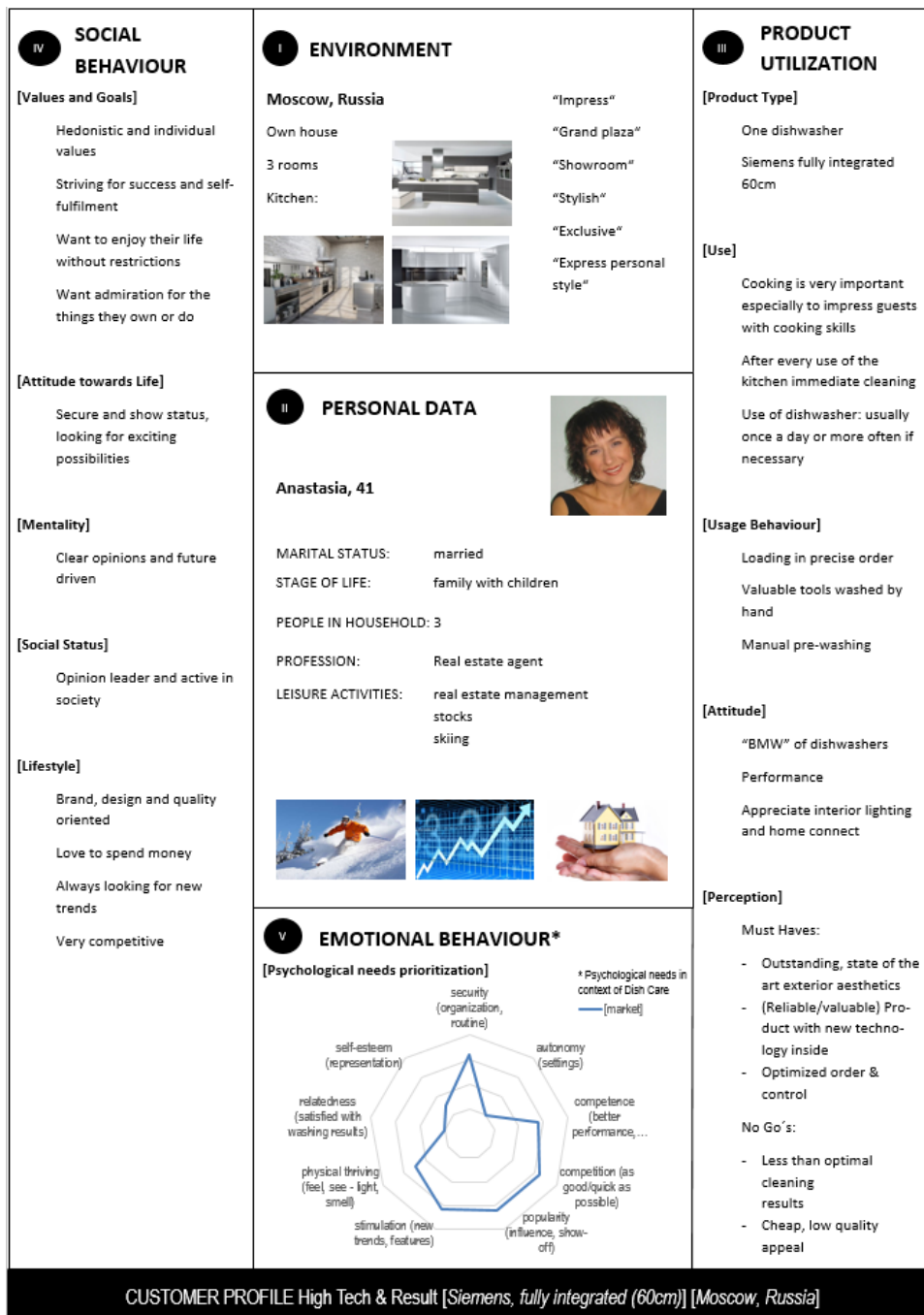


Figure 21: User profile “high tech & result”

A6.2 Integrate experiences

The desired result of the project was to propose four dishwasher prototypes; each addressing the needs of one user profile. To find out which concepts to integrate into each dishwasher prototype we worked with the support of matrix analysis.

Firstly, we examined which needs are most relevant for each user profile (Figure 23).

User Need	Quality & Simplicity	Convenience & Efficiency	High Tech & Result	Pragmatism & Fun
Organization	3	3	3	1
Autonomy	2	2	1	1
Competence	3	2	2	2
Competition	1	3	3	2
Popularity	1	1	3	2
Stimulation	1	1	3	3
Physical thriving	2	2	2	2
Relatedness	3	2	1	1
Self-esteem	1	1	1	2

Figure 22: Relation “need is relevant for user profile” (1: low relation; 2: medium relation; 3: high relation)

Then, we identified the use cases that stress the needs in focus.

Need Use Case	Organization	Autonomy	Competence	Competition	Popularity	Stimulation	Relatedness
Opening door			x		x		
Pull out rack/tray		x				x	
Loading	x		x	x			
Push in rack/tray		x				x	
Dosing detergent							
Switch on device		x				x	
Program choice		x	x	x	x		x
Start cleaning		x				x	
Result check			x	x			x
Closing door			x		x	x	
Unloading, storing	x		x	x			

Figure 23: Relation “use case stresses need”

Next, we identified the mechanical components used in each use case.

component \ Use Case	Door	Tray	Upper rack	Lower Rack	Filter	Start button	Control Panel	Detergent Dispenser	Door handle
Opening door	x								x
Pull out rack/tray		x	x	x	x				
Loading	x	x	x	x					
Push in rack/tray		x	x	x					
Dosing detergent								x	
Switch on device						x	x		
Program choice							x		
Start cleaning						x			
Result check		x	x	x					
Closing door	x	x	x	x					x
Unloading, storing	x	x	x	x					

Figure 24: Relation “mechanical component is used in use case”

Finally, we examined the mechanical compatibility of the concepts.

	open while loading	easy open/close door	automatic pull out racks	same level racks	no crash door-racks	loading few items	folding rods of racks
open while loading	x		x	(x)	x	x	
easy open/close door		x	x	x	x	x	
automatic pull out racks			x	(x)	x		
same level racks				x			
no crash door-racks					x	x	
loading few items						x	
folding rods of racks							x

Figure 25: Relation “concept is mechanically compatible to concept”

A6.3 Create a user experience story

In order to create the story, we first created a story setting.

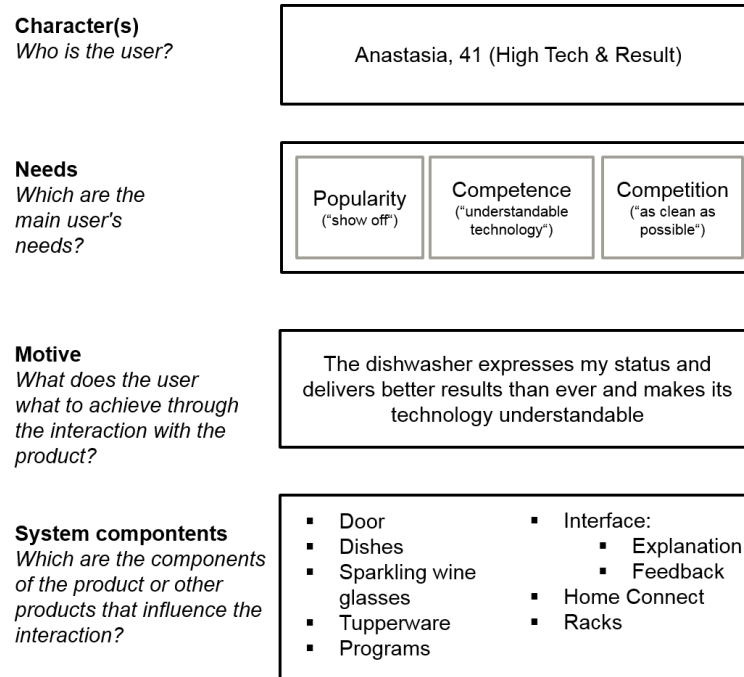


Figure 26: Story setting

Then, we proceeded with the steps of the method to create a user experience story within a workshop. Two company employees (product experts) and one member of the student team (user expert) were the workshop participants.

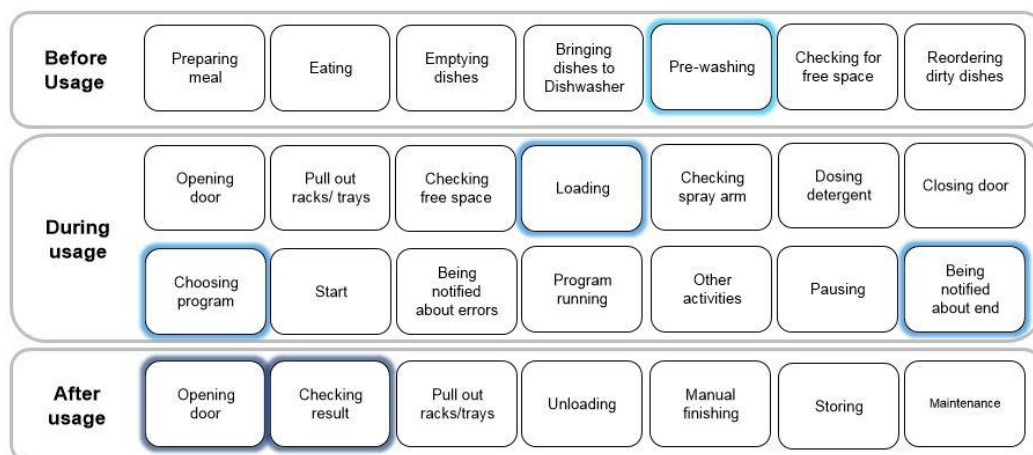


Figure 27: Use cases and key events (highlighted)

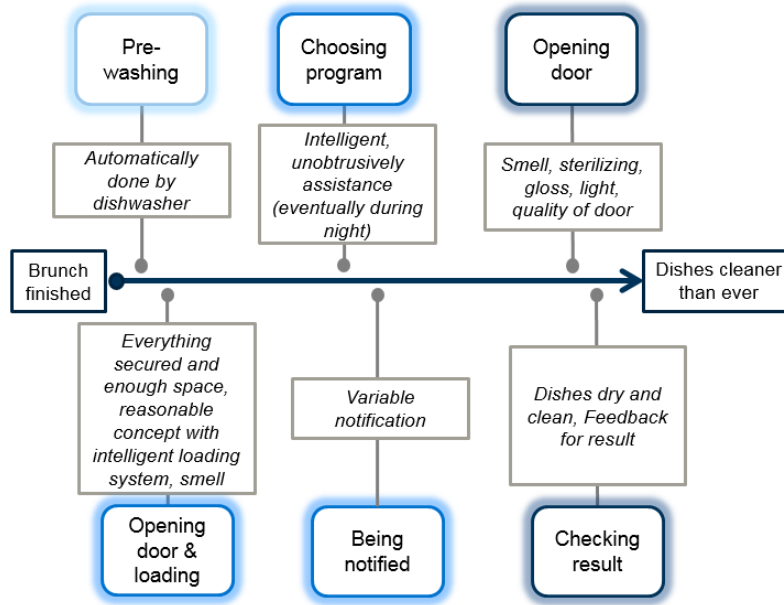


Figure 28: Story plot

After creating the story plot, the participants formulated six substories.

