EXPERIENCE DESIGN IN THE AUTOMOTIVE CONTEXT

DISSERTATION

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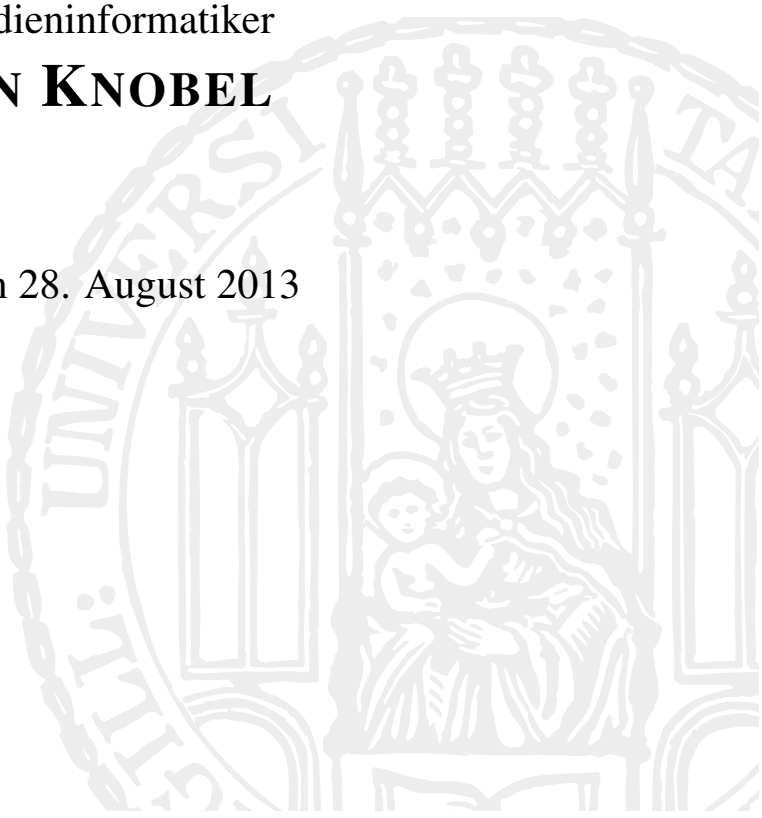

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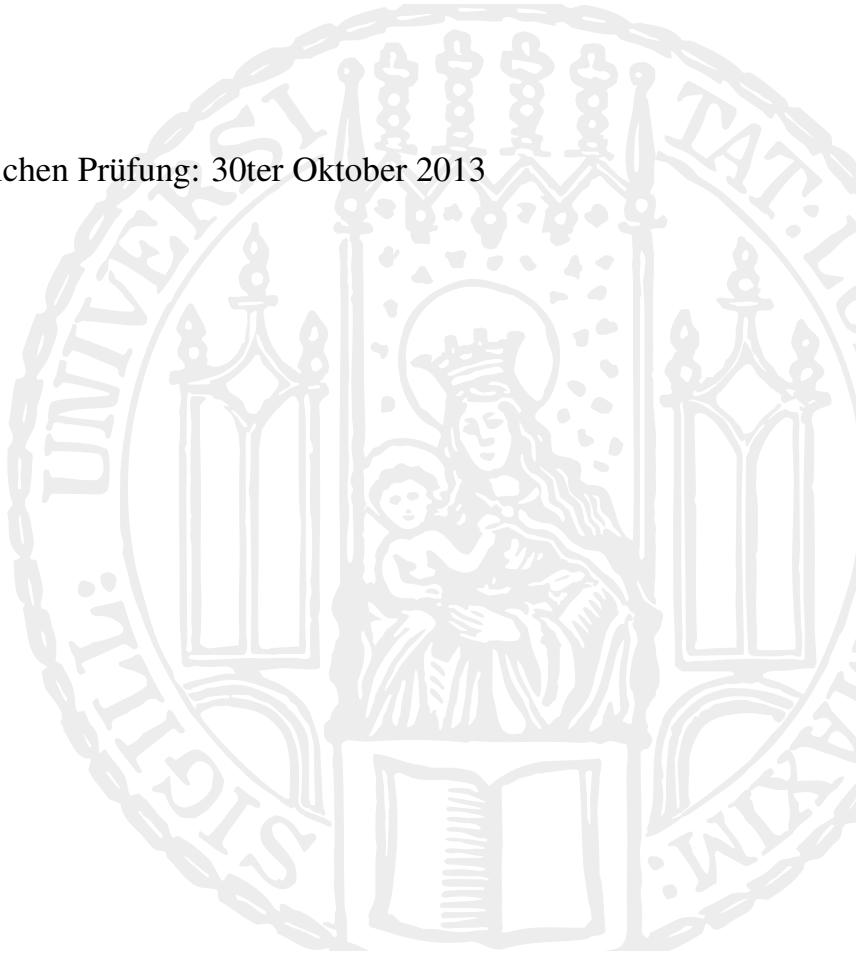

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- For Herman, Marie, and You -

Abstract

Various experiences in modern life are in one or another form connected to car rides. However, the automotive industry so far only regards driving as the only relevant experience, a perspective which consequently dominates the field of interaction design for vehicles. Yet, the car is an exceptionally potential space for experiences that go beyond the actual driving task, such as intensive conversation or exploration. So how is it possible to design for special situations like those, and thereby create positive emotions for drivers and passengers alike?

To meet this objective it is necessary to use the human, instead of the function, as the starting point. The design approach of "Experience Design" defined by Marc Hassenzahl provides exactly this focus on the human and concentrates first on their experience. Here, positive emotions are specifically created through the fulfilling of psychological needs.

Experience Design enables the precise analysis of experiences in advance of the design by clarifying with the help of psychological needs why a considered experience is viewed as positive. Furthermore, Experience Design supports the composition of an Experience Story, which is attuned to the desired psychological needs and which defines the experience to be designed. This experience can then gradually be translated into an interaction design. Finally, with the help of technology, the created experience can be lived through in situ by participants and later analysed.

Based upon this design approach and by means of methods drawn from the fields of human-machine-interaction as well as psychology, four studies on the design of experiences through interaction products in the automotive domain are presented. The created experiences are divided into "Experiences at Group Drives in the Car for Pleasure" and "Experiences While Commuting Alone". These experiences take place in different scenarios, namely: in a motorcade, an exploratory cruise, a commuting ride, and while driving considerately. Out of the practical application of Experience Design in these studies a best practice for the use of the employed methods is developed.

Thereby, this work brings to light the possibilities for using technology to design experiences that go beyond the mere act of driving. Furthermore, the challenges of designing experiences in usability-focused environments are shown. Thus, this work is aimed at offering inspiration to designers and researchers particularly in the automotive domain for designing experiences and thereby furthering innovation.

Zusammenfassung
Viele unterschiedliche Erlebnisse im Leben sind auf die eine oder andere Weise mit Autofahrten verbunden. Jedoch wird in der Automobilindustrie das Erlebnis im Auto bisher gleichgestellt mit dem Fahrerlebnis selbst, was folglich auch das Interaktionsdesign in Fahrzeugen bestimmt. Dahingegen bietet gerade das Auto Raum für Erlebnisse, die über die eigentliche Fahraufgabe hinausgehen, wie intensive Gespräche oder Entdeckungen. Wie also lassen sich derartige Erlebnisse gestalten, und wie kann dies auf eine Art und Weise geschehen, dass bei FahrerIn als auch Mitfahrenden positive Emotionen ausgelöst werden?
Zu diesem Ziel sollte beim Menschen und nicht bei der Technologie angesetzt werden. Der von Marc Hassenzahl aufgestellte Designansatz „Experience Design“ bietet eben diesen Fokus auf den Menschen und konzentriert sich auf das Gestalten von deren Erlebnissen. Hierbei werden durch das Erfüllen psychologischer Bedürfnisse gezielt positive Emotionen erzeugt.
Experience Design ermöglicht, Erlebnisse im Vorfeld der Gestaltung genauer zu analysieren, indem anhand psychologischer Bedürfnisse geklärt wird, warum ein betreffende Erlebnis positiv empfunden wird. Weiterhin unterstützt Experience Design das Konzipieren einer Erlebnisgeschichte, welche auf die zu erfüllenden psychologischen Bedürfnisse ausgerichtet ist und das zu gestaltende Erlebnis definiert. Dieses Erlebnis lässt sich dann Schritt für Schritt in ein Interaktionsdesign übertragen. Schließlich kann das gestaltete Erlebnis von StudienteilnehmerInnen mithilfe der Technologie in situ durchlebt und analysiert werden.
Aufbauend auf diesem Designansatz und mittels Methoden insbesondere aus den Bereichen Mensch-Maschine-Interaktion sowie Psychologie werden vier Studien der Gestaltung von Erlebnissen durch Interaktionsprodukte im automobilen Bereich vorgestellt. Die gestalteten Erlebnisse lassen sich untergliedern in Erlebnisse bei gemeinsamen Fahrten in unbekannten Gegenden sowie in Erlebnisse beim alleine Fahren auf bekannten Strecken. Sie finden in unterschiedlichen Szenarios statt, nämlich in einer Kolonnenfahrt, einer Entdeckungsreise, einer Pendelfahrt und im rücksichtsvollen Straßenverkehr. Aus der praktischen Anwendung von Experience Design in diesen Designstudien wird eine „Best Practice“ zur Verwendung der benutzten Methoden erstellt.
Damit werden in dieser Arbeit Möglichkeiten aufgezeigt, wie über die Fahraufgabe hinausgehende Erlebnisse mithilfe von Technologie gestaltet werden können. Diskutiert werden weiterhin Herausforderungen des Gestaltens von Erlebnissen in Umfeldern, die auf Benutzbarkeit spezialisiert sind. So soll diese Arbeit Designer und Forscher insbesondere im automobilen Bereich dahingehend inspirieren, Erlebnisse zu gestalten und damit neue Wege für Innovationen zu finden.

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I

Understanding Designing Experiences in the Automotive Domain

Chapter 1

Rethinking the Car:
Designing Experiences Besides Driving

Automotive slogans and advertisements, in routinely presenting cliché images of cars racing along lone winding roads in the mountains or by the seashore, highlight the so-called "Joy of Driving." Their products are optimised for getting the most out of the physical capacity of the car to achieve the ultimate driving experience. However, the act of driving has an additional aspect of experience that manufacturers and advertisers have neglected to develop and design for, and that is a "Joy While Driving." Building upon classic social driving experiences such as singing along to the radio with friends, intense conversations, and the excitement of exploring new areas, these previously undeveloped areas of automotive experience can be exploited through the design of interactive products.
This work will do so by illustrating the development of positive experiences that go beyond the driving task through interactive design and by describing the application of methods and tools. For this, design cases are presented for: feeling related with friends in different cars, exploration rides with friends, fostering closeness in a family when one member is commuting, and fostering prosocial behaviour in traffic. Additionally, a "best practice" for designing experiences beyond driving within the automotive industry is established.
In other words, cars affect our everyday lives, so let's get beyond just the "Joy of Driving" and design for the "Joy While Driving" as well!

1.1 Start Designing Experiences!

Cars are designed as tools to perform the task of driving as effectively as possible. The key aspect of design and innovation was for a long time the "driver's work place," as it is called in the industry. The focus is here on efficiency, effectiveness, and the satisfaction of the user, in this case the driver. This is defined as usability according to the ISO standard [ISO99]. Usability helps to

shape the car as a "tool" for its purpose. On the one hand, interaction is designed to be effective (i.e., the car responds to the interaction as the driver expects it) and on the other hand to be efficient (i.e., the driver can interact in an optimised, fast, and accurate way). Thanks to usability, systems can be evaluated with respect to the driving task by standardised valid evaluation methods, which measure the quality of usability in the driving context [RC08]. Since that quality is one of efficiently and effectively solving a task, designing products according to usability generates product satisfaction and avoids negative product experiences. However, interaction design should not only deliver product satisfaction by avoiding negative experiences through bad usability, but needs to go beyond solving the product's specific task, in this case, the driving. Instead, it should build upon positive experiences, which create positive emotions for the driver and passengers alike. In order to design such specific experiences a new mindset is needed for product designers in order to overcome the common function-driven approach (cf.[DH12]).
The term "experience" is introduced here and with more detail to follow in Chapter 2. Experience is defined by Marc Hassenzahl in his book "Experience Design" from 2010 as follows: "An experience is an episode, a chunk of time that one went through - with sights and sounds, feelings and thoughts, motives and actions; they are closely knitted together, stored in memory, labeled, relived and communicated to others" (p. 8 in [Has10]).
This shows that experiences are integral to human life. In his book "Experience Society" Gerhard Schulze goes so far to claim that modern society craves experiences in such a way that these become the meaning of life [Sch92]. Consequently, more and more authors in different fields have observed a rising relevance of experiences. Pine and Gilmore, for example, recognise such a shift towards experiences in the economy [PG99]. Concerning the tourism industry, Beedie and Hudson describe that "[...experience] holidays are likely to become more attractive as the collection of experiences begins to undermine the more materialistic elements of consumer society" (p. 639 in [BH03]). The fact that living through experiences is increasingly becoming more important than owning material goods corresponds to the phenomenon called post-materialism. What is more, the designing of products in ways that enable experiences can also support the idea of post-materialism [BHL09]. This focus on experiences leads to an industrial paradigm shift: it is no longer the product that is the decisive factor in product design, but the experience that is enabled by the product. Thus, as Pine and Gilmore state, "As the demand for experiences grows, so too will the demand for those goods which enable experiences" (p. 18 in [PG99]). Therefore, the product and its quality will no longer be the singular goal of design, but the human and their positive experiences while interacting with the product will be central.
Technology is sometimes involved in positive experiences without being explicitly designed for that purpose. One example described in [KHL$^+$12] is a social practice in Italy, which creates the positive experience of being close to a significant person. This practice, which is called *squillo*, happens when one uses the phone to ring someone and then hangs up before the call is answered. The receiver of the call can see the number and knows who has been thinking of them. The phone as an invention was never designed for performing a *squillo*, and without sharing the underlying social practice the *squillo* can be misunderstood. However, this practice triggers a positive relatedness experience through the use of technology. The fact that people invent and use such practices and therefore "misuse" technology for their own purpose shows that users are looking for ways to utilise technology to enhance their experiences.

In areas outside of the automotive industry, experiences have already been designed and sold for a long time, as in theme-parks like Disneyworld, among other examples. Here, the visitors can immerse themselves into an experience through interaction with the designed environment [PG99]. In research, too, interaction products are being designed with a focus on experiences. One such example is "mo," a mobile player designed by Lenz and colleagues made of at least two devices. Every user fills their player-unit with just a few favorite songs. When more than one device is brought into proximity with each other, the music of all the devices is played randomly over the built-in loudspeakers. The fact that the devices only play when at least two "mo" users meet with their devices results in a social experience [Has10], [LDHL12]. One of the users always knows the actual song and can explain why they chose this specific one, thus fulfilling the communicative aspect of experiences as described by Hassenzahl above.
Due to the paradigm shift towards experiences, the automotive industry should take experiences into account within the design of interaction products. An interaction with the product should be designed to create positive experiences and trigger positive emotion [Has10]. Cars can be designed to enable various experiences through product interaction. By using experiences as a focus for interaction design in cars, the user will obtain more than just the material aspects [Has10]. By providing experiences, the economic value of the product can be multiplied [PG99]. Moreover, the well-being of humans can arguably be enhanced precisely because experiences make people happier than material goods and because experiences are more open for positive reinterpretations and can become a meaningful part of someone's identity [Has10], [VG03]. As Pine and Gilmore state: "The best things in life are not things", (p 20 in [PG99]). So keeping that in mind, let's start designing experiences!

1.2 Experiences by Driving vs. Experiences beyond Driving

Automotive design is predominantly focused on driving as is expressed in slogans by which car manufacturers advertise their products, such as "The Ultimate Driving Machine" (see Figure 1.1). Companies across the industry use similar themes in their advertising and consistently improve the driving experience with even more powerful engines, brakes and more accurate steering.
However, the act of driving itself need not be the only source for positive automotive experiences. In fact, recent technical developments have furthered the progress towards "Joy While Driving"-focused design as the pure driving experience is more and more influenced by assistance systems, which take over parts of the driving task [EKHS12]. Furthermore, developers are putting a lot of effort into the development of autonomous driving, which takes driving completely away from the driver (see e.g., [Jur13]) and thus hinders the positive experience associated with the act of driving. With these kinds of developments the automotive industry more than ever should design for experiences that go beyond the mere act of driving as there is much potential for product interaction while driving. Moreover, the closed space of the car creates an exclusivity of the driver that makes them receptive for experiences. Additionally, many drivers commute and spend a lot of time in their cars.

Figure 1.1: The Ultimate Driving Machine (figure from [BMWb] ©BMW Group).

All of these factors make the car a suitable domain for supporting different kinds of experiences. The challenge ahead is to rethink the car as a product and bring in the components needed to enhance the automotive experience beyond the act of driving itself.

1.3 The Scope of "Joy While Driving"

The whole car is a confined space made up of a complex interaction system [SDKS10], which can be used to support and enable experiences. Beyond that, the environment of the car offers many sources for experiences (some are described in [SDKS10]), which are not yet used for design purposes [KHL+12].
Sarah Redshaw divided driving experience into driving for pleasure (as a choice) and driving to work (as a necessity) (p.51 in [Red08]). For this thesis Redshaw's definition is adopted and further detailed in coherence with possible contexts for positive experiences beyond the act of driving. These situations constitute fields in the design space of "Joy While Driving" and are of opposite nature: (1) experiences on group drives for pleasure, and (2) experiences while commuting alone.

(1) Experiences on Group Drives for Pleasure
Driving with friends for pleasure is a social experience, which can be enhanced through interaction design.
In the past, social interaction took place through joint action during group drives. One example is that the co-driver often took over the task of navigation and guided the driver. Modern automotive design, however, is more focused on effective functioning, as illustrated by the term "The Driver's Work Place" (see Figure 1.2) (see e.g., [Pro06]). Consequently, social aspects are neglected in favour of more technical aspects, such as improving ergonomics. One example of this is the development of guiding information shown in the head-up display (where information is projected into the windshield [New95]), which can not be recognised by the co-driver. It is precisely this sort

Figure 1.2: The Driver's Work Place (figure from: [BMWa] ©BMW Group).

of driver-centred technology, which disregards social experiences, that provides the impetus for this work. Therefore, the aim in designing experiences on group drives for pleasure is to address all passengers and provide them with a common experience.

(2) Experiences While Commuting Alone

Commuting alone can be a burden. As one driver stated: "I get bored. Like, once I get past ten minutes of driving I'm just like ... ugh. Not because it's hard, it's just boring. It's the same stretch of road for ages. Especially driving home, it's so boring" (in [Red08] p.55). Whereas the car as a container gives privacy to passengers on a group drive, it is also a physical barrier and a hindrance towards feeling related to those outside the car [KHL+12]. Modern driver-centric technology does not take into account the purpose of feeling related to others. Only very few authors focus on the relation to those outside of the vehicle. One is Oskar Juhlin who argues that, "Driving becomes a lonely activity. [...] Emerging technologies could be used to reintroduce some of the socialisation that used to occur in the streets". There are social practices that overcome the barrier between vehicles, as a means of communication to the outside world, e.g., truck drivers thanking one another with a specific sequence of the turn signal after overtaking on the highway. Overcoming this barrier, thus creating feelings of relatedness, is one possibility for designing positive experiences while commuting alone. On the other hand, driving alone can also provide the feeling of autonomy, as

one driver describes, "I like driving by myself. It does give you time to think. You can go at your own pace, look at stuff you want to look at" (p. 58 in [Red08]).
Designing experiences while commuting alone takes the solitary commuting drive into account with the aim of designing positive experiences by opening up the defined space of the car interior and helping to communicate with others, in addition to encouraging autonomy where applicable.

1.4 Research Objectives

As the authors contributing to the topic of "Interaction Triggered Experiences with Products" have different mindsets and design philosophies (e.g., [Has10], [MW04a], [MWSV08], [BC10]), this work aims to find an appropriate approach for the application of designing experiences in the automotive domain. Within such an approach, applicable tools to design and evaluate experiences are to be adapted. From this, experiences beyond driving are to be created, a task that has been mostly overlooked in automotive research so far. For this, the following two objectives are taken into account throughout the entire research work:

Objective 1: Create Understanding and Insights on Designing for Experiences Beyond the Driving Task
A thorough understanding of the ideas behind designing experiences is to be mediated so that inhibitions about designing for experiences are ruled out. With the setting up of a best practice, insights for designing experiences are provided. Further insights are delivered by outlining important challenges of designing experiences in the automotive industry.
In order to generate these insights experiences have to be designed in practice, which leads to the second objective.

Objective 2: Design for Experiences Beyond the Driving Task
As a practical application of designing experiences design cases are to be implemented in practice within the automotive industry. Here, experiences are to be analysed, designed, implemented through technology, and evaluated step by step, so that the needed insights for the first objective are created.

1.5 Research Approach

The challenges in designing experiences within the automotive industry are mainly a result of the pervasive focus on usability. In order to find approaches for designing experiences it is necessary to look beyond the usability focus. Within the field of user experience Marc Hassenzahl's "Experience Design" provides a suitable approach to support the design of experiences, which puts the human being in the centre of design.

A practice has yet to be established for the application of Experience Design to design for experiences that go beyond the driving task, thus in the following a practical approach to the research is needed. As tools and methods for this have to function in real work environments, they are therefore applied directly in these surroundings. It is through this practical application of Experience Design that a best practice for the use of tools and methods is set up.

1.6 Contribution and Target Audience

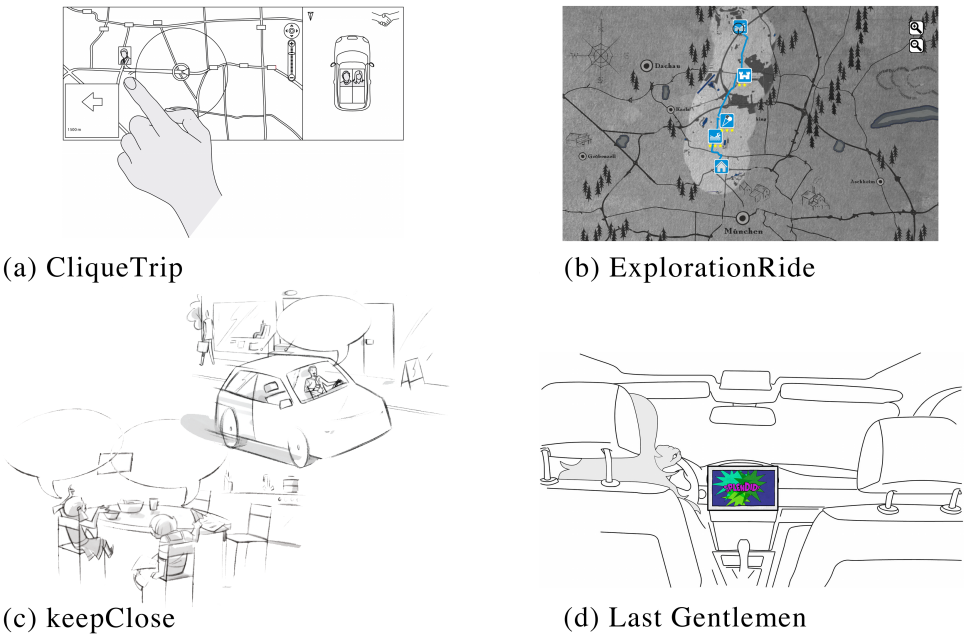
The work at hand provides two main contributions in order to help interaction designers and researchers design experiences, especially in the automotive industry: (1) Understanding and insights of applying Experience Design in that domain, (2) In situ tested design cases.
Both these contributions are built upon three years of practical working experience in the field.

Contribution 1: Understanding and Insights of Applying Experience Design
A best practice of designing experiences is elaborated as a resource with the factors necessary to design experiences in the target domain. Further insights on challenges of the application of Experience Design in the automotive industry provide information to help avoid problems while applying Experience Design in that area.

Contribution 2: Design Cases
This work serves as inspiration for human-machine-interaction specialists especially in the automotive domain to design experiences that go beyond the driving task. With selected design cases the concept of designing for the "Joy While Driving" is supported. The in-situ testing of the design cases secures external validity beyond a purely laboratory setting, thus strengthening the contribution. Through the designed experiences, the passengers in the car are enabled to immerse themselves into the designed experience while interacting with the product. Beyond that, each design case provides insights and recommendations regarding the application of the methods for designing experiences.
Table 1.1 gives an overview over the presented design cases. Figure 1.3 shows sample images of the design cases.

Name	Brief description	Single / Common Experience	Section	Figure
CliqueTrip	Increase relatedness for groups travelling in separate cars	Common	3.1	1.3-a
ExplorationRide	Explore the surrounding while cruising with friends	Common	3.2	1.3-b
keepClose	Keep a connection to home while commuting	Single	4.1	1.3-c
Last Gentlemen	Make drivers more considerate through self-affirmation	Single	4.2	1.3-d

Table 1.1: Overview of the design cases presented in Chapters 3 and 4.



(a) CliqueTrip (b) ExplorationRide

(c) keepClose (d) Last Gentlemen

Figure 1.3: Images of the design cases presented in Chapters 3 and 4. (illustration (c) from the Folkwang University of Art, Marc Hassenzahl, created by Frank Josten).

Two different groups are addressed as target audiences of this work:

Interaction Designers, Especially within the Automotive Domain

Interaction designers are often inspired by new technologies to create innovations on a predominantly functional level [Nor10]. Most have an engineering background and their creativity can be enriched through a focus on experiences. The focus on experiences can also help to put existing as well as new technology into a more meaningful context and contributes to enabling the customer to live experiences instead of just using functions. For this, interaction designers receive a new way of using tools and methods to design experiences beyond driving.

Researchers, Especially in the Area of Designing Experiences Through Technology

Researchers are provided with insights in the practice of designing experiences in the automotive context. However, the design cases also provide ideas for fields other than the automotive industry. Furthermore, the application of the tools used here provides insights for other fields in which experiences are created through interaction products, e.g., the use of stories to develop technology in a large industry, the usage of evaluation methods for experiences, and the ideas of collecting and evaluating experiences (see Chapter 5).

1.7 Structure of the Thesis

The work is structured into three parts:

Part I: "Understanding Designing Experiences in the Automotive Domain"

The outline of the motivation in the present chapter, Rethink the Car: Designing Experiences Besides Just Driving, explains why it is a good idea to design experiences beyond the driving task in the first place. Building upon that, Chapter 2, Designing Experience: Approaches, Tools, and Methods from the Literature, clarifies what to design for. Here, related approaches from research within the field are presented. Beyond that, methods and tools for designing experiences are described.

Part II: "Experience Design Beyond the Driving Task: Design Cases"

The second part provides the practical design cases. In Chapter 3, Design Cases: Experiences on Group Drives for Pleasure, two design cases form the category of group drives for pleasure are presented: CliqueTrip, which creates relatedness, and ExplorationRide, which creates a common exploration experience. In Chapter 4, Design Cases: Experiences While Commuting Alone, two design cases for commuting alone are illustrated. The first, keepClose, is a system that attempts to remedy the sense of distance between a commuter and their family. The second, Last Gentlemen, is a system that creates positive emotions through fostering the driver's prosocial behaviour in traffic.

Part III: "Recommendation and Discussion"
The concluding chapters convey guidance for Experience Design in the automotive industry. Chapter 5, Insights from Practice: Best Practice and Recommendations for Automotive Experience Designers, presents insights for the application of the design in terms of a best practice and challenges in the target domain. For this, the methods and tools introduced in Chapter 2 are discussed with regard to their application in designing experiences. Finally, in Chapter 6, Conclusion, the work at hand is summarised and the contribution is outlined before a look into the future of designing experiences in the automotive context is given.

Chapter 2

Designing Experience:
Approaches, Tools, and Methods

This chapter is structured in three parts, the first of which discusses the terms "user experience" and "experience". It is followed by a second part where two different mindsets and design philosophies are presented, one dealing with technology as an experience, the other with experiences triggered through product interaction. In the third and final part, common methods and tools usable for designing experiences are explained. The design philosophies, tools, and methods provide a starting point for the design cases introduced in Chapters 3 and 4.

2.1 Designing Towards Positive Experiences

In general, product interaction is about the relation between the user and the technology, focussing on optimisation, learnability, effectiveness, efficiency, that is, on usability (as was briefly discussed in Chapter 1). But usability serves only one specific goal: proper functioning. It does not lead to positive emotions by and through itself, rather it becomes a "hygiene factor" in designing experiences through interaction [Has10], because the technology, which mediates the experience has to function according to the design.
A computer game serves as an example here: the interaction with the game has to function, but the game as such deals with emotions, for example, concerning the user's desired competence. This competence can be evaluated by the user (e.g., through the completion of differed levels) or by others (e.g., through a competition). If function is the focus of design, then usability is applied. If, on the other hand, technology already "deliver[s] basic needs" by being usable, then, as Norman claims, "user experience dominates" (p. 32 in [Nor04]).
User experience goes beyond usability by aiming for aesthetics, joy of use, and fun during product interaction (see [HP12], [GCMB11]). One way to measure this is through the evaluation of factors

that lie beyond usability, such as the use of questionnaires that try to capture the emotional aspects related to the use of a product (e.g., eMap [BC10], or AttrakDiff [HBK03]). As an example, the AttrakDiff is a questionnaire, which measures the features of a product (pragmatic quality) and some basic emotional aspects of using this product (hedonic quality). Another way is to provide additional information for actually designing according to user experience, for example, product-centered checklists support the design process in order to raise the quality of product experience [FB04]. An example for such a checklist is the set of eight criteria by Lauralee Alben [Alb96]. The author argues that the design should integrate the *understanding of users*, create *learnable and usable*, *needed*, and *mutable* products through an *effective* and *appropriate* design process, with an *aesthetic* and *manageable* experience. According to Alben, that taking these eight criteria into account while designing interaction enhances the quality of product experiences. Alben also came up with a set of questions underlying these categories (e.g., how was that learning reflected in the product), which should be applied while designing interaction [Alb96]. By helping to take important aspects into account in order to design for more than just a usable product, these methods aim towards realising user experience.

User Experience

The term "user experience" has become a buzzword in the research domain of human-computer interaction (HCI) [HT06] but is used in different ways [BAHk11]. As Roto describes, "The multidisciplinary nature of UX [user experience] has led to several definitions of and perspectives on UX, each approaching the concept from a different viewpoint" (p. 4 in [RLVH11]). Hassenzahl and Tractinsky wrote an outline on user experience where they discuss three classifying facet areas for research publications [HT06]. The first facet is beyond the instrumental, under which they classify works whose focus goes beyond the task that a product should solve, thereby emphasising aspects like beauty, aesthetics, and hedonism. For the second facet of research, Hassenzahl and Tractinsky classify work based on affects and emotions. The third is the experiential, which is about research that "emphasises two aspects of technology use: its situatedness and its temporality" (p. 94 in [HT06]). This refers to publications focused on the artifacts or on experiences that are changing over time depending on situations.

But no facet of its own can define "user experience," as the authors further argue, "[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 (or the environment) within which the interaction occurs (e.g., organisational/social setting, meaningfulness of the activity, voluntariness of use, etc.)" (p. 95 in [HT06]). Thus, the work of Hassenzahl and Tractinsky demonstrates the interdisciplinarity of user experience. This interdisciplinarity, which focuses on more than the product itself, is one distinctive feature of user experience in comparison to other common practices, like usability.

Scientific publications work out the difference between user experience and usability (e.g., [BAHk11]) and emphasise the particularity of user experience. While Bergas-Avila questions user experience as "old wine in new bottles" [BAHk11], Hassenzahl claims that it is more than that [Has08].

To find a common definition, workshops and seminars have been held [LHB07], such as a seminar in Dagstuhl where the participants approached the term "user experience" by the following

description, "The noun 'user experience' refers to an encounter with a system that has a beginning and an end. It refers to an overall designation of how people have experienced (verb) a period of encountering a system. This view emphasises the outcome and memories of an experience rather than its dynamic nature. It does not specifically emphazise its individual nature because 'a user experience' can refer to either an individual or a group of people encountering a system together" (p.7 in [RLVH11]).
The aim of this work is to enable user experience through technology. Hereby user experience is understood as human experience appearing through the interaction with a system. To design for user experience, this research starts from the experience, thereby building upon Hassenzahl who in his design approach puts experience first [Has10]. Consequently, instead of only analysing the technological system, which creates and mediates the experience [Has10], it is first and foremost the experience itself that is analysed.

Experience

The initially mentioned quote of Hassenzahl encapsulates what experience is, "It was an episode, a chunk of time that I went through and I am going to remember. It was sights and sounds, feelings and thoughts, motives and actions, all closely knitted together and stored in memory, labeled, relived and communicated to others." This differs from *experiencing*, as Hassenzahl shows, "Experiencing is the stream of feelings and thoughts we have while being conscious, a continuous commentary on the current state of affairs" (p.1 in [Has10]).
The same two differing concepts can be found in the work of Forlizzi and Battarbee, only named differently. What Hassenzahl calls *experience*, is labeled by Forlizzi and Battarbee as *an experience*: "An experience is more coalesced, something that could be articulated or named" (p. 263 in [FB04]). On the other hand, what to Hassenzahl is *experiencing*, is to Forlizzi and Battarbee *experience*, which they describe as "...the constant stream of 'self-talk' that happens while we are conscious."
To give a practical example in accordance to Hassenzahl's definition *experiencing* can be singing along with friends to the radio while driving, which results in a stream of feelings (i.e., the feeling of relatedness) and thoughts while being conscious. The whole drive, as just described above, is *an experience*, an episode that the passengers go through and remember afterwards, with a definite beginning and end [Has10], [FB04].
In this work Hassenzahl's terms are used. Consequently, it is *experience* that is the aim of the designing in this work.

From Experience to User Experience

In an experience interaction, products can also be involved, as in the squillo from Chapter 1:

> *The Squillo Story*
> "I spent a semester in Italy. The Italians have this habit to call a friend and hang up before he picks up. This is just to say 'I just thought of you.' The Italians have a term for it, they call it squillo. A friend of mine did a squillo to me half a year

> after I returned home [...] and it made me happy" (cf. p. 29 in [KHL+12]).

In this example, the experience becomes a user experience, "...by focusing on a particular mediator of experiences – namely interactive products and the according emerging experiences" (p. 2 in [Has10]). This user experience is triggered by the interaction product (the mobile phone in "The Squillo Story"), although the product was not designed for this particular purpose. Instead, the technology was adapted to create an experience. The aim of this work, as briefly described in Chapter 1 and in greater detail here, is making user experience possible and designing technology that fosters positive experiences.

2.2 *Technology as Experience* and *Experience Design*

Designing for user experience as opposed to product experience is rarely discussed explicitly. Different approaches that go beyond product experience within academia help interaction designers to move away from focusing purely on the product. One example is "worth-centered design," which places emphasis on worth and thereby on, ... "sponsor and user goals for digital products" (see p.173 in [Coc06]). Therefore, worth-centered design starts from the assumption, "...that people may not be able to articulate (name) what they could value; only what they have found to be worthwhile" (p.169 in [Coc06]), which should lead to designing worth. With its focus on worth this approach goes beyond product experience but does not cover user experience.
Other approaches specifically design for experiences. One such example is the book, "Subject to Change: Creating Great Products and Services for the Uncertain World" by Merholz and Schauer from 2008. In it they claim, "Stop designing products!" (p. 75 in [MWSV08]). They argue that a designer should create customer experience, not items. To this end, they claim to reduce complexity and make easy-to-learn products instead, so that consumers do not need to put effort into product usage but just have the experience delivered by the product. This approach leads to good product experience. In their book, Merholz and Schauer give examples for product experiences, such as the experience of taking a picture or the experience of listening to music from a portable player. From this they infer that, "The experience is the product" (p. 12 in [MWSV08]).
This section provides a detailed description of two academic approaches to design experience, which differ from the just mentioned approaches by focusing specifically on the experience for humans while interacting with a product. These approaches provide insights for designing experiences.

2.2.1 Technology as Experience

The first approach presented in this section is from McCarthy and Wright who discuss, "...how technology can be seen in terms of experience with technological artifacts" (p. 42 in [MW04b]).
and who state in that regard, "We don't just use or admire technology; we live with it" (p. 2 in

[MW04a]). McCarthy and Wright orientate on the felt-life of technology, taking into account that, the feeling-life does not begin and end with the immediate quality of an experience, rather it extends across space and time to the sense we make of experience in terms of our selves, our culture, and our lives" (p. 42 in [MW04b]). Building upon that Wright and McCarthy further created a framework, which they presented in their book "Technology as Experience" in 2004 [WMM05].
The framework encounters subtle and complex parts of the pragmatist approach to self-other relations [MW04a]. This describes the emergence of an orientation towards experience in HCI, which, "...suggested that conceptualizing technology as experience might provide appropriate foundations for this new orientation, and outlined the bones of a framework for working with technology as experience that is described more fully elsewhere" (p. in 43 in [MW04b]). By doing so McCarthy and Wright claim that "...self, senses and experience interpenetrate each other, and that the coherence required for a story that is convivial in the telling sometimes shapes the experience (p. 128 in [MW04a]).

The Framework of McCarthy and Wright

The framework is a set of four threads which are connected to each other. It further consists of six sense-making processes [MW04b]. The threads and processes together describe the "Technology as Experience."
The Four Threads of Experience
As seen in Figure 2.1, McCarthy and Wright chose four threads derived from studying pragmatist literature, e.g., of John Dewey (from the late 1920s and the 1930s) and Mikhail Bakhtin (from the 1980s and 1990s) [MW04a]. These threads are not elements of experiences, rather they support the analysis of technology as experiences more clearly. The presented threads should "provide ways of talking about technology that heighten sensibility to people's experience of it" (p. 80 in [MW04a]). The threads are, as seen in Figure 2.1, (a) the sensual, (b) the emotional, (c) the compositional, and (d) the Spatio-temporal.

(a) The Sensual Thread
The sensual thread questions, "What does the design and texture and the overall atmosphere make us feel?" (p. 42 in [MW04b]). It is about the sensory engagement with situations and guides towards the palpable and visceral character of an experience [MW04a]. It focuses on things gathered pre-reflectively as an "immediate sense of a situation" (p.80 in [MW04a]). Here the material affects the quality of an experience, like the warmth of a social space or the look and feel of a mobile phone [MW04b]. As an example, McCarthy and Wright refer to Dewey who describes in [Dew] a mechanic's sense of an engine, the feeling of the rhythms of the engine and the sound. They can hear the slightest problem with the engine and the involvement of the senses leads instinctively to the problem of the engine [MW04a]. The mechanic has the sense of, "...the meaning of things present in immediate experience" (p. 22 in [Dew]).

(b) The Emotional Thread
The emotional thread addresses, "What emotions color the experience for us?" (p. in 42 in [MW04b]). Emotions are seen by McCarthy and Wright as dependent from circumstances, and therefore they differ, for example, the joy of solving a problem from the joy of required love (p.

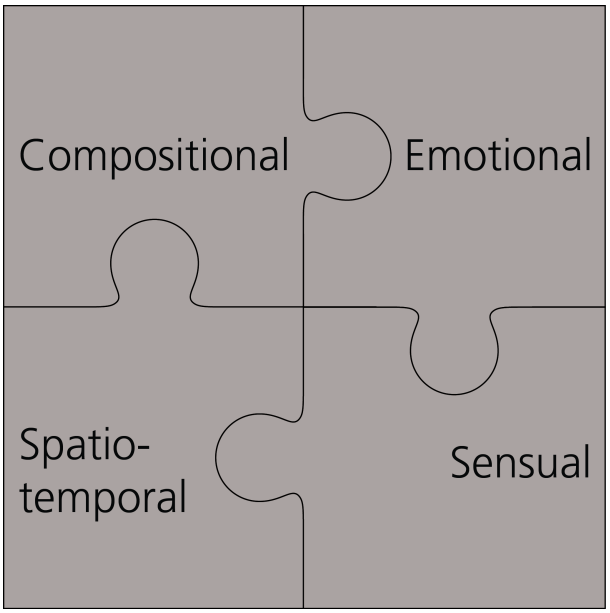


Figure 2.1: The four (intertwined) threads of experience (based on the figure in the top of p. 42 in [MW04b]).

83 in [MW04a]). These emotions are qualities of experiences and are furthermore, "...the color shot through the experience that holds all aspects of the experience together and makes it different from other experiences" (p. 83 in [MW04a]). Thereby, the emotional thread is about value judgments through the emotions, "...that ascribe importance to other people and things with respect to our needs and desires" (p. 84 in [MW04a]). These emotional aspects are essential to how an experience is remembered, e.g., as fun or as frustration [MW04b].

(c) The Compositional Thread
The compositional thread discusses, "How do the elements of an experience fit together to form a coherent whole?" (p. 42 in [MW04b]). Thus, it is about the relationship between the parts and the whole experience [MW04a]. This, "...refers to the narrative structure, action possibility, plausibility, consequences, and explanations of actions" (p. 87 in [MW04a]). The composition thread handles what the experience is about, what happens, how things go together, what happen next, and so on.

(d) The Spatio-temporal Thread
The Spatio-temporal thread examines, "What effects do place and time have on our experience?" (p. in 42 in [MW04b]). Every experience has a Spatio-temporal component [MW04a]. Space and time are important factors for experiences (cf. [Gru02]). These factors are differently sensed depending on the things we experience (e.g., if we are visiting a place for the first time or visiting the place over and over again) [MW04a]. Also the sense of time changes depending on, e.g., "our

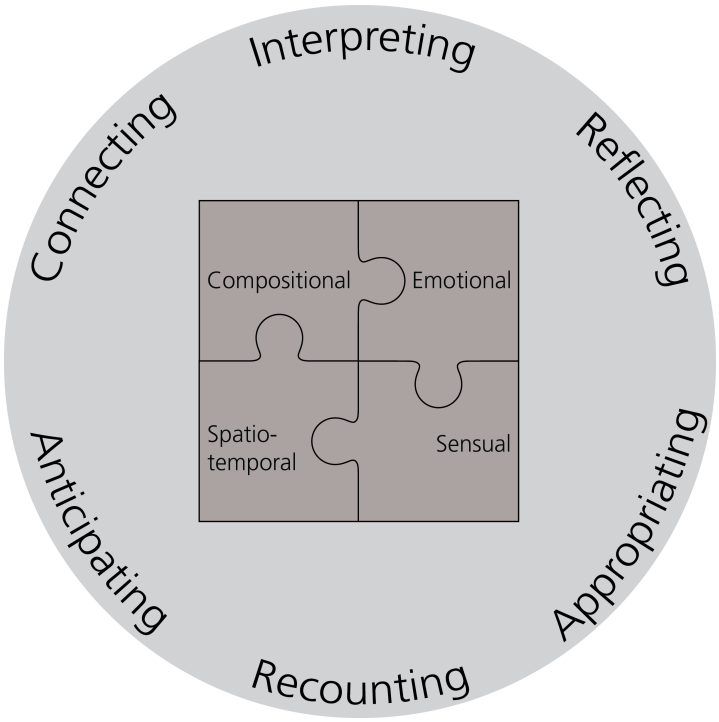


Figure 2.2: The six sense-making processes (based on the figure in the bottom of p. 42 in [MW04b]).

willingness to linger" (p. 42 in [MW04b]).

The Six Sense-Making Processes

As McCarthy and Wright state, "Experience does not come to us ready made" (p. 105 in [MW04a]). In addition to the four threads of experience, McCarthy and Wright further add six interrelated, non-linear, sense-making processes to the framework in order to, "...actively construct or make sense of an experience –reflexively and recursively– in a way that seems to fold back into the experience itself" (p. 42 in [MW04b]). To render practical the whole experience, these individual sense-making processes help to analyse technology as experience [MW04a]. The sense-making processes, which are taken under consideration, are (1) anticipating, (2) connecting, (3) interpreting, (4) reflecting, (5) appropriating, and (6) recounting (see also in Figure 2.2). Between the processes no implications of linear or causal relations are made.

(1) Anticipating, or expectation, is one of the sense-making processes in an experience [MW04a]. Prior experiences lead to expectations, possibilities and sense-making, thereby, "We never come to technology unprejudiced" (p. in 42 in [MW04b]).

(2) Connecting, which refers to the sense-making of a situation, is encountered immediately, pre-conceptually and pre-linguistically [MW04a], "We make judgment in an instant and without much thought" (p. in 42 in [MW04b]).

(3) Interpreting as a sense-making process is about the sensing of the narrative structure of an experience. It is about the characters and the action possibilities [MW04a]. So the interpreting process is therefore described as, "We work out what's going on and how we feel about it" (p. in 43 in [MW04b]).
(4) Reflecting as a sense-making process is about reflection on the feelings (e.g., frustration and pleasure) and, like an inner dialogue, it helps us to meaningfully share the experience with others [MW04a], as "We examine and evaluate what is happening in an interaction" (p. in 43 in [MW04b]).
(5) Appropriating is a sense-making process based on our senses, on our personal history, and on our anticipated future [MW04a]. "We work out how a new experience fits with other experiences we have had and with our sense of self" (p. in 43 in [MW04b]).
(6) The sense-making process of *Recounting* is about the fundamental dialogue, which includes telling the experiences to our selves and others [MW04a], "We enjoy storytelling and make sense of experience in stories" (p. 43 in [MW04b]).

Discussion of the Framework of McCarthy and Wright

This framework helps to understand the facets of technology as experience. McCarthy and Wright put the technology first, and therefore the four threads described in their framework are focused on product design. The six sense-making processes help to put the product into an experience context. Thanks to the latter, this analytical approach thus includes an orientation towards experiences. Yet it does not facilitate the user as the centre of the design and is therefore still focused on the product instead of on the human.

2.2.2 Experience Design

A more recent work is "Experience Design: Technology for All the Right Reasons" by Marc Hassenzahl from 2010 [Has10]. Hassenzahl comes up with a different understanding of designing for experiences than McCarthy and Wright. In his design approach he puts the experience first, "The experience approach to designing interactive products, thus, starts from the assumption that if we want to design for experience, we have to put them first, that is, before the products" (p. 2-3 in [Has10]). Therefore, the focus is on experiences, whereas technologies serve as "...creators, facilitators and mediators," (p.9 in [Has10]) of experiences. Hassenzahl argues for the possibilites of creating experiences through interactive products, because, "Although interactive products are not considered as experiences in themselves, through their power to shape what we feel, think, and do, they will inevitably influence our experience" (p. 9 in [Has10]).
For designing experiences through interactive products Hassenzahl highlights crucial aspects, which are described in the following.

Hierarchical Goals in Experience Design

Human-computer interaction (HCI) is understood by Hassenzahl as, "...goal-directed action mediated by an interactive product" (p.11 in [Has10]). It is upon goals of action that he sets up a

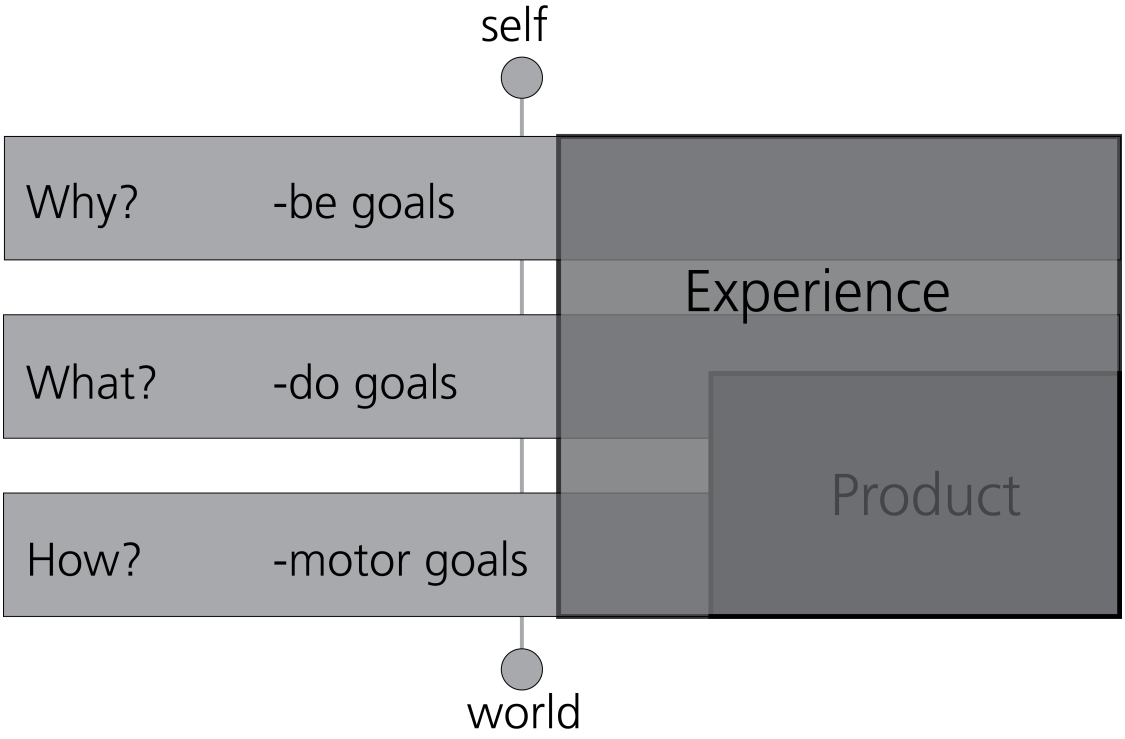


Figure 2.3: The hierarchy of goals (cf. Figure 2.1 on page 12 in [Has10]).

hierarchical model for the designing of interactive products, which describes the interplay of an actor and the world through different levels of goals.
The model is divided into three levels (see Figure 2.3). The middle level contains the do-goals (the WHAT level), which define WHAT an actor wants to obtain. Hassenzahl explains the do-goals by example of "making a telephone call," which can be performed through different technologies, for example with Skype, with a cell phone, or with a landline. These do-goals exist only because of the underlying technology, without the invention of communication technology no one had the do-goal of "making a telephone call."
The bottom level is the level of motor goals (the HOW level), which describe HOW an actor performs the *do-goal*, decomposed into sub-goals, like taking the handset, pressing the buttons, or reading letters from a display. These *motor goals* differ from the underlying technology. Hassenzahl discerns that the HCI focuses on the middle and the bottom level (the WHAT and HOW levels), which clarifies WHAT an actor obtains through interacting with a product and HOW an actor performs this action. But his hierarchical model of goals contains another level on top, the be-goals, which constitute the WHY level. Examples given for be-goals are, "being competent," "being admired," "being close to others," "being autonomous," and "being stimulated" (p.13 in [Has10]). This layer is more self-related, as seen in Figure 2.3, than related to the outside world. The be-goals motivate the action, like "being close to each other," in the example

Need	Description
Autonomy-Independence	Feeling like you are the cause of your own actions rather than feeling that external forces or pressure are the cause of your action
Competence-effectance	Feeling that you are very capable and effective in your actions rather than feeling incompetent or ineffective
Relatedness-belongingness	Feeling that you have regular intimate contact with people who care about you rather than feeling lonely and uncared of
Selfactualizing-meaning	Feeling that you are developing your best potentials and making life meaningful rather than feeling stagnant and that life does not have much meaning
Security-control	Feeling safe and in control of your life rather than feeling uncertain and threatened by your circumstances
Money-luxury	Feeling that you have plenty of money to buy most of what you want rather than feeling like a poor person who has no nice possessions
Influence-popularity	Feeling that you are liked, respected, and have influence over others rather than feeling like a person whose advice or opinion nobody is interested in
Physical thriving—bodily	Feeling that your body is healthy and well-taken care of rather than feeling out of shape and unhealthy
Self-esteem-self-respect	Feeling that you are a worthy person who is as good as anyone else rather than feeling like a "loser"
Pleasure-stimulation	Feeling that you get plenty of enjoyment and pleasure rather than feeling bored and understimulated by life

Table 2.1: List of Psychological Needs (from p. 46 in [Has10]).

of the do-goal "making a telephone call." Through this motivation the do-goal of "making a telephone call" becomes meaningful. Thereby the be-goals clarify WHY a user wants to act, i.e. interact with a product. Hassenzahl's three-layer model clarifies, "...that experience [is comprised] of perception, action, motivation, and cognition—it emerges from the simultaneous activation of those sub-processes represented by the three levels and integrates them into a meaningful, inseparable whole" (p.13 in [Has10]). For the designing of experience, what is called Experience Design by Hassenzahl, all three layers of this model have necessarily to be taken into account.

Psychological Needs in Experience Design

In order to benefit in Experience Design from the extended view of the be-goals, that is the WHY of an action, Hassenzahl introduced a non-hierarchical list of psychological needs (based on [SEKK01]). This list categorises and clarifies the motivations expressed in be-goals (see Table 2.1). It defines the core of each experience, which occurs in an infinite number of variations. The addressing and fulfilling of the psychological needs in the interaction with the product create positive emotions, and thus meaning. To fulfill a psychological need through interacting with a product, the product should be able to "create or shape the experience as desired" (p.57 in [Has10]). Therefore, psychological needs are used as an important tool to help to focus the design

of an interaction product.

The Story: The Experience Before Product in Experience Design

The story is a decisive tool in Experience Design, one that puts not the technology but the human into focus. Hassenzahl goes so far as to say that, "An experience is a story, emerging from the dialog of a person with her or his world through action" (p.8 in [Has10]). He argues to set up a story of an experience before considering how to recreate that story, which is the experience, through technology. In a story "...emotion, cognition, motivation, and action are inextricably intertwined" (p. 3 in [Has10]), hence in creating the story and thus representing the experience, this intertwining has to be taken into account. To do so Hassenzahl argues that it is important for designers to overcome the focus on the tangible aspects of the experience and for engineers to avoid the focus on technical solutions. He claims that only when the story is set straight can one think about how to recreate this story through a product. It is in doing so that the design goes beyond functionality, content, presentation, and beauty. These aspects have to go in line with the experience being designed.

Experience Pattern in Experience Design

An experience pattern describes a human practice that leads to a positive experience. It condenses the complex nature of a positive experience to a minimal set of crucial insights, which explains why people enjoy experiences of that kind (cf. p 45 in [Has10]). Furthermore, experience patterns become a blueprint of various experiences and present a modeling form for shaping a specific experience, hence providing "...a way to reduce the gap between needs and a specific product" (p. 70 in [Has10]). Hassenzahl also asserts that these patterns should relate to a psychological need, for example, "Autonomy patterns are about creating and maintaining individuality, relatedness pattern about deepening interpersonal relationships, and so on" (p. 71 in [Has10]). There is a minimal set of requirements for experience patterns; they should consist of a clear scope (i.e., not too broad), plausibility (i.e., face validity), and resonance as a feeling of recognition and affirmation by the pattern's user (p. 71 in [Has10]). Furthermore, he claims to avoid patterns that appear to be outlandish. The quality of a pattern is given when the pattern is, "...[proven] applicable (i.e., there are domains/products which benefit from the insights captured by the pattern), generative (i.e., able to inspire designs), and successful (i.e., produce superior products)" (p. 71 in [Has10]).

Discussion of Experience Design by Hassenzahl

Hassenzahl explicitly puts the human in the centre of design. His focus on the experience can already be detected from the placing of "experience" first in the naming of his approach "Experience Design." Also, in the hierarchical model of goals Hassenzahl brings the user to the fore by describing the experience in terms of how emotions are created with the help of psychological needs. It is building upon this WHY level, which describes the user's motivation, that the experience is translated into technology through the WHAT and HOW layers of this model.

Discussion of the Two Approaches

McCarthy and Wright's approach of "Technology as Experience" puts technology before experience, which can already be detected in their approach's naming, where "technology" stands before "experience." In this approach, the four threads of experiences combined with the six sense-making processes provide factors to focus on during the design of a product. The authors analyse the experience in detail (with their four threads of experience, see Figure 2.1 and the product in the experience context (with the six sense-making processes, see Figure 2.2 in detail. Yet, the way they describe how experience arises is centered on technology and not on the human, and they do not explicitly design experiences with all their complexities. Moreover, as McCarthy and Wright view each experience as unique and irreducible, it becomes impossible to purposefully design experiences.

Hassenzahl, on the other hand, regards the experience from the human point of view and focuses the design thereupon, only afterwards thinking about the technology. In contrast to McCarthy and Wright who analyse the experience as a result of using technology, Hassenzahl begins the Experience Design with the user and their needs and emotions. In accordance to the hierarchical model of goals the design is here started at the WHY level, thus, from the outset Experience Design relates to the user's motivation and explains, with the help of psychological needs, how positive emotions appear. Within an experience, the user's action is thereby linked to motivation and emotions, whereas McCarthy and Wright do not take these aspects explicitly into account (see also p. 3-4 in [Has10]). The moving away from the product to the user (through the WHY level of the goal model) makes the user the focal point of Experience Design, thus fostering customer focus. The goal model further helps to design concrete interaction steps (through the HOW level) and function (through the WHAT level). Thereby, Hassenzahl clearly approaches the product from the experience. The product itself still stays in consideration, as Hassenzahl states, "It is through the product's functionality, content, presentation and interaction with people that designers create particular experiences. An easy, simplified product, reduced to core functionality, is unlikely to create sustained competence or even stimulation experiences" (p.49 in [Has10]).

In summary, Hassenzahl's focus on the experience before the product radically puts the human in the centre of the design and enables to design an outcome experience instead of a product. The hierarchical model of goals helps to make the interaction with the product meaningful by addressing the be-goals (motivations and emotions with the help of psychological needs) in the design. On the contrary, out of McCarthy and Wright's approach no direct design implications for experiences follow, as the dividing of the experience into the threads and the sense-making processes make it difficult to define steps that lead to explicitly designing experience. All this considered, the approach of Experience Design proves to be more strict to the designing of experiences. For these reasons and for the practical nature of Hassenzahl's approach, Experience Design is used throughout this work as approach for designing experiences beyond driving in the automotive domain.

2.3 Tools and Methods to Design Experiences

This work is not about creating a process, it is about methods and tools, and about how to use them for designing experiences beyond the act of driving in the automotive industry. In this section, methods and tools from the field of product design are introduced, which are thereafter applied in design cases in Chapters 3 and 4, and finally transferred to a best practice in Chapter 5.
Methods and tools are needed to gather and analyse experiences, to create an experience through a story, to design experiences through experimental prototypes, and to analyse the resulting technology-related experiences created while interacting with the prototype. These consecutive design steps are in line with *universal abstract activity circle* defined in [HP12]. This circle includes: analysing, designing, prototyping, and evaluation. Because it focuses on design rather than on experiences, this design process begins with analysing the context of use, and not the experiences, as intended in this work. Instead of creating a story, as aimed at in this work, the requirements in the universal abstract activity circle are set up for producing design solutions with prototypes. After that, it is again the design, and not the resulting experience, which is evaluated in that design process (e.g. [JIMK03]). In that way, the common design process, here interpreted by a company in the field, *frog design* [Fro], starts by discovering where "analysis becomes insight," goes on to design where the "insights become the idea," and finally arrives at where "ideas become reality."
But for designing holistic experiences, the experience has to become the focus of the design in every design step. This is achieved by analysing past experiences as a first design step and by designing experiences through the creation of an experience and by representing it in a story as a second step (as learned from Hassenzahl [Has10]). Furthermore, the experience is the focus of the implementation of a prototype, in the third step, as well as of the evaluation, in the final step.
For the purpose of designing experiences, methods from user-centred design are adopted in this work. User-centered design invokes an, "...active involvement of users and a clear understanding of user and task requirements" (page 3 in [ISO99]). Its focus is not directly on the system and also not on the experience, but rather on the users and their requirements. Moreover, the fundamentals in user-centered design are the allocations of functions [ISO99]. Nevertheless, user-centred design provides common methods to develop an idea until it becomes concrete and until the user is able to perform a task through the design solution.
In addition, tools from the field of psychology also help to analyse experiences and provide a focus for the design.
Before elaborating the methods and tools according to the respective design steps in which they are used, the concept of psychological needs is presented, as introduced in the field of Experience Design by Hassenzahl (see Section 2.2.2), since this tool figures throughout every design step to ensure the focus on the human.

Psychological Needs

Hassenzahl explored the idea of psychological needs as a source of positive experiences in the context of interactive products (e.g., [Has10], [HDG10]). The outcome of the study, where over five hundred positive experiences were analysed, was that experiences through technology can be cat-

egorised by the primary need they fulfill. Additionally, a clear relationship was revealed between the fulfilled psychological need and the corresponding positive affect. There are different systems of needs outlining motivations of actions and behaviour. Hassenzahl's list of needs (see Table 2.1) is based on the list of the top-ten psychological needs by Sheldon et al. [SEKK01]. Sheldon's top-ten needs refer to the "Self-Determination Theory" of Ryan and Deci [RD00], which contains the universal needs of "autonomy," "relatedness," and "competence" (also discussed in [Has10]). According to Hassenzahl, the psychological needs can be used to categorise positive experiences with interactive products in a way to describe and classify them. Hassenzahl further claims that an advantage of using psychological needs as categories is that they are based on extensive psychological research. He argues, "Each psychological need covers an important class of experience, central to being a human" (p. 55 in [Has10]). Thereby, the need system by Hassenzahl is non-hierarchical. This is in contrast to the hierarchical needs of "Theory of Personality" by Abraham Maslow [Mas70], which for that reason is not useful for categorising technology-related experiences because, according to Maslow, to fulfill a specific need all underlining needs have to be fulfilled (apart from that, it consists partly of physical needs). Anyway, Hassenzahl claims that the need fulfillment, which creates positive emotions and meaning in interaction with a product, depends on the situation at hand, more precisely, on the need deprivation or saturation. He further shows that the fulfillment of psychological needs is blocked in prolonged episodes and he identifies these blocks. However, to Hassenzahl, "The true challenge for Experience Design [is...] to fulfill needs without making this too obvious" (p. 57 in [Has10]).

2.3.1 Gathering and Analysing Past Experiences

When designing a particular experience through interaction products, understanding is necessary regarding the context of an experience, the arising emotions, and the single steps of the interaction within that experience. The main insight is the motivation, the above mentioned WHY in Hassenzahl's theory of Experience Design [Has10]. This motivation and the underlying addressed psychological needs have to be identified before one can create an experience, namely in a way to make more meaningful the product interaction, that is the WHAT of Hassenzahl's theory.
The application of the methods and tools presented in this section serves two purposes: On the one hand, they are directed at gathering human experiences. On the other hand, they help to analyse experiences in a holistic way for the design of the related technology that is to be build. The more insights received by gathering an experience, the more possibilities the analysis brings, and the more specifically the design can be focussed.
To be able to understand the experience from the participants' point of view, the participants should tell their story. At this point of the analysis, interviews come into focus, which constitute an important part in the major methods for gathering experiences (p. 29 in [WM10]). This work does not elaborate on methods that gather insights without interviews, like evocative stimuli, an example of which are cultural probes, because while they may help to understand the context, they do not gather experiences. As a consequence, they do not lead directly to the design [GDP99].

Interviews for Gathering Experience: Narrative and Episodic

The intention of an interview is to hear and understand the story of an experience from the participant who lived that experience in their memory. For this reason, the interview should be of a narrative nature. A structure should only help to focus on specific elements of the experience after its actual telling of the story by the participant. Hence, the focus of the interviews is on the narrative analysis by Murray [Mur08].

Before discussing the interview itself, the importance of the atmosphere as well as of memory activation in the interview situation needs to be outlined. Since experiences are mostly connected with personal aspects, a conversational atmosphere is essential for gathering an experience, as described by Johnsten, "One image that we use is of two people sitting side by side, paging through a family album of pictures, one telling stories, the other listening with friendly and personal interest" (p. 111 in [Joh02]). This conversational atmosphere is analysed by Murray as being created by the two aspects of encouragement and empathy [Mur08]).

Another important aspect is the memory activation of the participant, which helps the participants to re-live their past experiences [MR02]. One strategy to achieve such a memory activation is to conduct the interview at the place where the past experience took place.

Taking the atmosphere and the activation into account, the interview has to focus on people's narratives of the experiences. This helps, firstly, to create a suiting atmosphere, and, secondly, to gather holistic experiences. Since "...narrative analysis seeks to consider the account as a whole" (p. 104 - 105 in [Mur08]), the experience needs to be gathered as a holistic one. This provides the essential insights for the later design. When analysing narrative interviews, one important feature is to take the narrative structure deliberately into account, and not the particular themes within the narrative [Mur08].