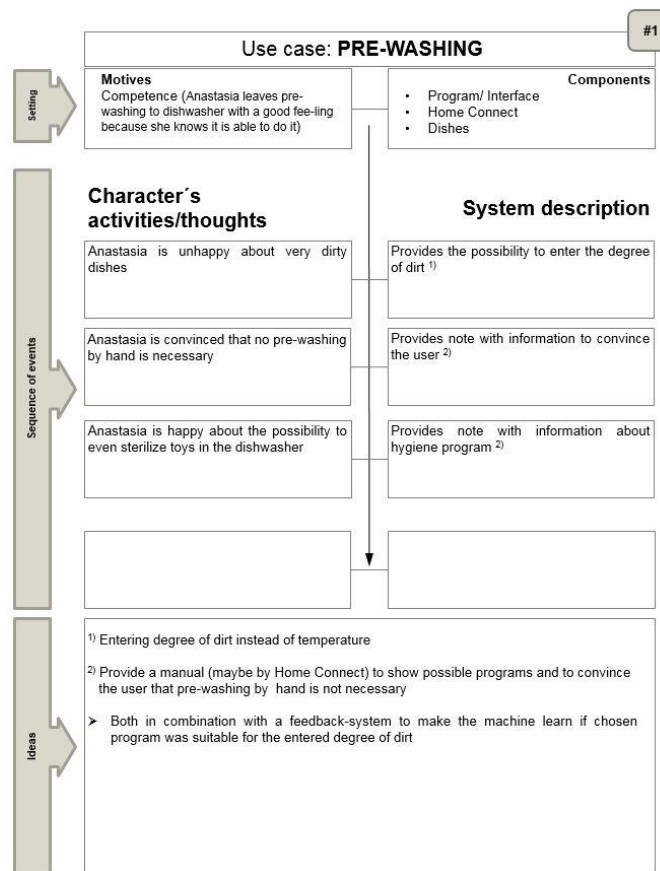


Figure 29: Exemplary substory

After the end of the workshop, a member of the project team created the narratives corresponding to the substories. Finally, the narratives were supplemented with graphs and sketches.

User Experience Story: High Tech & Result

“A dishwasher that expresses my status and delivers better results than ever and makes its technology understandable”

Anastasia has just finished the brunch she hosted for her friends. She is happy about her very clean and representative kitchen where her dishwasher is not noticeable as it is a fully integrated one.

She clears the table and takes everything to the dishwasher. Since she has a new one she is convinced she does **not need to pre-wash** everything by hand anymore. Her Home Connect App has provided her clear instructions about that and notes about other possibilities of her dishwasher. She now even relies on her dishwasher for **sterilizing her daughter's toys**.

Anastasia tells everyone to come together around her dishwasher eager to impress them by her new one. She **opens the door automatically** without having to touch it. When opening the door even the upper basket is pulled out automatically. Anastasia is relieved that the days are over when she had to touch the dirty inside of the door and when bad smells left from the inside when opened. Now the dishwasher shows her by the use of a **special lightning system** where still is free space for the dirty dishes. ...



Concept for opening door with sensor
(Source: Project Part Digitalisation and Servitization)

Figure 30: Excerpt from the user experience story

A6.4 Evaluate the user experience story

Questionnaire for the evaluation of user experience stories

Dear survey participant,

we appreciate a lot that you take part in this survey. This questionnaire was developed to evaluate the extent of satisfaction of psychological needs in *User Experience Stories* in the context of dish care. In that way, aspects for an improvement of the stories shall be identified. You will be presented thirteen questions, which may take you about ten minutes to answer. Note: Please fill in this survey seriously! During this survey, no personal data will be collected to ensure that you stay anonymous.

Instructions:



1. Answer the first question on page 2 to identify to which *User Type* you best identify with.
2. Go to the section about the previously chosen *User Type* (e. g. if you have chosen *User Type A* go to Section A on page 4)
3. Read the *User Experience Story*
4. Answer the following questions

Thank you for your participation!

User Type Selection

Choose one of the following *User Types* you can identify with by comparing your kitchen and your use of the dishwasher:

- Type A:** If you choose this *User Type* please continue on page 4!

I consider cooking as very important and enjoy hosting dinners	
I see my kitchen as: <ul style="list-style-type: none"> • A showroom to impress others • stylish • exclusive 	Kitchen Impressions: 
I use: <ul style="list-style-type: none"> • My dishwasher immediately after using the kitchen • A very precise order of loading and pre-rinsing • To wash expensive items manually 	Loading Impressions: 

User Type A - Story

Please read the story and try to identify yourself with the protagonist.

User Type A - Questions

Imagining that you are the protagonist of the story, please indicate your level of agreement to the following statements. Thank you for your participation!

While using the dish washer, I felt ...							
		Strongly disagree	Rather disagree	Moderately agree	Rather agree	Strongly agree	nap*
1	... that I had an advantage over others.	1	2	3	4	5	0
2	... that I would be proud when others see me with this product.	1	2	3	4	5	0
3	... I showed others that I was superior.	1	2	3	4	5	0
4	... full of energy or physically active.	1	2	3	4	5	0
5	... that I was a reputable and respected person.	1	2	3	4	5	0
6	... I was successfully completing difficult tasks.	1	2	3	4	5	0
7	... I could preserve personally meaningful memories.	1	2	3	4	5	0
8	... well supported to complete the task successfully.	1	2	3	4	5	0
9	... I was a person who had an influence on the opinion of others.	1	2	3	4	5	0
10	... I was very capable of what I did.	1	2	3	4	5	0

While reading the story, I was able...							
		Strongly disagree	Rather disagree	Moderately agree	Rather agree	Strongly agree	nap*
1	... to understand the protagonist and his/her needs	1	2	3	4	5	0
2	... to understand the benefit of the introduced dish washer and its features.	1	2	3	4	5	0
3	... to understand the situations, in which the dish washer was used.	1	2	3	4	5	0

Do you have further annotations or ideas?

A7. Questions for method evaluation

For evaluating individual methods and the overall methodology, applicants of the methods answered the following open-ended questions and questionnaire.

Open-ended questions

Answering/commenting the open-ended questions was the concluding part of the method application.

- What is in your opinion the added value of this method?
- How could this method influence your general way of working?
- How easy/difficult was the workshop structure that we proposed?
- Do you have any recommendations concerning the method application?

Questionnaire

Through the questionnaire, practitioners evaluated the perceived fulfilment of the requirements, which had been derived in chapter 3.

	Strongly disagree		Strongly agree		Not applicable
<i>During the workshop I was provided with sufficient explanations</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>I found the method descriptions and explanations understandable</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>I found the documentation of information in templates intuitive</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>After applying the method I know how the method works</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method fits well in the development process that I practice</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method enables the participation of end users</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method is applicable in interdisciplinary teams</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>I find the results of the method easy to communicate to other stakeholders</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>I can argue the traceability of results</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>I expect the method to be flexible in application (e.g. depending on project needs)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The application of the method requires minor costs</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The application of the method requires no special equipment</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>I would recommend the method to a colleague</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method is engaging, not boring to use</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method is slow, complicated to use</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Overall I am satisfied with the way the method works</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The effort to apply the method is worth the benefits</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>This method helped me understand prospective consumers and their needs better than other data I already had</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method application provided concrete results</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method application provided complete results</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method application provided reusable results</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method helped me understand users and their needs</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method helped me understand the physical and emotional context of usage</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method helped me be creative</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method supported my communication with other team members</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>The method supported the participation of end users</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

A8. Method descriptions - Practical guide

The practical guide for applying the scenario-based methodology for user experience design is available in form of a brochure, as well as in the interactive form of a webpage (www.uxfirst.com).

PRACTICAL GUIDE FOR APPLYING THE SCENARIO- BASED METHODOLOGY FOR USER EXPERIENCE DESIGN

PART OF THE DOCTORAL THESIS
MICHAILIDOU, I. (2016). *DESIGN THE EXPERIENCE FIRST: A
SCENARIO_BASED METHODOLOGY FOR THE DESIGN OF COMPLEX,
TANGIBLE CONSUMER PRODUCTS:* TECHNICAL UNIVERSITY OF MUNICH.

AVAILABLE AT WWW.UXF1RST.COM

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INTRODUCTION

User experience is a complex phenomenon concerning users' subjective impressions of interaction with products. In order to design user experiences, a shift of focus in the traditional design practice is required. The scenario-based methodology provides guidance in the (new) practice of designing experiences. This guide will lead you through the steps towards designing user experiences. For each method, you will find an overview, examples and detailed instructions. Moreover, the execution of some steps can be facilitated by the use of templates or complementary information, available in the appendix.

WHAT IS THE SCENARIO-BASED METHODOLOGY FOR USER EXPERIENCE DESIGN?

The scenario-based methodology proposed in this practical guide consists of five methods. They will help you in early design phases to focus on user experience-related aspects and come up with concepts for new, positive user experiences. The methods build on each other and work best in application in multi-disciplinary teams.

WHAT BENEFITS BRINGS THE APPLICATION OF THE METHODOLOGY?

- Focus on user experience
- Communication of experience-related aspects
- Concrete and traceable results
- Conceptualization of new, positive user experiences
- Structured, manageable procedure

DO THE PRODUCTS I DEAL WITH MAKE A GOOD SETTING FOR THE APPLICATION?

The methodology works great for complex, tangible consumer products, like cars or household appliances. Complex products are those that have a large number of components and possible states. If the products you deal with fall into this category, there is a great chance to benefit.

WHICH METHODS TO APPLY?

It is advisable to invest the resources to apply the whole methodology. The systematic process and the outputs that build on each other make results valid and traceable. However, if you already have available results from your previous practice (e.g. user profiles), you can skip steps.

To set an application plan, start by reflecting the objective of the user experience project. Is your goal to define, design, evaluate or improve user experience? In which phase of the design process can you interfere? Which are the general project conditions (e.g. time frame, budget)? Moreover, try to map the proposed methods and steps of the user experience design process (depicted on the next page) to your design practice.

WHO SHOULD BE INVOLVED IN AND WHO IS RESPONSIBLE FOR THE APPLICATION?

It is possible to apply the methods in multi-disciplinary teams without expertise in user experience. The perspectives of engineering, design, human factors and marketing enrich a user experience project, so do assign those roles to members of the design team. Participation of end users is also possible. The method descriptions recommend which roles to include in the application. The *human factors expert* is responsible for analysing, measuring and evaluating experiences from early analysis over to the actual usage of a product. The *experience designer* brings creative skills to create a story describing the new experience and generate concept ideas about the mediation of the experience. The *developer* has knowledge about new technologies, manages requirements and implements concepts that translate the user experience story into a product. The tasks of a *user expert* include the continuous communication with users to understand their needs and structure or even quantify their input.

As to responsibility for a user experience project, define a “*storykeeper*” from high-level management, who will guard the project success. The implementation of user experience requires conviction about the importance of user experience, commitment, conscious decisions and investment of resources to implement necessary changes. Management can influence many of those aspects. To some extent, it is required for a successful implementation that the upper management supports the implementation of the new methodology.

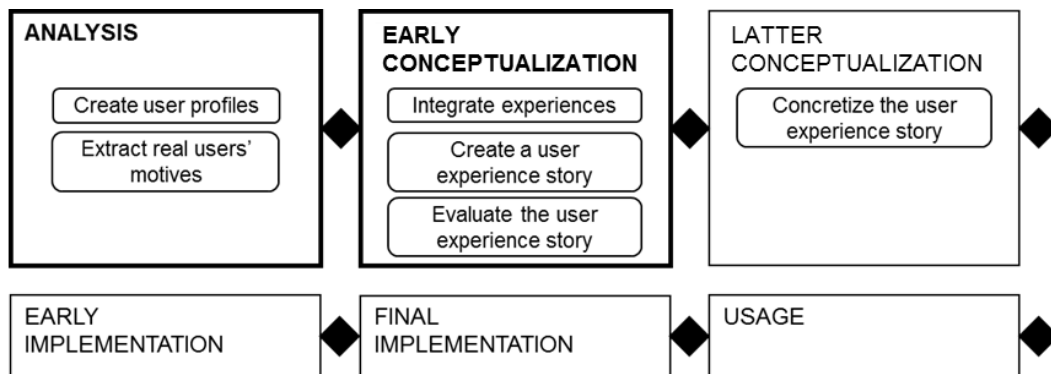
THE USER EXPERIENCE DESIGN PROCESS

A prototypical user experience design process¹ consists of six generic *phases*; in each phase, activities, i.e. *steps*, take place iteratively until reaching a *milestone*, while *methods* and tools support the delegation of those activities. Actors in the experience design process are persons with different *roles*, i.e. competences, responsibilities and goals. This process provides a structured frame for the application of the scenario-based methodology. You can use it to map your current practice and plan new activities. Moreover, the method descriptions refer to phases, steps, objectives and roles.

Phase	Goals	Milestone
Analysis	Defining target user group(s); Understanding users and their motives; Identifying opportunities for new experiences	User profiles, users' motives
Early concept	Generating concepts for new, overall experiences	User experience story, integration concept
Latter concept	Creating detailed representations of concepts that mediate one or more experiences	Storyboard, rough prototypes
Implementation	Implementing single components that mediate experiences	Implemented components
Final implementation	Integrating components into a final, implemented product	Implemented product
Usage	Evaluating experience-related aspects of real users' interactions with the new product in real environment	Proof of concept

THE METHODS OF THE SCENARIO-BASED METHODOLOGY

The scenario-based methodology consists of five methods, which support the analysis and early conceptualization phases of design.