Afterwards, aspects of episodic interviews come into focus. Compared with narrative interviews, episodic interviews are more focused due to the structured series of topics introduced by the interviewer [Mur08]. The aim of episodic interviews is to have "...extended narrative accounts about [the participants'] experience with each of the topics" (p. 104 in [Mur08]). No interview is unstructured [DBC06], but this aspect provides a stronger structure to the interview, albeit still preserving the interview's narrative character. The topic can help to get the right focus on a specific experience and avoid getting lost in general statements.

The structure here is such that after starting the interview with general experiences, one comes to the specific aspects of the experience. The most important aspects are the motivation of the experience, the resulting emotions, and the detailed single course of actions within an experience. This is in line with Smith who argued, "It is a good idea to aim for the interview to start with a question, which allows the participant to recount a fairly descriptive episode or experience. This way, the participant quickly becomes comfortable talking. Invitations to be more analytical can be introduced as the participant begins to feel at ease" (p. 59 - 60 in [SFL09]). This again helps the setting of a conversational atmosphere: starting with the experience in general, continuing with the specifics through structure and focus on the narrative.

Need-Questionnaire: Structuring and Analysing Gathered Experiences

Questionnaires can be used to structure and analyse gathered past experiences. In this work, a questionnaire was based on the ten needs of Sheldon [SEKK01] (see in Section 2.3), in order to

Psychological Need	Item (During this event, I felt ...)
Autonomy	That my choices were based on my true interests and values. Free to do things my own way. That my choices expressed my "true self."
Competence	That I was successfully completing difficult tasks and projects. That I was taking on and mastering hard challenges. Very capable in what I did.
Relatedness	A sense of contact with people who care for me, and whom I care for. Close and connected with other people who are important to me. A strong sense of intimacy with the people I spent time with.
Self-actualization-meaning	That I was "becoming who I really am." A sense of deeper purpose in life. A deeper understanding of myself and my place in the universe.
Physical thriving	That I got enough exercise and was in excellent physical condition. That my body was getting just what it needed. A strong sense of physical well-being.
Pleasure-stimulation	That I was experiencing new sensations and activities. Intense physical pleasure and enjoyment. That I had found new sources and types of stimulation for myself.
Money-luxury	Able to buy most of the things I want. That I had nice things and possessions. That I got plenty of money.
Security	That my life was structured and predictable. Glad that I have a comfortable set of routines and habits. Safe from threats and uncertainties.
Self-esteem	That I had many positive qualities. Quite satisfied with who I am. A strong sense of self-respect.
Popularity-influence	That I was a person whose advice others seek out and follow. That I strongly influenced others' beliefs and behaviour. That I had strong impact on what other people did.

Table 2.2: The Need-Satisfaction Items (from p. 328 in [SEKK01]).

identify psychological needs fulfilled through a specific experience.
One example of a technology-related application of a need-questionnaire is with Second Life, by Timo Partala, [Par11], used in order to analyse what people enjoy about Second Life. A further example to assemble a need-questionnaire is presented by Hassenzahl [Has10]. In his work, Hassenzahl deduced need-items for every specific need in order to measure their fulfillment. Sheldon and colleagues had defined those items in the first place, ascribing three need-items to ten psychological needs [SEKK01] (see Table 2.2). The information on the fulfillment of psychological needs in a gathered past experience can be used to focus the designing of an

Positive Affect Adjective	Negative Affect Adjective
interested	irritable
inspired	distressed
excited	ashamed
determined	upset
strong	nervous
attentive	guilty
active	scared
alert	jittery
enthusiastic	hostile
proud	afraid

Table 2.3: The Affect Adjectives (from [WCT88]).

experience throughout every single design step.

PANAS: Specifying Positive and Negative Affects

There is a clear relationship between a fulfilled psychological need and the positive affect, that is, the resulting feeling or emotion. The measurement of these outcoming affects specifies the gathered experience by linking them to the fulfillment of a specific psychological need. This understanding can then be used to shape the story of the experience, and hence the experience to be designed. To gather this information, Sheldon [SEKK01] and Hassenzahl in [Has10] use the questionnaire PANAS (Positive Affect Negative Affect Schedule) by Watson et al. [WCT88]. As to Hassenzahl, this questionnaire is well accepted and validated [Has10]. It consists of ten positive affect adjectives, and ten negative affect adjectives as shown in Table 2.3. Each affect adjective is rated by the participant as: very slightly or not at all, a little, moderately, quite a bit, or extremely. For a more accurate gathering of emotions and affects, there exists an extended version of the PANAS, the PANAS-X. This questionnaire gathers 60 items and thereof 28 positive affect and emotion items. The PANAS is also available in a German version translated by Röcke and Grühn in 2003 [RG03].

Affinity Diagram: Analysing the Gathered Experiences

The Affinity Diagram is a method to analyse qualitative data from methods such as interviews [CB05]. In their book, "Understanding Your Users" from 2005, Courage and Baxter claim that the aim of Affinity Diagrams is to detect key points from the data and cluster similar findings. They further explain that out of the qualitative data, structures and relationships will emerge, which can be grouped together and then be labeled. At this point, the question can be asked: Why do certain key-points belong together? The answer to this is given by the context. The method of the Affinity Diagram can be applied with an open-minded and creative team to add structure to complex issues by clustering data from multiple areas according to similarities. To do so, Courage and Baxter presented a seven-step walkthrough for this method ([CB05]), which is as follows:

1. *Finding a space*
   From the data space is needed on a wall or white board where the diagram is safe from other coworkers or cleaning undoing the work [CB05].

2. *Assembling the team*
   The "...affinity diagram works best with a team approach" (p. 717 in [CB05]). Within the team, different points of views are essential. Thus, having different backgrounds within the team is beneficial. Also, the data should be fresh in everyone's mind while applying the method and the creativity of the team should be fostered to not criticise the others' ideas [CB05].

3. *Creating the cards*
   Key points from the data are written on index cards. The team is able to add quotes, hypotheses, or design ideas on the index cards. Different colours can be used to differentiate types of data [CB05].

4. *Sorting the cards*
   After all cards have been created, each one is posted on the wall while the content is called out. Index cards can be duplicated if they belong to different groups [CB05].

5. *Labeling the groups*
   After thematic groups have emerged, the grouped index-card stack is labeled with a title or a description [CB05].

6. *Regrouping*
   After adding more data, e.g., through further gathering of qualitative data, duplicate groups should be merged and smaller groups can be merged to a bigger group, or they can become an under-level group (also seen in [HP12]). Also, large groups can be divided in more meaningful sub-groups [CB05].

7. *Walking through the diagram*
   When all data has been added, the team should walk through the diagram. Big groups can again be divided into sub-groups. When all the groups have a description by agreement of every group member, additional information for clarification and new insights can be added to the diagram [CB05].

Experience Pattern

The Experience Pattern introduced by Hassenzahl (see Section 2.2.2) captures practices that constitute the essence of an experience, even though played out differently in different situations [Has10]. Thanks to this essentiality, "Experience patterns can be applied for designing technology" (p. 17 in [Has10]). Hassenzahl argues, "Awareness of those patterns, their abstraction, and application to new cases lies at the heart of Experience Design" (p.19 in [Has10]). Breaking down an experience into its essence, as represented in an experience pattern displays a common core of every particular experience. Hassenzahl exemplifies this assumption with the comparison to weddings, "...each a

unique experience and all similar at the same time" (p.19 in [Has10]). He also states that the context of an experience should not be ignored, since the experience to be designed is highly situated in itself, "Even with an experience pattern, [...] at hand, the designer's task is still to apply it to a particular product, used by particular people in a particular place. The designer contextualises the pattern" (p.19 in [Has10]).
Furthermore, the positive experiences designed upon an experience pattern form the very essence of a whole class of experiences, so that a new experience can be created based on one experience pattern [Has10].
Kim et al. defined the experience pattern even more concretely in their work from 2011 [KPHE11], stressing to bridge the gap between psychological needs and the concrete product, service, or activity. For Kim, every experience pattern is related to a particular need, which makes a pattern a generic way to fulfill a psychological need. Above that, experience patterns condense positive experiences into a minimal set of crucial elements. These elements explain, "...why people enjoy these experiences and highlight the essence of a whole class of experiences" (p. 80 in [KPHE11]).
According to Kim (see p. 80 in [KPHE11]), each experience pattern consists of:

- activities with their sequences,
- related thoughts and feelings,
- general rules, which bind and shape the experience,
- important potential problems and their sequences.

In summary, an Experience Pattern is used to transfer the essence of an experience, which clarifies the focus, to a specific psychological need of an experience, which is then represented in a story. In that way, the experience pattern ensures the maintaining of focus on specific psychological need(s) in the design.

2.3.2 Creating an Experience with a Story

Based on the gathered and and analysed past experiences, the next design step is to create an experience, which involves interaction with a product. Since "...the basic claim of Experience Design is to consider experience before products" (p. 76 in [Has10]), it is not the product being developed at this point, but the experience being elaborated with the help of a story. This story becomes the core element of designing the experience. Hassenzahl propounds that such an experience goes further than merely "... [taking] the world in through our senses" (p. 16-17 in [Has10]), because it changes through one's goals and actions. He further claims that an experience becomes a story, "An experience is a chunk of this time, packaged, interpreted, and labeled – a story" (p. 19 in [Has10]). Since an experience can be represented in a story, then the aim for the story in the Experience Design process is, "...to set the story straight before we start thinking about how we can create this story through a technology" (p. 63 in [Has10]). For that reason, designing the experience through a compelling story is essential for designing an experience through technology later on.

Thereby, "The experience designer becomes foremost an author of experiences" (p. 76 in [Has10]).

Experience Story

A story as a method that describes a technological system is not of use here. Instead, the Experience Story creates an experience through product interaction. Thereby, the system, which is to mediate and create the experience, is defined. An important element of an Experience Story are the characters with whom the audience can empathise. As Gruen points out, "Good stories have fleshed-out characters with details that allow an audience to understand, relate to, and empathise with them. This includes having a sense of their values, fears, weaknesses, and overall goals: knowing what is important to them and what they would like to avoid" (p.505 in [Gru02]). In his work "Poetics" from 335 BC, Aristotle, too, ranked the characters as the second-most important element directly after the plot [Ari97]. Another element to consider is the motivation, which explains the actions of the characters. As described by Gruen, "Compelling stories also require a sense that the actions of the characters are clearly motivated. It is critical for the audience to be able to understand the reasons for their behaviour" (p. 506 in [Gru02]). This element comes into focus especially when integrating psychological needs in order to focus on the description of the WHY of the Experience Design theory [Has10]. The final element to consider when writing Experience Stories is the conflict, as Gruen depicts, "The plots of compelling stories typically are based on a conflict or obstacle that the characters overcome to accomplish a goal" (p. 505 in [Gru02]). The elaboration of a conflict may clarify the motivation and address the specific need, which is then fulfilled afterwards by accomplishing a goal as a source for positive emotions. Through empathy with the characters, the understanding of their motivations, and a conflict related to the fulfilling of need(s), the recipient can be thrilled and the story becomes compelling. Following McKee who declares that, "A story is about principles, not rules" (p. 3 in [McK97]), these elements can be used as an orientation while writing, but are not set rules of any kind for a compelling story.

2.3.3 Designing the Experience through Technology

The experience represented by the Experience Story is the starting point in designing an experience through technology, before proceeding to develop a prototype. In order to reduce the usual gap between the Experience Story and the prototyping, the methods of storyboards and mock-ups are implemented to keep focus on the story. With the help of storyboards and mock-ups a meaningful product interaction can be created through a prototype.

Storyboard

Storyboards are originally used in the creation of cartoons, video reports, and movies (e.g., [TJ81], [BBF+93], and [Gel09]). Their function is to highlight the most important aspects of a narrative [WMD+11]. Beyond that, storyboards are used in design to present an interactive flow of user and product [Red10]. The utility of storyboards lies in their ability to "...communicate a broader view of the interaction to show contexts and events" (p. 256 in [Red10]). A storyboard can be employed to translate the story into its interaction steps. Thereby, the storyboard takes a step into

the direction of a technical representation of the experience.
Before creating a storyboard, the single actions of an experience, that is, the interaction steps of the design, are to be taken into consideration by asking step by step, "What is going to happen next in the story?" (p.112 in [Gel09]). Through this, a storyboard becomes a sequence of visual frames in itself, used in the design for representing an interaction sequence and for envisioning interaction design solutions. The single frames consist of a hand-sketched picture annotated with few describing words [HP12]. In these frames, it is important to include the whole storyline of the Experience Story to show the experience over time, and not only the mere interaction with the system [HP12]. Besides the actual interaction with the system, the storyboard includes physical user actions, cognitive user actions, and activities of the system [HP12]. The designed technical system can thereby be seen as a black box to illustrate the potential of the system in its context [HP12]. The emotional perspective must also be displayed with phenomena like fun and joy [HP12]. When doing so the psychological needs and the levels of goals (see Section 2.2.2) in Hassenzahl [Has10] can provide a focus.
Compared to the Experience Story, storyboards are more explicit because of the added visual information. Their visuality at the same time provides simplicity to complex facts [BBF+93]. More than that, storyboards serve as a fast method, which omit insights about details of the user interface and therefore on technical solutions, but instead provide elements like context, sequence, location, and emotion [Red10], which are important for the experience. Thereby, also the suspense curve can be displayed [BBF+93]. The focus is therefore on states of the experience, that is, on the one side, the emotional states of the users, and on the other side, the states of interaction with technology over time. Storyboarding is hence a helpful method in the designing of experiences, linking Experience Story and the developing of the technology, which creates and mediates the experience.

Mock-up

Through the creation of a mock-up the insights of the Experience Story as well as of the storyboard are transferred into technology. At this point of the design, techniques are needed that provide solutions for the technical representation of the experience, which defines the technology. To give technology a first form mock-ups are used. The mock-up is a not fully functional prototype, but should be able to concretise the experience by means of technology. Similar to the Experience Story and the storyboard mock-ups are a representation of the experience, in this case an "experience prototype." Buchenau and Suri describe, "By the term 'Experience Prototype' we mean to emphasise the experiential aspect of whatever representations are needed to successfully (re)live or convey an experience with a product, space or system. [...] we can say an Experience Prototype is any kind of representation, in any medium, that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing" (p. 424 - 425 in [BS00]). Mock-ups enable a clear understanding of the fully functional technology, which is created later on. Thereby, the mock-up is more concrete than prototypes, such as low-fidelity paper prototypes (see [Bux07], [HP12]). The term "wireframe" is sometimes used for a kind of mock-up (e.g., in [McD07]) that focuses rather on the pure representation of the user interface, that is, on the look, the content, and the connections of the interface [WMD+11] (see in [HP12], [RM12], or [MHR+11]).
The understanding in this work is that mock-ups exceed the wireframes' representation of physical

artifacts (cf. [TE11]). In this work, mock-ups make parts of the designed experience exist for the first time through technology.. In the course of the implementation of the mock-up, a representation of the fully functional prototype, that is the aim of the design, is created. Through exploring and validating with the help of participants, the technology can be formed or re-thought (e.g., in [BS00]), before creating the fully functional prototype.

Prototyping for Experiencing: Experimental and In Situ

So far, the creation of prototypes in research is divided into horizontal prototypes (which are very broad in features but offer less functionality) and vertical prototypes (which offer deep functionality but only for limited features) (e.g., in [HP12]). Beyond these, there are also hybrid forms of prototyping, an example of which is the T-prototype (which offers a broad functionality in specific features) [HP12].
Since the aim here is to act out a story through a technical prototype, the prototype has to offer all the functionality and the features needed to operate throughout the experience. Therefore, the fully functional prototype becomes an experience prototype.
Buchenau and Suri argue, "Experience is a very dynamic, complex, and subjective phenomenon. It depends upon the perception of multiple sensory qualities of a design, interpreted through filters relating to contextual factors" (p. 424 in [BS00]). Thus, in order to capture the context of the experience in the intended setting (cf. [RCT+07]), the prototype should be able to be tested in a real setting, hence in an in-situ environment. In that way, the complexity and richness of the real world [RCT+07], where the actual experience takes place, are integrated in the design.
In contrast to the Experience Story, the storyboard, and the mock-up, the prototype is intended for a more active audience. It should thus support active participation with the aim to provide a relevant subjective experience through the technology [BS00]. The creation of prototypes that enable the participants to relive an experience is "...less a set of techniques, than it is an attitude" (p. 425 in [BS00]), as Buchenau and Suri argue. They elaborate that creating such a prototype "...requires hybrid and overlapping skill-sets such that it is not exclusive to any single design discipline" (p. 431 in [BS00]). Moreover, the functionality of the prototype, the degree of context, and the explanation provided to the participants to frame the experience depend on the experience and on the participants [BS00]. To give an example, the designing of a relatedness experience demands an intimate atmosphere, as this is essential to live through the relatedness experience.

2.3.4 Evaluating the Designed Experiences

After designing an experience through technology with an in-situ prototype, participants live the experience. The participants' experience during the interaction with the created prototype is to be analysed and subsequently compared to the experience as defined in the Experience Story (see Section 2.3.2).
To this purpose, the experience designed through technology is analysed by the same tools and methods as used for the design step of the analysis (see Section 2.3.1). Thus, the Narrative Episodic Interviews are called to action again, in order to gather information on the experience in a

holistic way. Additionally, with the help of the need-questionnaire and the PANAS additional data is gathered to verify if the intended psychological needs have been addressed and if the intended emotions have occurred.

Interpretative Phenomenological Analysis (IPA)

An addition method, the *Interpretative Phenomenological Analysis*, helps to analyse the phenomena of the experience in its context. In their book, "Interpretative Phenomenological Analysis," Smith, Flowers, and Larkin describe the IPA as a method for a detailed qualitative analysis of peoples' experiences [SFL09]. Furthermore, IPA is presented as an approach, "...to qualitative, experiential and psychological research which has been informed by concepts and debates from three key areas of the philosophy of knowledge: phenomenology, hermeneutics and idiography" (p. 11 in [SFL09]).
By being phenomenological, the IPA is focused on the experience and its perception. Thereby, also the context of an experience becomes relevant, because people are not isolated but "embedded and immersed in a world of objects and relationships, language and culture, projects and concerns" (p.21 in [SFL09]). Smith further argues, "In IPA research, our attempts to understand other people's relationship to the world are necessarily interpretative, and will focus upon their attempts to make meanings out of their activities and the things happening to them" (p.21 in [SFL09]). As a theory of interpretation, Smith chooses to use hermeneutics. Following Heidegger, "IPA is concerned with examining how a phenomenon appears, and the analyst is implicated in facilitating and making sense of this appearance" (p.28 in [SFL09]). Another influence of IPA is idiography, which is concerned with the particular [SFL09]. This is in contrast to the nomothetic approach of psychology, which is concerned about the establishment of general laws for human behaviour. As Smith describes, "This emphasis on the particular (and the focus on grasping the meaning of something for a given person) cannot be conflated exactly with a focus on the individual even though this may appear to provide a convenient shorthand for what idiography does" (p.29 in [SFL09]). The focus of the particular is two-level [SFL09]. On the one hand, it is on the sense of detail, which offers depth to the analysis and requires a thorough and systematic analysis. On the other hand, the focus of the particular is on the perspective of particular people and particular contexts, which require, "...small, purposively-selected and carefully-situated samples, and may make very effective use of single case analyses" (p.29 in [SFL09]).
By the application of IPA, gathered experiences are analysed in an iterative and inductive circle following different strategies, as Smith et al. elaborates. One strategy consists of a close line-by-line examination of experimental claims, concerns, and understandings of each participant [SFL09]. Another strategy is built upon the identification of patterns emerging from the experimental material, developing a dialogue between researchers, their data, and their psychological knowledge about, e.g., the reasons of the concerns of the participants. Another strategy is the development of a structure, frame or gestalt, which illustrates relationships between themes. Furthermore, Smith et al. initiates six flexible steps to apply IPA. These are described in the following:

1. *Reading and re-reading*
   Reading the script over and over again and letting the participant become the focus of the analysis.

2. *Initial noting*
   Analysing not only the semantic content but also the language on a highly exploratory level and noting with an open mind everything of interest.

3. *Developing emerging themes*
   Reducing the volume of the detail but keeping the complexity of the data.

4. *Searching for connections across emerging themes*
   Searching for connections by using abstraction and subsumption.

5. *Moving to the next case*
   Taking the ideas of the first case into account and moving on to work on the second one (if this is not a single-case study).

6. *Looking for patterns across cases*
   Identifying connections between cases, which can lead to illuminating a different case.

After having completed these steps, Smith et al. recommend to go deeper into the interpretation by taking more experiences. Moreover, they argue that it is important to note doubts (e.g., through psychological theories) only in separated abstracts.
When working with large samples (bigger than six) the focus switches from themes in single cases to themes in the whole group, looking for patterns and connections between all cases. Smith et al. further argues that it is important to measure recurrence, e.g., by counting how often a theme is talked about [SFL09].
As the IPA is a method focusing on the impact of something in a real life environment, it is used to analyse the impact of a prototype that is created to trigger experiences in situ. Thereby, it can be possible to link design decisions to their experimental consequences [LHB+13].

II

Experience Design Beyond the Driving Task: Design Cases

Chapter 3

Design Cases:

Experiences on Group Drives for Pleasure

As mentioned in Chapter 1, this work focuses on experiences beyond the driving task, either on group drives with friends for pleasure, or on commuting alone. These situations do not define a design space for experience beyond driving, but they are common opposing situations in this design space. Both of the situations can create positive experiences based on their unique characteristics. The experiences designed in this chapter are connected to driving together with friends for pleasure. Driving together with friends contains possibilities for social experiences, in the sense that one wants to feel part of a group and feel close to loved ones. When driving across mostly unknown roads, cruising around can become an exploration experience.
This Chapter shows two cases of designed experiences for driving with friends on an unfamiliar route. The first design case, *CliqueTrip*, takes place in the scenario of driving with friends in a motorcade. This system aims to foster the relatedness of the group of friends even when separated into different cars. The second design case, *ExplorationRide*, takes place in the scenario of exploring new areas by car with a group of friends. This case is designed to provide the mood of exploration and to make the exploration trip a positive joint experience.
In each design case, possibilities for experiences are first collected and analysed. Following that, a story is written as a blueprint of the design experience. After creating an experimental prototype, a respective summative in-situ user study analyses the experiences the participants lived through. Later on, in Chapter 4, a best practice and recommendations based on these case studies are presented.
Through creating insights and generalisable knowledge the design cases help to understand and better design such experiences. Therefore, different experiences are created and illustrated from the analysis to the experience that the participants live through during interaction with the system. First of all, Section 3.1 shows a design case of feeling related despite distance while driving in a group with more than one car. Afterwards, in the second design case, presented in Section 3.2, the designed experience fosters exploration through a group drive with friends.

3.1 Mastering Distance in a Motorcade: Let the Whole Group be Close

This section is based on the paper "*CliqueTrip*: Feeling related in different cars" published in 2012 by Martin Knobel, Marc Hassenzahl, Melanie Lamara, Tobias Sattler, Josef Schumann, Kai Eckoldt and Andreas Butz [KHL+12].
Tobias Sattler implemented the mock-up and the prototype under my supervision.
This design case takes place in the first situation of driving together with friends. The aim of this design case is two-fold: first of all, it explores the designing of experiences in practice, and secondly, it examines the designing of an experience in the specific scenario of driving together with friends in a motorcade.

3.1.1 Social Experiences While Driving in a Group

Positive experiences happening within a group, like driving in a motorcade, are strongly connected to social aspects. According to the psychological need of relatedness (described in Section 2.3) there are different possibilities for fulfilling this need. According to Sheldon et al. [SEKK01], relatedness is addressed through the following statements: (a) "A sense of contact with people who care for me, and whom I care for", (b) "Close and connected with other people who are important to me", and (c) "A strong sense of intimacy with the people I spent time with" (p. 328 in [SEKK01]).
The first of the authors' statement (a) points to being part of a group. The other aspects (b-c) are summarised as closeness among people, what Hassenzahl describes as "Feeling that you have regular intimate contact with people who care about you [...]" (p.46 in [Has10]). To reach the fulfilling of the psychological need of relatedness, Hassenzahl and colleagues find six different strategies to follow, which help to categorise concept ideas and experience reports (see [HHE+12]):
(1) Awareness (generating the feeling of cognitive awareness and continuity)
(2) Expressivity (creating things that provide the affective and emotional aspect of intimacy)
(3) Physicalness (providing the feeling of physical intimacy)
(4) Gift Giving (sending gifts for demonstration of caring and valuing of other persons)
(5) Joint Action (carrying out an action together)
(6) Memories (recording moments of relationships and past activities)
Looking back into positive social experiences in the context of cars, there are many social experiences between participants within a car or even extending beyond the internal space of the car.

Relatedness Experiences Within the Internal Space of a Vehicle

One example of a designed social experience within a vehicle is, "The Car as Musical Instrument," (see Figure 3.1), in which Eckold and Schultz build a social relatedness experience by constructing

The Car as a Musical Instrument

The internal space of a car is perfect for group activities, where in this case making music enables the creation of positive emotions.

Eckoldt and Schulz installed electric drum pads in the interior of a car. This fosters a very interactive social experience as communication is built up between all passengers in the car, including the rear seat passengers, and generates moments of social interaction.

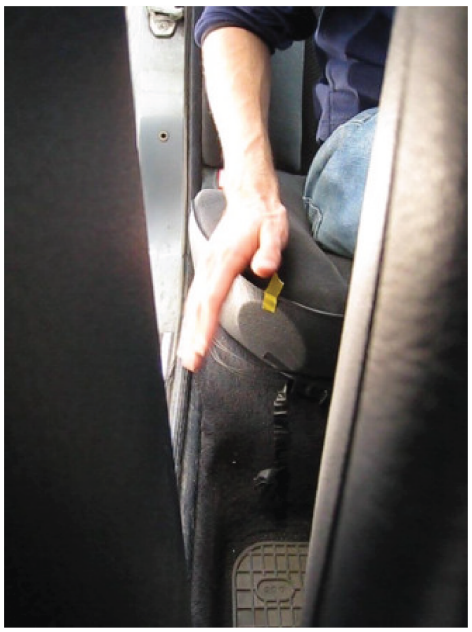


Figure 3.1: The car as musical instrument: by Eckoldt and Schulz (figure from [ES09]).

electrical drum pads in the interior of a car [ES09].
Thanks to the strategy of Joint Action a relatedness experience is created among the music performing passengers in the car. Playing with the internal space, drum pads are distributed at different positions in the interior, and some are only reachable from certain positions in the car. Thus, music is performed in more various ways when all drum pads are used by the different friends placed throughout the vehicle.
This example shows a playful practice of a joint action through a common musical interaction where every group member can join.

Relatedness Experiences Beyond the Internal Space of a Vehicle

The "Hocman" system is an example of a relatedness experience that goes beyond the physical space of a vehicle [EJO04] (see Figure 3.2). This system for motorcycles has the possibility to create relatedness experiences between passing bikers. Here, positive experiences are created by connecting individual bikers to other members of the biker community. The strategies towards relatedness in this example are categorised as Awareness, Joint Action, and Memories. As to Awareness, the bikers are cognitively aware of each other by sharing information about themselves and their similar interest in their bikes. Also, the bikers have a Joint Action because the exchange of information only takes place if they both use the system and pass it to each other. Therefore, joint action is required to enable the resulting experience. Furthermore, the bikers create Memories, which they can share through the exchanged data stored in a log file where the information

Hocman
The passing of bikers on the motorway becomes a social event through the exchange of a personal html page including a photo of the motorcycle and the driver's contact information among other details.

The Hocman system enables a "Joy While Driving" experience by appreciated soundclips and inspection logs of the bikers passing by. The information provided about the bike and the driver creates the possibility for bikers to "…express identity and community membership" (p. 98).

Through this exchange of personal data, the system has the ability to provide "…arrangements to increase social interaction"(p. 98). The saved log provides a retrospective memory of the moment of passing by.

Figure 3.2: Hocman: Associating motorcycle ethnography with design by Esbjörnsson and colleagues (figure from [EJO04]).

is available later on. If this results in a social interaction afterwards, enabled by the sharing of personal information, the log-file will serve as a memento of the first meeting.
The "Hocman" example shows an interplay of the group belonging of bikers. Beyond relatedness they express identity through their created data which they share with others. The bikers find similarity with this concept (e.g., type of motorcycle or even same home town), which fosters social interaction. The bikers do not meet afterwards as strangers, instead, they are bikers with something in common, hence, in some way members of the same group.

3.1.2 Gathering and Analysing Past Experiences While Driving in a Group

In order to design an experience for relatedness while driving in a group, first of all, positive experiences of this special focus are collected as they provide insights for the design later on.

Collecting and Analysing Past Experience

In-depth narrative interviews are the most promising method to collect unique and subjective social experiences (see [LK11]). Experiences are gathered of the participants' need of relatedness becoming fulfilled by the feeling of being part of a group, as well as by feeling close to persons they care for, in a car related environment. With a semi-structured guideline for interviews based on Murray's narrative analysis [MCRY03] and his episodic interviews [Mur08], the interview has a less abstract level, which leads to more detailed narratives of the participants' experiences (see p. 103 in [Mur08] or Section 2.3.1). Furthermore, participants have to be in a suitable atmosphere to speak about their experiences. One possibility to set up a friendly atmosphere is to bring the participants into the actual setting, in this case, to conduct the interview in the car (as seen in Section 2.3.1) so that the participants are able to relive their experiences with the aid of the supportive conversational atmosphere and memory activation ([MR02], or Section 2.3.1).
After the interview is started with relatedness experiences in general, it continues with experiences while traveling in general and then proceeds to experiences while traveling in a car specifically. Finally, it is also asked about experiences mediated by technical devices.
In a pilot interview it was recognised that participants felt overwhelmed to be asked about their experiences and did not know exactly what was meant by "experience" in this context. Furthermore, the interviews were conducted in German, and the German term for experience, "Erlebnis," has the connotation of an exceptional experience. For this reason, the German term for experience was avoided and the expression "meaningful situation in everyday live" was used instead. The term "relatedness" was also exchanged for "feeling part of a group" and "feeling close to a significant other."
One example of the experiences collected through these interviews is narrated as follows:

> *Stop at the Return Journey*
> "[...] It was the last evening of the holiday, we were at a camping site and for a last time all cooked together for the next day's return journey. [...] On the next day, we drove until sunset, still hours away from home. We stopped next to a country road. We drove the cars with the trunks together, and sat on the trunks. [...] We were sitting together as a group after two weeks of wonderful vacation. [...] Out of two boxes, we all ate the chili con carne we had prepared together and which we handed around. This was positive for the group spirit. [...] It was like a nice goodbye ritual." (P14)

This example shows the character of the gathered relatedness experience while traveling by car. They are human experiences not focused on technology.
To gain a deeper knowledge about the collected experiences the lead of Hassenzahl and colleagues was followed [HDG10] who, like Sheldon [SEKK01], use the PANAS-X, a more detailed version of the PANAS (60 items compared to 20) [WCT88], to collect additional information about the gathered experience. The PANAS-X supports the results with a positive - negative dimension

PANAS-X(No. of items)	N	Mean (SD)	95 % CI	
			Lower	Upper
General dimensions				
PA (10)	21	2.86 (0.46)	2.65	3.07
NA (10)	21	0.24 (0.17)	0.16	0.31
Specific emotions				
Joviality (8)	15	3.48 (0.36)	3.28	3.68
Attentiveness (4)	15	2.83 (0.40)	2.61	3.05
Self-Assurance (6)	15	2.03 (0.70)	1.65	2.42

Table 3.1: Results of the PANAS from the gathered past experience: Participants (N) and mean intensity of selected PANAS-X scales (standard deviation, 95% confidence interval), five-point scale from 0 – not at all to 4 – extremely (table taken from p.31 [KHL+12]).

of the collected experiences [WCT88]. Furthermore, the German translation of the (expanded) PANAS questionnaire supplements additional subscales, which distinguish between specific emotions (joviality, self- assurance, attentiveness, fear, hostility, guilt, sadness) and affects (shyness, fatigue, serenity, and surprise) [WCT88], [RG03]. Finally, the fulfillment of psychological needs is analysed. Therefore, the three different describing sentences of every tested psychological need are used for ranking, a procedure derived from Sheldon et al. (p. 328 in [SEKK01]).
In the analysis, aside from relatedness the tested needs were autonomy and competence. These three needs were selected because they together define all dimensions of psychological needs of the self-determination theory from Rayn and Deci [RD00].
21 participants (nine female, twenty in the age between 20 and 30, one between 30 and 40) were interviewed, reporting one or two experiences per person, which resulted in a total of 26 different reported experiences. During the main part of the interview, five experiences were collected, fifteen related to cars and six technology supported ones. To analyse the participants' emotional state in detail, the PANAS-X was used after the sixth interview.
The result of the questionnaires was that positive affects are significantly higher due to the collected experiences (see Table 3.1). Joviality, attentiveness, and self-assurance were the most dominant emotions. Also, the most prominent affect items were analysed, which in comparison to the average ($M = 3.39$, $SD = 0.36$) differed significantly from the general positive affect (PA) ($t = 6.29$, $df = 15$, $p < .001$, $d = 1.37$, two tailed).
The following items were used later on as emotional descriptors for the Experience Story: "cheerful," "delighted," "happy," "excited," "joyful," "enthusiastic," "interested," "energetic," "attentive," and "alert." As expected, the psychological need of relatedness was significantly more dominant ($M = 3.35$, $SD = 0.73$) in comparison to competence and autonomy ($M = 2.55$, $SD = 0.75$), ($t = 3.80$, $df = 20$, $p < .01$, $d = 1.04$, two-tailed), and all gathered car related experiences fulfilled the need of relatedness.