The central element of the methodology is the method to *create a user experience story*, which describes an interaction from a user's perspective. For envisioning the experience, it is essential to develop realistic and well-drawn story characters, which you can accomplish by applying the method to *create user profiles*. To understand users' behaviour, you can analyse real users' stories and *extract motives*. In users' stories you will find further story elements, like use cases and functions. Once you have collected the story elements, you can analyse the relations among them with the method to *integrate experiences*. By the end of that step, you will know, which story elements fit together. Then you can *create the user experience story*, by analysing fragments of the interaction that are critical to the experience and combining them through a plot line in a narrative. To collect feedback about the content and form of the story from representative users, you can apply the method to *evaluate the user experience story*.

¹ Find out more about the user experience design process at www.designingexperiences.org

CREATE USER PROFILES: DATABASED REPRESENTATIONS OF USER SEGMENTS

OVERVIEW

WHEN

Analysis phase

WHY

Knowledge about real users and the special characteristics of each market segment builds the basis for the generation of meaningful experiences. Data about the physical and social environment of interaction, as well as about the utilization and emotional behaviour of users serve as input for the profiles. User profiles are the characters in storytelling and archetypes for structuring real users.

WHAT

Create in five steps databased descriptions of user representations that correspond to market-specific user profiles. The results are a database with user data and visualized user profiles.

WHO

The Experience Designer, The Developer, The User Expert

HOW

General planning	Minimum resources: Preparation: 2 hours; Execution: 2 hours/person; Analysis: 2 hours Method characteristics: Individual/workshop application, qualitative output (text and images), digital format
Input	Potential user group as well as structured and unstructured user data
Collect Data	In a first step, collect the necessary data from the appropriate sources.
Create User Profile	Carry out the following steps within a workshop: <ol style="list-style-type: none">1. Collect production and sales figures and specify the market.2. Define geographic surroundings and (in case of outdoor usage) the climatic conditions or (in case of indoor usage) the size and characteristics of rooms.3. Define the social environment, use behaviour and the use of products.4. Examine emotional behaviour and prioritize psychological needs.
Visualise	In the last step, create a vivid illustration in form of a profile. You can use the databased character for the personalization of realistic usage scenarios. A summary that includes the database of the user profiles allows for a more in-depth questioning and analysis of the data for the technical design of functions in further stages of development (e.g. story and storyboard).
Output	User profiles, use cases, database with evaluated user data.
Downloads	Set of needs; Template for profiles

EXAMPLES

In the CAR@TUM project², the profile of "Dr. Sola" was created as a representative driver of a car of type 1 (T1) from region 1 (R1). The segmentation in this case was region-based. Further profiles were created to represent other geographical regions and other car types. This profile represents most adequately a typical driver of an electric car –therefore, it was used in the next design stages.

USER PROFILE [R1] [T1]

I Utilization context

R1 (country, city)



Climate:

Ø T: 9°C

Ø rel. humidity: 75%

Ø sunshine hours/day: 7

Ø rainy days/year: 140

II Personal data

Dr. Sola (55)



Married, with young children
3 personas in household

Annual income: 80,00€ net

Profession: Entrepreneur

Leisure activities: golf, reading,
wine tasting



III Product utilization

Product type: T1, M1

Attitude towards product

Usage behavior: frequent usage,
mostly in country road (Ø: 3
trips/day, 19 mins, 97 km/day, 40-
70 km/h)

IV Social behavior

Milieu: "upper conservative
segment"

High social status and
educational level

Values & goals: financial
independence, family
traditions, high moral

Lifestyle: exclusive, etiquette

V

Market-specific prioritization of
psychological needs



Meaning of psychological needs

Security: personal security and
confidence in environment

Stimulation: striving for happiness

Autonomy: personality vs. mass

Perception of the product:
Powerful, secure, luxurious

² www.designingexperiences.org

In the coffee machine case³, three profiles were created to represent three user groups of German market. The segmentation was in this case according to users' social characteristics. Julia Wolf represents users of the segment "comforts" from the modern worker-milieu.

USER PROFILE [Germany, "modern worker"] [HD8769]

<p>I Utilization context</p> <p>Stuttgart, Baden Württemberg</p> <p>Apartment in parental house</p> 	<p>IV Social behavior</p> <p>Modern worker milieu</p> <p>Values & goals: open for new, determined, flexible, feeling of belonging is important</p> <p>Attitude towards life: looking for joie de vivre, mastering time, success- orientation</p>
<p>II Personal data</p> <p>Julia Wolf (32)</p> <p>Not married, 2 persons in household</p> <p>Annual income: 3000€ net./month</p> <p>Profession: freelance facilitator of event locations</p> <p>Leisure activities:</p> 	<p>V</p> <p>Market-specific prioritization of psychological needs</p> 
<p>III Product utilization</p> <p>Product type: capsule machine, price 500-1000€</p> <p>Usage behavior: during the first hour after waking up</p> <p>Attitude towards product: limited time for enjoying coffee</p>	<p>Meaning of psychological needs</p> <p>Stimulation: high-tech, multi- sensory experience</p> <p>Autonomy: individual settings</p> <p>Relatedness: enjoying coffee with friends</p>

³ **Fluhr, D.** (2015). *Applying scenario-based methods to improve user experience of an automatic coffee machine*. Master Thesis, Technische Universität München, München

INSTRUCTIONS

PREPARATION

SEGMENTATION: The first decision to make is the type of segmentation. Possible segmentation strategies include regional-, market-, brand- or need- specific segmentations. Choose the strategy that best applies to existing company practices.

DATA GATHERING: First, read the method description to get an overview of the required data. Then, identify possible information sources in the company (stakeholders and departments). If necessary, make adjustments in the profile [template \[1\]](#), according to the data you have identified.

EXECUTION

CLIMATIC AND GEOGRAPHICAL SURROUNDINGS: First, define a representative country and city in the selected market segment. To do so, examine production and sales data. Select the countries with the largest market shares. If you deal with the design of products used outdoors, retrieve climatic data from meteorological statistics concerning the city that you have selected. For an exterior experience, average and extreme temperatures, sunshine hours, as well as humidity and precipitation values are highly relevant. If you deal with products used indoors, define properties of the interior environment.

PRODUCT UTILIZATION: Now examine, which is the most popular product type/variant for the product type and market in focus. In the next steps, you will focus on one product variant. Then, retrieve data on the frequency and styles of usage. That refers to usage frequency per day, frequency on working days/weekends, daytime of usage, number/duration of paused usage (if applicable and available). It could also be interesting to document how many persons live in the household and are potential users of the product. Furthermore, qualitative statements on the perception of users towards the product, often available in online sources, are relevant.

SOCIAL BEHAVIOUR: To describe the social behaviour of representative users, look for marketing studies in you company that concern values, goals and lifestyles. If no company-internal marketing studies on users' social behaviour are available, you can apply the SIGMA-milieu categorization. Milieus outline social groups, whose value orientations, goals, lifestyles and attitudes are sufficiently similar. The SIGMA studies are available online. You and your colleagues from marketing would have to determine which milieu(s) are relevant for the product type and market in focus.

EMOTIONAL BEHAVIOUR: Now analyse the meaning and prioritization of psychological needs for the selected market. You can use as basis the set of needs defined by Sheldon or the needs relating to car usage defined by [Hassenzahl \[2\]](#). Using the support of a psychologist, define the meaning of each need in the context of usage of you company's product. Then, prioritize the needs and create a radar chart. To validate the definition and prioritization of needs, it is advisable to conduct studies with real users.

PERSONAL DATA: You can complement your profile with personal data, like age, marital status, stage of life, annual income, profession, leisure activities. Those give a human face to the profile. Buyer/consumer surveys provide the corresponding data.

VISUALIZATION: The information collected so far build your database. Finally, create a vivid representation of the profile to summarize your data. To do so, fill in [template \[1\]](#) with your team.

ANALYSIS

The created profiles should be reviewed by all stakeholders involved and, after revised, be approved by management.

MAKING USE OF THE PROFILES

- Analysis phase: derivation of qualitative requirements, derivation of use cases, prioritization of requirements
- Concept phases: characters in storytelling, archetypes for selecting subjects for user testing and categorizing real users
- Implementation phases: archetypes for selecting subjects for user testing, characters for marketing concepts
- Usage phase: archetypes for structuring after-sales data and categorizing real users

RECOMMENDATIONS

- Often there are differences between marketing personas and real users; therefore, it is important to obtain a databased image of users and compare it to existing personas.
- The procedure of creating a user profile encourages the reflection of interaction from a user's point of view (vs. developer's point of view) and supports the derivation of market-specific requirements and the safeguarding of the product properties.
- Personal photos and a fictitious name help to create a vivid image of a "typical user". In general, the visualization gives a human face to the profile and thus boosts its memorability.
- Listing the data sources and the database itself would encourage acceptance of the profiles.
- Limitations: this method requires a rich data logger in the company.

APPLICATION CASES

- **Project types:** all project types, as long as there is a reference/"predecessor" product
- **Alternatives:** (fictive) personas

FURTHER READING

Adlin, P., Pruitt, J. (2010). *The Essential Persona Lifecycle - Your Guide to Building and Using Personas*. Burlington, USA: Elsevier Inc.

Cooper, A., Reimann, R., Cronin, D. (2007). *About Face 3 - The Essentials of Interaction Design*. Indianapolis, USA: Wiley Publishing Inc.

McGinn, J. J., & Kotamraju, N. (2008). Data-driven persona development. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.

Michailidou, I., Franzen, F., & Lindemann, U. (2016). Method to Create Market-Specific Customer Profiles for Enhancing Positive User Experiences in Cars. DS 84: Proceedings of the DESIGN 2016 14th International Design Conference.

Nielsen, L. (2007). *10 Steps to Personas*.

TEMPLATES & DOWNLOADS

- Templates user profile: interior and exterior usage [1]
- Needs [2]

EXTRACT REAL USERS' MOTIVES: MAKE PRODUCT-RELATED USERS' NEEDS EXPLICIT.

OVERVIEW

WHEN

Analysis phase, Usage phase

WHY

The process of analysing real users' stories gives rich insights into implicit users' motives that are (in-) directly related to product usage. Making those insights explicit is a precondition for their further usage in the process as theme of user experience stories and criteria for evaluating conceptualized experiences.

WHAT

After extracting narrations about interactions and usage context from real users' stories, analyse those in the three steps of argument, opposition and enthymeme identification. The gained insights lead to the extraction of motives.

WHO

The User Expert

HOW

General planning	Minimum resources: Preparation: 4 hours; Execution: 8 hours/person; Analysis: 2 hours Method characteristics: Individual application, qualitative output (text), digital format
Input	Real users' stories (after-sales feedback, product reviews, transcribed interviews)
Identification of stories	Firstly, parts of users' stories that include rich descriptions of interactions or context of usage (opposed to technical details) are selected for further analysis.
Narrative analysis	Each of the identified as relevant quotes may contain arguments, oppositions or enthymemes (i.e. implicit information). Analysing and documenting those elements will increase the understanding about the deeper meaning of stories.
Extraction of motives	An effective way of communicating the interpreted essence of a user's story is by formulating in a concrete and positive way the motive that incited the thoughts and actions described in the story. Extracted motives that have similarities may be clustered.
Output	Motives, use cases
Downloads	Template (table) for narrative analysis

EXAMPLES

In the CAR@TUM project, semi-structures interviews with drivers and reviews from the press were the main sources for real stories about the driving experience. After identifying the relevant to electromobility data and statements, we analysed and assigned the statements to motives. The extracted motives built clusters of possibilities for future experiences. One of them was the motive of “understanding the energy flow in a comprehensive way”, which inspired the concept of Heartbeat.