Preparing the Experience Story: Getting the Essences of the Collected Experiences

To prepare for writing the Experience Story the complexity of the single collected experiences has

to be reduced to a minimal set of essential insights [Has10]. The essence of the experience, called the experience pattern by Hassenzahl, can be used "... as a way to reduce the gap between needs [in this case to design for relatedness] and a specific product experience. [...] By that, it [an experience pattern] becomes a blueprint of various positive experiences and serves as a 'molding form' for shaping an experience" (p. 70 in [Has10]).
After sketching out the scenario, a concrete setting is created in which the designed experience takes place. Collected experiences from that scenario are analysed as to how psychological needs were fulfilled, which requirements were necessary for the experience, and which feeling was evoked by the participants. These insights are defined later on through the Experience Story.
Fifteen experiences relating to a journey in a car were collected, which did not all take place in the same scenario. For example, one group had a prominent unusual artifact in their car (a giant chocolate easter bunny) placed in the front passenger seat. While driving the group of friends in the car received attention from outside by other drivers. This evoked a social interaction within the car and led to the fulfilling of relatedness. It also plays with the reactions of persons outside the car stimulated by the easter bunny. Such an experience can foster group belonging by being a part of the group in the car with the prominent unusual object. The passengers in the car can feel close to each other from the triggered social interaction through the outside reactions. Above that, stimulation is a psychological need, which is fulfilled for other drivers because of the novelty effect, that is, were they constantly noticing unusual objects in cars, they would no longer find them stimulating. Also, the passengers in the car with the object can become bored of stimulating others.
Due to such scenarios not being convincing in terms of experiences, a different scenario of a motorcade journey was chosen in which four of the overall fifteen collected car related experiences occur. Driving in a motorcade on a journey includes the common drive of friends, is car related, and contains no technical support nor special scenario at this time. Two reported experiences were collected where the participants felt close to other members of the group, even to those in another car.
One of the collected experiences in this context is the following:

Walkie-talkie:
"In the wintertime of 2002, I drove with twelve friends to Norway for the New Year holidays. We rented two minivans. So at the beginning of the journey we had to decide with whom to drive for the next day. We had not seen each other for a long time and we had a lot to talk about. But we had to split up. We drove to Norway in two different vans, each equipped with a walkie-talkie. We could communicate when we were close to each other on the road. To be able to communicate, we had to do something - we had to earn it. One time we didn't pay attention to the walkie-talkie, and the car I was sitting in was driving way in front vehicle. After some time we suddenly heard our friends on the walkie-talkie, just before we saw them. It felt as if they had been sleeping in the back of the car and had then woken up. It was as if we were all

traveling together in one big group. The cars did not separate us." (P21)

As an important insight, this experience report shows the overcoming of physical separation by a verbal communication through walkie-talkies. This communication line being restricted by distance, it was used not to deliver communication, but rather to listen to the other group and take part in their conversation.
Another story, in which the participants use paper notes for communication, is of a similar essence:

Communication with Notes:
"We all drove to France on vacation in two different cars in a motorcade. To communicate, we wrote little notes on paper [and held them against the window]; this was fun." (P4)

As in the walkie-talkie story, the participant here speaks about a limited communication channel for which to function the cars had to be close in space, however, in this scenario the communication was restricted to the length of messages.
In both stories, the passengers had to put effort into the communication (P21) resulting in the communication becoming more valuable. Beyond that, the passengers of the separated cars had to work together as a group to overcome the separation.
Other reported experience mentioned the interplay of finding and locating the other car as important to the feeling of being one group:

Happy to be Close Again:
"I went on a weekend trip together with a couple of friends. We used two cars for the trip. On the highway, we quickly lost sight of the other car. A couple of hours later, a short time before we had to leave the highway, I suddenly saw the other car again. I was surprised, because I didn't expect the others to be that close to us. I was happy, took my mobile out and called a friend in the other car. They were also happy to be close to us again." (P19)

In this experience, it is due to the pleasure of finding the related car and of being able to estimate its location that the separated groups become as one again.
The same phenomenon was analysed in the next reported experience:

After the Wedding:
"After a wedding celebration, the guests all said goodbye to each other and took off in their cars - each one heading for different cities in Germany. None would have expected to see each other again. But as we drove to a rest area, there they all were

> again, unexpectedly stopping at the picnic place, in the very same moment! We all were very pleasantly surprised about our reunion!" (P21)

All four reported experiences together result in one scenario, a motorcade of a group of friends driving together but separated by the internal spaces of different cars. Through the reported experiences two experience patterns to overcome this separation were identified, leading to a social experience on the conjoined journey.
Pattern (1): For a limited communication channel, the focus should not be the exchange of information, but rather the enabling of the group members to express emotions within a conversation [KLN+05]. Thus, the existence of a limited communication channel ties in with Expressivity.
Pattern (2): The ability to estimate the location of the other car is, according to the categories of Hassenzahl and colleagues, about Awareness: being aware of the others' position [HHE+12] should lead to the feeling of group belonging across the separation of different cars.
The strategy resulting from Pattern (1) is to initiate a communication channel dependent on the closeness in space of the cars involved. Another strategy based on Pattern (2) is to enable to estimate the location of the other car.
The practices described in the experience patterns become a blueprint for the experience to be designed later on. The insights from the analysis are taken into account to compose an Experience Story, which is used later on as a construction plan for further design steps and as a communication tool within the interdisciplinary experience design team (see Section 2.3.2).

3.1.3 Creating the *CliqueTrip* Experience with a Story

For composing the Experience Story (see Section 2.3.2), the insights from the design step of the analysis provide essences, which the Experience Story can mediate in a specific way. These can be condensed into the following headline for the Experience Story:
"*CliqueTrip* provides the experience of being one group even when traveling in separate cars – as if the interiors of the cars unite."
To create this experience, *CliqueTrip* offers a communication channel that is restricted and needs some effort to be established and maintained. In addition, "*CliqueTrip* plays with the tension between the feeling of separation and closeness" (p. 32 in [KHL+12]).
Taking into account the most dominant emotions from the reported experiences from Section 3.1.2 ("cheerful," "delighted," "happy," ...) the Experience Story is written from a user's point of view. As discussed in Section 2.3.2, the focus of the Experience Story lies on the experience as well as on the psychological needs to be fulfilled. It is the fulfillment of the needs that triggers the positive emotions and motivates the actions of the user. The created story of this experience takes place in the scenario of a motorcade. Six friends are on a journey together to a common destination. They are separated by traveling in different cars, but the system helps to overcome this and enables a relatedness experience based on the headline mentioned above.

> *CliqueTrip*: The Experience Story
> Max, Sarah, Marianne, Martin, Monica, and Matthias have known each other for ages. Lately, they don't spend time together as often as before. But one event is always fixed: each year they visit their favourite city in a group - Paris. As usual, they go there in two cars. This year, however, something is different. Max invites all of the friends to the trip via *CliqueTrip*, a new app he wants to try out. This app promises to make its users feel close to each other, even while driving in two different cars. All of the friends are excited to test *CliqueTrip* because they dislike the feeling of being separated during the trip. It is time to depart. Max is driving one car, Sarah the other. Sarah is a very sporty driver (some say reckless) and Max drives very relaxed (some say painstakingly slow). Consequently, they tend to lose each other on the motorway, with Max getting more and more behind. But *CliqueTrip* helps out. It changes the navigation system so that Max (in the rear car) is guided to Sarah (in the leading car). Sarah is taking the scenic route. "Good choice," Max thinks. He announces, "I guess the others plan to visit the nice little café in the city centre of Reims. Let me try to catch up." He does, and when the cars are close to each other, *CliqueTrip* opens a communication channel. They can now talk to each other, as if sitting in one car. "Hey," Max yells, "I hope you are not planning to have a first glass of Champagne already? I am driving! (p. 32-33 in [KHL+12])

The Experience Story describes that the friends lately do not spent much time together, therefore the group has the motivation to exchange thoughts and stories. After they lose each other due to Sarah's speedy driving the group behind is guided to Sarah's car and the group in the rear car can estimate the position of the friends in Sarah's car. As both cars come in close proximity the communication channel supports the feeling of being together as a whole group.

3.1.4 Designing the *CliqueTrip* Experience through Technology

This Experience Story is further divided into single interaction steps. Afterwards, different design solutions are tested through a mock-up before implementing a working prototype, which triggers the experience through the interaction of participants in a summative in-situ evaluation.

The *CliqueTrip* Storyboard

The storyboard (described in Section 2.3.3) is used to visualise the story, but also to create awareness of the Experience Story's interaction steps within the key frames. No technical

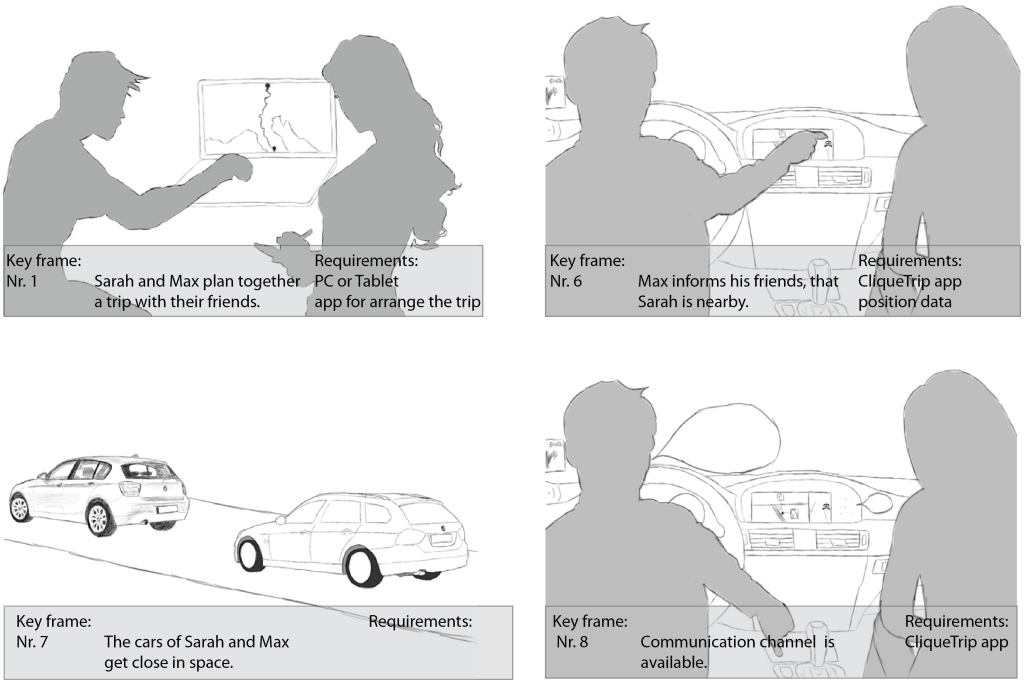


Figure 3.3: Example key frames from the *CliqueTrip* storyboard (illustrations by Tobias Sattler).

solution is given, whereas technical requirements are still taken into account (see Figure 3.3). The storyboard works in addition to the Experience Story and helps to identify different aspects of interaction mainly with the purpose of communication within the design team.
Figure 3.3 shows the first key frame, which constitutes the planning of the trip. After meeting and beginning the trip together the distance between the cars increases. At this point, the system assists the rear car to find the front one by navigating towards it. Key frames 6 to 8 in Figure 3.3 show the navigation and the communication of the *CliqueTrip* system, once in close proximity.
All representations of the experience so far, that is, the headline, the Experience Story, and the storyboard, are experience prototypes. This is in line with Buchenau and Suri who explain, "[...] an Experience Prototype is any kind of representation, in any medium, that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing" (p. 425 in [BS00]). This storybord serves as a guidance for the designing of experiences by an interaction system enabling the realisation of the designed experience.

The *CliqueTrip* Mock-Up

To make the designed experience more realistic a more material representation is needed. Before building a fully functional prototype, mock-ups are created to simulate parts of the experience

Figure 3.4: Mock-up of the smart phone app: Adding one friend to the trip as an example.

through interaction products. As seen in the Experience Story and in the storyboard, the system is implemented within the car (for the navigation and communication) and outside the car (for planning the common trip). Thus, the system presented within the mock-up is twofold, requiring both an app for arranging the trip and an app within the infotainment system of the car, which enables the communication and the navigation. The aim of the implemented mock-up is to compare different design ideas as a step towards the fully functional prototype, which is designed later on.
The planning app was simulated as a mock-up of a smart phone app implemented in Adobe Flash. A smart phone app is chosen for this purpose, so that the friends can plan the cruise and invite their friends without needing a computer. Hence, planning can happen spontaneously and without much effort. With the smart phone app one friend can select the starting point, the destination, which cars are involved as well as which friends shall become part of the group (see Figure 3.4). After arranging the trip with the mock-up of the smart phone app a mock-up of the app within the car infotainment system is implemented, also as an Adobe Flash application functioning within a browser. This mock-up presents different design ideas, which can be compared through interaction with the mock-up of the in-car app. Figure 3.5 shows the mock-up's first interface of the *CliqueTrip* system. On the left side of the display, on which the *CliqueTrip* system is shown the functions of the infotainment system are indicated. In the centre is a map for navigation. When in the leading car or when driving next to one another the navigation guides towards the destination of the journey (see 3.5 Panels a) and b)). For the rear car the navigation guides towards the leading car (see 3.5 Panels c) and d)) in order to maintain a common route, just as in the story when Sarah drives ahead. On the right side of the display, signal beacons show an approximation of the proximity of the vehicles. If the communication channel is open, the other car is seen from the top with the passengers inside (see 3.5 Panels b) and c)). If the communication is lost, the signal beacons disappear and the other car is seen from the front, in the case of the own car leading (see Figure 3.5 a)), or the car is seen from the back, in the case of the other car leading (Figure 3.5 c)).
This interface mock-up is informally evaluated through design reviews. A number of changes are adopted into the system based on the experience defined through the Experience Story and story-

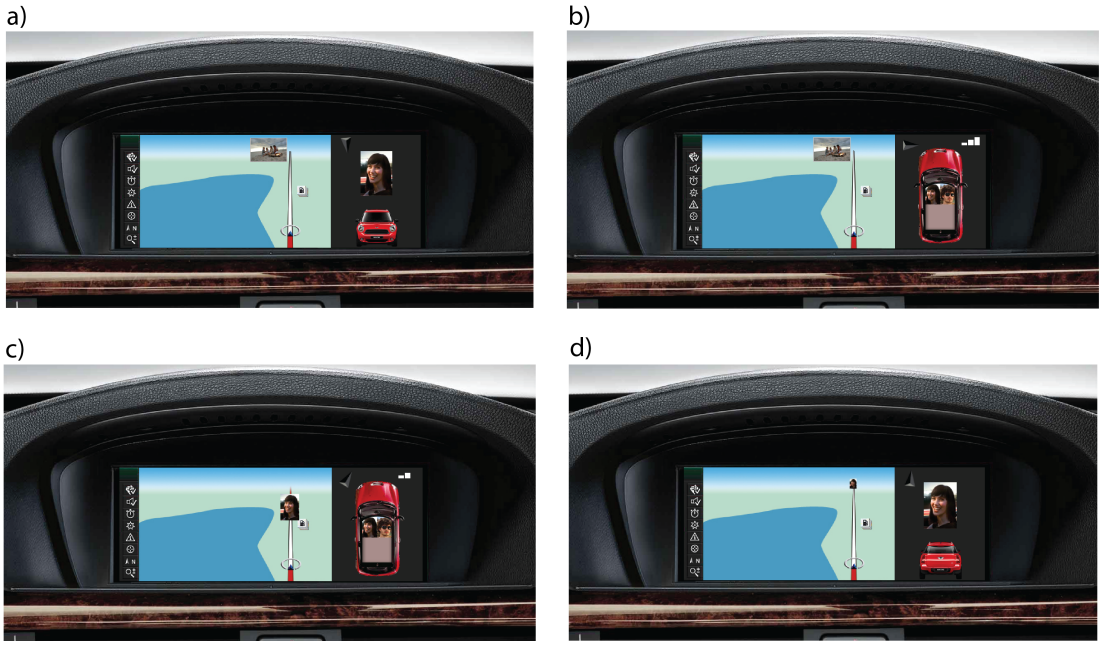


Figure 3.5: Mock-Up of the app within the car infotainment system: a) sitting in the leading car guided to the destination; b) cars driving next to each other, communication channel is available; c) sitting in the rear car guided to the leading car; d) sitting in the rear car, communication channel is not available.

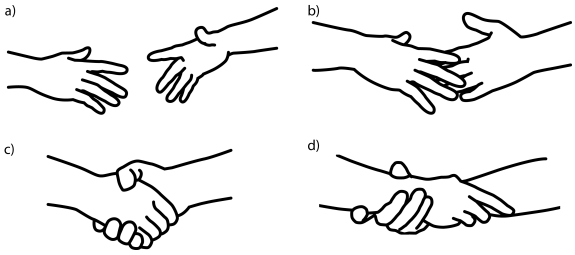


Figure 3.6: Distance indicator of the *CliqueTrip* System.

board. One example of a change is the distance indicator. Signal beacons are a technical solution common in the mobile communication, but the distance in the *CliqueTrip* experience is more about feeling close to the people in the other car and belonging to the same group. Therefore, a more appropriate visualisation was chosen for indicating the distance between the cars. Figure 3.6 shows, in Panel a), the icon for losing communication with the other vehicle, and in Panels b) to d) the indicator for the enabled communication channel depending on the distance between the cars. Aside from this indicator, other parts of the visualisation were changed, such as the distance indicator for the navigation. In the original version, as seen in Figures 3.5 a) and c), on the right hand side of the

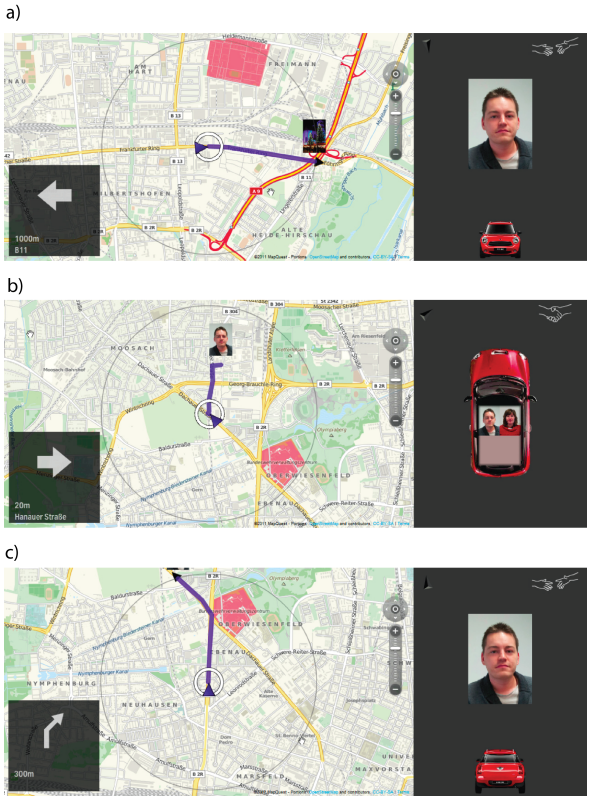


Figure 3.7: The interface of the fully functional prototype of the *CliqueTrip* system: Panel a) shows the system from the perspective of the leading car; Panels b) and c) show the display from the rear car.

display an image of the driver is shown above the car, which is seen from the front or back depending on if the other car is leading or not. This image of the driver was used to indicate the distance by getting smaller or larger depending on the distance. In the final prototype, an adjustment was made to shrink and rise the representation of the other car, instead of the driver. Furthermore, there were also technical reasons for changing the interface of the final prototype. For example, the API, used to implement the prototype was only providing a two-dimensional map[1] (see Figure 3.7) as opposed to the three-dimensional map depicted in the centre of the display in Figure 3.5.
The final prototype was represented in the mock-up and implemented as a smart phone app for the appointment of the friends before they start the trip, and as an app within the car.
The smart phone app was implemented as a web application using HTML and Javascript on the prototype device, which had an Android as operation system. The user interface elements were

[1] The API used for implementing the map in the prototype was OpenStreetMap (for more information see www.openstreetmap.org)

Figure 3.8: One fully functional prototype implemented in both cars.

jQuery mobile framework[2]. A server was utilised to deal with the communication of the position data using the AJAX functionality of jQuery. The smart phone was also communicating with the server using PHP, so the trip details, friends, cars, and starting time were thereby stored in the MySQL database of the server. For the guiding destination an address was translated into a GPS coordinate. Therefore, the server communicates with MapQuest's Search API called Nominatim, which again uses OpenStreetMap[3] as a provider for the position data. The app within the car was implemented on a PC inside two cars, installed in the trunks, and connected to the dashboard (see Figure 3.8) so that all passengers are able to see the screen. The application running on the PC in the trunks was written in Adobe Flash with ActionScript 3. To gain accurate positioning for each car the application had access to the car's CAN-bus [fS03] Here, the signal from the GPS system of the car is used to determine the vehicle's own position in the navigation system. Furthermore, the GPS signal of the CAN-bus was forwarded to the server. The position of each car was collected by the server and forwarded to the other car, in order to be able to show the position of both cars and calculate the distance between the cars in each application. MapQuest's OpenDirections API was used for routing and guiding (the front car was guided to the trip destination, the rear car guided to the front car). The routing was constantly recalculated based on the continuously collected GPS positions. For guiding a box was displayed before the next turning point. The information provided by this box was the distance to the next turning point, a turn sign, and the name of the street to turn into.
In an early test of the fully functional prototype the communication channel had a delay. Taking this into account, the communication channel was ultimately implemented using a peer-to-peer connection between both cars. The service Adobe Cirrus established the connections.
This prototype environment consisting of two cars with the *CliqueTrip* system (for special naviga-

[2] for more information see jquerymobile.com

[3] http://www.openstreetmap.org/

tion and communication) and a smart phone (for arranging the trip) was later used for the summative evaluation.

3.1.5 Evaluating the *CliqueTrip* Experience In Situ

In order to verify the *CliqueTrip* system and to further analyse the intended experience described in the Experience Story a real-life environment is needed. The evaluation concerns the experience, emotions, and the dominant psychological need, the need of relatedness. A successful evaluation supports the here presented practical approach for the creation of experiences and emotions through stories.

In Situ Evaluation of the *CliqueTrip* Experience

To obtain a real-life environment groups of real friends were brought together to use the system on a day trip to a destination of their choice within a distance of 200 km (ca. 125 miles). For this, three groups of real-life friends were enlisted (N = 13, seven male, six female, age between 20 and 50). Before the start, each group was given a small introduction to the system, i.e., a description of the navigation and communication. Then, each group used the smart phone app by which they selected the passengers (user accounts had already been established by this time) and the destination. The system was turned on and ready to go when they got in their cars. The groups picked a driver for each car and drove to the destination using the *CliqueTrip* system, with two or three participants as well as one member of the design team for the evaluation in each car.

After the trip, during which the groups had been separated, they were reunited in personal at the destination. It was only after the participants had had some time to arrive that semi-structured narrative interviews were conducted individually with each participant. The interviews were conducted in the car and documented by video recording. The member of the design team interviewed those participants that they had not been driving with, in order to avoid the influence of familiarity. To take the experiences into account that happened during the user study the following questions were posed:

"During the last two or so hours, did you experience a situation you would describe as rather meaningful or unique? Could you describe this situation in more detail? What thoughts did you have? How did you feel?" Further questions focused on the specific experiences within the car while using *CliqueTrip*. Based on these experiences the participants filled in questionnaires for additional information about the collected experiences. For this, the German translation of the PANAS-X scales [RG03] were used in order to analyse the emotions and affects that appeared while using the system. Furthermore, the need-questionnaire based on Sheldon et al. [SEKK01] was used, such as in [Has10], to analyse the fulfilling of the psychological needs, in this case, the fulfilling of relatedness compared to the other needs. The same quantitative tools from the analysis phase were used. First, the PANAS-X scales were used for analysing the positive affect (PA), and negative affect (NA), in addition to the joviality, sadness, and surprise as subscales.

To be able to identify if someone felt alone or left out, sadness and negative affects were additionally used. In order to detect the emotions triggered by the novelty of the system and social

PANAS-X (No. items)	α	Intercorrelation	Mean (SD)	95 % CI	
				Lower	Uper
General					
PA (10)	.86	-.01	2.28 (0.66)	1.87	2.70
NA (10)	.65	-.01	0.30 (0.25)	0.14	0.46
Subscales					
Joviality (8)	.86	.13[1]	2.43 (0.66)	2.01	2.85
Surprise (3)	.79	.41[1]	1.50 (0.83)	0.97	2.03
Sadness (5)	.44	.24[1]	0.05 (0.12)	-0.03	0.13

Table 3.2: Results of the PANAS from the *CliqueTrip* user study: Internal consistency (Cronbach's α), scale intercorrelations (mean inter-correlations based on Fisher's Z) and mean intensity of selected PANAS-X scales (standard deviation, 95 % confidence interval), five-point scale from 0 – not at all to 4 – extremely (Table taken from p.31 [KHL+12]).

interaction, surprise was also used. Internal consistency (represented by Cronbach's α) and discriminant validity (scale inter-correlations) were all satisfactory for the small sample size, except for sadness, which had a low internal consistency (see Table 3.2, Columns 2 and 3). The PANAS itself is already a validated instrument (as seen in Section 2.3.1), hence its scales were used.
After the PANAS-X the Need-Questionnaire was used to analyse the needs fulfilled by using *CliqueTrip*. Here, a version was used that is based on the questionnaire by Sheldon et al. [SEKK01], but every scale was improved by two additional items. The used scales from the questionnaire were for measuring the experienced fulfillment of autonomy, relatedness, competence, stimulation, and competition. *CliqueTrip* was used in a real-live environment and not in a laboratory environment, which makes it a multifarious situation with different sources for need fulfillment, e.g., the fact of mobility can lead to autonomy, and the driving task itself can lead to competence. For this reason, these factors were measured in addition to the target need of relatedness. Another need, Stimulation, was detected to differentiate among the positive emotions between relatedness and the novelty of the first usage of *CliqueTrip*. Competition was included for the reason of tracking down misuse of *CliqueTrip*.
As shown in Table 3.3, (see Column 2) the internal consistencies (Cronbach's α) of the scales are from .55 (competition) to .90 (competence). Although the internal consistency of competition was not satisfactory, it was included to the analysis because it was only an added control scale. The original correlations between each scale ranged between a non-significant - .05 and .58. Only the scales of competence and autonomy correlated significantly ($r = .72$, $p < .05$). The general mean inter-correlations were small, between .35 (competence) and .22 (competition) (see Table 3.3, Column 3) showing satisfactory discriminant validity.

Results of the *CliqueTrip* Experience

All interview results were translated form German into English.
The analysis of the qualitative data leads to the assumption that the participants felt related through using the *CliqueTrip* system.
One participant explained:
"We felt kind of close to each other, not like on the telephone. [...] I kind of liked the communi-

Psych. Needs (No. of items)	α	Intercorrelation	Mean (SD)	95 % CI	
				Lower	Upper
Stimulation (5)	.85	.34	3.02 (0.64)	2.59	3.45
Relatedness (5)	.75	.24	2.67 (0.57)	2.29	3.05
Competence (5)	.90	.35	2.11 (0.86)	1.53	2.69
Autonomy (5)	.79	.33	1.55 (0.75)	1.04	2.05
Competition (4)	.55	.22	0.64 (0.56)	0.26	1.01

Table 3.3: Results of the need-questionnaire from the *CliqueTrip* user study: Internal consistency (Cronbach's α), mean scale intercorrelations (mean scale inter-correlation based on Fisher's Z) and mean intensity of psychological needs (standard deviation, 95% confidence interval), five-point scale from 0 – not at all to 4 – extremely.

cation when everybody was chatting, that you didn't hear just a person one to one, but you could witness the atmosphere in the car. [...] that's why the vacation begins earlier. [...] If you go on vacation together you certainly meet at the vacation spot [...]. And here this is beginning earlier, that spirit of community" (P8 Co-driver).
"As if you sat together in a big van, simply [the group of the other car] sitting further in the rear and you sitting in front and then you're chatting together" (P10 Driver).
"Thanks to the communication and the navigation we all drove together. It was a conjoint drive." (Driver 2)
"I had the impression that the interiors of the two cars merged". (Co-driver 1)
The participants were also directly asked about aspects of the design, in the follow up, about the communication:
"Yeah, it was like you're sitting at the table in a group, drinking some coffee and everybody is chatting together. [...] It was a communicative chaos which I found funny" (P8 Co-driver).
"If you drive with a group in more than one car you have to decide who to sit with and who to talk to, because most of the time you spent the whole trip in that one car. This has now been done away with because everybody can talk together" (Co-driver 9).
"...when you talk from time to time, driving isn't that drab. You really feel like you're traveling together, because if you drive one behind the other it is kind of lonely" (P10 Driver).
Further questions concerned the guiding: "It's more like driving together..." (P1 Co-driver).
"I find it actually very good, because when you agree on driving together, I'm more interested in where the other one is ahead of oneself" (P3 Driver).
"...it's again nice to see where the other one is... you see the distance. That's brilliant. It's incredibly relaxing and I think plenty of accidents can be avoided. Simply because you know, he can see where I am and is able to approach and that's really awesome" (P8 Co-driver).
"On the one hand there is of course the vacation spot, on the other hand the other group...it's always interactive with the other group...It's another affiliation than the vacation spot, which is fixed. That's two movements. And that is of course this other feeling in addition. I think it is exciting, it is awesome" (P8 Co-driver).
The quantitative results gathered by the questionnaires supported the qualitative findings. As mentioned above, the used questionnaires were the Need-Questionnaire (see Section 2.3.1) to analyse

the need fulfillment through the experience, and the PANAS-X (see Section 2.3.1) to analyse the needs and affects resulting from the experience.
According to the results of the PANAS-X, joviality (M = 2.43, SD = 0.66) is the most prominent emotion, but all in all the positive affect (PA) (M = 2.28, SD = 0.66) is salient in the *CliqueTrip* experience (see Table 3.2, Column 4). Concerning the Need-Questionnaire, stimulation is the most prominent need triggered (M = 3.02 SD = 0.64) followed by relatedness (M = 2.67, SD = 0.57) and competence (M = 2.11, SD = 0.86) (see Table 3.3, Column 4). But, according to the confidence intervals, the means of adjacent needs did not differ significantly (see Table 3.3, Column 5). The most salient needs other than the target need relatedness were stimulation and competence. Even before relatedness stands stimulation, which is triggered by using products for the first time. Besides relatedness, competence was gathered. Our first assumption was that this is connected to the driving task. Thus, the need for competence was analysed, in particular for the driver but for other passengers as well. The result for the driver were (M = 2.36, SD = 0.74) and other passengers (M = 1.90, SD = 0.97), which supports the assumption of the fostering of competence due to the act of driving. Relatedness was significantly more salient than autonomy and competition (see Table 3.3, Column 5).