Quote	[...] Without the vibration of the car, the roar from the exhaust, the clacking of the transmission, the electric frenzy feels somehow synthetic [...] As long as [the vehicle] is not moving, you could think it is a driving simulator . [...] The revolution counter tachometer , an otherwise central cockpit instrument , is missing [...] -There are only a few toggle- and rotatory switches [...]
Storyline	The driver of an electric vehicle does not get concrete feedback on the energy status (engine on / off, acceleration, etc.) due to the absence of a combustion engine.
Oppositions	vibration, roar, clacking → direct feedback <-> no feedback synthetic, fake <-> natural, real driving simulator <-> real car revolution counter tachometer <-> toggle- and rotatory switches central cockpit instrument → central, important indicator <-> unnecessary indicator
Enthymeme	Due to the absence of a combustion engine, there is no acoustic or any feedback in important situations. The vehicle does not feel real. The indicators do not appear centrally and are rather unimportant.
Motive	I want to feel the energy status of my electric vehicle.

In the coffee machine case, online product reviews written by users of premium coffee machines were used as users' stories. The ones describing interactions or context of usage were considered in the analysis, which resulted into 35 motives (13 motive clusters). The two highlighted motives built the basis for the relatedness and stimulation experience mediated through the concept of Coffee Chips.

Source	Quote	Story	Storyline	Oppositions	Enthymemes	Motive
Amazon 1	<p>Personally, I always find the look of glasses and cups really elegant. [...] Meanwhile, I was even able to impress some friends who visited me. Two of them are considering seriously even the purchase one..</p>	<p>Personally, I find looks [...] elegant. I was able to impress friends who visited.</p>	<p>The user, who finds an elegant look important, could impress and influence his visitors with an optical and qualitatively good result.</p>	<p>elegant look <-> unattractive look meanwhile <-> before [purchasing machine] visiting, being close <-> being distant some friends <-> few impress <-> be neglected</p>	<p>I could impress friends with my elegant coffee machine. These friends came over for a visit. Possessing the coffee machine increased my popularity and makes visits more interesting.</p>	<p><i>Making an impression through my coffee machine</i></p>
Amazon 3	<p>In the first few days, as proud owner of the machine, I enjoyed the whole thing with the perfect milk foam. Then, the powder was out and I came up with the idea to try once if adding cocoa powder and a little sugar possibly improves the taste of cappuccino. And behold, just my first attempt with a coffee measure cocoa powder and a teaspoon of sugar worked.</p>	<p>[...] The powder was out and I came up with the idea to try once if adding cocoa and sugar improves the taste of cappuccino. [...] My first attempt worked.</p>	<p>The user added cocoa and sugar in his machine and received easily a better tasting cappuccino.</p>	<p>[...] try, experiment, explore <-> bore, neglect [...] first attempt <-> many attempts</p>	<p>Triggered through the great machine foam and a coincidence (not enough coffee powder), I experimented with the taste. I am fascinated that this first experiment worked.</p>	<p><i>Easily exploring better taste</i></p>

INSTRUCTIONS

PREPARATION

DATA GATHERING: While preparing the extraction of motives, you need to collect real users' stories of high quality for your analysis. High quality stories have relevant content, which describes the product to be designed, and come from relevant data sources, which match to the predefined user profiles. Possible sources for real users' stories are after-sales feedback, product reviews or transcribed users' quotes, which refer to an initial ("predecessor") product to be redesigned. If you design a novel product, you can use quotes from interviews, which refer to the situation addressed by the new product.

MATCHING TEXTS TO PROFILES: After you gathered the stories, you can group/cluster them according to their sources. For doing that, you first have to match the sources according to their characteristics to the predefined user profiles. To structure the information, you can use the [template \[3\]](#) and fill out the column "source" in the lines below the corresponding profile.

EXECUTION

The extraction of motives happens by (at least) two independent analysts.

IDENTIFYING STORIES: Before starting the narrative analysis, you have to select the relevant quotes. Not every user quote contains information about motives. Relevant are just quotes that include narrations about interaction or context of usage. Look for quotes that include a plot (i.e. a temporal sequence of events) or descriptions of thoughts and feelings. Quotes including technical details are irrelevant. Then enter the selected quotes into the second column of [template \[3\]](#).

IDENTIFYING USE CASES: If you come across information concerning the context of interaction (time and environment) you can directly register it as use case in [template \[4\]](#).

NARRATIVE ANALYSIS: During the narrative analysis, you implement three steps to understand the deeper meaning of selected quotes: identification of storylines (arguments), identification of oppositions (meaning of arguments) and identification of enthymemes (implicit information). For identifying a storyline, you summarize the main argument described in a quote. In order to identify oppositions, you extract the adjectives mentioned in a quote and write synonyms and antonyms for their meaning. By doing that, you will have an increased understanding, which will allow you to identify the so-called enthymemes. Enthymemes are parts of information that are not explicit in the quote, but are implicitly mentioned. You have to read "between lines" and if necessary, add words/sentences to the original quote, so that you describe the meaning of a quote. Enter the results of those three steps in the columns "storyline", "oppositions", "enthymemes" of [template \[3\]](#).

EXTRACTING MOTIVES: Now you can extract the motives. A motive describes the reason for acting, so you have to ask why the user interacts with a product in a certain way. Although the motives are matter of interpreting an unknown users' thoughts, the understanding you have built in the previous steps brings you closer to the foreign mind-set. To formulate a motive, create an "...ing ..." -sentence and enter it in [template \[3\]](#). You might find more than one motives in a quote, whereas other quotes may include no motives.

ANALYSIS

Now compare your results with those of the other analyst(s). Discuss misinterpretations or convergence and come to a common result.

Finally, cluster similar motives, because that would give you a better overview of all motives corresponding to a user profile.

MAKING USE OF REAL USERS' MOTIVES

- Concept phase I: Input for matrices in the method to integrate experiences, input for storytelling
- All phases: Fulfilment of motives is the criterion for success of user experience design

RECOMMENDATIONS

- Analyse all quotes from one source together, then cluster the extracted motive/s with motives extracted from other sources
- Grasping the meaning of arguments, oppositions and enthymemes could be challenging for an inexperienced analyst, but practice will certainly help! Do not forget that the main goal is to understand better prospective users. This is achieved through the analysis, regardless of whether the oppositions or enthymemes are accurate.
- The steps of formulating enthymemes and motives are based on analysts' objective interpretation. Validating the results with a second or even third person would decrease ambiguity.
- Online product reviews are easily accessible without any effort. A limitation, however, is that in many cases the background of their authors is not public, so it is impossible to match them to predefined profiles.
- How many texts to analyse? This is a matter of available resources and of course dependant on the quality of data. Literature suggests the "magic number +/-12". A rule of thumb is that the analysis is adequate when the extracted motives start to repeat.

APPLICATION CASES

- **Project types:** the method delivers best results when data on an initial product are available
- **Alternatives:** laddering (Reynolds & Gutman, 1988), projective tests (Rorschach, 1942)

FURTHER READING

1. Clandinin, D.J. and Rosiek, J. 2007. Mapping a landscape of narrative inquiry", in Clandinin, D.J. (Ed.), Handbook of Narrative Inquiry, Sage, Newbury Park, CA, 35-75.
2. Feldman, M.S., Sköldbberg, K., Brown, R.N., & Horner, D. 1978. Making sense of stories: A rhetorical approach to narrative analysis, Journal of public administration research and theory, Vol.14, No.2, pp 147-170, 2004.Leontjev, A.N., Activity. Consciousness. Persona. Prentice-Hall, Englewood Cliffs, NJ, USA.
3. Pucillo, F., Michailidou, I., Cascini, G., & Lindemann, U. 2014. Storytelling and a Narrative Analysis Based Method for Extracting Users' Motives in UX Design Processes. DS 81: Proceedings of NordDesign 2014, Espoo, Finland 27-29th August 2014.
4. Reynolds, T.J., & Gutman, J., 1988. Laddering Theory, Method, Analysis, and Interpretation, Journal of Advertising Research, Vol.28, No.1, pp 11-31.
5. Rorschach, H., 1942. Psychodiagnostics.

TEMPLATES & DOWNLOADS

- Template for narrative analysis [3]
- Template for use cases [4]

INTEGRATE EXPERIENCES: EXPLORE USER EXPERIENCE ELEMENTS AND THEIR RELATIONS EARLY ON.

OVERVIEW

WHEN

Concept phase I

WHY

The combination (integration) of various components and functions into a product influences the overall user experience. Therefore, a holistic view over experience elements is necessary early on. The analysis of the relations indicates which elements to consider when creating a user experience story.

WHAT

After gathering and prioritizing the relevant for a specific project user experience elements, experts discuss the relations of elements among each other with the help of matrices. Possible results are clusters of elements that create a meaningful experience.

WHO

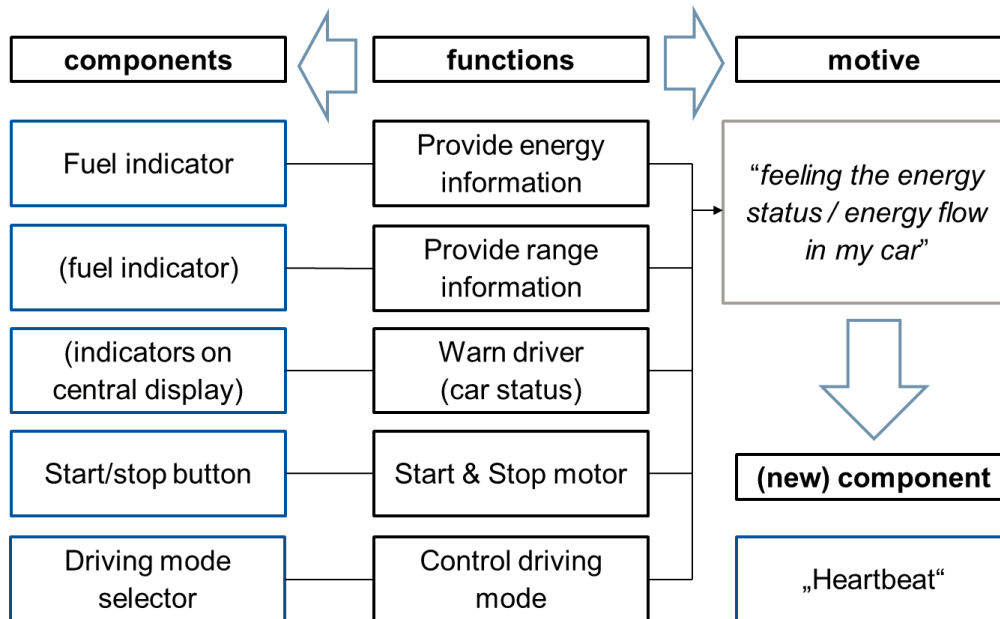
The Developer, The Experience Designer, The Customer Expert, The Human Factors Expert

HOW

General planning	Minimum resources: Preparation: 16 hours; Execution: 16 hours/person; Analysis: 16 hours Method characteristics: Workshop application, quantitative output (matrices), digital format
Input	User profiles, needs, motives, use cases, functions
Adjust meta-model	In the first step, identify the relevant (for your project) user experience elements. An initial meta-model of possible elements and relations among them is a basis for the decision.
Filling of matrices	The selected elements and relations are depicted as matrices. The method moderator enters the relations in the matrices in discussion with experts.
Extraction of clusters	Finally, the filled matrices are analysed in search for clusters. Clusters of user experience elements that fit together build a possible setting for a user experience story.
Output	Relations among elements, clusters, story settings
Downloads	Initial meta-model, Methods for data collection

EXAMPLES

In the CAR@TUM project⁴, we dealt with the motive of feeling the energy flow in the car. The new interface element of “heartbeat” offered the opportunity to integrate functions and features that address the motive of feeling the energy flow. In order to explore which functions come in questions and in which use cases, we worked with matrices. The result was a cluster of functions to be integrated into the “heartbeat”: start-stop button, driving mode selector and range/speed indicators. Moreover, we identified that the needs related to the addressed motive are the needs for physical thriving, competence and stimulation. We used those needs in next steps as evaluation criteria.



⁴ www.designingexperiences.org

In the coffee machine case, the new concept of “coffee chips” integrated functions that could contribute to fulfilment of needs for relatedness and stimulation, i.e. most relevant needs for the profile of “modern workers”. Those needs were the starting point for applying the method. Only few existing functions of coffee machines address those needs, so there is a clear opportunity to develop new concepts. The analysis of three matrices helped specifying this goal. In the matrix “motive is related to motive”, it was possible to identify motive clusters, while “motive meets need” made clear which main needs to stress. Results are depicted in the first table. Finally, “function fulfils motive,” indicated which functions to consider integrating into the new concept of “coffee chips”.