Summary and Discussion of the Design Case *CliqueTrip*

The design case had the aim to script and design a specific experience for participants, in the case of *CliqueTrip*, a relatedness experience while driving together in a motorcade, hereby overcoming the distance between different cars through communication and navigation. To this end, experiences were collected that focused on the psychological need of relatedness. These past experiences were analysed and extracted in an experience pattern, which made up the base for the Experience Story, a blueprint of the experience to be mediated by product interaction. An in-situ user study showed that *CliqueTrip* was able to address and fulfill the target need of relatedness through the created experience. According to the qualitative results of the study, participants felt as if they were driving in one group together even though being separated while driving. The quantitative results of the study showed the fulfillment of relatedness, and joviality was proved as a dominant emotion.
The evaluation of *CliqueTrip* is a first approach to gather the outcoming experience of the system. In a real-live environment there are many factors that influence the experience and that can not be gathered, one example being different group constellations. Another influencing factor was that only the first usage of the *CliqueTrip* system was tested, which led to a novelty effect. More groups testing of this system over longer periods of time could produce additional insights about the system and even more meaningful experiences. The intended end-user of the system would be anyone who drives with friends on a joyride in two cars.
The concept is also imaginable for more cars when driving in an even bigger group as well as for drivers driving alone in a motorcade. The users of the system within the different cars should have a social relation in order to participate in the conversation through the limited communication channel provided when the cars are in close proximity. Therefore, the intended end-user will utilise the system to overcome the distance, spending time with friends, and being mobile. The end-user can interact with the system by deciding over the distance between the cars and with it over the communication channel, however, this kind of interaction is reserved to the drivers. *CliqueTrip* is the beginning of an approach to work with the tools and methods from Chapter 2) to include experience in interaction design.

3.2 Exploring While Cruising with Friends

This section is based on the publication "A Trip into the Countryside: An Experience Design for Explorative Car Cruises" by Knobel, Hassenzahl, Schumann, Lamara, Eckoldt and Butz from 2013 [KHS+13]. The navigation of the system presented in this section is based on the patent application PA 2012221305 DE submitted to the German patent office [KS12], by the inventors Knobel and Schumann. The mock-up and the explorative prototype was implemented by Eduard Held under my supervision. As the design case of *CliqueTrip* showed, the designing of an experience is based on the analyses of different past experiences and defined by an Experience Story, in which the essences from the analyses are included. In this design case the aim is to recreate a past experience, namely one based on a childhood memory. This past experience is analysed and recreated through an experimental prototype, which is then examined in an in-situ user study. This design case involves designing for experiences on group drives with friends for pleasure. However, in contrast to Section 3.1 the focus is not only on the friends driving together but also on their pleasure of exploration.
The act of exploration is a task so far not supported by technology in cars. Modern cars provide passengers with comfort through their infotainment system, such as the navigation system, which replaces the hassle of map reading [Red08]. Since navigation systems are designed to find efficient routes from A to B and to provide guiding information in a turn-by-turn manner, exploration as an automotive experience becomes increasingly unlikely. Already in 1947 Max Horkheimer argued, "Our spontaneity has been replaced by a frame of mind which compels us to discard every emotion or idea that might impair our alertness to the impersonal demands assailing us" (p. 98 in [Hor]). This is also the case with modern navigation systems in that they are accurate for direct guiding, but therefore restrict spontaneity and hinder many opportunities for positive experience through exploration.

3.2.1 Gathering and Analysing the Past Exploration Experience

In this specific design case, it is not different experiences that are gathered by participants through reported past experiences, from which then one scenario is chosen. Rather, it is one past experience that is gathered out of a childhood memory, which is then analysed specifically to recreate the past experience in a novel way through an interaction system. Creating an experience based on a specific childhood memory is linked with strong emotional recollections and social connections, such as in the here collected past experience:

The Specific Exploration Experience

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   Exploring with Grandfather
When I was a little boy my grandfather took me on exploration
rides.  Every Sunday, we made a trip in his car.  One time, while
```

> driving through a big forest, we happened to find an adventure playground. Another time, heading towards a castle, we came across a huge dam. Each month, my grandfather ordered a different map of the surrounding area from his automobile club. We took the map and started cruising. These maps were detailed, but covered only limited areas. It happened that certain places my grandfather had heard about were just outside of the area covered by the map. Once, he told me about a bird park, which was said to have a talking parrot. The park lay beyond the range of our map, but I was so excited to find the talking parrot that my grandfather crossed the border of the map. We drove into the wild, risking getting lost but looking forward to discovering new places. For the sake of the parrot we became explorers, adventurers united by challenge and curiosity. From that trip on, we often discovered new sights and spots before we finally arrived at the chosen destination. Later, my grandfather and I reflected, conserved, and collected these experiences. 'Can you remember?', we asked ourselves while looking at Polaroids we took on these trips. We still remember this time we had together even though my grandfather, being 90, suffers from dementia now. (cf. [KHL+12])

This experience has many facets: the stimulation by the surroundings, the exploration of unknown areas, the discovering of things through insider knowledge of the local area, and most importantly a shared experience, which brings people closer together.

In the following, the different aspects of the story "Exploring with Grandfather" are analysed in detail: (1) the trade off between getting lost and finding new places, necessary for an exploration, (2) impulses to leave the intended route, and (3) the fostering of the mood of exploration in a group. Additionally, these aspects are discussed based on systems from academic research and the consumer market.

(1) Exploring Unknown Areas: Trade Off Between Getting Lost and Finding New Places

In the story "Exploring with Grandfather," one main aspect of the experience is to drive into unknown areas outside the boundaries of restrictive maps, but with the ability to turn around and return to the areas marked on the map. The trade-off between getting lost and finding new places can thereby become a meaningful experience. Gaver and Martin wrote a proposal for a system dealing with this situation (see Figure 3.9).

The authors used (De)Tour Guide to conceptually design an exploration system that helps to free users from constrains and provides the right amount of freedom to leave the known path and find new routes and places. As Gaver and Martin's state, "People might sometimes use the device

(De)Tour Guide

"Exploring a strange city (or even one's own), is an enjoyable experience. But maps force a certain way of seeing the city, from the top, as an objective and officially sanctioned network of junctions and road names. The necessity of orientation can interfere with the pleasant feeling of immersion in the city, leading, at worse, to the problem of mistaking the map for the terrain.

The (De)Tour Guide would use audio and tactile prompts to help users navigate the city. The device could use GPS and vector sensors to determine the users' location and orientation, or alternatively prompt the user to capture images of street signs for comparison against an internal database. Based on this information, the Guide would offer an audio commentary about the immediate surroundings, as well as suggestions about routes to follow.

The Guide would permit a variety of functions, from leading users to a designated location to encouraging them to become totally lost in unfamiliar districts. Different tours might be available for the same locations, including idiosyncratic routes allowing users to explore good skateboarding sites, places where ufos had been sighted, or the routes and preferences of a local eccentric." (p. 210)

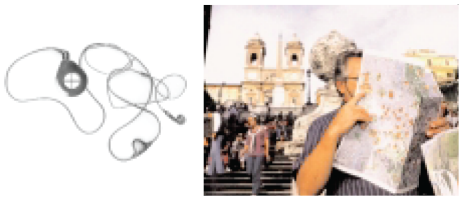

Figure 3.9: The (De)Tour Guide by Gaver and Martin (picture and text from p. 210 in [GM00]).

to get lost on purpose, or to follow the idiosyncratic path of strangers" (p. 211 in [GM00]). Therefore, it is not only a tool for the specific purpose of exploration, rather it materialises experience in a way to support the exploration experience with haptic and additive information for orientation but prevents information that could undermine the experience of exploration, e.g., the feedback of the exact location at all times. This distinguishes the (De)Tour Guide from interactive navigation systems, which support the user with additional information (such as [DW99] providing information for tourists, or [SOA00] providing information in a museum). Thereby, (De)Tour Guide supports the exploration experience by allowing the freedom necessary for the possibility to get lost on purpose, which is one of its aims.

The famous literary scholar De Certeau describes, "It is true that the operations of walking on can be traced on [...] maps in such a way as to transcribe their path [...] and their trajectories [...]. But these thick or thin curves only refer, like words, to the absence of what has passed by. Surveys of routes miss what was: the act itself of passing by" (p. 97 in [dC84]).

With Gaver and Martin's (De)Tour Guide as a leading example of an approach to immerse into an area beyond the common use of map reading, the aim of this design case is to design for experiences focused on exactly this "act itself of passing by" through immersing into the local surrounding while driving. Here, the strategy is to foster the trade off between getting lost and finding new routes through avoiding strict guiding, hence becoming open to explore new places.

(2) Giving Impulse for Exploration Beyond the Intended Route

Besides the above mentioned trade-off, other incentives can motivate the exploration of unknown

"Road Goodies" by Waze app

Waze is a navigation app with additional information provided by and for the user.

Users can warn others in case of e.g. traffic jams or police controls. To update maps a different mechanism is used, one of which is called Road Goodies. Road Goodies is reminiscent of the 1980s video game Pacman by the Japanese company Namco. (www.namco.com). In Road Goodies, Waze provides "goodies" in form of objects such as cherries or a hammer to user's accounts on the way in order to encourage users to improve the map material.

The users are motivated by collecting points while picking up objects. The users with the most points are then rewarded with an Amazon voucher.

Figure 3.10: Road Goodies by Waze.com (figure from [Waz]).

areas. In the experience "Exploring with Grandfather" the impulse to leave the intended route comes from the grandfather's insider knowledge of interesting points in that area (the bird park in the story).

There are already services that help to find interesting places. *Viamichelin.com* provides an offline service for navigation, which not only guides from point A to B on the fastest or shortest route possible but also offers a sightseeing route. By following this sightseeing route the passengers are inspired to stop at points such as scenic views.

However, this sightseeing route is only for places directly on the road but does not encourage taking a detours nor creates a mood of exploration. Furthermore, it is not interactive, hence it does not foster spontaneous trips into the wild for reasons of exploration.

Another system is Road Goodies by the Waze App [Waz] (see Figure 3.10), in which the provided "goodies" motivate the user to take a detour. However, the motivation here is not an intrinsic one as the user takes the detour for the purpose of earning points and the possibility of winning prizes. Such a rewarding system undermines the concept of detours as a method of exploring the surrounding. Also, the extrinsic motivation provided by the "Goodies" can destroy the user's intrinsic motivation, in this case for exploration (see undermining effect [RD00]).

Even though impulses for taking detours are given in this system, it is not the user's intrinsic motivation to explore and find new places that motivates the taking of detours.

Consequently, impulses for exploring new places should trigger the user's intrinsic motivation.

The user should be intrigued about surrounding points of interest, such as the bird park in "Exploring with Grandfather," but without being providing with external rewards. One possible strategy to give an impulse to internally motivate exploration is a map where parts are hidden from view in the first place, but are uncovered through exploration (e.g., [DeL01]). Here, the motivation is to explore the map in order to make it complete, as in a collection.

(3) Getting in the Mood for Exploration in a Group

Fostering the right mood for exploration is important in this case because if shared it can strengthen

The Drift Table

As Gaver and his team describe, "The Drift Table is an electronic coffee table that displays slowly moving aerial photography controlled by the distribution of weight on its surface. It was designed to investigate our ideas about how technologies for the home could support ludic activities - that is, activities motivated by curiosity, exploration, and reflection rather than externally defined tasks.

[...]

Observations of the Drift Table being used in volunteers' homes over several weeks gave greater insight into how playful exploration is practically achieved and the issues involved in designing for ludic engagement" (p. 585).

Figure 3.11: The Drift Table by Gaver and colleagues (picture from [Gra] and text from p. 210 in [GBB+04]).

the feeling of relatedness in a group instead of allowing competition so that the group exploration experience is positive for all the participants. Through a Joint Action (see in [HHE+12]) a common experience can be enabled for all passengers and relatedness can be established. To this end, everyone in the car should be able to participate and the system should encourage interaction between the participants.

An example of exploration experienceable in a group is the Drift Table by Gaver and colleagues [GBB+04] (see Figure 3.11). Here, participants use "...a coffee table that displays slowly moving aerial photography controlled by the distribution of weight on the surfaces" (p. 885 in [GBB+04]). Among others, this supports "social engagement in ludic activities" as everyone is able to participate in the exploration experience. This strategy of involving all participants fosters the mood of exploration in the group.

Insights for the Exploration Story

The Experience Story is based upon the insights from the childhood memory of the described past experience "Exploring with Grandfather" including the deducted strategies, (1) the trade off between getting lost and finding new places, (2) giving impulses for exploration through the possibility of uncovering hidden parts of a map, and (3) fostering a joint exploration mood by involving all participants of a group exploration.

To start with, the grandfather and his grandchild have a fixed appointment for explorations (every Sunday). This stirs pleasant anticipation.

The previously mentioned trade-off between getting lost and finding new places (1) is important to the experience as it provides a stimulation component. While too much and too precise information hinders the excitement of exploration, grandfather and grandchild still need to ensure a way back to familiar territory. This is provided by the map they bring and by making sure not to stray too far from their path.

The maps from the automobile club, which the grandfather obtains every month, give regular new impulses to go on tour. The maps serve as sources of information and are used to gain familiarity with the roads of the area. However, this information is still vague. For example, grandfather and grandchild could have picked the highest hilltop in an area to enjoy the view. While a map might show that there is a hilltop and how it is reached, it certainly does not represent the actual view. Also, the limitations of the maps leave things to be discovered (2) so that what is outside the map becomes desirable and mysterious, hence creating stimulation.

Besides stimulation, the experience has a strong relatedness component (3). The experience becomes meaningful especially because unknown areas are explored together. It is not an autonomic experience, but an experience shared by the group of grandfather and grandson.

To preserve relatedness in the aftermath of the experience, mementos of the string of activities culminating in the experience are edited and shared (see [GM00] or [Has10]). Mementos as a strategy for relatedness (see the strategy of Memories in [HHE+12] are described by Hassenzahl and colleagues as "Artifacts which keep records of past activities and special moments of a relationship" (p. 5 in [HHE+12]). In the experience of exploring with the grandfather, Polaroids are used as records of the experience, for remembering, reflecting, and sharing afterwards.

3.2.2 Creating the *ExplorationRide* Experience with a Story

ExplorationRide: The Experience Story

ExplorationRide: The Experience Story

"Hey friends," Mary posts on her social network, "want to go swimming this weekend?" The first answers from her best friends Katharina, Andre, and Charly are quick, "Yes, definitely!" But then Andre has doubts about their usual swimming location, "The rocks in that lake are so sharp, I really hurt my feet last time." Charly adds,"Plus this lake will be so crowded again."

Mary wonders how she could surprise her friends. The answer is, they could go on a new explorative journey where both the route and the destination will be new. So Mary takes over the planning and via *ExplorationRide* invites her friends to become co-explorers on an exploration cruise, with no defined place, but only the activity "swimming" as a destination. Via Mary's social networks, the system generates an expert repertoire of recommended destinations out of which an undiscovered map is created. When the weekend comes and Mary picks up her friends in her car, they all start *ExplorationRide* together and find the undiscovered map, with a guided beam and a field of vision that uncovers the map towards the destination. "Wow," Andre points out, "this is how we're going to navigate, a bit out into the blue?" "A whole new thing," finds Charly. "And where to first?" wonders Katharina, "it's still morning and chilly." Mary smiles at her friends, "Let's explore the area on the way!" "Yeah," her friends agree, "this is a totally unknown area to us, let's check it out!" While Mary is driving them out of the familiar areas, points of interest appear on the map. "Hey, what's that?" Charly points out a high building on the map. "It might be some kind of medieval tower," Andre, the history student, supposes, and Katharina suggests to drive there. Mary takes a detour towards the tower. Through a forest they reach what turns out to be... "... a viewing platform!" Enthusiastically, the friends quickly get out of the car. "Excellent, let's climb up there!" Laughing and playfully pushing each other up the stairs, they reach the top and hold their breaths, "How beautiful!" they exclaim, "We can see so far!" and "We're above the trees!" Mary grabs her camera and takes snapshots of her friends, arms around each other and smiling happily, standing high up above the forest with the land spread out beneath them. On their way down, they reflect upon finding that spot, and back in the car, they rank that location. While driving on, the map is uncovered more and more. They see other spots pointed out on the maps and change course to make stops on the ride: They run up a hill and let themselves roll down through the grass. They take pictures in front of a castle, and stop for ice cream at a cafe. "It's getting hotter," the friends then find and head towards the system-suggested swimming destination. "Look, there are several lakes close by each other." "What do the recommendations suggest?" "Ah, this one has fine sand, no rocks." "And it's the least crowded." They quickly agree, "That's the one!" And Mary turns into the nearby parking space. "Have a look," she points out at the final overview of their map,

> "here are all the things that we explored today." Then, she shares their exploration experiences via her social network with others. "That's something," Katharina concludes on their ride, "exploring, sharing, and now finally..." "...swimming!" the friends shout all together and run towards the sandy beach.

As shown, the remembered past experience "Exploring with Grandfather" is analysed to gather insights, which provide the focus for the design of the *ExplorationRide* experience and upon which the Experience Story is composed. Thus, through the underlying insights the remembered experience helps to understand exploration experiences with its different aspects to be addressed and translated through design.

3.2.3 Designing the *ExplorationRide* Experience Through Technology

Building upon the Experience Story a fully functional prototype is developed. As part of the specific solution a mock-up is created in order to enable early tests before implementing the fully functional technology. To this purpose, technical solutions have to be found to make the system experienceable. Besides the decisions made through the Experience Story (described later in this section), restrictions from the employer, from technical limitations, and time limitations have to be followed.
For example, the interior design of the vehicle was inspected for a spot to place the *ExplorationRide* system so as to be visible to all passengers. Since the design was restricted to using common structures within the car, the system had to be placed within the central display on the dashboard to the right hand side of the steering wheel between driver and front passenger seat. This is a spot that is visible from every seat, but not ideal. The interactive possibilities of the system are greatly reduced as only the passengers in the front have the possibility for physical interaction with the system.
The mock-up concentrated on the exploration itself, whereas the invitation, the joint start of the exploration trip, and the mementos, which are enabled by technology, were designed for the experimental prototype afterwards. The exploration in the prototype later on was based on the results of the mock-up. The aim for the exploration in the system was to be capable of handling the complex group exploration through gradually revealing hidden maps and providing impulses to explore points of interest.

ExplorationRide: The Mock-up

The mock-up was implemented (without a storyboard, which is discussed in Chapter 5) within an Adobe Flash project and developed as a web application. Within this application different ideas of map uncovering and the provision of giving impulses for exploring interesting places were tested. One idea was to cover the map with clouds (see Figure 3.12), giving the participants the feeling of

Figure 3.12: Clouds as map cover (illustration created by Eduard Held).

being above the road and the area they are exploring. But this visualisation would contradict the desired feeling of immersing in the surrounding. Considering this, a two-layered map was chosen, with one detailed layer displaying the surroundings in an extended view from out of the window, and one vague layer providing only information about highways and rivers. In the beginning, the first layer is hidden by the second one and only becomes uncovered during the cruise (see Figure 3.13). As one aim of the system is to navigate towards a destination, the gradual uncovering of the detailed map is used to guide the group towards that direction in a vague way. In Figure 3.13 , Panel a) gives a first idea of the direction as the detailed beam guides vaguely. A more precise, but still vague guiding is seen in Panel b). Here, the shape of the guiding beam leads in a slightly more accurate direction, but restricts the undiscovered areas on the map. The detailed map of the guiding beam displays the points of interest on the way. Detailed information is provided by the map, not only on the direct route to the destination area, but also in off-path areas as well. To this end, in the functional prototype the detailed map has to be uncovered in an extended field of vision. The points of interest give impulses to take detours in accordance to the chosen destination theme. In the Experience Story, swimming was chosen, however had the host chosen skiing instead, different points of interest would be listed as interests). They appear next to the road chosen by the passengers. Here, the mock-up shows different visualisations, that is, points of interest appear when on the way, when within a specific distance (see in Figure 3.14), and when in the guiding beam to the destination, or in the field of vision.
While experimenting with the mock-up different possibilities and difficulties were observed. One example is that the relevant points of interest appeared sometimes after the path to reach this point had already been passed. Therefore, in the prototype the points should be activated depending on the distance from the field of vision, instead of from the car itself as it was implemented in the mock-up.

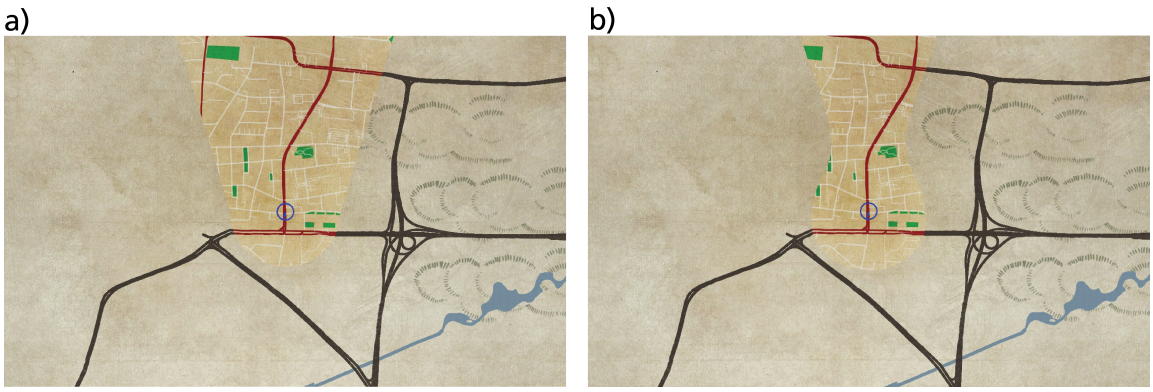

Figure 3.13: Uncovering detailed map layer for guiding (illustration created by Eduard Held).

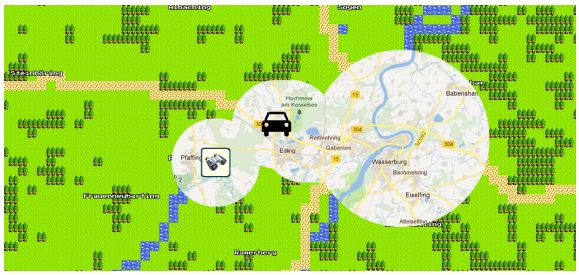

Figure 3.14: Appearance of interesting spots according to the chosen destination area (illustration created by Eduard Held).

ExplorationRide: The Experimental Prototype

After analysing the mock-up for the guiding and providing of stimuli for exploring points of interest the fully functional prototype was implemented with the goal of creating an executable version of the prototype for testing.

In a later in-situ study, the prototype should enable that the participants live the Experience Story. The focus of the prototype's design was limited to the exploration cruise of the friends itself, hence the invitation as well as the distribution of the mementos by the system, as described in the Experience Story, were realised manually. Because of this, the implemented system begins when the friends are all together and start the trip. To begin, the system shows an overview map with the starting point, the destination area, and a button to start (see Panel a) of Figure 3.15). The map in the system is implemented in three zoom levels: one overview level as seen in Panel a) of Figure 3.15, one middle level for standard use as seen in Panel b) of Figure 3.15, and finally a zoomed level for exploring the direct surrounding as in Panel a) of Figure 3.18. The overview map is distinct in two different areas, one undiscovered as seen in Panel a) of Figure 3.15, and one discovered as in Panel b) of Figure 3.18.

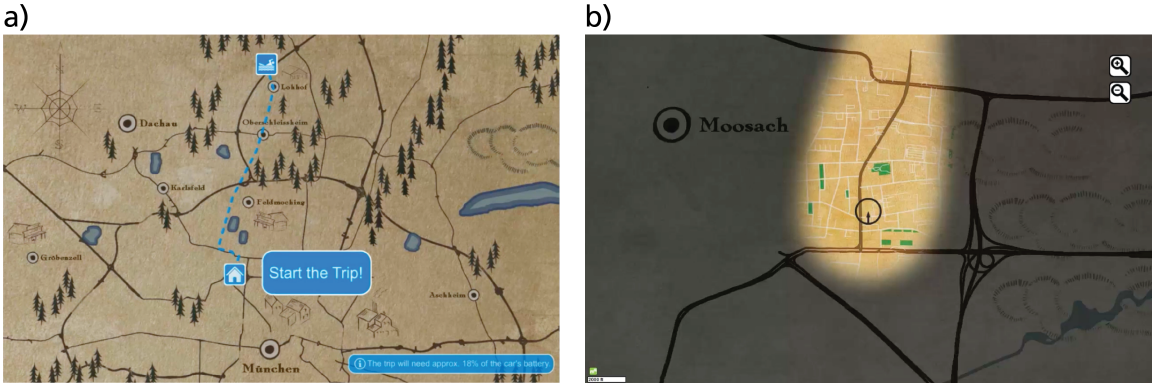

Figure 3.15: The *ExplorationRide* at the system start: a) overview map, with a starting point; b) first uncovering of the detailed map.

Finding New Ways: The Map of *ExplorationRide*

During exploration, the standard and zoomed layers show three areas on the map: one uncovered area (dark areas in the Panels of Figure 3.16), one uncovered area, which already lies behind (red marked area in Panel d) of Figure 3.16), and one uncovered area with detailed information on all small streets (lighter area in Panel d) of Figure 3.16). The last area is in the field of vision around the car and towards the destination (see Panels a) and b) of Figure 3.16), as well as around points the group might like to discover (see Panel c) of Figure 3.16).
This map ensures that the passengers do not get lost while exploring. The detailed area on the map appears within the guiding beam, which leads into the direction of the destination area (see marked area in Panel a) of Figure 3.16). The detailed area also appears in the field of vision in front of the car (marked area in Panel b) of Figure 3.16), and also around points of interest so to enable reaching them (marked area in Panel c) of Figure 3.16). After passing an uncovered area the map loses the detail level (marked area in Panel d) of Figure 3.16), which is no longer needed as a detailed knowledge of the already explored route behind the car is not necessary for focusing on what is coming ahead.

Provide Impulses for Exploration

The points of interest provided by the social network of the host and the invited friends as well as the chosen destination provide the stimuli for exploration. The points of interest appear when the radius around the point touches the guiding beam (see marked area in Panel d) of Figure 3.16 or the field of vision (see marked area in Panels a) and b) of Figure 3.16). For the prototype, the destination area was chosen in advance to be a swimming lake. The points of interest were gathered through manual investigation querying local residents and researching on the internet in order to gather expert knowledge of the local areas and provide insider information for the participants. In the actual application participants were allowed to believe that these points originated from their social networks. When a point of interest appears, the group has the possibility to view a short description, such as, "small airfield." More detailed information is not

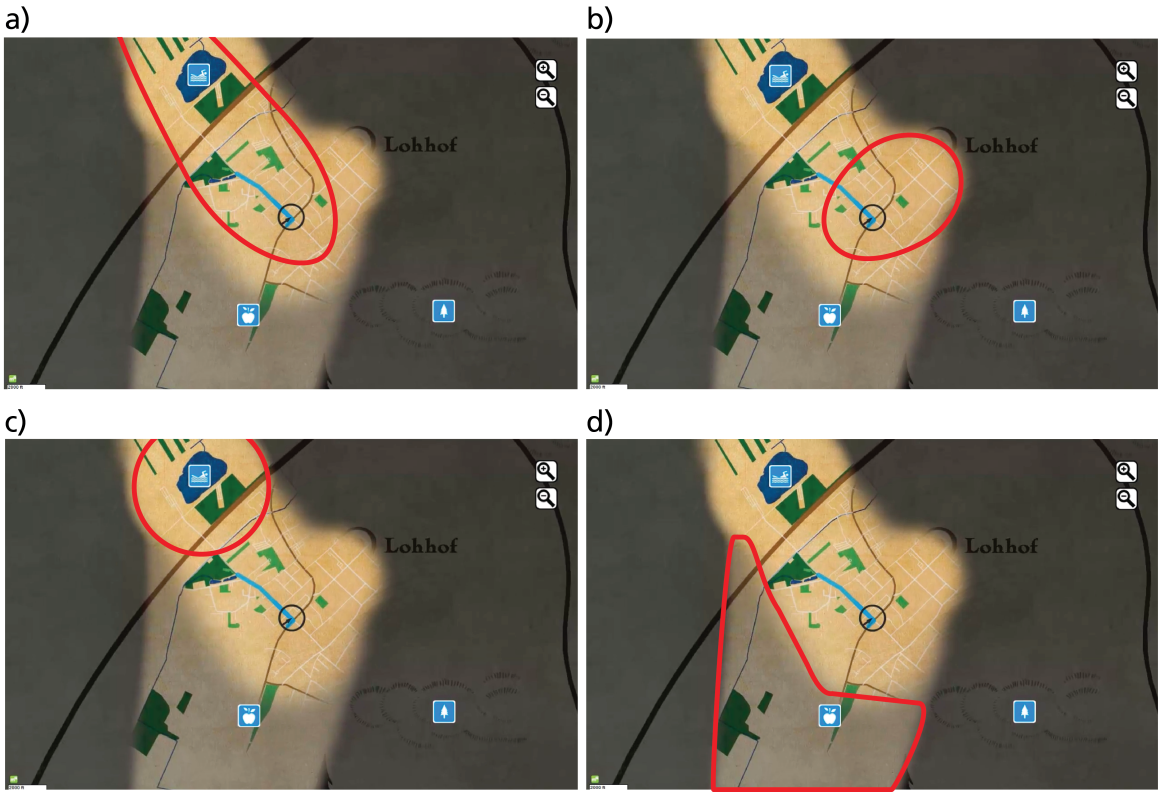

Figure 3.16: Discover the map with the *ExplorationRide* system.

provided in order to encourage the group to explore this point.

Mementos with *ExplorationRide*

In order to reflect upon the experience after exploring a point of interest a ratings screen appears (see Figure 3.17) which should trigger the group to reflect about their experience and, as there is only one ranking possibility for the group, come together with a common opinion.
When the group reaches the final destination the guiding beam ends (see Panel a) of Figure 3.18). Furthermore, the field of vision does not provide a detailed map of the area if the car is within a certain radius of the final destination. Corresponding to the Polaroid pictures in the story "Exploring with Grandfather" the system provides mementos. Once the group arrives at the destination the memento appears on the monitor in the form of an uncovered overview map (see Panel b) of Figure 3.18), consisting of the route of exploration, the visited places, and the rankings the group

Figure 3.17: Ranking for group reflection.

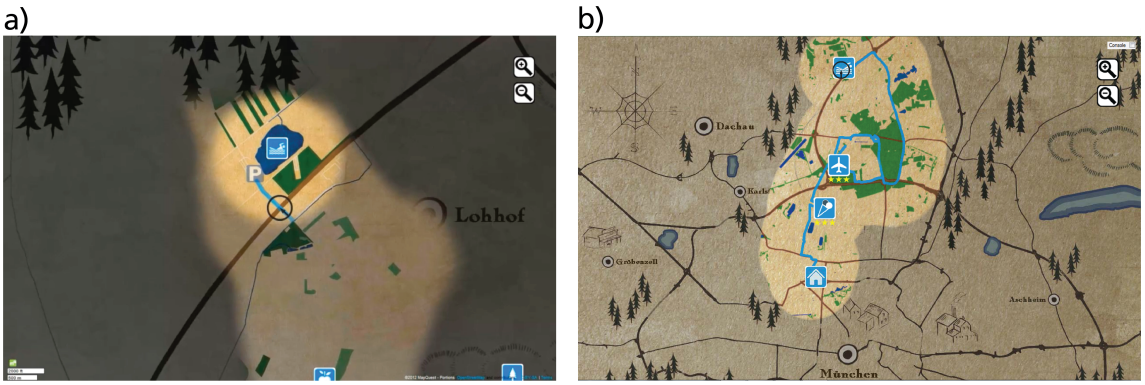

Figure 3.18: The group arrives at the final destination.

had provided. This memento is then sent to all group members to share and reflect upon their joint exploration experience later on (this distributing was not part of the implementation and was completed manually).

ExplorationRide: Agile Testing

Before the system was ready to be evaluated in a user study, dozens of test drives were undertaken by the design team with the system, playing through the story in order to identify aspects that fail to do not match the story. Many design decision were made according to these test drives. For example, while exploring the target area, ahead of many intersections or at traffic lights a lively discussion ensued on where to drive. For the most part the discussions were still inconclusive when the vehicle arrived at the intersection or when the traffic light turned green, hence resulting in the driver feeling overwhelmed by the situation as the decision on which way to drive had not yet been made. This situation is not only bad for the group spirit but also dangerous in traffic. As a consequence, the decision was made to implement a limited guiding system in the form of a

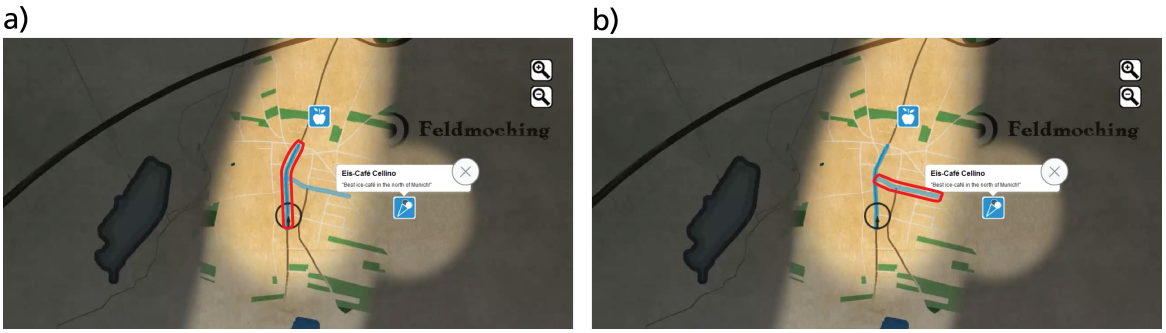

Figure 3.19: Guiding at the next intersection.

guiding path ahead of the car to provide a direction if the group is undecided as to where to drive. The passengers are to be freed from the constraints of the route to enjoy new routes, while at the same time receiving ideas through the points of interest. Thus, the routing was implemented to guide only by intersection and to follow the guiding beam. Different ranges of a guiding path ahead of the car were tried. A short guiding path gave only directions immediately in front of an intersection, which was still stress inducing as the directions sometimes came after the vehicle needed to be in the proper lane. However, if the guiding in the form of a marked path on the route was too long (over more than one intersection) the group sticked to the guiding of the system and did not take detours. The provided guiding path, which leads towards the destination in an unobtrusive way (as seen in the marked area in Panel a) of Figure 3.19) was set up through the adjustment made from addressing these observations. This provided guiding is only visual, there are neither acoustic notifications nor an icon with a traffic sign arrow for the directions. In order to inspire the group to explore the points of interest an additional routing path appears whenever an intersection to a point of interest is right ahead of the car (as seen in the marked area in Panel b) of Figure 3.19). If the group decides to head for the point of interest, the system's guiding path towards the destination is redirected via the point of interest. If the group decides to not drive towards the point of interest the additional guiding path disappears.

Technical Realisation of *ExplorationRide* Prototype

The final *ExplorationRide* prototype was built in a car fitted with a computer in the trunk, which was then connected to the CAN bus of the car (for more information about CAN (controller area network) see [fS03]) This was necessary in order to gain access to the GPS (global positioning system) data of the car. This GPS data was used for the prototype because it provides more precise location data, as the signal is calculated by the car in cases when the satellite signal is lost, e.g., within a tunnel, and the GPS signal is matched to positions on a street (when driving on roads marked on the map). Using a mobile phone as a source, the signal jumped to points next to the street. A mySQL[4] database on the computer received the position as input and triggered an online routing calculation, whereby the maps are stored locally on the computer to avoid data traffic. The

[4] http://www.mysql.com

system was provided within the car on a touch screen on the dashboard between the driver and the co-driver. The touch-screen was connected to the computer in the trunk and the internet connection for online routing calculation was realised through the UMTS connection of a smart phone. For the map and its manipulation Open Flash Maps API[5] from MapQuest[6] were used which utilises data from OpenStreetMap[7], and takes over the calculation of the position with the API provided service OpenDirectionsService[8]. The system's maps were implemented using CloudMade[9].

3.2.4 Evaluating the *ExplorationRide* Experience In Situ

In evaluating the *ExplorationRide* prototype in situ with groups of real friends who regularly spend time together the aim was twofold: first, to examine the "...the psychological, social, and cultural effects that systems [*ExplorationRide*] might make," (p. 215 in [GM00]), and second, to verify the *ExplorationRide* system.
The hope was to create a meaningful experience, which fulfills the psychological needs for stimulation and relatedness in order to better design for positive exploration experiences.

Procedure and Method for Analysing the *ExplorationRide* Experience

For the in-situ evaluation six groups of friends were recruited (19 individuals, 7 female, age: M=22, Min=20, Max = 33) with an average of three friends per car and a member of the research team as an observer. To simulate the trip the system was restricted to the destination area of a nice swimming lake (12 km distance, a 15 minutes drive when driven directly). On the day before the trip each member of the participating group was given an invitation (see Figure 3.20) and instructions to bring their swimming suits and things they might need for the time at the lake. All participants received a small introduction to the *ExplorationRide* system. After the introduction the group began the exploration trip together and drove actively with the silent observer in the back seat. The first column in Table 3.4 shows the places additionally explored by the group before arriving at the destination area. The third column in Table 3.4 shows the total time the different groups took to get to the destination. The groups explored an average of two additional places and took an average of more than 70 minutes for the cruise, thereby spending an average of over 55 minutes more than needed to get to the destination. After arriving at the final destination of the swimming lake, the memento was sent to the participants via social media. The group was given time to arrive at the destination before semi-structured narrative episodic interviews (such as described in Section 2.3.1) were conducted with each participant separately inside the car and subsequently audio and video recorded.
The focus of the interviews was on the exploration experience, the social experience, and the mementos. The participants were asked if they experienced a situation that was unique or

[5] http://developer.mapquest.com/web/products/open/flash

[6] http://www.mapquest.com

[7] http://www.openstreetmap.org

[8] http://open.mapquestapi.com/directions

[9] http://cloudmade.com

Figure 3.20: Invitation for the participants to the *ExplorationRide* trip.

Group Nr. (Members)	Detours	Duration of cruise in minutes
1 (3)	ice cream parlour, castle	60
2 (3)	ice cream parlour	55
3 (3)	ice cream parlour, castle	60
4 (3)	castle	65
5 (3)	ice cream parlour, castle, airfield	100
6 (4)	store, ice cream parlour, castle	90

Table 3.4: Overview of the detours while exploring.

meaningful while cruising with their friends. They were also asked to describe the situation in more detail, including their thoughts and feelings. Based on the experience that the participants told they filled in a German translation of the PANAS-X [RG03] (as described in Section 2.3.1) and a psychological needs questionnaire based on [KPHE11] and [SEKK01] (see in Section 2.3). To capture the experience even more comprehensively, the PANAS-X scales were used for positive affect (PA) and negative affect (NA), and additionally the sub-scales for joviality and surprise. Surprise is connected to stimulation and joviality to relatedness. The scales for PA, NA, and for the subscale joviality showed to be satisfactory α values (see Table 3.5, Column 2) except for the scale of surprise, which could not be used because of the bad α value.
The needs questionnaire was used to examine which psychological need was fulfilled through the *ExplorationRide* experience as reported by the participants. An extended version with additional items (from [KPHE11] and [Rei04]), based on Sheldon and colleges was used [SEKK01], which includes scales for measuring the fulfillment of psychological needs based on a specific experience. Here, the subscale preserve was used in order to analyse experiences based on the mementos, as well as the subscale for competition as an indicator since this need should be avoided by the system. The scales friendship and community as facets of relatedness were subsumed to a higher

factor relatedness, whereas idealism, security, and competition were excluded because of their unsatisfactory α values. The mean intercorrelation for stimulation was very satisfactory, whereas the other scales had acceptable values.

Results and Discussion of the *ExplorationRide* Experience

All interview results were translated from German into English.

The qualitative findings were categorised in the stimulation experience through exploration, in relatedness experiences through being social, and the experience mementos were connected to memorising and sharing.

Stimulation Experience through Exploration:

Every single group discovered places through exploration with the system on their way to the destination (see Table 3.4).

Five different groups mentioned how the *ExplorationRide* affected their sense of time. One participant (P (participant) 4, G (group) 2) reported, "It's true that the system forces one to relax a bit. Normally, we try to get from one point to another in the most effective way possible. But because of the vague description of the route, one begins to think, 'Ah yes, right, we don't have to get from one point to the other that fast, we can relax a bit, look around.'" This participant clearly related the versatility inherent in the system to certain feelings and activities such as "to relax" and "to take one's time to look around." Another participant (P 6, G 2) explained, "I totally lost track of time... and also of the actual final destination..." (P 6, G 2). This losing sense of time and relaxation led to a certain mental state, crucial to the experience of being a discoverer: "[And I also then] slipped into a state of mind where one somehow comes to this explorer-experience ..." (P 14, G 5)

While designing the prototype much focus was placed on the trade-off between getting lost and finding new places, within which a specific "exploration-mood" should be triggered. Members of four groups mentioned this specific "exploratory mood." The undiscovered territory of the map triggered the exploration impulse playfully, as was mentioned by four members of groups. One of the participants (P 7, G 3) mentioned, "... to see only a beam of light, this reminded me of driving in the darkness... This was exciting and made me curious about what lay ahead." The participants' curiosity was piqued and could be satisfied by the created freedom of space provided through the undiscovered territory, which was mentioned by members of three groups.

Another participant (P 14, G 5) described that the focus on driving directly to the destination faded to the background, "...this is not the deterministic case in which you now have a destination you have to get to in any case and where you only see the way...instead you have a space in which you can move around, and where you can live it up."

Members of three groups mentioned that the system altered their relationship to the environment, making them more observant, "One just gets to know nice places, which, had one strictly followed the route, one would have never seen. And already at the ice-cream parlour it was just like a reward: One gets a delicious ice cream and can say, 'Here, I recommend this, I was there'"(P 19, G 6). The system indicated and guided through exploration areas where according to one the participant, there was no pressure of time in discovering, "Generally, I felt that thanks to the system... one drives through the world with eyes wide open" (P 2, G 1). Due to the shared space of the vehicle, the discovery of the surrounding happened more intensely, and therefore one group

used hints from the surrounding for guiding decisions. "Wow, there is a glider that's rising." "Yes, that's roughly the direction of the airfield." "So, what do we do? Should we have a look if we get to the airfield over there?" (P 14, G 5).

Relatedness Experience Through Social Exploration:
Members of four groups mentioned that the use of *ExplorationRide* encouraged discussion and less conversation lapses occurred. One participant explained how this system influenced the topic of the conversation, "We talked much more about what we were just doing, where we were and where else we could go... Normally, I speak much less about the route while driving, but it was actually quite nice because one attunes more to each other" (P 4, G 2). Since the exploration topic is a matter affecting all of the passengers no one was excluded, as this participant describes: "Everyone has the same information, and everybody knows everyone is interested in exchanging ideas" (P 7, G 3). This group discussion led to the exploration becoming a communal task, such as for this participant, "The common exploration, this was what I liked" (P 7, G 3). All this leads to a stronger group relationship, which was mentioned by four groups, with one participant explaining, "[It was] a nice cruise. Everyone was chatting... and saying, 'Look there!' 'Go right!'" (P 12, G 4)

Mementos, Experiences of Memorising and Sharing:
Participants of three groups wanted to memorise and share the positive experiences of discovering new places. One participant said, as mentioned before, "... we could say, 'Here, I recommend this, I was there'" (P 19, G6). The rating of the individual experiences also helped members of three groups to reflect upon the experience. One participant mentioned, "...then all are together, enjoying this newly found place, and you can take a picture, and also immediately talk with the others about how this place was, whether we liked it or not" (P 1, G 1). By viewing the complete map at the end of the trip, participants of three groups were able to reflect on what they experienced and discovered together, "When, in the end, our trip was recorded ... when we saw, cool, there we have been, this we have seen, then this was just as if we had made something" (P19, G 6).

Quantitative Results of the *ExplorationRide* Experience

The PANAS-X scales imply that the positive effect was salient in the *ExplorationRide* experience (as seen in Table 3.5, Column 4). The emotion joviality was most salient, even before PA. Stimulation was the most salient need experienced, followed by relatedness and autonomy. Stimulation, as one of our target needs, did differ significantly to all of the other needs (see confidence intervals Table 3.6, Column 5). Relatedness, the other target need differed significantly to competition (see also confidence intervals Table 3.6 Column 5).

Conclusion and Discussion of the *ExplorationRide* Experience

Every experience is unique, just like the past exploration experience from the childhood memory, but it was shown here how the analysis of such a positive experience can support the design of systems that focus on human experiences, rather than on effectiveness or efficiency, while interacting with a system. The practical approach described shows a constructive way to engineer systems for

PANAS-X (No. of items)	Cronbach's α	Mean (SD)	95 % CI	
			Lower	Upper
General				
PA (10)	0.85	0.56 (0.55)	0.29	0.82
NA (10)	0.67	-1.78 (0.26)	-1.91	-1.66
Subscales				
Joviality (8)	0.94	0.88 (0.64)	0.57	1.19
Surprise (3)	0.02	0.18 (0.39)	-0.01	0.36

Table 3.5: Results of the PANAS from the *ExplorationRide* user study: Internal consistency (Cronbach's α), mean intensity of selected PANAS-X scales (standard deviation, 95 % confidence interval (CI)), five-point scale from 0 – not at all to 4 – extremely.

Psych. Needs(No. of items)	Cronbach's α	Intercorrelation	Mean (SD)	95 % CI	
				Lower	Upper
Stimulation (2)	0.27	0.01	1.66 (0.50)	1.42	1.90
Relatedness (8)	0.60	0.45	0.29 (0.43)	0.08	0.49
Autonomy (3)	0.87	0.42	0.21 (0.99)	-0.27	0.69
Competence (3)	0.81	0.42	- 0.07 (0.93)	-0.52	0.38
Preserve (3)	0.78	0.36	- 0.19 (1.07)	-0.71	0.32
Status (3)	0.67	0.40	-0.77 (0.84)	-1.18	-0.37
Physical Thriving (3)	0.70	0.42	-1.11 (0.84)	-0.51	0.30

Table 3.6: Results of the need-questionnaire from the *ExplorationRide* user study: Internal consistency (Cronbach's α), mean scale intercorrelations (mean scale intercorrelation based on Fisher's Z) and mean intensity of psychological needs (standard deviation, 95 % confidence interval (CI)), five-point scale from 1 – not at all to 5 – extremely.

a variety of other postive experiences. One crucial part is the extraction of the aspects of the story "Exploring with Grandfather," but it is equally important to keep a focus on these aspects during all design and implementation steps, mainly through the Experience Story. While this facilitates the story-driven Experience Design in the first place, it also can make it challenging.
Through the in situ evaluation it was shown that *ExplorationRide* is able to address and fulfill the need of stimulation and relatedness as intended through the specific exploration cruise with friends. As shown in the qualitative results, the essences from the story were identified by the participants. Thereby, they enjoyed the experience of the exploration, triggered by vague guiding and stimuli from the system. The participants further liked the feeling of relatedness while experiencing *ExplorationRide* together with friends, triggered by communal decisions and the same information being provided for everyone therefore avoiding competition. Finally, the participants enjoyed remembering and sharing the experience thanks to the mementos sent out by the system.
Every group used the possibility to make detours in order to have a pleasurable experience while exploring unknown places. Furthermore, they immersed into the surrounding landscape while using *ExplorationRide*. Although the results indicate that *ExplorationRide* is a new way of navigating

in order to foster a group exploration experience, there are aspects for improvement. One example of this is to focus the passengers' attention even more on the surrounding. Screens such as the one used in the *ExplorationRide* system have a stimulative nature, which might distract from the surrounding.

3.3 Essence of this Chapter

This chapter presents two design cases focused on the situation of being on a joyride with friends. The first design case, *CliqueTrip*, focuses on the relatedness of one group driving in a two car motorcade. The system created relatedness by strengthening the group belonging as well as the feeling of being close to each other. To create a feeling of group belonging the system navigates the rear car to the front car instead of to the trip's destination. Thereby, the passengers in the rear car never have the feeling of losing the other part of the group. The closeness between the members of the group, separated through the interior of the two cars, is fostered through the system's acoustic communication channel. This is limited due to the distance between the two cars, whereby the communication is established only if the cars are in close proximity.