Need	Motive cluster	Motive	Coffee chips
relatedness	fascinating contacts	making an impression through my coffee machine	
		coffee machine enriching visit	x
		fascinate friends with great coffee	
		being able to offer the coffee that my contacts want	x
	attracting contacts	possessing a machine that my friends like	
		attracting contacts through the coffee machine	x
		influencing contacts through the coffee machine	
...	...		
stimulation	stimulated through new taste	easily exploring better taste	x
		being supported through my search for the ideal taste	x
		receiving taste benefits	
		being able to create different coffee tastes	x
	tasting and smelling great coffee	x
....	

Function fulfils motive	fascinating contacts	attracting contacts	being stimulated through taste	...
Activate machine				
Display message				
Retain water				
Clean machine				
Decalcify machine				
Remove waste				
Take coffee selection request	x		x	
Manipulate settings	x		x	
Make coffee		x	x	
Boil water				
Dispense coffee	x		x	
Foaming milk	x		x	
Manage energy consumption				
...				

INSTRUCTIONS

PREPARATION

DEFINING OBJECTIVES AND ADJUSTING THE META-MODEL: First, the objective of the method application needs to be clear in the team. Make explicit in your team the starting point and the desired output of the method. During the discussion, use the [initial meta-model \[5\]](#), which depicts possible user experience elements and their relations. Depending on your objectives, decide with the design team which elements to consider and which matrices to fill in the next steps.

DATA GATHERING: Now collect the data corresponding to the selected elements. Ideally, data is available through the previous steps (user profiles, extraction of motives). If no data is available, you can consider applying further [methods for data collection \[6\]](#): qualitative methods (e.g. interviews, laddering, storytelling, experience sampling), modelling approaches (e.g. function modelling, morphological case) or even usage of company data (production, sales and marketing data, social media analysis, product manuals, data loggers) or literature-based data (e.g. needs).

EXECUTION

ENTER ELEMENTS OF RELEVANT DOMAINS: Create the matrices and enter in their columns/rows the corresponding data (elements of the relevant domains). Do not wonder if the matrices look diverse: the amount and level of detail of data can differ.

DEFINE RELATIONS AMONG ELEMENTS: Now identify and enter the relations in each of the selected matrices. The analysis of relations can proceed within the team, i.e. with discussion with a corresponding expert. Expert for the “user” domain is the customer expert; expert for the “function” and “use case” domains is the developer; expert for the “need” and “motive” domains is the human factors expert. Outcomes of this step are the filled matrices and additional remarks.

SELECT APPROACH TO CLUSTER: In this step, you set your strategy for combining (integrating) the user experience elements. Possible strategies/approaches are *use case-based* (i.e. functions most likely to be needed in a use case are clustered), *motive-based* (i.e. functions addressing similar motives are clustered), *need-based*, etc. Again, the strategy depends on the project-specific objectives.

CLUSTER EXPERIENCE ELEMENTS: A meaningful cluster of user experience elements shows which motives and underlying needs are relevant in a use case, but also which functions are likely to address those motives and needs in the selected cases. Such a combination of needs, motives and functions for a user in a use case builds a possible cluster or story setting.

ANALYSIS

QUALITY CHECK: After applying the method, assess the quality of results. The integration concept must be compatible to safety, geometry and ergonomics constraints. If there are, for instance, components that must remain unchanged (e.g. due to safety issues), they should be excluded. Make sure that the integration concept does not include too many functions.

MAKING USE OF INTEGRATED USER EXPERIENCE ELEMENTS

- Concept phase I: Input for storytelling (story settings)
- All phases: Matrices can help in planning user tests

RECOMMENDATIONS

- More important than the entered relations is the understanding of experience elements built during the process.
- Depending on the availability of resources for data collection, you can decide for conducting new studies/surveys, which would provide exact and detailed information, or for using available data, which is a less time-consuming variant.
- This method increases understanding from a user perspective and forces collaboration within the design team. Data from many different sources are collected and experts of different backgrounds come together.
- Unlike conventional approaches of geometrical integration and 1:1 mapping of functions to interfaces, the suggested approaches are more likely to have a positive effect on overall experience with less perceived complexity.
- Depending on the project goal, the approach can be applied in a bottom-up (create new interface from a function cluster) or top-down (integrate new function in existing interface) way.
- Results are traceable (documented in matrices) and measurable (according to needs fulfilment).
- Practitioners should make sure that the relations are based on data and not entered objectively.
- Matrix analysis and creation of clusters are iterative activities.
- Consider applying this method iteratively to the method for creating a user experience story.

APPLICATION CASES

- **Project types:** all project types
- **Alternatives:** integration of features/components according to geometrical restrictions
- **Limitations:** the method requires comprehended data gathering and analysis, as well as inclusion of experts in some cases.

FURTHER READING

Michailidou, I., Saucken v., C., Kremer, S., & Lindemann, U. (2014). Managing Complexity In User Experience Design: Matrix-based Methods For Connecting Technologies and User Needs. In DS 77: Proceedings of the DESIGN 2014 13th International Design Conference.

Michailidou, I., Diergarten, L., & Lindemann, U. (2015). Applying Matrix-Based Methods for Improving User Experience of a Driver Advisory System. In DS 80-5 Proceedings of the 20th International Conference on Engineering Design (ICED 15) Vol 5: Design Methods and Tools-Part 1, Milan, Italy, 27-30.07. 15.

Saucken v., C., Michailidou, I., Kremer, S., & Lindemann, U. (2014). Motive-Oriented Design. In Design, User Experience, and Usability. User Experience Design Practice (pp. 370-377). Springer International Publishing.

TEMPLATES & DOWNLOADS

- Initial meta-model [5]
- Domains and methods for data collection [6]

CREATE A USER EXPERIENCE STORY: EXPLORE AND COMMUNICATE IDEAS FOR NEW USER EXPERIENCES

OVERVIEW

WHEN

Concept phase I.

WHY

The process of creating a story promotes the understanding of the system to be designed from a user's point of view in the interaction context. New experiences and requirements can be derived during this process. The story brings together the results from the previous steps and results in an understandable representation of conceptualized experiences, which can later be evaluated.

WHAT

Determine a setting and a plot and formulate the user experience story. Along the way, explore new ideas and write down important points for the clarification of requirements.

WHO

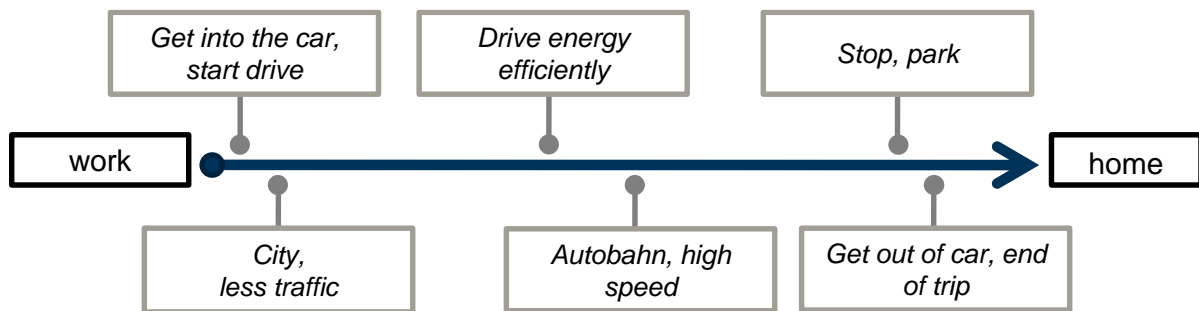
The Experience Designer, The User Expert, The Developer, The User

HOW

General planning	Minimum resources: Preparation: 2 hours; Execution: 3 hours/person; Analysis: 2 hours Method characteristics: Workshop application, qualitative output (text and images), digital format
Input	Use cases, characters, needs, as well as interrelations among those elements
Create the Setting	Define the story characters with their motives and the physical environment of the interaction as "setting".
Create a plot	Collect and select use cases that are critical for the experience. Then order the use cases in a plot line. In a workshop, describe in detail the actions of characters and/or changes in the surroundings, as well as functions of the technical product. Insights from this process can be considered in next steps as technical requirements.
Formulate and visualize	Presenting the possible interaction sequence of the previously described characters with the development object is the essence of an experience story. Here, the individual goals and experiences of characters are in the forefront. Depending on specific project needs, the user experience story can take the format of a textual narration, storyboard, or even film.
Output	User experience story
Downloads	Set of needs; Template for character description; Template for story setting; Template for collecting use cases; Possible plot lines; Template for prescriptive story plot line; Template for creating substories; Checklist with criteria for good stories; Support for media selection

EXAMPLES

In the CAR@TUM project⁵, the concept of "Heartbeat" was demonstrated in a user experience story about Dr. Sola's drive from his work towards home. Dr. Sola is the character incorporating the characteristics of the user profile created in a previous step. The story was broken down in five critical use cases composing the plot. The use cases were identified in the matrices of the method to integrate experiences, as the ones, in which the motive to feel the energy appears. Each use cases was described in form of a brief narrative with explanatory pictures.



Getting in, sitting and start

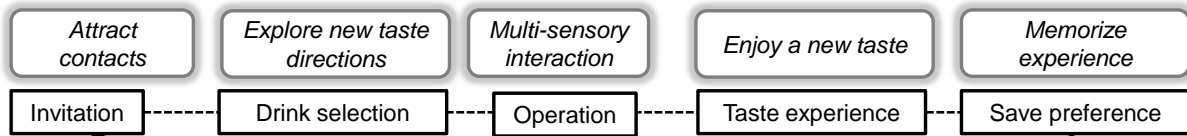
As Dr. Sola leaves the company and steps out into the parking lot, he has a long day of hard work behind him. But as soon as he sees his electric car, the tension of the day changes to a feeling of anticipation. "Finally some time to enjoy", Sola thinks. When he opens the door to the car and gets in, he takes a deep breath. He loves that special smell of his new car. He tries to remember his past vehicles - no, no comparison! This car communicates with him even through smell.

As he puts his hand towards the Energy Flow (aka heartbeat), it looks like his electric vehicle slowly awakens. First, the brightness of the Energy Flow increases, lightly pulsating. Then, as the light color changes from bright white to deep blue, Sola knows that sufficient energy is available. Now, as he carefully places his right hand on the Energy Flow, he is able to feel the pulsating energy flow. With a little force, he overcomes a small resistance and can immediately feel a reaction. The pulsing is now faster, the displays awaken and shine. Sola smiles: "All systems ready!"



⁵ www.designingexperiences.org

In the coffee machine case, a new experience for relatedness to friends and family was envisioned in the user experience story about the concept of “coffee chips”. Critical use cases in the interaction with the coffee chips were ordered in a plot line and then explored in substories. The resulting descriptions along with pictures from first physical representations synthesized the illustrated story of Julia and Jonas.



Jonas knows Julia’s coffee machine and its features. The coffee chips offer him a way to select the depicted drink and order it from the coffee machine without having to manipulate any other settings. In his search for a light coffee flavor, Jonas is fascinated from the great variety of drinks. “Café noisette, interesting”, he thinks, as he grasps the chip. It feels lighter than the espresso ristretto chips he usually prefers -just like café noisette itself!



Jonas approaches the coffee machine with the chip in his hand. He leads the chip towards the coffee dispenser. As if by itself, the chip gets attached to its special position on the machine. In order to initiate the making of coffee, Jonas just turns the chip downwards. “A new taste with just a single movement”, he thinks.



INSTRUCTIONS

PREPARATION

DATA GATHERING: First, identify possibly missing data and the corresponding information sources (stakeholders and departments). The templates (described in the individual steps) give an overview of the data needed for the application. Ideally, you can use directly: user profiles as story characters; motives from the narrative analysis; relevant use cases and functions from the integration concept.

WORKSHOP PLANNING: Storytelling works best when applied in team (3-5 participants). Consider, according to your objectives, which are the most valuable participants in your case. A user expert would bring in knowledge about users. If co-creation is important, end users corresponding to the predefined user profile can participate. Product-related knowledge is important in case of adaptive design. After identifying the participants, invite and brief them. Make sure that the workshop takes place in a “creative room” with available presentation materials.

CREATING FIRST PROPOSALS: To ensure an efficient application, prepare your proposals for the choice of characters (step 1), examples for system components (step 4), as well as critical cases -aka key events (step 6) already before the workshop.

EXECUTION

The method to create a user experience story consists of 10 steps. Steps 1 to 4 concern the definition of a story setting, while steps 5 to 8 result in the definition of a story plot. The story setting can be a direct result of the method to integrate experiences (if applied in previous steps). The final steps include writing and visualizing the user experience story in an appropriate format. Five [templates](#) support the process steps and documentation of results.

CHOOSING THE CHARACTERS that appear in a story is the first step towards defining the story setting. If user profiles are already available, choose the one that is most critical for the project and corresponds to the participants’ interests. Take enough time during the workshop to describe the profile and its special characteristics. If profiles are not available, use the [template for character description \[7\]](#) to create a representation of the character and his/her usage pattern. It is possible that a story requires more than one characters, for instance in case of social interactions.

DETERMINING THE MAIN MOTIVE of interaction is a major step for choosing the theme of the story. A motive (or be-goal) in the form of a “being ...”-sentence summarizes the essence of the new experience from a character’s perspective. Ideally, use a motive extracted through the narrative analysis and is relevant for the story character (according to the matrix analysis in previous steps). The motive-sentence makes an appropriate story title.

DETERMINING THE NEEDS to be fulfilled through the new experience is the next step towards defining the setting. The description of the user profile indicates which needs are particularly relevant for the selected character. If the workshop participants are not familiar with the meaning of basic needs, show some examples from the [need collection \[2\]](#) of [Hassenzahl].

IDENTIFYING SYSTEM COMPONENTS that might affect the product experience is the last step of defining the story setting. List here existing features of product, new concepts, super-, or sub- systems that are related to the predefined motives and needs. Again, this collection is ideally a result of matrix analysis.

Summarize the result of the steps 1-4 (STORY SETTING) in the [template for story setting \[8\]](#).

COLLECTING USE CASES is the first step towards creating a plot. Use cases illustrate how users are related to or how they use the system to be developed. Their emphasis lies on users’ goals and the way a system satisfies those goals. The [template for collecting use cases \[4\]](#) prescribes the consideration of such possible cases before, during and after the usage of a product. All those temporal aspects can be interesting/critical for the new experience. You can derive use cases from consumer and user journeys, if available. Furthermore, encourage the inclusion of new use cases.

DEFINING “KEY EVENTS” means selecting the use cases to be considered in the user experience story. “Key events” (or critical events, critical cases) are the use cases, which arouse characters’ emotions. Key events may describe a past problem solved by the new solution, or a new opportunity for a positive experience. Key events can and should consider all time spans of

interaction (i.e. before, during, after usage). Again, you can use the results of the method to integrate experiences as support.

CREATING A PLOT LINE is the step about arranging the chosen use cases and key events. The most intuitive way to describe the events of a story is in chronological order. This applies to the so-called prescriptive plot. The [template for prescriptive story plot line \[10\]](#) indicates how to order use cases and key events. Other ways to arrange events can be found in the [collection of possible plot lines \[9\]](#). By this point, you will have identified the overall frame of the story and can proceed with the exploration of individual scenes (so-called substories).

DESCRIBING EACH USE CASE in detail will enable your team to understand better the interaction between a specific character and product in a certain context, but also envision a better experience. Ask the workshop participants to describe interactions as a dialogue between user (character) and product in the [template for creating substories \[11\]](#). The left side in the sequence of events describes users' behaviour and thoughts, while the right side describes responses and features of the product. While envisioning new interactions encourage participants to tell stories about an intended user experience and conceptualization its steps. Document ideas about new aspects of the product that would mediate the intended experience in the bottom part of the template.

You can conduct the subsequent steps (formulating and visualizing story) in a separate workshop or individually.

FORMULATING each substory in narrative form will result in the complete user experience story! Go through the [checklist with criteria for good stories \[12\]](#) to understand better what kind of story you are going for. Formulation is important: most of all, the story should describe how the new experience feels like not how it looks like, so focus on thoughts, emotions and feelings instead of technical aspects.

VISUALIZING the story in an appropriate form is the final step. Possible visualization forms include text, illustrated text, storyboard, film. Choose the visualization form of the story according to the audience (e.g. design team, management, end users) and the available resources. Use the [support for media selection \[13\]](#) for making that decision.

ANALYSIS

Once the first draft of the user experience story is ready, communicate it to further stakeholders and proceed with an initial evaluation (via [checklist with criteria for good stories \[12\]](#) or open feedback). Furthermore, invite the participants of the workshop or the user expert in particular to reflect the story from another character's perspective and check its applicability. Make sure that all involved stakeholders have reviewed the story and that you have made necessary revisions to reach its acceptance. The final story must be approved by the management. In the next design phases, the user experience story will be a part of the product specification.

MAKING USE OF USER EXPERIENCE STORIES

- Concept phase I: Initial evaluation of experience (evaluate story), elicitation of requirements
- Concept phase II: Basis for storyboarding

RECOMMENDATIONS

- In inexperienced groups, work with the “easiest” character and the most simple plot line. Experiment with further possibilities in advanced groups.
- Demonstrate examples of the story creation process and of final user experience stories to help the workshop participants focus on the experience instead of technical solutions.
- Use the checklist of criteria for a good story as inspiration before writing.
- A purely textual description of a story is not always sufficient. Consider using complementary to the text pictures or sketches created during the workshop to clarify important scenes.
- You could skip steps 1 to 4 (defining story setting), if all necessary inputs are available from previous process steps and you want to focus on the creation of new ideas. Even so, take enough time to make the participants familiar with the story setting.
- In steps 6 and 7 (defining key events and creating a plot line), include four to seven use cases.
- In step 8 (describing each use case), it is possible to work in two or more groups. Each group describes an intended experience based on a given (and common for the groups) setting. Results of the group work are finally discussed in plenum.
- In step 8, you can inspire participants by reflecting on current interactions (before envisioning possible future experiences). This could be done by filling out the substories templates twice: first in regard to the current situation, then to a possible future interaction.
- In step 9 (formulating story) you can engage a professional author to fine-tune the result.
- If you want to hold a short workshop, exclude steps 9 and 10 (visualization) from the group work.

APPLICATION CASES

- **Project types:** all project types, including original design and co-creation projects
- **Alternatives:** co-constructing stories, storify tool, context mapping, experience patterns, user experience principles

FURTHER READING

Brooks, K., & Quesenbery, W. (2011). *Storytelling for User Experience*: Rosenfeld Media.

Knobel, M. (2013). *Experience design in the automotive context*. (PhD Thesis), Ludwig Maximilian Universität LMU, München.

Michailidou, I., Saucke, C., & Lindemann, U. (2013). How to create a user experience story Design, User Experience, and Usability. *Design Philosophy, Methods, and Tools* (pp. 554-563): Springer.

TEMPLATES & DOWNLOADS

- Needs [2]
- Template for character description [7]
- Template for story setting [8]
- Template for collecting use cases [4]
- Possible plot lines [9]
- Template for prescriptive story plot line [10]
- Template for creating substories [11]
- Checklist with criteria for good stories [12]
- Support for media selection [13]

EVALUATE THE USER EXPERIENCE STORY: IS THE STORY PERCEIVED AS INTENDED?

OVERVIEW

WHEN

Concept phase I

WHY

Before using the experience story as fundament for creating and concretizing concepts, ensure that independent users relive the experience as intended. It is a great opportunity to identify necessary changes at a very early design stage.

WHAT

Present the story to a variety of stakeholders and evaluate according to predefined criteria the communicated experience.

WHO

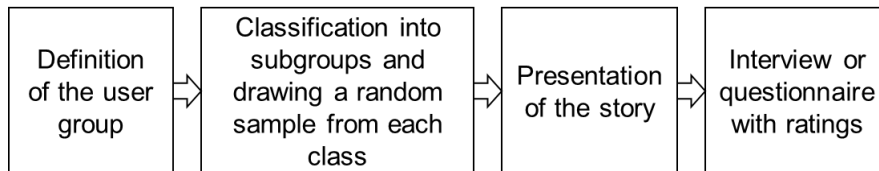
The Developer, The Human Factors Expert, The User

HOW

General planning	Minimum resources: Preparation: 16 hours; Execution: 32 hours/person; Analysis: 8 hours Method characteristics: Workshop/online application, quantitative and qualitative outputs, digital format
Input	User profiles, story, needs, motives
Initial evaluation	Using a checklist with criteria, company-internal stakeholders evaluate the content, expression, structure, audience-orientation and effect of user experience stories.
Evaluation with users	Using user profiles as archetypes, a sample of users is invited to assess the experience story qualitatively as well as according to predefined criteria.
Adjustment of story	According to quantitative and qualitative feedback collected, essential adjustments are made to improve the user experience story.
Output	Quantitative (questionnaire results) and qualitative feedback
Downloads	Template for initial story evaluation; Questionnaire for assessment of story content

EXAMPLES

In the CAR@TUM project⁶, prospective users assessed the content of user experience stories. After the presentation of stories, which were visualised in storyboards, subjects were asked to fill in a questionnaire consisting of items that describe predefined needs. The responses show quantitatively if the intended experience can be relived through the story. Furthermore, users gave in interviews qualitative feedback on their experience, the realism of the story and possible misunderstandings.

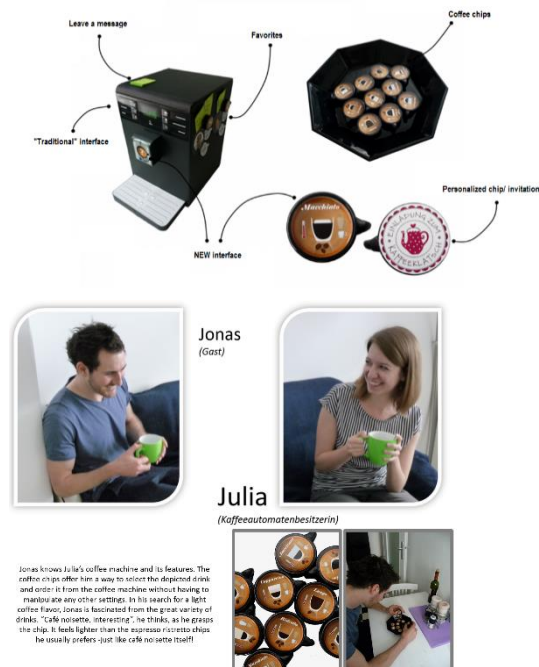


By using the system, ...							
		Fully disagree	Somewhat disagree	Agree in part	Somewhat agree	Fully agree	NC
1	...I was in full control of this situation.	1	2	3	4	5	0
2	...the situation was completely predictable and not threatening.	1	2	3	4	5	0
3	...my action was efficient and effective.	1	2	3	4	5	0



⁶ www.designingexperiences.org

In the coffee machine case, we conducted an initial evaluation and an online evaluation of the user experience story. The initial evaluation was made according to criteria derived from a checklist and led to improvements in expression, structure and plot of the story. Next, we posted the improved story in an online platform (google forms) and invited users to submit their answers to a questionnaire or open comments after reading the experience story. Results were filtered according to demographics of participants and relevant responses were considered for further improvements in the story.



Identify yourself with Julia und Jonas!

The initial page introduced to visitors the new coffee machine, while inviting them to explore it through the story of Jonas and Julia.

The "story" page demonstrated the new coffee machine experience through short texts and images. Visitors of the webpage were invited to put themselves into the position of the protagonists and answer some questions in the "assessment" page.

Durch/Bei Benutzung der Kaffeemaschine...

Markieren Sie nur ein Oval pro Zeile.

	stimme gar nicht zu	stimme eher nicht zu	stimme mittelmäßig zu	stimme eher zu	stimme voll zu	Keine Angabe möglich
... wurden persönliche Erinnerungen geweckt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... war ich lebendig und vital	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... habe ich eher allein als zusammen mit anderen gehandelt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... verbessert sich mein Eindruck bei anderen Leuten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... habe ich ein besseres Gefühl	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The "assessment" page included four questions about participants' demographics and nine questions related to need fulfilment.

INSTRUCTIONS

PREPARATION

DRAWING OF A REPRESENTATIVE SAMPLE: Taking the user profiles as archetypes, select a representative sample of users, which have demographical, social and emotional characteristics similar to prospective users.