The second design case is about exploration. With the system *ExplorationRide*, a group of friends is enabled to go on an exploration journey together. In order to encourage the group to find new ways without getting lost the system provides a covered map which is gradually uncovered by the group's exploring. Both the guiding and the final destination are kept vague in order to entice the group to take detours to nearby points of interests, which appear during the exploration. The feeling of relatedness is strengthened by common decisions and by providing mementos to the participants, which help to remember the common experience afterwards.
The two design cases based upon two selected scenarios are examples of how to design for experiences other than the act of driving in the situation of driving with friends for pleasure. The focus of the designed experiences in the presented examples of this chapter is on the relatedness of the group, even when driving in separate cars (in the example of *CliqueTrip*), and on the stimulation by unfamiliar areas (in the example of *ExplorationRide*).
These cases are only a first step of practically applying the design approach of Experience Design in the automotive context.They are to inspire interaction designers to build systems for other scenarios, such as driving on a family vacation or driving for sightseeing, among many others. The usage of the methods and tools for designing experiences from Chapter 2, which are applied in these design cases, are discussed in Chapter 5.

Chapter 4

Design Cases:
Experiences While Commuting Alone

As this work focuses on how to apply Experience Design, experiences are created according to this design approach for the situation of group drives with friends for pleasure and for the situation of commuting alone. The first situation, social cruising in groups, was applied in the design cases presented in Chapter 3.
This chapter focuses on experiences based on the second situation, commuting by oneself. Here, two design cases are presented for experiences while commuting alone. The first design case of this situation, *keepClose* (in Section 4.1), is aimed at providing the feeling of relatedness while driving between a commuter and the loved ones at home. The second design case, *Last Gentlemen* (in Section 4.2), is a system that fosters prosocial driving in traffic by acting according to personal norms.
Both design cases start by an analysis. For *keepClose*, past stories of experiences were analysed in which distance is overcome through commuting. For *Last Gentlemen* a pre-study gathered insights for the later design through interviews. In both cases, Experience Stories were composed out of the gathered insights to define the experience that was to be created through technology. The implementation of the *keepClose* system included an agile refining through a user study, necessary for the usage of the final prototype to be analysed in a long term study. The *Last Gentlemen* experience, on the contrary, was analysed without agile refining. A best practice and recommendations drawn from these case studies are presented in Chapter 5.

4.1 Providing Commuters with the Feeling of Home While Driving

A first technical implementation of this design case was accomplished by Helena Helgert and a second by Simon Männlein, both under my supervision.

In the previous design cases (see Sections 3.1 and 3.2) it was shown that experiences can be actualised through technology, so that users live out specific experiences while interacting with products. This study goes further in that the designed experience through an interaction product is not only for one-time usage during an in situ study. Instead, the experience is designed to affect the routine and rituals of the participants, thus having an impact on a real life environment. As with all case studies in this chapter, the focus is on commuting alone, in this section specifically on the commuting to and from work.
Commuting is a far reaching issue. As seen in the *American Community Report* in 2009, 86.1% of the people commute by vehicle to work, and 76.1% do so alone [MR11]. This number has risen continuously, from 41 million commuters in 1960 to 120 million in 2009 (in the United States) [MR11]. However, high levels of commuting are not unique to the United States. In Germany, for example, 56.1% of the people commuted (alone) in 2008. A report from 2009 also shows an increase of the distance between work and home between 1996 to 2008 [MR11].
This rising trend of commuting, tendentially alone and over longer distances, affects the social life of commuters. For this reason, the aim here was decided to be to reconnect the commuter to their social surrounding, thus enhancing relatedness. To create such a relatedness experience, different strategies to foster relatedness from [HHE+12] are analysed in order to gather different aspects of a relatedness story in this context for designing the prototype later on.

4.1.1 Gathering and Analysing Past Commuting Experiences

Commuting affects both the persons waiting for a commuter to return home and the commuter themselves. The following commuting stories gathered among the design team capture situations of commuting, both from the point of view on the road and at home. They are used as inspiration to create an Experience Story, upon which the experience is then created.

> *Commuting Story 1:*
> "When I was a child my father was commuting. Often we waited for him to arrive, especially in the wintertime, when road conditions were bad. We worried, especially when he took longer than usual. Sometimes my siblings and I went to bed before he arrived, but while still awake we heard the sound of passing cars from the road. When my father arrived we heard his car, which we had learned to recognise by its unique sound. We felt that he was home even while he was still driving up the little driveway to our house."

As seen in this story, the situation can be tough for the people waiting for the commuter at home. Daily rituals, such as the evening family meal and going to bed, suffer from the absence of the commuting family member. This situation is also difficult from the commuter's point of view, as seen in the next stories:

Commuting Story 2:
"When I was working on construction sites I sometimes had to drive for hours to get home after work. I looked for ways to have the feeling of being home sooner in order to feel close to my loved ones. I wanted to be there to take part in our daily routines. At the end of my commute I exited the highway. Then I felt almost as if I was already home. This feeling increased when I finally drove into the street where we lived, just before arriving. Then I tried to look and see if I could recognise the light from my flat, to see right away if the others were home. This always gave me a thrill of anticipation."

Commuting Story 3:
"For six months my company sent me to a different town, so that I had to commute one and a half hours each morning and evening. I suffered of spending so much time in my car instead of with my partner. But one day I came to the car and found a love letter from my partner under the wiper of my windshield. I was so touched when I saw this message, especially as I knew the effort it had taken. I got the feeling that if my partner could overcome the distance to express feelings then the distance between us became less big."

In all three stories commuting effects everyday life as it hinders the commuter and those at home to be together. Hence, it is by focusing on the psychological need of relatedness that this design case attempts to create positive experiences for commuters and their families, overcoming the distance even despite commuting.
In order to address relatedness and thereby engender positive emotions different strategies can be used, as described in [HHE+12]. Based upon the commuting stories, different strategies are discussed, which are to be transferred into the design of an experience later on.

(1) The Loved Ones Expressing Themselves

Sometimes when the commuter is still at work the partner at home might want to express feelings, as in "Commuting Story 3." Using a phone is not always the best means of communication because, among other reasons, it is often inappropriate to call someone at work or while driving. To express feelings over telephone is also not that easy. Nevertheless, Joseph Kaye and Liz Goulding who research communication between couples argue, "...my phone has become the most important mediator between me and my girlfriend: I spend approximately an hour a day talking on my cellphone, which then relays the message to my girlfriend. But this is the same cellphone I use to talk to my bank manager and my mother. It would be nice to have a shared communication object that allows for the communication we need" [KG04].
Hassenzahl and colleagues categorise this type of communication as Expressivity [HHE+12]. The

Intimate Objects

Kaye and Goulding show sketches of Intimate Objects based on couples experiences of their own relationship gathered with interviews. These sketched devices are for exchanging physical interaction, like holding hands, or to send and receive massages e.g. secretly.

Kaye later on actualized two prototypes for intimate communication. Panel a) shows the physical small intimate objects. For sending and receiving one-bit messages over a box, with a button and a LED transmitter via internet to the partners box. Kaye shows further virtual intimate objects (see Panel b)) thereby a simple massage are displayed in the user's task bar of the windows screen. Both partners have a circle in the task bar. If one of the partners clicks on their circle, the circle of the partner will turn red. Then over a 12 hour period the circle will slowly change back into the blue colour.

Devices like this deliver the partner with an "I am thinking of you message" in a simple and subtle manner. A pilot study uncovered that the experience the objects provide was for the user more meaningful than the object itself.

a)

b)

Figure 4.1: Intimate Objects (sketches from [KG04], for the prototypes and the figures from [Kay05]).

strategy of Expressivity leads to systems, which "emphasise the affective and emotional aspect of intimacy" (p. 4 in [HHE+12]).
Example systems for Expressivity are the Intimate Objects by Kaye and Goulding (see Figure 4.1), which maintain intimacy between loving persons at a distance [KG04]. The "intimate objects" are technical mediators for specific intimate communication. This communication can be very minimalistic, like the transmission of feelings in form of a colour cycle in the task bar of the computer screen: when one partner clicks on the own cycle the colour of the partner's cycle changes (see Figure 4.1).
Intimate objects are not recognised or understood by other people and transmit just a single message, that is one thinking of the other. Another example of designing for Expressivity, which allows for more accuracy, is PictureFrame [DdG06]. In this system two partners have framed pictures of each other, on which the online presence of the other person is indicated via icons. The maintaining of intimacy becomes even more concrete with HomeNote, a system to post messages within a home [SHE+06]. By providing self-expressing notes the user can handwrite and remotely situate messages (see Figure 4.2). The receiver of the messages is everyone in the respective home.

Figure 4.2: Homenote (figure from p. 388 in [SHE+06]).

(2) The Commuter Conveying Their Whereabouts

In "Commuting Story 1," the children were keenly interested in knowing when their father would be coming home and, therefore, listen to the sound of the passing by cars to recognise as early as possible the moment when he arrives. They want to be aware of where he is.

As Hassenzahl and colleagues explain it is important to share information about one's mood or about current activities (in this case where the father is at) in order to enhance Awareness of one another [HHE+12]. But providing information to distant others, e.g., on one's location, is a complex task, no one should feel monitored, but it can lead to relatedness as already seen in Section 3.1. Hassenzahl and colleagues present an overview of different systems that foster Awareness. One system, *Social TV 2*, creates Awareness of current activities of geographically dispersed friends in an amiable way: through a specific coloured lamp the user receives information and is able to know if one or more friends are watching the same television program [HMB+08]. Another example is BuddyClock, which exchanges information between two separated people who display their state, sleep, snooze, or awake, to the other by an icon on a tablet computer [KKPA08].

There are already systems that communicate the location of others. One example is the Whereabouts Clock (see Figure 4.3), which displays location and activity among family members to support awareness. The device is placed in a communal area of the home, where it can be reached by everyone. Participants stated that when using the Whereabouts Clock, "...they liked the feeling of having a virtual presence" (p. 1310 in [SEIH06]). This virtual presence corresponds to hearing the sound of the father's car in "Commuting Story 1." Moreover, there are also products already available on the consumer market that address issues of overcoming distance by displaying one's presence at specific places to loved ones, e.g., the Good Night Lamp[1]. The focus of this device lies again on relatedness between users. Here, as in the Whereabouts Clock the information is displayed in such a way as to reduce the feeling of being monitored. With the Good Night Lamp the virtual representation is triggered by the providing of information, were the Whereabouts Clock displays only a vague representation of someone's location, which is then displayed only for specific places (like work, school, and home), and the system disregards the exact positioning

[1] For more information see: `http://goodnightlamp.com`

Whereabouts Clock

Abigail Sellen and her team describe the Whereabouts Clock as a device "to support awareness of people's location and activities" (p 1307).

"...We used the metaphor of a clock as a starting point because it implied aspects of its design we felt were important:
1st, it is a situated [...] in a place in the home [...] where it becomes part of the routine of family life, much as a clock does.
2nd, the interface is designed to let the family see information at a glance. [...] the display is "always on", persisting in the periphery of vision in the way that information on a clock persists.
3rd, like a clock, it is designed to broadcast information to anyone occupying that space. [...]
4th, like many domestic displays, it can only be seen when physically in the home [...] only people who are entitled to be in the home can see the device.
5th, it displays only coarse-grained information [...]. Precise location isn't necessary for the purpose of planning a meal, knowing someone is on their way home, or being reassured a child is at school" (p.1309).

Figure 4.3: Whereabouts Clock interface and prototype (text from [SEIH06], figure from [SIHE]).

data of the information it receives.

(3) The Loved Ones and the Commuter Being Together

As seen in "Commuting Story 2," the feeling of being home arises even before arriving at home. At some point, while commuting towards home, the surroundings feel increasingly familiar. This helps the transition from work to home life. Commonly, an anticipation of social interaction with loved ones builds up during the homeward commute and, by increasing as one gets closer to home, initiates home life with all of the social activity and rituals it entails.
Anticipation has the potential to become an essential part of a positive commuting experience through technology. It can be e.g., enhanced by connecting the user to home rituals across the distance. They describe the strategy of Joint Action [HHE+12], by which persons separated in space can carry out an action together through a technological artifact.
As to what regards the commuting experience that is to be designed here, such an artifact could help to generate the feeling of home for commuters when they near their home.
Already existing systems show diverse possibilites to foster Joint Action. There are systems for completing a task together, like taking care of a jointly owned online virtual aquarium together [BB08b] or playing family "Distributed Hide-and-Seek", where the members, separated by dis-

Roomlink

Debby Hindus and her team describe Roomlink as:

"An 'always on' connection that links two rooms in separate households using only high quality audio. You can hear everything that happens at the other location. Room Link doesn't tie up your phone line and has better quality audio than a speakerphone" (p.328).

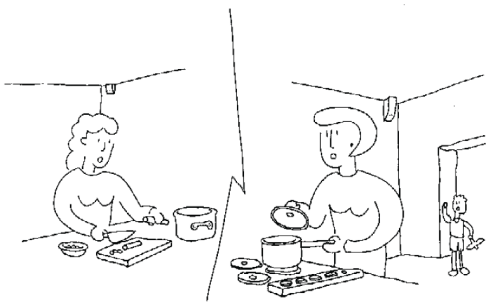

Figure 4.4: Roomlink (text and figure from p. 328 in [HML+01])

tance, can play hide and seek online via a location sense technology [VNR06].
However, Joint Action can also mean to share a certain space. One example of an artifact using Joint Action as to share a space is a table in which the surface is video recorded and projected onto another table and vice versa,. Hence, in addition to face-to-face video communication, activities and actions can be shared [Yar08].
In "Commuting Story 1" the shared activities are rituals, like arriving at home and going to bed, they are not concrete actions, like playing board games on a shared table. What happens here is that cognitive awareness is generated through shared information about current activities among the family members (like the boy recognising the father's car in "Commuting Story 1"). One concept that combines the strategies of Joint Action and Awareness is called *Roomlink*, a system that permanently connects two rooms in separate households [HML+01] (see Figure 4.4). Here, the shared space is the audio space, which allows for the sharing of common activities, such as cooking, but also provides general awareness of the respective other households. Regarding the design case of commuting alone, such a combination of Awareness and Joint Action can be used to facilitate the participation of the driver, however limited, for the driver in rituals at home, such as the exchanging of news and the planning of activities. A shared audio space helps the driver to become aware of the loved ones, but also to overcome the distance by Joint Action. The driver not only recognises if someone is at home, as in "Commuting Story 2", but the corresponding thrill of anticipation can also be directly expressed through the shared audio space. The primary function of the communication via a shared audio space is not to transmit pure information, but to create relatedness.
The analysis of the commuting stories shows that there are strategies for enhancing relatedness according to Hassenzahl and colleagues (see [HHE+12]). These are Expressivity, in the sense that feelings can be expressed between loving people despite the inability to be on site, Awareness, in the sense that the loved ones at home know of the wherabouts of the person away, and a combina-

tion of Joint Action and Awareness, in the sense that the separated family members can be together even across the distance.

4.1.2 Creating the *keepClose* Experience with a Story

The Experience Story narrates how relatedness between the commuter and their loved ones is supported during the commuting drive.

keepClose: The Experience Story

Maggy is driving to work.
Since Maggy has a new job she gets up early in the morning to spend time with her family. She is happy about the possibilities and responsibilities given by the new job, but she now has to commute for an hour each morning and evening. She likes to have time on her own, but she likes even more to spend time with her family. For that reason, in her car she uses a system called *keepClose*, which allows her to feel related to her family even while commuting.
In the morning she sits together with her partner Steve and her kids Emma and Ben at the breakfast table. Emma is telling about her theatre play in preschool, "I have the role of Pippi, and when the curtain rises, I am riding on a horse." Ben interrupts her, "It's not really a horse, it is a buck from gym class." Emma protest, "Well, to me it's like a real horse, and so..." As the girl continues her narrative, Maggy looks at her watch. "No Mama," Emma insists, "I must tell you about the play." "One Second," says Maggy, "I'll just get in the car, and then you can tell me the rest."
A goodbye kiss for everyone, and Maggy is out of the apartment and in her car. "Here I am," she calls to Emma through the *keepClose* device, knowing that her daughter is now hearing her through the device's counterpart on the breakfast table. While Maggy drives out onto the streets, Emma goes on with her story, "So, there I am riding on this horse..."
After a while Maggy hears Steve's voice, "Come on everybody, time for school!" Maggy says goodbye. Then the device turns quiet. On the *keepClose* app in the infotainment system she sees that she is leaving the known home area and is now well on her way to work. This extra time that she is connected to her family helps her to take part at breakfast, an important family ritual.
After a long day in her new job Maggy finally closes the office door behind her. Her thoughts are still at work. But when she

gets in the car the *keepClose* app is started and a note from Steve appears! He has scribbled candles and steaming pots on it. She knows what this means: Steve will be making his special dinner tonight. Now she is on her way immediately! As the *keepClose* system displays that she is approaching home, her thoughts are no longer at her job, but with Steve.
At the same time in the kitchen, Steve is preparing food and the kids are arriving. "Is Mama already on the way?" Emma and Ben run to the device. "Look Emma," Ben explains to his sister, "she is driving! Soon she'll be in the home area, then we can talk to her!" - "But first I need you to help set the table," Steve prompts. The kids set the table while Steve tastes the food, Thai food, which is Maggy's favourite.
Maggy now exits the highway. Approaching her town on the rural road, she enters the home area. Here everything is familiar to her, here she knows every house and tree. "Should we put candles on the table?" she hears Emma asking her daddy. "I think Mama would like that," comes Steve's answer. "Yes, she will," says Maggy through the *keepClose* device. "Mama!", she hears the kids, and Steve, "Hey honey!" - Maggy asks, "How was theater practice?" and Emma starts telling about her day. "Hey, she's here," Ben notices on the device: it shows that Maggy is nearly there. The kids head for the door, laughing out loud, while Steve lights the candles and then awaits Maggy with wide open arms.

4.1.3 Designing the *keepClose* Experience Through Technology

Similar to *CliqueTrip* (Section 3.1) and *ExplorationRide* (Section 3.2) the Experience Story is used as a blueprint for the designed experience. It is further broken down in single interaction steps, which are visualised in a storyboard. The system is then implemented in the form of a device, which is placed in the home, and an app within the car infotainment system.
Based upon the insights drawn from the analysis of the commuting stories, the designed experience is comprised of three design strategies. In the order of occurance while driving home, these are (1) the loved ones expressing themselves, (2) the commuter conveying their whereabouts, and (3) the loved ones and the commuter being together. Figure 4.2.3 gives an overview of the positions at which each design strategy takes place within the commute.

The *keepClose* Storyboard

To analyse the single interaction steps of the system based on the *keepClose* Experience Story a storyboard (see Section 2.3.3) is created. Figure 4.5 shows example key frames of the storyboard. Drawing upon the Experience Story the storyboard of *keepClose* is about defining in which

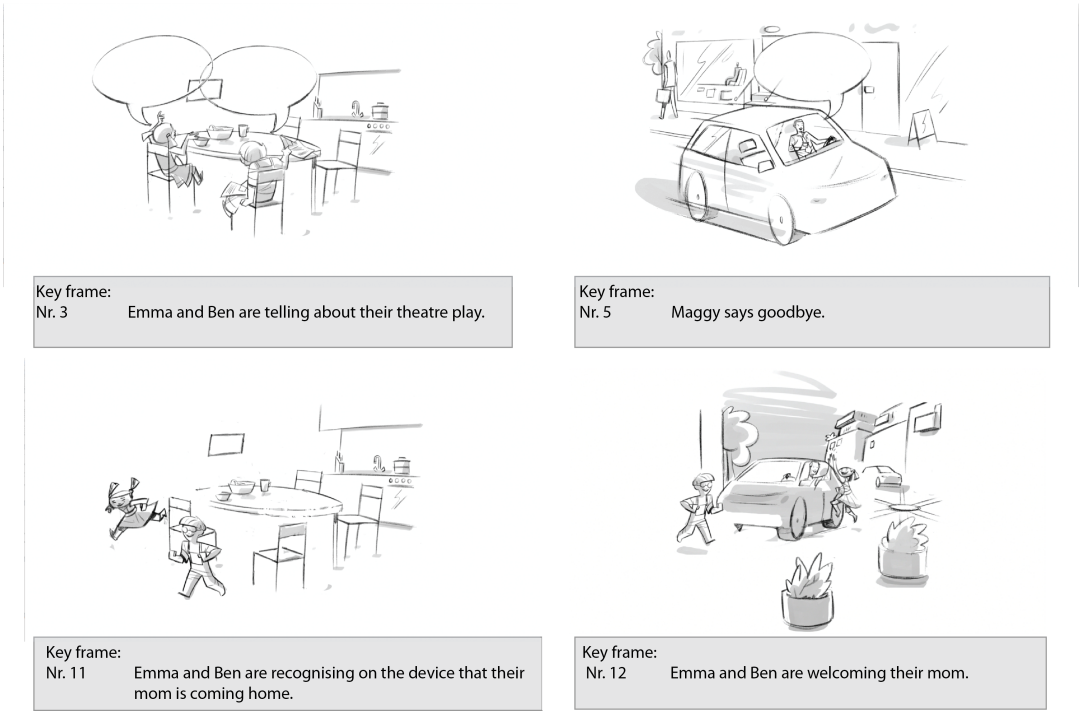

Figure 4.5: Example key frames of the *keepClose* storyboard (illustration from the Folkwang University of Art, Marc Hassenzahl, created by Frank Josten).

situations the system realises the design strategies. Thus, the storyboard helps to focus on the specific interaction steps while designing later on. Furthermore, it helps the communication within the interdisciplinary design team throughout the designing.

(1) The Loved Ones Expressing Themselves

The essence of this element of the Experience Story lies in Maggy receiving a message, which shows that Steve has been thinking of her. The loved ones at home are able to express themselves via the *keepClose* device in the form of hand written notes, painted or taken pictures, and audio notes. This communication is designed with two limitations. First, these messages can only be sent from home to the *keepClose* system in the commuter's car, and secondly, the commuter can receive the message only before but not while driving. For the message to be emotional it is important that only one person receives the message and not the whole group, hence there is no messaging from the commuter to the home. Secondly, those at home are only able to create a message when the car is parked at work so that the commuter only receives messages before starting the drive home, just as in "Commuting Story 3" a message is found under the wiper when the narrator gets to the car (see Figure 4.6).

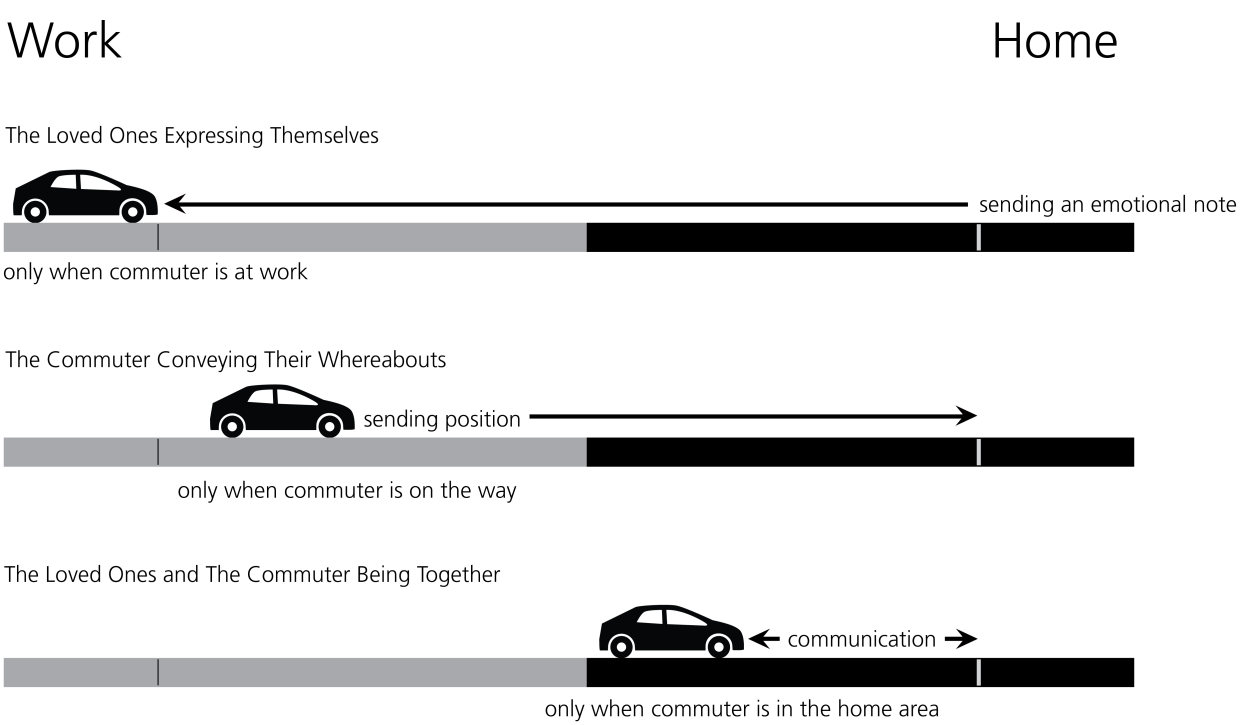

Figure 4.6: The design strategies and their function area.

(2) The Commuter Conveying Their Whereabouts
While Maggy is driving home, her family is able to watch her progression on the *keepClose* device. As shown in Figure 4.6, the commuter's vague positioning is sent to the home device. The system does not send the exact position of the vehicle, so that the commuter does not get the feeling of being monitored. The commuter also receives feedback on the approximate distance to home through the *keepClose* device in the car. In that way, those at home as well as the commuter in the car are able to pleasantly anticipate the proximity to the specific point from where on the commuter is familiar to the surrounding, that is home area home area, where communication is established, and the forthcoming arrival of the commuter.

(3) The Loved Ones and The Commuter Being Together
Once Maggy's position is located within the home area she is able to participate in the family's routines: the vibrant activity going on in the kitchen when driving home as well as the childrens' story telling when driving to work. This communication increases the thrill of anticipation and facilitate participation in home activities. The acoustic communication channel is designed only for the area close to home (see Figure 4.6), thus it is established at the home area.

4.1.4 Starting Point for Refining: A First Design of the *keep-Close*Experience

The designs of the system in the car and at home are heteromorphic. The commuter's experiences of leaving and coming home are different from the experiences of those at home letting the commuter go and expecting them back, and such are the connected emotions. For that reason, the corresponding parts of the system in the car and at home are designed differently.

During the Commuter's Drive to Work

When the commuter begins the outbound drive communication with the family is possible until the commuter leaves the home area. When this happens, those at home are still able to determine the location of the commuter, only without the acoustic communication channel.

During the Commuter's Drive Home

As long as the commuter is at work the family members ones at home have the possibility to send messages as a way of showing that they are thinking of the commuter. When the commuter starts the drive back from work, the device at home displays the decreasing distance between the commuter and home. Furthermore, those at home can estimate when the communication channel between the commuter and home will be established by the commuter driving into the home area. Once the commuter is arriving in front of the home (e.g., in the driveway) the communication channel is shut down in order to shift the focus from the device unto to the real encounter of the reunited family.

First Technical Realisation

The prototypes of the device within the car and of the device at home were realised with two different Android[2] applications. In order to be able to place the system in the cars of the different participants, it was implemented on an *HTC One S* smart phone. The device at home was installed at one specific place (like the Whereabouts Clock, see Section 4.3) in order to be available to every member of the group at home and to avoid any competition arising by one of the group potentially taking the device. To ensure that those at home are able to share the screen the device was implemented on a *Samsung Galaxy Note* tablet. Both devices communicate through a common server with two shared MySQL databases. The communication is implemented with the *Voice over IP* services called Sipdroid[3]. This service establishes a communication channel from the application within the car triggered by the position of the car on the road, hence opening the communication channel within the home area (see Figure 4.7).
The back-end realises the positioning and transmitting of messages. The general information about the position is delivered from the Android application in the car to the server via http requests. The PHP script on the server side processes the position data and stores the information

[2] API level 15, for more information see www.android.com

[3] For more information see: `http://code.google.com/p/sipdroid/`

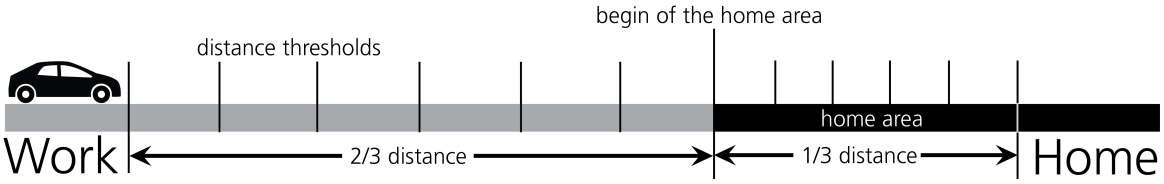

Figure 4.7: Distance thresholds on the way.

in a MySQL Database. The server sends the data to the Android application on the tablet in the home. The positioning interfaces in the car and at home display images to estimate the position on the road between the work and the home of the commuter. The home area involves 1/3 of the distance in the prototype as a first estimation of what a commuter recognises as the local area. The range of the home area has to be evaluated in the first study where the system is tested and nimbly adapted. Since one aim is to foster the thrill of anticipation, the distance thresholds in the home area are more condensed than outside so that the commuter's position within that area is updated two times faster than outside of it. The messages sent from the device at home (see Figure 4.6) are uploaded to the server and downloaded to the device in the car when it starts the drive home.

The Home Interface: The Commuter's Drive to Work

The interface of the *keepClose* device at home during the commuter's drive to work was created as

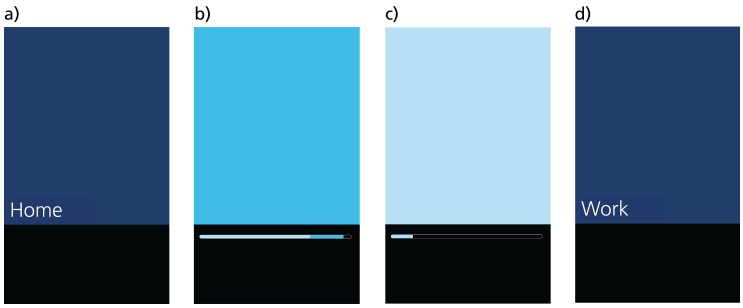

Figure 4.8: The interface of the *keepClose* device at home during the commuter's drive to work

follows. As seen in Figure 4.8, when the commuter starts the system, Panel a) is displayed on the device at home. After the commuter's departure the family at home sees the display in medium blue colour, as in Panel b), which illustrates that the communication channel is available. The status bar in the black bottom area (Panels b) and c)) indicates to the family at home how much longer the commuter remains in the home area where the audio channel is open, represented by the medium blue area in the status bar (Panel b)), and how much longer the commuter has left to drive before arriving at work, represented by the light blue area in the status bar (Panel c)). When the commuter arrives at work, Panel d) is displayed in the device at home until the commuter turns

off the system and leaves the car. Then, the message prompt is displayed, which can be used to send a message for the commuter to receive upon returning to the vehicle.

The Car Interface: The Commuter's Drive to Work

The interface of the *keepClose* system within the car infotainment system for the drive to work

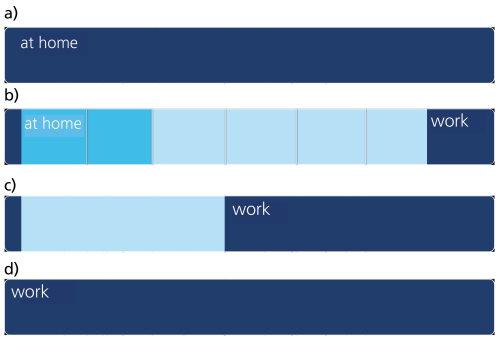

Figure 4.9: The interface of the *keepClose* system in the car during the commuter's drive to work

is shown in Figure 4.9. When the commuter turns on the system in the car at home, Panel a) is displayed until the commute is started. While driving, the interface displays the road ahead with the actual position represented by the dark blue field on the left side. The section left within the home area is represented by the medium blue field on the left side in Panel b), whereas the lighter blue field on the right side stands for the section remaining before the arrival at work. The interface is segmented according to the distance thresholds ahead. In Panel b), the commuter has six segments left before arriving at work, and in Panel c) only one. When the commuter arrives at work, all of the light blue segments representing the distance remaining to work are gone and the interface is coloured entirely in dark blue.

The Home Interface: The Commuter's Drive Home

The interface of the home device during the commuter's drive back home (see Figure 4.10) is designed similarly to the interface during the commuter's drive to work. Only in this case the status bar now works in a different direction so as display the homeward journey. When the commuter starts the *keepClose* system, the message option disappears from the home device and Panel a) is displayed instead. Now the family members at home know that the commuter has received any sent messages. During the commuter's drive the distance left ahead before reaching the home area, when communication is possible again, is indicated by the light blue colour in the status bar. The black area in the status bar shows the area already driven. As soon as the commuter enters the home area the colour in the upper field changes to medium blue (see Panel c)),which indicates that the audio connection is now available. When the commuter arrives home, Panel d) is displayed and the audio channel is disconnected in order to shift attention from the system to the

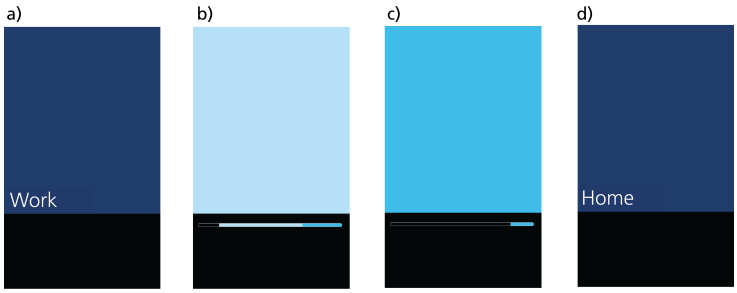

Figure 4.10: The interface of the device at home during the commuter's drive home

arriving commuter.

The Car Interface: The Commuter's Drive Home

The interface of the *keepClose* system in the car for the commute home after work is designed as

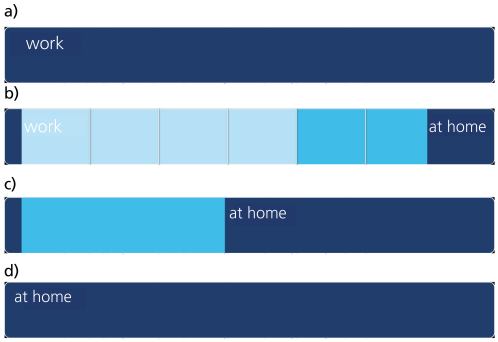

Figure 4.11: The interface of the *keepClose* system in the car during the commuter's drive home.

seen in Figure 4.11. When the commuter starts the system at work, any sent messages are received. Then Panel a) is displayed until the drive begins. Again, as in the commute to work, the distance ahead is segmented. The light blue segments indicate the distance remaining before reaching the home area (as seen in Panel b)). The medium blue segments (Panel b)) show the home area, and when the commuter arrives at home the interface turns dark blue (Panel d)).

4.1.5 Agile Refining: The *keepClose* Prototype

To evaluate the initial prototype and the design strategies upon which it is built, a first study is conducted. The aim of this study is to test the technical implementation of the device. The system

Family No.	Commuter / Partner at home	Kids
1	father age 33 (controller) mother age 28 (psychologist)	son age 2
2	father age 48 (engineer) mother age 45 (real estate manager)	daughter age 12 and son age 10
3	father age 42 (engineer) mother age 42 (construction draftswoman)	sons age 10, 8 and 7

Table 4.1: Demography of the pre-study participants.

is adjusted to optimise the technology for an enhanced experience.

Procedure and Methods for the Agile Testing of the *keepClose* System

To optimise the system during testing, agile adaptations were made after each test period. For the testing to happen in a real environment, three families were recruited to use the system in situ (see Table 4.1). The commuters had a travel time of at least 30 minutes, up to a maximum of 60 minutes.

A test period comprised one family using the initial prototype in their everyday life for two days. The day before the test, both systems were installed, one system within the commuter's car and the other system in the home. The device with the android application was placed in the family's common space in the house. Additionally, the family received an introduction to the *keepClose* system. The day after the testing, the devices were returned and semi-structured narrative interviews (see in Section 2.3.1) were conducted with the mother and father of the family individually. Hereby, two commutes to work and two commutes home with the *keepClose* system were observed. All interviews were video recorded for later analysis, and the results were translated form German into English. The interview focused on the family's perception and usage of the *keepClose* system and provided important starting points for the system's enhancement for the long-term study. Thus, the protoype was optimised after each test period.

The Loved Ones Expressing Themselves: Adjustments

In the testing of the initial prototype, the feature of sending messages was not used by the participant families, presumably because they habitually send messages by mobile device and also because the messaging had no stimulative nature. Therefore, two changes were made. First, the creation of messages was limited to a digital pen and paper function. Those at home can write or even paint directly on the screen with a digital pen of the android tablet. Secondly, to foster a stimulative nature, the message interface arises automatically once the commuter arrives at work and closes once he drives home. Thus, throughout the commuter's time at work an empty paper on the screen is prompts the creation of messages.

The Commuter Conveying Their Whereabouts: Adjustments

When testing the system, Family 1 was unsatisfied with the display of the distance estimation. The mother of this family pointed out that when using the *keepClose* prototype just before the

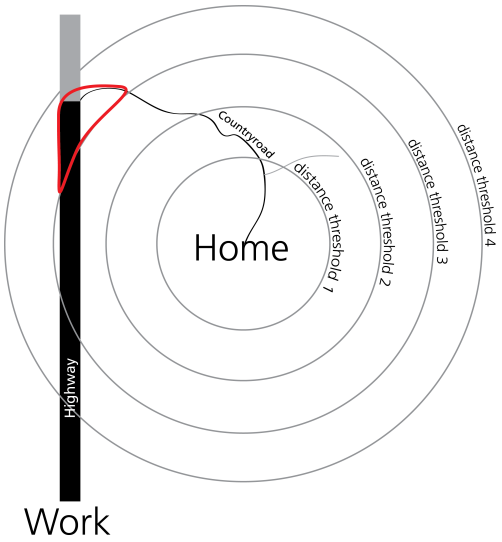

Figure 4.12: The commuter's path crosses the home area threshold on the homeward journey.

commuter arrived, "... to our complete surprise, it displayed my husband [the commuter] to be deviating from home at the very next instance. My child was quite disappointed and me, too, of course" (mother of Family 1). The problem that occurred was that the displayed distance from car to home depended on the car's position in the distance thresholds (see Figure 4.7), so that if the commuter drove detours or shortcuts, the system jumped between the thresholds. In the case of Family 1, after the commuter has been constantly approaching home during the return journey, the distance between his position and home suddenly increases again at one point (see marked area in Figure 4.12. In this figure it can be seen that on his drive home the commuter enters into Threshold 3, but while exiting the highway he has to leave this threshold and cross back into Threshold 4. The home device is then displayed as if the commuter drives back to work.
This issue only occurred in Family 1 and was rectified before the testing with Family 2. The problem was solved by a displaying of a direction change only if the commuter crosses a total of three thresholds in the direction away from home.

The Loved Ones Expressing Themselves: Adjustments

Family 1 also expressed frustration with the long time span between starting the system and the opening of the audio channel. The mother of Family 1 commented, "Well, we personally said goodbye and then he [the commuting husband] went out the door. Until he finally switched on the *keepClose* in the car, it felt like ages passed. So it felt like we said goodbye twice." This occurred because in order for the connection to be established the system first searched for a GPS signal in order to localise the car's position and to recognise if the system was within the home area, a process which sometimes required up to five minutes. This issue was solved by establishing a connection immediately upon starting the system, instead of waiting for a GPS signal to calculate

the position, which in the morning was then automatically assumed to be the home position. Instability and poor conections caused other problems with the audio channel. Because of the bad connection the commuter could not count on the audio channel, and therefore sometimes did not pay attention to it. As the mother of Family 1 mentioned, "... he [the commuter] had turned on the radio and didn't notice the open communication channel." This problem was fixed after the pre-study by re-implementing the audio channel from the beginning. The reason for the bad connection was the use of a *Voice over IP* service, and hence the dependancy on the mobile internet network for the audio transmission.
In the countryside where Family 1 lived the mobile internet connection was poor or even unavailable, especially since the mobile device requires a relatively strong *3g* connection in order to have an open network connection and call at the same time. Thus, the communication channel was instead implemented via a telephone connection. The Android application in the car automatically called the tablet within the commuter's home where the call was automatically answered in the background. Although this made the audio channel robust, the system in the car was now comprised of two distinct mobile devices, one for calling and another one for sending position updates via the mobile network.

4.1.6 Evaluating the *keepClose* Experience In Situ

The impact of the *keepClose* system is further analysed in a more intensive study. The aim of this evaluation is to generate a detailed understanding of the *keepClose* experience and of the system's influence on family routines and rituals.

Proceeding and Methods for the Analysis of the *keepClose* Experience

For the purpose of analysing the *keepClose* Experience two families were given the system for testing. These two recruited families met the requirements of having children of the age between 2 and 10 years, one parent being a commuter with a distance to work of at least 30 kilometres (ca. 20 miles), and the commuter not taking part in a carpool. The *keepClose* system was installed within the car's dashboard and in a shared space at home where the family met during the commuter's drives to work and before the commuter's arrival. The families used the system over a period of two weeks. During the pre-test phase, while testing,immediately afterwards as well as after an extended time period, semi-structured interviews (see Section 2.3.1)were conducted with each parent individually. The first interviews were held before the installation of the system in order to get an impression of the familys' everyday lives and their habits in the context of commuting. The second interviews were conducted after one week of using the system, the third after two weeks of usage, at the time at which the system was uninstalled. After another week, further interviews were conducted to see how the families felt about the system in retrospect. The questions focused on the family routines and rituals before, during, and after the commuting of one family member.
The objective was to try to understand the overall impact of the system over the long term. Therefore, two contrasting families were chosen to test the system. One family had a very

structured daily routine, whereas the other one had shifting routines. Both of them used the system for two weeks. This made it possible to study the longer-term impact and to ensure that the system is not just perceived as stimulating through its first-time utilisation.
In order to embrace all facets of the complex impact of the system, an Interpretative Phenomenological Analysis (IPA) was conducted (see Section 2.3.4). Here, themes are first identified at the case level. Subsequently, it searched for recurrent themes among all participants. This method enabled a close look at the experiences of the participants.
During the process of analysing, it became apparent that the system had disparate impacts on the two families. As a consequence, the decision was made to report their experiences separately and summarise key emergent themes afterwards.

All interview results were translated from German into English.

Family I: Family Portrait

Family I lives in a small town and consists of five people. The mother (participant number: FI.1) is a 34-year old sociologist and the father (participant number: FI.2) is a 39-year-old engineer. They have three girls, aged five, three, and one year old. The father works in the next largest city. Additionally, he and his wife have a small home business. The father commutes 30 km (ca. 20 miles) to work.

Structure of the daily commute:

This family has a strongly structured daily routine. The tasks between the parents are well defined and they have the same procedure every workday.

Commuting to work:

The morning drive is not of a commuting nature because the father spends time with the children each morning as he has breakfast together with them and then drives them to kindergarten on his way to work. While driving the father and the children listen to the childrens' music. After dropping off the children, the father either calls his wife to discuss the home business or prepares for his job (e.g., makes calls).
At this time, the mother has 30 minutes on her own while the baby is sleeping. She calls this her morning ritual.

Commuting back home:

On the way back home, either the commuting father or the mother calls the other to talk about when the father will be home. While driving the father makes work-related calls. The family at home prepares the dinner independently from the father. The latter comes home at different times, hence the family often starts dinner without him. At this time of the day, the children ask about the father's arrival.

Arriving home:
When the father returns the family is either sitting at the dinner table or the children are already in bed. If the children are still awake it is a pleasant surprise for the father. If the dinner is still going on the father joins them immediately.

Family I: Findings

Baseline Interview (before using the system)

Commuting to work: In the first interview, the father describes the morning ritual of having breakfast, driving the children to kindergarten and afterwards commuting to work as rather emotionless, "That's daily routine, so it's not rather emotional" (FI.2-I1, 4:34).
For the mother, this time of the day is the calmest. As the morning ritual is well attuned, she can relax for thirty minutes. She trusts her husband and the children, "I'm relaxed, because I know they're doing well" (FI.1-I1, 37:30).