SELECTING PRESENTATION MEDIUM: Having defined the audience of your story (sample), select the most appropriate medium to present the story to this audience. Depending on characteristics of the audience, the evaluation setting and the availability of physical artefacts, a story could be presented in form of written text, storyboard or video. It is also possible to enact the storyline together with the participants. Use the [support for selection of story presentation media \[13\]](#) to identify the most suitable option.

EXECUTION

CONDUCT AN INITIAL ASSESSMENT OF THE STORY: Use the [checklist with criteria for good stories \[12\]](#) as heuristics to refine the visualized story. Go through the criteria together with the design team to judge the quality of the story and improve it.

CREATE A QUESTIONNAIRE: In the previous design steps (latest during the creation of the user experience story), you defined the motives and needs that the new experience addresses. You can now use them as criteria for the evaluation. Select from the [UXNQ questionnaire \[14\]](#) the items that correspond to the needs in focus. You do not necessarily need all items; 2-3 items per need can be adequate. Prove if the content of the items fits to the content of your story. If not, you can make adjustments. For example, you can rephrase an item, so that the meaning of the need is closer to the context-specific meaning of needs related to the usage of your product. You can use the emotional behaviour of user profiles to do that. Furthermore, you can add items; for example, you can use motives derived from the narrative analysis. Finally, place the items in a random order.

PRESENTATION OF THE STORY: Present the story with the medium you selected during the preparation. Walk the participants through the story that describes the future experience and ask them to project themselves into the role of the story characters and relive the experience. Due to their characteristics, such specific nature and integration in context, stories provide a great basis for achieving identification and immersion.

ASSESSMENT OF STORY CONTENT: After viewing the story, ask the participants to fill out the questionnaire. Stories ideally describe a positive user experience and contribute to need fulfilment. When creating a story, designers emphasize on communicating needs and motives addressed by the new product. Potential users will now assess in the questionnaire whether they received the emphasis on those needs. An advantage of questionnaires is that need fulfilment is expressed quantitatively and experiences from different stories are comparable. On the other hand, open questions enable participants to express their overall impression without being restricted in answer options. Open questions could consider the realism of stories and experiences described in them. Participants could also describe possible difficulties in comprehension.

MAKING NECESSARY CHANGES: Comments on misunderstandings or difficulties in comprehensions are hints for making essential changes in the story before proceeding with its further evaluation.

ANALYSIS

The story generates qualitative and quantitative statements regarding the experience and released emotions. Analyse the responses of questionnaires to produce quantitative results regarding need fulfilment and the responses in open-end questions to identify possible improvements.

MAKING USE OF EVALUATION RESULTS

- Concept phase I: Input for making necessary changes in the user experience story
- All phases: Fulfilment of needs is the criterion for success of user experience design

RECOMMENDATIONS

- For the highest possible representativeness, divide the samples into classes (for example, according to user profile characteristics). The share of participants in the sample from one class should represent the share of the class in the customer group.
- In case of an online evaluation, add in your questionnaire a part on demographics. You should be able to match each evaluation participant to the corresponding user profile.
- Use a pre-selected set of questionnaire items, like UXNQ items, but with necessary adaptations, so that the questions are relevant and the total questionnaire length not too long. In cases of very specific project-related needs, a customized questionnaire might be necessary. In such cases, relevant needs or motives should be formulated as statements in a new questionnaire, to which the degree of approval is listed on a scale (e.g. from 1-5).
- Define in your team the meaning of each scale point and even consider adjusting the scale.
- Ask all participants the same questions in the same order.
- An inadequate evaluation result implies the need for an iteration and probably the creation of a new user experience story. Such an iteration is still more time- and cost- effective than a change in any later development stage.

APPLICATION CASES

- **Project types:** all project types, required that there is a user experience story
- **Alternatives:** expert appraisal, focus groups, observations, questionnaires with different scales (e.g. AttrakDiff, PANAS, PrEmo, SAM)

FURTHER READING

Körber, M., Eichinger, A., Bengler, K., & Olaverri-Monreal, C. (2013). User experience evaluation in an automotive context. In *Intelligent Vehicles Symposium (IV)*, 2013 IEEE (pp. 13-18). IEEE.

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TEMPLATES & DOWNLOADS

1. Checklist with criteria for good stories [12]
2. Support for selection of story presentation media [13]
3. Questionnaire for assessment of story content (UXNQ) [14]

TEMPLATES AND DOWNLOADS

[1] TEMPLATE FOR USER PROFILES (LEFT: EXTERIOR USAGE; RIGHT: INTERIOR USAGE)

USER PROFILE [segment/ cluster] [product type]		USER PROFILE [segment/ cluster] [product type]	
<p>I Utilization context</p> <p>Country, city</p> <p>Climate [temperature, sunshine hours, humidity, precipitation values]</p>	<p>IV Social behavior</p> <p>Values & goals</p> <p>Attitude towards life</p> <p>Mentality</p> <p>Social status</p> <p>Lifestyle</p> <p>Mottos</p>	<p>I Utilization context</p> <p>Country, city</p> <p>Apartment, kitchen</p> <p><input type="text"/></p>	<p>IV Social behavior</p> <p>Values & goals</p> <p>Attitude towards life</p> <p>Mentality</p> <p>Social status</p> <p>Lifestyle</p> <p>Mottos</p>
<p>II Personal data</p> <p>Name (age) <input type="text"/></p> <p>Marital status <input type="text"/></p> <p>Stage of life <input type="text"/></p> <p>Nr. of people in household <input type="text"/></p> <p>Annual income <input type="text"/></p> <p>Profession <input type="text"/></p> <p>Leisure activities <input type="text"/></p>	<p>V Emotional behavior</p> <p>Market-specific prioritization of psychological needs</p> <p><input type="text"/></p> <p>Meaning of psychological needs</p> <p>Need 1</p> <p>Need 2</p> <p>Need 3</p> <p>Perception of the product</p>	<p>II Personal data</p> <p>Name (age) <input type="text"/></p> <p>Marital status <input type="text"/></p> <p>Stage of life <input type="text"/></p> <p>Nr. of people in household <input type="text"/></p> <p>Annual income <input type="text"/></p> <p>Profession <input type="text"/></p> <p>Leisure activities <input type="text"/></p>	<p>V Emotional behavior</p> <p>Market-specific prioritization of psychological needs</p> <p><input type="text"/></p> <p>Meaning of psychological needs</p> <p>Need 1</p> <p>Need 2</p> <p>Need 3</p> <p>Perception of the product</p>
<p>III Product utilization</p> <p>Product type</p> <p>Attitude towards product</p> <p>Product utilization [usage frequency on working days/weekends, daytime of usage, and number/duration of paused usage]</p>		<p>III Product utilization</p> <p>Product type</p> <p>Usage behavior</p> <p>Attitude towards product</p> <p>No-go's, Nice-to-have's</p>	

[2] NEEDS⁷

Need	Description	I have the feeling of...	A product gives me...
Security	Security describes the feeling to be safe and to have life under control, rather than the feeling of insecurity and the threat of own living conditions.	... leading a good structured life. ... having a pleasant daily routine. ... neatness and regularity. ... bringing routine in my life.	Comfort, predictability, peace, intimacy, routines, serenity, structure
Popularity	Popularity describes the feeling of having influence on others and being respected, instead of being someone whose opinion has no value.	... being someone whose advice others seek and follow. ... being someone orientating others. ... being recognized and liked.	Influence, awareness, appreciation, recognition, appreciation
Competence	Competence describes the feeling of being capable and effective in own actions, rather than	... mastering difficult tasks successfully. ... asking for challenges and coping with them.	Control, effectiveness, competence, performance, mastery

⁷ Based on **Hassenzahl, M. (2011)**. "Freude und Fahren – Booklet on User Experience – Cooperation of the Folkwang Universität with the BMW Group". Essen: Folkwang Universität der Künste.

	being incompetent and ineffective.	... gaining control of the situation. ... mastering the situation.	
Relatedness	Relatedness describes the feeling to be close to people who are important to me, instead of being alone and isolated	... being near to people who are important to me. ... being surrounded by people. ... being in a society of like-minded people. ... experiencing intimate moments with others.	Communion, presence, friendship, trust, togetherness, caring
Autonomy	Autonomy describes the feeling, to act according to their interests and values, rather than being controlled.	... acting according to my own interests and values. ... being able to express my "true self" through my actions. ... doing things in the way I think is right. ... being independent. ... coping without help. ... meeting decisions without the advice of others.	Freedom, independence, limitlessness, autonomy, independence, detachment
Conservation of something meaningful	Conservation of what is meaningful describes the feeling of being able to rely on a variety of positive memories, instead of emptiness and the loss of personal subjects.	... finding myself in my things. ... preserving important things. ... collecting meaningful things. ... remembering.	Personality, completeness, reflection, remembrance
Stimulation	Stimulation describes the feeling of experiencing something new and being excited, instead of being bored.	... satisfying my thrive for knowledge. ... satisfying my curiosity. ... exploring. ... making new positive experiences.	Novelty, surprise, discovery, richness, diversity, renewal
Physical thriving	Physical thriving describes the feeling of having a healthy and well-groomed body, instead of being weak and unhealthy.	... being physically active. ... operating physically. ... promoting my health. ... giving to my body exactly what it needs.	Health, vitality, energy, physical performance, vitality

[3] TEMPLATE FOR NARRATIVE ANALYSIS

Profile 1							
Source	Quote	Story	Storyline	Oppositions	Enthymemes	Motive	Cluster
...	...						
Profile 2							
Source	Quote	Story	Storyline	Oppositions	Enthymemes	Motive	Cluster
..							

[4] TEMPLATE FOR COLLECTING USE CASES

Before Usage	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
During usage	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
After usage	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

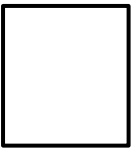
[5] INITIAL META-MODEL

	User	Need	Motive	Use case	Function
User		<i>has</i>	<i>has</i>	<i>is affected by</i>	<i>controls</i>
Need				<i>is relevant in</i>	
Motive		<i>meets</i>	<i>is related to / occurs simultaneously with</i>	<i>rises in</i>	
Use case		<i>stresses</i>	<i>stresses</i>	<i>arises simultaneously with</i>	<i>influences</i>
Function		<i>fulfils</i>	<i>fulfils</i>	<i>is used in</i>	<i>is redundant with</i>

[6] METHODS FOR DATA COLLECTION

Domain	Method to collect data
User	Production, sales and marketing data Customer studies
Need	Literature-based sets of needs
Motive	Surveys, interviews, laddering, customer feedback, social media analysis, storytelling, experience sampling
Use case	Moderated workshops, cognitive walkthrough, morphological case, studies
Function	Function modelling, product manuals, data loggers

[7] TEMPLATE FOR CHARACTER DESCRIPTION

Name.....	
Age.....	
Status.....	
Profession.....	
Personality.....	
Hobbies.....	
Context of use.....	
Relation to the product	
.....	
.....	

[8] TEMPLATE FOR STORY SETTING

Character(s)

Who is the user?



Needs

Which are the main user's needs?



Motive

What does the user want to achieve through the interaction with the product?



System components

Which are the components of the product or other products that influence the interaction?



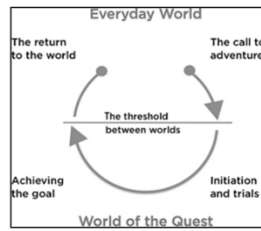
[9] PLOT LINES

Title
Given (context)
And (more context)
When (event)
Then (outcome)
And (other outcome)

Prescriptive story



Layered story



Hero story

ME		
THEM		HERE
ME	NOW	THERE
	THEN	HERE
	NOW	

Framed story

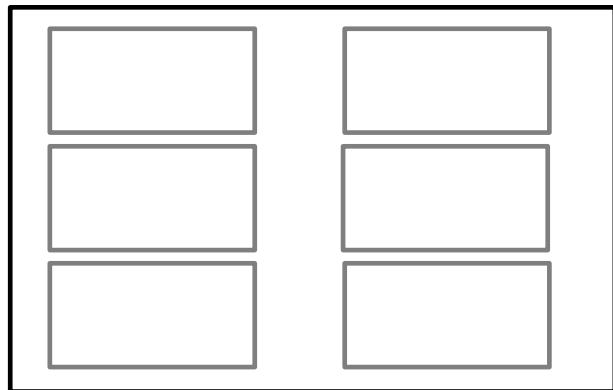
Familiar
Transition into the unfamiliar
Even more unfamiliar
Leap into the unknown
Resolution

Familiar to foreign

[10] TEMPLATE FOR PRESCRIPTIVE PLOT LINE

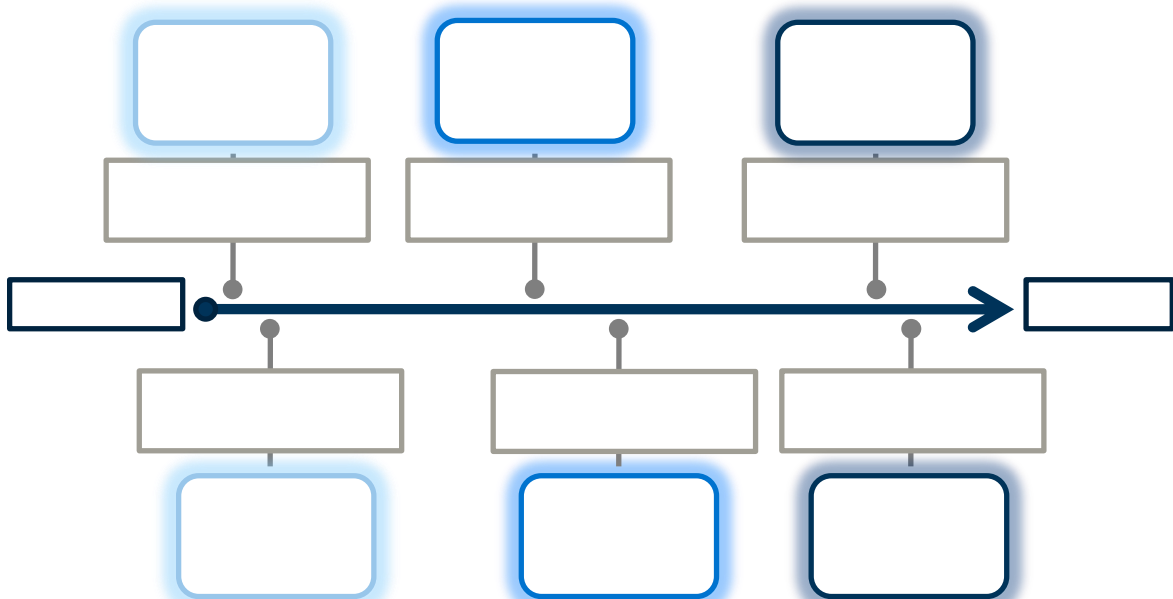
Use Cases

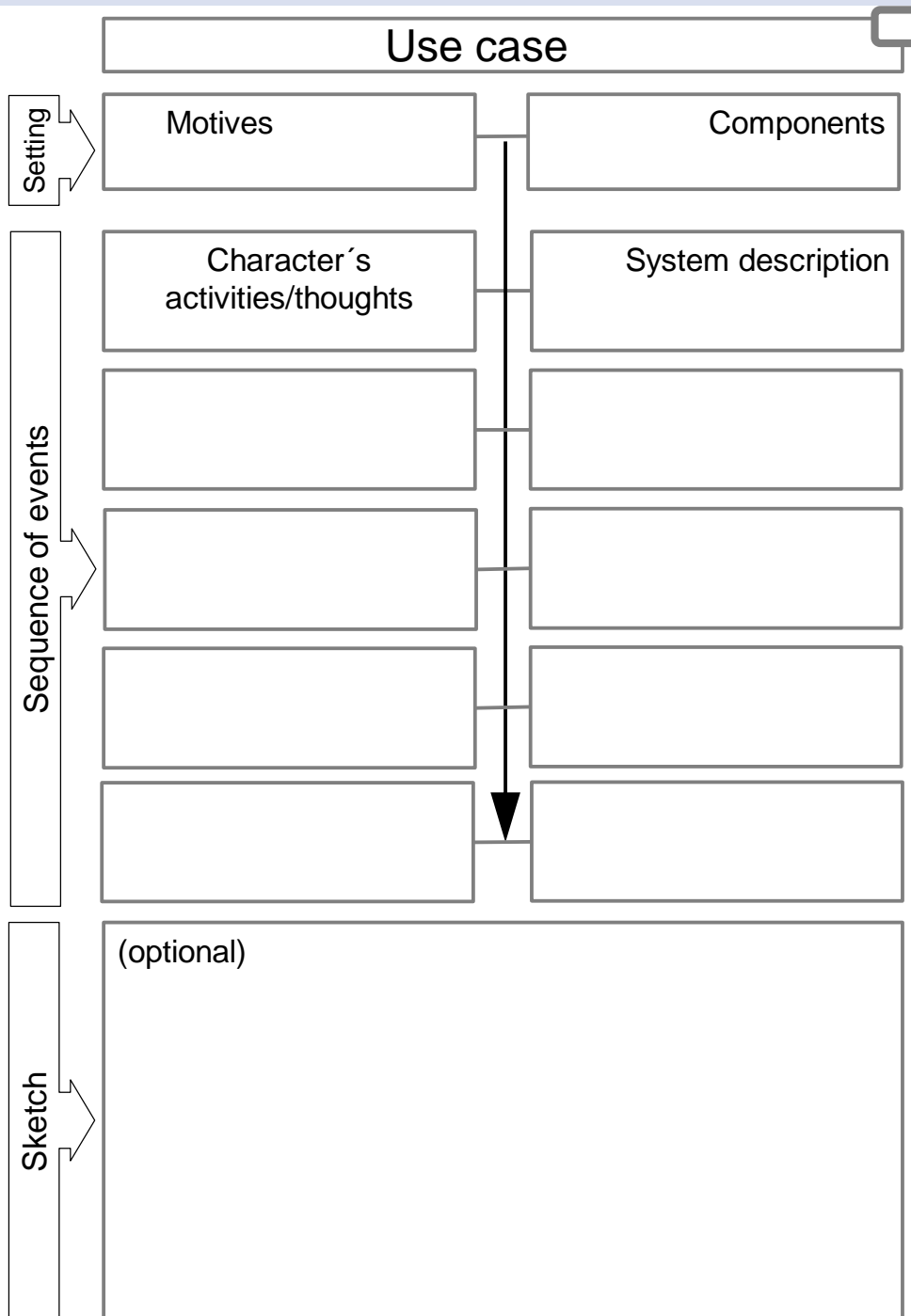
Which are instances before, during and after the interaction that shape the experience?



Key events

Which are critical use cases involving an emotional highlight?





[12] CHECKLIST WITH CRITERIA FOR GOOD STORY

CONTENT	
Honesty	<i>Does the scenario base on real data? Does the content of the scenario portray user research accurately, without distorting the real data?</i>
Authenticity	<i>Does the scenario reflect the feeling of the original events and the way in which the participants themselves might express it?</i>
Richness in action detail	<i>Does the scenario describe the way things happened thoroughly? Does the scenario provide more value than just a quote?</i>
Relevance for UX issue(-s)	<i>Does the scenario identify a point-of-pain / a market gap / a new approach / a trend that is relevant for the UX issue? Does the scenario help in explaining something about the UX in a way that gets beyond facts?</i>
Representativeness	<i>Are the characters and situations representative?</i>
Preciseness	<i>Is the content of the scenario specific and tangible? Is the point of the scenario explicit enough for the audience to comprehend without further explanations or adjustments?</i>
EXPRESSION	
Clarity	<i>Does the scenario have a clear focus / a clear point?</i>
Simplicity	<i>Does the scenario use just enough details to help the audience recognize its focus and authenticity, and no more? (...or does it involve many technical details / irrelevant information that might confuse the audience?)</i>
Accurateness	<i>Is the message of the scenario direct? (...or does it describe "a story about the story"?)</i>
Richness in contextual detail	<i>Does the scenario provide enough contextual detail to help the audience relate to it? Does the scenario bring data to life by grounding it in a specific physical and emotional context?</i>
Authenticity	<i>Does the scenario use the characters' language?</i>
Vividness	<i>Does the scenario use active descriptions?</i>
STRUCTURE	
Coverage	<i>Does the scenario address all of the facts, even inconvenient details?</i>
Coherence and plausibility	<i>Do the facts and explanations delivered in the scenario make sense? Is the scenario believable?</i>
Uniqueness	<i>Is the explanation / solution delivered in the scenario convincing? (...or does it seem like there are many other explanations / solutions that would work equally well?)</i>
Fittingness	<i>Do the presented facts fit well in the scenario? (...or have they been forced into place?)</i>
Length	<i>Is the scenario as long as it needs to be, but no longer? Are the contents provided efficiently?</i>
AUDIENCE-ORIENTATION	
Resolution	<i>Does the scenario provide an ending that suits the purpose of the story? Is the audience able to complete the "journey" in their minds? Is the audience able to relate and incorporate the contents of the scenario into their lives and design task?</i>

[13] SUPPORT FOR MEDIA SELECTION

Form	Development phase			Presentation format			
	Analysis	Conceptualization	Implementation	Digital	Paper-based	Live	Offline
Oral narration	+	O	O	+	-	+	-
Textual narration	+	O	O	+	+	-	+
Text and pictures / figures	+	+	+	+	+	+	+
Storyboard	O	+	+	+	+	+	+
Film	O	O	+	+	-	O	+
				+	:	appropriate	
				O	:	applicable	
				-	:	not applicable	

[14] USER EXPERIENCE NEED QUESTIONNAIRE (UXNQ)⁸

Need	Item “While using the system, I felt”	Invert items ⁹ “While using the system, I felt”
Stimulation <i>Making new discoveries, exciting adventures, being stimulated by life instead of being bored</i>	... I experienced something great. ... I was fascinated by making new experiences. ... I could make new experiences.	... I was not struck by exciting new impressions. ... I did not do anything interesting.
Control <i>Having everything under control, feeling secure, being familiar with the situation, understanding consequences.</i>	... I had everything under control in the situation. ... my actions were effective. ... I could successfully master the situation.	... the situation was not sufficiently predictable. ... in the situation I was not safe and secure.
Conservation of Something Meaningful <i>The feeling of preserving something personally meaningful or being reminded of something by it.</i>	... something personally valuable happened. ... the situation triggered personal memories. ... I could preserve personally meaningful memories. ... something personal, which will be remembered, was created. ... I could preserve something that is meaningful to me.	
Physical Thriving <i>A feeling of physical well-being, vitality or fitness.</i>	...active and sportive. ...physically well. ...alive und vital. ...comfortable within my own body.	...not full of energy or physically active.
Autonomy <i>Not being constrained by external factors, feeling autonomous, being independent.</i>	... that I was free in my decisions. ... that I was able to act the way I wanted to. ... that I was able to act independently.	... that I was not able to act according to my interests and values. ... that I was not able to act according to my interests and values. ... that my actions were influenced by external pressure.
Popularity <i>Social reputation, being popular, being the opinion leader, strengthening of social identity, status</i>	...that I was a popular person. ...I was a person who had an influence on the opinions of others. ... that I was a reputable and respected.	...that I would not be proud when others see me with this product. ...that I was not able to improve my social image.
Relatedness <i>Companionship, team spirit, meaningful relations to others, belonging to a group, sense of belonging.</i>	... I was close to people who I care for. ... that I built a team. ... that I was part of a community. ... that I belonged to a group or other persons.	... I rather acted alone than with others.
Competition <i>Being better than others, overtrump others, feeling of self-worth.</i>	... that I had an advantage over others. ... able to surpass others. ... I showed others that I was superior. ... I used something better than others.	... that I performed not better than others.

⁸ Based on **Körber, M., & Bengler, K. (2013)**. *Measurement of momentary user experience in an automotive context*. Paper presented at the Proceedings of the 5th International Conference on Automotive User Interfaces and Interactive Vehicular Applications.

⁹ Items must be inverted for analysis of responses

ACKNOWLEDGMENTS

The examples demonstrated in the practical guide lean on results from the project “CAR@TUM - User Experience” (www.designingexperiences.org) and the master thesis of Daniel Fluhr [**Fluhr, D.** (2015). *Applying scenario-based methods to improve user experience of an automatic coffee machine*. Master Thesis, Technische Universität München, München].

List of dissertations of the Institute of Product Development

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Technische Universität München, Boltzmannstraße 15, 85748 Garching

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- Prof. Dr.-Ing. U. Lindemann

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