A statement made by the father shows how important the ritual also is for the children, "The mood depends on the girls. When they're having a bad day, everything is rather tense, and if you then set them in the car in a different seat than usual, the tantrums starts" (FI.2-I1, 4:48).

Commuting back home:
During the way home the father is still at work with his thoughts. The border between work and home is the front door. "During the trip, I often make some last phone calls or think about work stuff" (FI.2.-I1, 13:45). For the mother, the time of arrival is not as important, but she mentioned the children starting to ask more often when the father will come home.

Arriving home:
For the husband, coming home is the highlight of the day. He talked about how he stands behind the door, with a chuckle, knowing that his daughters will start to scream and 'attack' him when he enters the room, "It's like running into a stadium. [...] They jump up and hug my legs, that's funny" (FI.2.-I1, 9:44). The mother, however, does not have any special feelings about this situation. She is mostly busy with the children and dinner. It is after bringing the children to bed that she has time for her husband.

First-Week-Usage Interview
Commuting to work:
Regarding the journey to work, the father had not had positive experiences through the system. He claimed that the system usage was rather incompatible with the attuned morning ritual, "It was a disruption of a well-rehearsed procedure" (FI.2-I2, 1:15). The same went for his wife, "In the car in the mornings, it is strange for the children, because it is a different routine" (FI.1-I2, 9:40).
Furthermore, the father did not feel related to the home while driving to work - he talked about spending the time in order to prepare for his job. "Driving to work is mostly a preparation for work, not really an absence from home" (FI.2-I2, 2:20).

The mother also had a problem with the communication, as she felt she was mistrusting him and the children. "I felt a little bit like a stranger, as if I would like to control [their drive to kindergarten and work] " (FI.1-I2, 10:05).
Additionally, she expressed her generally sceptic regard for technology, hence she switched off the tablet once her husband had left the home area. "For me, there is nothing natural about having such a thing in the kitchen" (FI.1-I2, 7:15).
Furthermore, both parents explained that the kids were strongly focused on the tablet, "The children are staring at it all the time" (FI.2-I2, 2:05). "The children are disturbed by it. They don't understand it" (FI.1-I2, 9:15).

Commuting back home:
More than for the way to work, the commuting father felt positive about the way back. His thoughts were directed towards home earlier than the week before. "Driving home was mostly positive - it is not really an 'attuning,' but you are a little bit closer" (FI.2-I2, 2:40).
The status bar did not trigger any feelings, because he already had some reference points on his way back, like a furniture store. The home area overlapped with their own sense of home. "We often phone there anyway, 'I am already at the [store]'" (FI.2-I2, 4:35).
Furthermore, the father could not see any difference to calling home himself. The mother found that it was good that she was able to estimate approximately when he will be at home. Besides she sometimes had a bad feeling when she was not in the kitchen while he was entering the home area. "Once I came into the kitchen and heard him, 'Hello, hellooooo,' I thought 'Poor one, he is screaming and no one reacts'" (FI.1-I2, 7:50).

Arriving home:
Concerning the arrival at home the father perceived less positive emotions than without using the system. The childrens' awareness of his location had weakened the surprise effect of entering the dining room. "The surprise of the children was less than usual, but this used to be a highlight" (FI.2-I2, 10:45). In the mother's perception nothing had changed concerning this.

Second-Week-Usage Interview
Commuting to work:
The two partners explained that in the second week they mostly had to leave the house at the same time, which made the system obsolete on these days. Regarding those days they did not leave at the same time, the father again talked about the ambiguous border between the house and the drive to kindergarten with the children and the disturbed morning ritual. "The feeling when driving away from home was a little bit like a blurred line"(FI.2-I3, 22:20).

Commuting back home:
After the commuting father had perceived the way home positively in the first week of usage, his impression was confirmed in the second week. In contrast to the outbound journey, the blurred border between work and arriving at home was positive for him. "There are almost positive

feelings when you are returning home, because then it is the other way around, you close the door of the office and you really finish your work day and then on your way home you are more ready to already be with your family" (FI.2-I3, 23:00).
The father also confirmed another aspect he had mentioned a week before: the status bar did not cause any positive feelings, as the way home was already familiar to him and he had his own reference points. "The status bar did not trigger any emotions, because the way home is already so familiar to me that one knows where one is and how far there is still to go" (FI.2-I3, 23:20).
The mother's impression of the system during the homeward journey had become more clear. She mentioned some kind of learning effect regarding the meaning of the father entering the home area: "The positive aspect really is the moment when he enters the zone" (FI.1-I3, 8:00). The kids also now had a better understanding of the system and were looking forward to the father's arrival. The mother told us, "The children said, 'Dad is coming soon, he is already close,' and then they go outside" (FI.1-I3, 8:30).
One negative aspect she mentioned was the dissatisfying conversation. As she had housework to do, she did not concentrate on talking to her husband and the conversation was not as communicative as she wanted it to be. "It is not an exchange because one is not concentrated" (FI.1-I3, 9:20).

Arriving home:
Even though the children were more familiar with the system and (according to the mother) awaited the father on the street, the latter repeated the statements about the moment of coming home, "The emotional experience of coming home is weakened" (FI.2-I3, 33:20). According to him, the fact that the communication was only auditive and not visual or even physical took away from the experience, "The communication takes place without seeing, without expressions and gestures" (FI.2-I3, 33:45). Therefore, the coming home experience as a whole was weakened. The issue with the mother's scepticism about technology had become less important, she explained, "I can think of nothing explicitly negative to say, like 'that was exhausting,' or, 'this was getting on my nerves'" (FI.1-I3, 5:50).

One-Week-After-Usage Interview
Commuting to work:
In the morning, the father was glad to return to the old procedure, as he now had time again to prepare for work. "On my way to work, there was again this clear cut - door closed, work starts. [...] I always feel more comfortable when I come to the office and am already prepared" (FI.2-I4, 0:24).

Commuting back home:
During the drive back, the father had caught himself thinking about work-related things again. "On my way back, it was a little bit like I stay longer in the office with my head and things are still running afterwards" (FI.2-I4, 0:54). While testing the system, he had positively noted that this happened less often. "There is a positive effect because it pulls you a bit more out of work, if you usually have the tendency to stay in there" (FI.2-I4, 2:12). After the first week of usage the father had not seen any benefit in the automated system call as to calling the family himself.

However, after having stopped using the system, he admitted that these calls normally don't take place. "One can call home with hands-free equipment just as easily as with the system, but one doesn't do it anyway. [...] When it is about something to buy or to bring along, these calls you make, but you don't do this regular thing" (FI.2-I4, 3:13).
The mother stated about the system, in general, "I did not really miss it" (FI.1-I4, 1:50). However, she admitted that the communication with her husband during the commute home had become less frequent again without the system. This had thus impacted the family's behaviour: "In the evenings, one communicates less, you just hear from each other when there is something concrete, like it used to be before the system"(FI.1-I4, 2:00), especially as she further added, "For me, there is a difference if one has already spoken each other, or not" (FI.1-I4, 2:20).

Arriving home:
Concerning the moment of the arrival at home, no special statements were made.

Family II: Family portrait
Family II lives in a village. The mother is a 44-year-old qualified social education worker (participant number FII.1) and the father is a 43-year-old teacher (participant number FII.2). They have four children. The oldest child is a 23-year-old girl who does not live at home anymore. They further have two boys who are nine and seven years old and a four-year old girl. The father commutes 60 kilometres (ca. 40 miles) to his work.

Structure of the daily commute:
The family is less structured than Family I, with the children being more independent due to their older age-set. As a teacher the father has varying working hours.

Commuting to work:
The father has to leave at different times in the morning, sometimes very early. Therefore, the family mostly does not have breakfast together.

Commuting back home:
The commuting father usually calls before driving home to ask if the family needs anything and to let them know when he will be back. This is important for the family as he returns home at different times. For the father the commute is neither work nor family time, rather he is on his own and, e.g., listens to the radio.

Arriving home:
The children want to know when their dad returns from work. When the father arrives the family is sometimes already at the dinner table. Upon his arrival, he receives a hearty welcome, except if the children are playing in that moment, e.g., outside with friends.

Findings: Family II
Baseline Interview (before using the system):

Commuting to work:
Due to their varied schedules the family has not much time for breakfast together, as the father explains, "There is no strong ritual, because everyone leaves the house at different times. [... Eating together] is not possible very often because of our daily routines" (FII.2-I1, 2:45).

Commuting back home:
The commuting father happily anticipates coming home, "I am always looking forward to coming home" (FII.2-I1, 7:10). He gets in contact with his family before driving back, because "The kids want to know when I am coming home" (FII.2-I1, 6:15). At home, the children look forward to welcoming their father, as the mother narrates, "The kids ask me already an hour before when he will return" (FII.1-I1, 25:10).

Arriving home:
Concerning the moment of the arrival at home, no special statements were made.

First-Week-Usage Interview:
In general, the father found that the commuting "procedure stayed the same" (FII.2-I2, 3:20).

Commuting to work:
The father experienced the way to work as a kind of extended breakfast. He was able to participate in the family life and talk to his wife and children while driving to work, as he describes, "In the mornings it was nice when the kids were still sitting at the breakfast table or just came downstairs" (FII.2-I2, 0:55). "The kids told all kinds of things and I listened" (FII.2-I2, 1:05).
The mother also valued the additional time her husband had together with the family: "The positive thing really is that one has contact with each other ten minutes more, that is really great" (FII.1-I2, 1:30). "The kids chatted a lot with my husband" (FII.2-I2, 1:45).

Commuting back home:
During the first week, the father had to fight technical issues concerning the speech quality, "If one has to ask again and again, it's a turn-off" (FII.1-I2, 4:20). The family at home, however, was excited about when the father would enter the home area. This was especially true for his wife who was often in the kitchen at this time, preparing dinner. "In the evenings when I am preparing dinner and the kids are outside, all of a sudden, the system starts – a little 'click, click' and then his voice, 'Hellooo.' That was really nice" (FII.1-I2, 2:10).
Most of the time the children were playing outside, but they came in to talk to their father, as the mother narrates, "And then I call the kids and they all come, that is really funny. And then they

chat until he is at home" (FII.1-I2, 2:40).

Arriving home:
According to the mother, the arrival of the husband had become a bit less exciting. This was mainly because they had already exchanged the most important information of the day. "Because of that, the welcoming is not as lively [between the father and the children] as it was before. They [the father and the children] start the conversation where they had left off" (FII.1-I2, 3:40). However, this was not perceived negatively because the children were old enough to talk in a more deliberate way (in comparison to the younger children in Family I).
Similar to the way to work the way back including the arrival constituted an extension of family time. Apart from that, the system changed the children's behaviour, as they went outside onto the street to await their father.

Second-Week-Usage Interview
Commuting to work:
After the second week of usage, the system had become an inherent part of family life. The father ascribed this to the opportunity to stay connected for a longer time with his family, "For me, the predominant feature was being involved longer, especially in the mornings" (FII.2-I3, 24:51). He even enjoyed just sitting in the car and listening to the others, knowing that they were there at home, "Yes, I can remember that I often just sat there and listened to what was happening there. [...] It was positive to have this connectedness... a soothing feeling" (FII.2-I3, 24:03). Furthermore, the father asserted, "Often it was like being attended by a presence, which was stretching out" (FII.2-I3, 25:02).
The mother had recognised that the use of the system in the morning had taken on a ritualistic nature. The children even hurried to come down to the kitchen in order to talk to their father. "It was kind of a ritual. They quickly started to come downstairs faster and contact their father. I found this was nice – all on their own!" (FII.1-I3, 2:51). In one particular situation she appreciated the system for herself, "One time I could not say goodbye, and then the system was great. He [the commuting husband] had just said, 'I have to go, it is already late,' and then there was this 'click, click' (FII.1-I3, 3:45).

Commuting back home:
After the second week, the father experienced the way home more intensely. He described himself picturing the family watching the tablet, "I imagined that they might be sitting in front of the tablet and seeing where I am" (FII.2-I3, 4:02). He trusted the system to make it possible to talk to his family after reaching a certain reference point, "I relied on it. Exiting [a specific town], there I can talk to home" (FII.2-I3, 1:04). In this situation he was excited to find out whether anyone was at home that he could talk to, "I found it really exciting to see, 'Is there anybody? Can I talk to someone?'" (FII.2-I3, 32:26).
However, if nobody was there, he was a bit disappointed, "Two to three times no one was there, and I also had a concrete matter, which I wanted to tell my wife" (FII.2-I3, 0:00).
His wife confirmed the family's experiences of the first week. She described the moment when the

father entered the home area, "We hear, 'Hello, it's me,' – and then they come from all directions and sit in front of the tablet like in front of the radio in old times" (FII.1-I3, 4:12).

Arriving home:
The arrival at home had become an extended process. In contrast to Family I, the father considered the time in the home area more as a phase of raising expectations than of weakening the actual arrival, "For me it felt like a growing feeling of eager expectancy, until I finally was home" (FII.2-I3, 3:05).
His wife talked about the longer period of arriving as well. Even if it did not happen physically, she explained that it was equally emotional, "The process of coming home is longer of course it is different if you have the person next to you, but it is sentimental and emotional" (FII.1-I3, 4:47).

One-Week-after-Usage Interview
Commuting to work:
After one week without the system, the father talked about missing the communication in the morning, "I kind of missed it, I thought for example, 'Now it would be nice to speak longer with the family" (FII.2-I4, 8:56). Just as the father from Family I, the father here talked about theoretically being able to make a phone call himself but admitted that this would be too laborious most of the time, "And I eventually realised that I could call with my mobile, but that seemed too circumstantial to me. It is not like this automatic call, through which the time together is prolonged for a quarter of an hour" (FII.2-I4, 8:56).
The mother also complained about the recurring lack of time to talk with her husband in the morning, "Yes, I miss it that one does not see and hear each other. Of course, this had been different before" (FII.2-I4, 0:45).

Commuting back home:
Furthermore, the father talked about how nice it had been to get into the car and switch on the smartphone to announce his departure, "When I got into the car and switched on the system to announce that I will come home soon, that was really nice" (FII.2-I4, 7:36). He also mentioned watching the status bar and looking forward to be able to talk to the family, "It was nice to have the application and to take a look at it from time to time" (FII.2-I4, 7:45).
His wife explained that her husband returned to calling when he leaves work. The welcoming was relocated again to the family's house, which reduced the anticipation, "The opportunity to talk to him [the husband] is not longer be available, it is now more restrained" (FII.1-I4, 1:39) "... It's exactly this anticipation that is different now" (FII.1-I4, 0:45).

Arriving home:
Without the system the arrival had again the surprise-effect it had had before. The childrens' excitement had grown again, "It was the same way before using the system that they were happy, and while using the system it was a little bit more restrained, of course – and then it was really

strong again" (FII.2-I4 3:05).

4.1.7 Discussion and Conclusion of the *keepClose* Experience

The analysis here displays the impact of the system over in two example studies. The aim for the system was to create relatedness experiences for commuting families, so as to enhance positive emotions for the commuter while on their way to work and home again as well as for the family at home. As the results from the interviews showed, the system generated positive experiences while in usage (see e.g., Family I, Interview 3), but also negative ones, (see e.g., Family II, Interview 2). Why and when positive experiences were created depended on (1) the impact the system had on the family rituals, (2) the long-term approval of the system, and (3) the requirements for a ritual-focused system, which needs to be adaptable to existing family routines.

(1) Impact on Family Rituals:
The impact of the system on the families differed. For the well organised Family I, the system disturbed the defined morning routine (e.g., see FI, Interviews 2 or 3). This was so because this family's morning drive is more communal in nature than commuting. The father drops the children off on the way to work, hence the connection via *keepClose* only concerns the mother who has a ritual of being on her own at this time of the day. The mother did not desire to change her ritual towards participating in the drive, neither did the system adapt the mother's daily routine.
Family II, on the other hand, had no commuting routine in the morning. The family members leave the house at different times, the commuting father sometimes leaves even before breakfast. Hence, to be able to say goodbye to the father with the help of the system, the children of Family II got ready early and thus spoke with him during breakfast (e.g., see FII, I3). It is this Joint Action of the father participating in the breakfast that is fosters relatedness within the newly created morning ritual. In this family, the commuter used the system to be a part of the family in the moment where he had to leave home (e.g., see FII, I3). Communication via the system's communication channel was for the feeling of being close, and not for transmitting organisational information.
On the way home, the habitual communication of the husband and wife of Family I as an organisational routine was not working via the system (e.g., see FI, I2). But for this commuter the system helped him to think of his family instead of his work (e.g., see FI, I3). This shows that a principle focus of the system's design is Awareness. Also, the commuter in Family II reported that while driving back home his thoughts were more with his family (e.g., see FII, I3). After having used the system, Family I stated that it had benefited their communication (see FI, I4). The relatedness of Family II also benefited from the communication (e.g., see FII, I3), and the conversation with the children was more deliberate. This implies a combination of Awareness and Joint Action.
As the providing of a shared space, that is the communication via the audio channel, enables relatedness in advance of the arrival, the overall excitement of the actual arrival was then experienced as being weaker (e.g., see FI, I2 or FII, I2). The reason for this can be that, in a sense, the

commuter arrives earlier, namely once communication is possible (e.g., see FII, I3). The families did not change the time for dinner, but they went out to welcome the commuter when he was arriving. The mother of Family II reflected that in their family they became more aware of rituals through using the system and learned to cherish communication in the context of commuting.

(2) Long-term Approval of the System

Both families stated that in the beginning they had to get used to the system. This phase of approval of the system worked differently for the families. Family I felt that they never truly got used to it, that they would need a longer period of time. In contrast, Family II got used to the system after the first week, "It's already fully integrated" (FII.1). The reason for this could be this family's wider scope for changing structure, in comparison to Family I in which a strong structure is necessary to complete the morning routine in time. This diverging reception of the *keepClose* experience implies the need for different requirements for systems focusing on family rituals.

(3) Requirements for a Ritual Focused System

Routines and rituals are the decisive aspect of the relatedness experiences created through *keepClose*, hence the approval of this system depends on its suitability to a family's rituals.
In Family I, who has a well structured morning routine to which the members are well attuned, the system was perceived as disturbing. By contrast, in Family II, where there is less strict structure, there was room for the system to foster the relatedness experience. It can also be assumed that their longer commute might give more impetus to use and appreciate the system.
From this follows that the system needs to be more adaptable to individual family rituals and support the structure given by family routines. The non-commuting nature of the drive to work for Family I did not fit the system's design, whereas Family II who had no fixed morning ritual embraced the rituals set up through the system. Also, positive experiences were enhanced when the families got used to the system and accepted the influence on their rituals (cf. Family I, who did not accept the system as much or as quickly as Family II). Consequently, in order to enable possibilities for positive experiences while commuting, the system must not disturb family routines.

Final Thoughts on the *keepClose* System

The user group for this system is very limited as rituals are different and in some ways unique. Nevertheless, as one example, this system shows that the rituals of families with commuters can benefit from the experiences enabled by a technology. It is therefore a first step to design experiences for family rituals focused on commuting and aimed at enhancing relatedness. Also, the analysis provides insights of the system's usage by two test families. The gathered in-depth knowledge should help to design more systems which support positive rituals for families, friends, and all those who desire to be close to each other. Designers should allow for the system's approval time and should not underestimate the given individual structure of routines of the families or other groups, so that systems are individually adaptable.

4.2 Being an Idealist on the Road: The Considerate Driver

This section is based on the publication "Become a Member of the *Last Gentlemen*: Designing for Prosocial Driving" by Knobel, Hassenzahl, Männlein, Lamara, Schumann, Eckoldt, Laschke, and Butz [KHM+13]. The prototype was implemented by Simon Männlein under my supervision.
After showing how Experience Design can have an impact on family rituals for commuters, this section concentrates on the commuter driving in known areas alone. Thus, the scenario for this design case is also the commuter driving alone. Yet in this study, the focus lies not on enhancing relatedness, but on encouraging the driver's prosocial behaviour in traffic.
Commuting is a "necessity" and, unlike driving for pleasure, not a "choice" (p. 51 in [Red08]). Driving for necessity, like commuting, is an obligation, which binds drivers to the road. On such everyday drives competition, too, defines the driver's attitude on the streets, putting an "emphasis on the individual and individual desires" (cf. 16 in [Red08]).
In a survey by the biggest German automobile club (ADAC), 93% of the sample manifested being a victim of aggressive behaviour [Str12]. However, prosocial behaviour, such as "hospitality," is less noticed than competitive driving. To foster prosocial behaviour on the road, one strategy is to focus on the people's sense of altruism. Altruism is the desire to help others, regardless of the potential cost, risk and effort on the part of the helper [AWA10]. Altruism depends on mood and culture [IL72] as well as personality [HMM29]. Thus, altruistic behaviour does not happen without a reason. One reason might be the calling to action based on personal norms and principles. Another reason can be acting based on social learning [BP03]. General prosocial behaviour can be based on intrinsic motivation, in order to not be motivated by outside pressure or external rewards [AWA10]. That is because a given external motivation can undermine, and therefore corrupt, the intrinsic motivation [AWA10] and [DKR99].
In traffic, prosocial behaviour can happen in the form of considerate driving. It not only helps other drivers, but also helps the driver themselves to increase awareness and responsibility in traffic.
In-car interaction systems nowadays do not focus on prosocial behaviour. This case study will do so by treating considerate driving, as an aware, considerate, and courteous social exchange with other road users (including pedestrians), which goes beyond the rules of road traffic. Ecological factors and factors of accident prevention are not regarded.

4.2.1 Gathering and Analysing Past Experiences While Driving Considerately

This section is introduced by two short stories on past experiences of prosocial behaviour in traffic. It then provides an example of an altruistic system as well as of a system to strengthen self-control. This is followed by a pre-study, which clarifies the important elements of prosocial behaviour on the road in order to gather and analyse insights on the motivation and the outside factors, which influence prosocial behaviour while driving.

What Made My Day: 1st Story
I drove to a nearby supermarket for groceries. The parking lot was packed, but luckily I found a space close to the entrance. I had almost parked the car, when I saw a woman with a toddler looking for an empty spot. I reversed out and drove to a space further from the entrance. I often behave like this. It is my contribution to friendly cooperation instead of the ubiquitous competition on the road. (taken from: [KHM+13])

What Made My Day: 2nd Story
I was under pressure, a little late, when I saw an elderly man with a very old dog at a [...] crossing. I found the pair touching. I smiled and stopped for them to cross the road. The man smiled back and slowly got under way. I thought, 'I should do this more often,' because it feels good. This was just a brief moment, which made my day. (taken from: [KHM+13])

Albeit sometimes a necessity, commuting alone also contains the possibility to become the idealist who one wants to be and live, and enable to others, positive experiences.
To design a system that supports prosocial behaviour on the road, various strategies are analysed in the following section.

Prosocial Behaviour in Our Everyday Life

The "What Made My Day"-stories illustrate possible examples of how prosocial road behaviour affects us on the road. There are rare examples from different contexts of products that focus on promoting prosocial behaviour as the goal of the interaction design, such as Altruistic Fan (see Figure 4.13) by Yeoreum Lee and colleagues [LLS11]. The system of Altruistic Fan consists of two fans, one person blowing in the sending fan and another person receiving the passed-on air from the other person. Thus, the Altruistic Fan is a product, which positively affects the receiver of the altruistic action. The sender receives no direct benefit from the idealistic action.
Indeed, driving considerately on the streets is more complex than blowing into a fan, and in the case of the Altruistic Fan the sender and receiver are familiar with each other, unlike in most road interactions. Therefore, a system that fosters considerate driving has to not only concentrate on fostering empathic social relations, but, furthermore, on the driver as well as on personal principles and norms. Human nature has an inherent element of kindness, therefore a system should help drivers to self-control their behaviour towards prosocial norms.
Systems fostering self-control can be found in other contexts as well. There are systems that help to control excess use of water while showering through visualisation of the wastage [LHDT11]. Another example is the paper towel dispenser, designed by Saatchi and Saatchi, which gives the user direct feedback of the negative influence of over-consumption (see Figure 4.14).
In contrast, Kehr and his colleagues invented a product to foster self-control, "The Chocolate Machine" [KHLD12] (see Figure 4.15), in which the device dispenses wrapped balls of chocolate

Altruistic Fan

The Altruistic Fan is a product made up of two interactive fans (see Panel a)). One fan is the input device that a user can blow into in order to generate wind for the output fan, which is placed by another person.
"Blowing into the center hole in the input fan results in the lighting up of the center-hole (by lifting the cover). An ultrasonic sensor was used to measure the distance from the person to the center-hold cover plate. For distances below the threshold, an activation signal was sent to the output fan (Panels a) and b)). The distance sets the speed of the output fan motor resulting in the strength of the generated wind, where a smaller distance translates to a stronger wind" (p. 2).
"... receivers wrote that they felt emotionally "warm" knowing that the sender was concerned about them" (p.3).
Also the sender "...felt emotional warmth through their altruistic action, as well" (p.3).

a)

b)

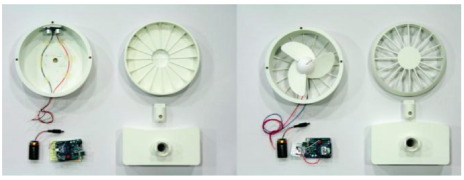

Figure 4.13: The Altruistic Fan (figures and quotation from [LLS11])

Figure 4.14: Paper towel dispenser by Saatchi and Saatchi (figure from [Feh]).

The Chocolate Machine

The Chocolate Machine is an explorative interactive product to foster self-control.

The machine "...consists of a slender container filled with wrapped chocolate balls placed at a study desk. Every 40 to 60 minutes the machine releases a chocolate ball onto the desktop. The user can either eat the chocolate or put it back into the machine, which is registered by a counter.

Repeatedly resisting the chocolate trains self-control strength, just like working out trains muscles [of self-control]" (p. 690).

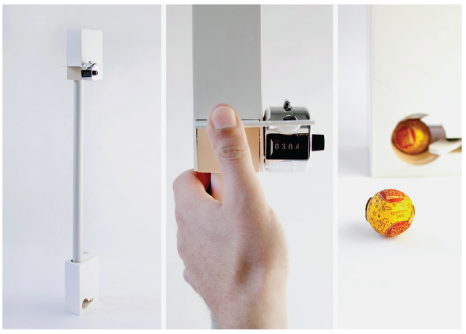

Figure 4.15: The Chocolate Machine (figures and quotation form [KHLD12]).

every 40 to 60 minutes, leaving the user with the choice of whether to eat the chocolate or return it to the dispenser. The machine counts the number of times the user chooses to return the chocolate balls, thus encouraging self-control and thereby providing positive feedback. The more chocolate balls that are put back into the machine, the greater the sense of self-control. The idea behind The Chocolate Machine is the Ego Depletion Theory [SOA00], which discusses the possibility of training the sense of self-control like a muscle, a concept that is also imaginable through systems in an automotive context. This could strengthen awareness for situations like those discussed within the "What Made my Day"-stories.
In order to design a system that encourages considerate driving, a pre-study to gather insights on the motivation and the outside factors, which influence prosocial behaviour while driving, was conducted.

Pre-study Considerate Driving: Procedure and Methods

15 participants were recruited aged between 22 and 31 (mean = 25), six female and nine male, for a semi-structured episodic narrative interview (see in Section 2.3.1) with an average duration of 30 minutes. Traffic situations in the form of four videos as well as one picture were shown to the participants as potential acts of considerate driving, to gather the participants' perceptions and attitudes towards considerate driving. After showing each situation to the participants, they were asked if they chose to act prosocially in such situations, and if so, why and when. The situations

Figure 4.16: a) to d) screenshots from the video shown to the participants; e) picture shown to the participants (figure from [KHM+13]).

were shown to the participants as follows:

a) Give way to a car coming from the opposite direction on a one-lane road, shown in Figure 4.16 Panel a)

b) Give way to a car pulling out of a parking lot, shown in Figure 4.16 Panel b)

c) Give way to a car exiting a driveway, shown in Figure 4.16 Panel c)

d) Give way to a pedestrian crossing the street, shown in Figure 4.16 Panel d)

e) Drive slowly through a reduced-traffic area respecting playing children, shown in Figure 4.16 Panel e)

The statements of the participants were classified and categorised using Affinity Diagrams (see Section 2.3.1). Thereby, each participant's statements for each category were clustered by similarity (as described in Section 2.3.1). As motivations for considerate driving, two main topics emerged in the results: (1) social learning, and (2) personal norms and principles. In the following, each topic is summarised with examples from the gathered interviews.

Pre-study Considerate Driving: Findings and Interpretations

All interview results were translated form German into English.

1. Social Learning
   The first motivation, as according to the participants' statements, addresses the social context as a reason for prosocial behaviour, that is, social learning.
   There are various influences that effect the motivation for considerate driving. 13 (of 15) participants discussed the concept of "the city" as a hindrance to prosocial behaviour. As one participant claimed, "I am often annoyed if no one lets me out into traffic" (P14). Another participant mentioned, "In the city, it's often kind of difficult to get out and so I'm always glad when someone leaves me a gap" (P4).
   Another issue in the context of social learning is that the positive feedback resulting from the prosocial behaviour is given an important role. This is shown by statements such as, "Yes, I think it would be nice if he'd say thank you. Such communication with other people is always kind of nice" (P3), "It's definitely a nice sign" (P13). Seven (of 15) participants argued that the resulting feedback is a precondition for prosocial behaviour in traffic, thereby missing feedback in one situation could result in a choice against prosocial behaviour in another situation, e.g., "Why did I do it at all, if he doesn't even say thank you?" (P15).

2. Personal Norms and Principles
   The other motivation found while analysing the participants' statements was that personal norms and principles influence prosocial behaviour in traffic.
   Eight (of 15) participants spoke about their norms and principles in general. One participant argued, "It just feels right" (P2), another, "That's my basic attitude, I also open doors for others" (P15). Nine participants mentioned their duty to protect "weaker" road members, like children at play, cyclists, and pedestrians. The following statements are examples of this idea, e.g., "Pedestrians have priority in residential neighborhoods" (P12), "Well, from my point of view, the pedestrian is the weakest link – therefore you stop" (P15).
   Eight (of 15) participants also explained that due to their norms and principles the role of the resulting feedback on prosocial driving was less important, as one participant argued, "It's not a big deal for me [to drive considerately], so actually it doesn't matter [whether I get feedback or not]" (P14).
   Besides these two main topics statements were made about factors that prevent the participants from acting prosocially on the road.
   Such influence factors were mentioned by 14 (of 15) participants, e.g., "By stopping in this

situation, I obstruct the street for the people behind me" (P3). Four (of 15) participants mentioned general time pressure, e.g., "I only don't do it when I'm in a hurry" (P13).
Feedback was also occasionally less important based on the specific traffic situation, e.g., "He has no time to say thank you because of the traffic situation, so it doesn't matter to me" (P11), "Well, of course it would be nice, but it's not that important – often you don't even notice" (P4).

These results show that the motivation for considerate driving is based on different influences. There are influences related to social learning, such as reciprocity and the prospect of positive feedback.
Taking these into account, prosocial behaviour in traffic is dependent on the feedback following this behaviour. Other influences, such as the feeling of responsibility towards the other road users, show that people try to act according to their personal norms and principles. This conforms to Batson and Powell [BP03] who also identified a relation between prosocial behaviour on the one hand, and norms and rules on the other hand. The latter motivation is less influenced by the prospect of positive feedback than the motivation of social learning aspect.
Apart from these motivational aspects, the decision of whether to act or not, however, depends on the concrete situation. Although norm-driven people depend less on feedback, as has been discussed, than reward-driven people, most of them still enjoy this kind of gratefulness – above all, no participant considered positive feedback by other road users as negative. Based upon these findings, strategies were outlined to instill more considerate driving habits. In the following, the strategies are first discussed, and subsequently an explorative prototype is designed based upon one of them.

Fostering Considerate Driving: Five Design Strategies

Based on the results of the pre-studies, five general reflections about potential systems were made. These reflections are represented in the following five strategies, which are focused to foster prosocial behaviour in traffic, i.e., considerate driving behaviour.

- Strategy 1: Shape the public perception
  As seen in the above mentioned findings, some participants act considerately because of the prospect of positive feedback. This is an indication of the desire for recognition by others while acting prosocially. Therefore, a system can potentially encourage prosocial behaviour by shaping the public perception of the driver through making their considerate behaviour visible for others.

- Strategy 2: Give personalised feedback
  Feedback for an act of considerate driving was perceived positively, not one of the participants perceived the feedback as negative. Thereby, another strategy can be to reward the driver when acting considerately in order to give additional positive feedback for the contribution to more harmonic traffic. As road users try to support each other, a system should confirm this attitude in order to keep the driver motivated by giving recognition. Here, the undermining effect (as described in the introduction of this design case) is to be avoided.

- Strategy 3: Internalise of prosocial behaviour by addressing personal norms and principles
  The importance of living up to personal norms and principles as shown by the findings can be supported by a system. Helping to support one's personal self-image can foster prosocial behaviour, and thus the internalisation of, e.g., considerate behaviour.

- Strategy 4: Impart the view of other road users
  The findings of the pre-study showed that prosocial behaviour in traffic also depends on the driver's empathy (e.g., for the "weaker" user). Therefore a system can show the current situation of other road users and make them transparent to the driver.

- Strategy 5: Provoke feedback by other road users
  As seen in the findings of the pre-study, positive feedback can play an important role in the context of considerate driving. Therefore, a system can foster the communication of positive feedback by provoking the feedback of the road users who benefit from the prosocial act.

The above mentioned design strategies can be used to build systems that foster considerate driving in different ways. In this work, one experimental prototype was implemented as an example with the focus on one strategy selected from the above mentioned strategies, "Internalise considerate behaviour by addressing personal norms and principles." Although the design focused on this strategy, the ideas of the other strategies were not ignored.
In the following step, an Experience Story is developed to define the experience for the later design of the experimental prototype.

4.2.2 Creating the *Last Gentlemen* Experience with a Story

The idea developed from the pre-study was to compose a cover story for a concept that builds upon personal norms to activate the internalisation of prosocial behaviour. The purpose is to provide support in situations where the choice would normally be made to act prosocially but tends to be forgotten because of, e.g., traffic situations or stress. The chosen cover story draws on the human desire for group membership, which is stereotypical for prosocial behaviour. In this case, it is a group with members of a mixture between a British gentleman and a superhero. Therefore, the headline created was: "Become a Member of the Alliance of the *Last Gentlemen*."

Experience Story: The *Last Gentlemen*

Nina is a cartoonist and loves her job. But in the morning, she has to hustle to office in the middle of rush-hour. She hence drives hectically, switching between lanes, always with the feeling of being in a traffic flow that is too slow. She arrives mostly exhausted and stressed out. But when she drives on the weekends, she drives differently. She is relaxed, drives calmly,

and feels more like the person she sees herself as, considerate and focused. Therefore, she tries out a new system in her car on her way to work, in order become the relaxed driver from weekends also on workdays. When Nina starts the system the first time, she is got in the mood by listening to a comic style story, told by a superhero by the name of Sir William Worcestershire, about the dark times on the streets, where all that before was consideration and helpfulness is now a nightmare of ignorance and aggression. But, there is at last hope, the story tells, "The Alliance of the *Last Gentlemen*," and Nina can join! Nina likes what she hears because this is exactly what she wants to be. She joins the alliance and starts the drive. Inspired by the story, she wants to be considerate, but the situation on the road hasn't changed and just like nearly every morning she is again stuck in traffic. The drivers around her are all looking out for their own best interests, which makes her forget about her intentions with The Alliance of the *Last Gentlemen*. Instead, she is stressed again. She tries to drive faster than the flow of traffic. Ahead, she sees a driveway whit a car waiting for a chance to drive out unto the road. "They will never get out," she thinks, and at this moment she sees that a young woman is driving the car with a little girl in the backseat. In that moment she remembers The Alliance of the *Last Gentlemen*. She stops and gives way. The woman in the other car waves. At the same time the system pops up with an encouraging "Fabulous!"-message written in old comic book style. So not only did she get a thankful wave from the woman she helped, but Nina also knows that The Alliance of the *Last Gentlemen* has noticed. She feels that she can help to make a difference on the streets. This inspires her to wait when a car is pulling out of a parking spot. Again, she receives a wave from the driver as sign of recognition - and a "Splendid!"-message as feedback from the system. When she arrives at work and turns off the car the system displays the first headline generated by Sir William Worcestershire, which tells the story of Nina as a superhero on the streets. She posts this headline on her social media networks so that everyone can see that Nina is now one of The Alliance of the *Last Gentlemen*. She closes the door of her car and goes into her office, feeling not stressed, but rather cool like a superhero.

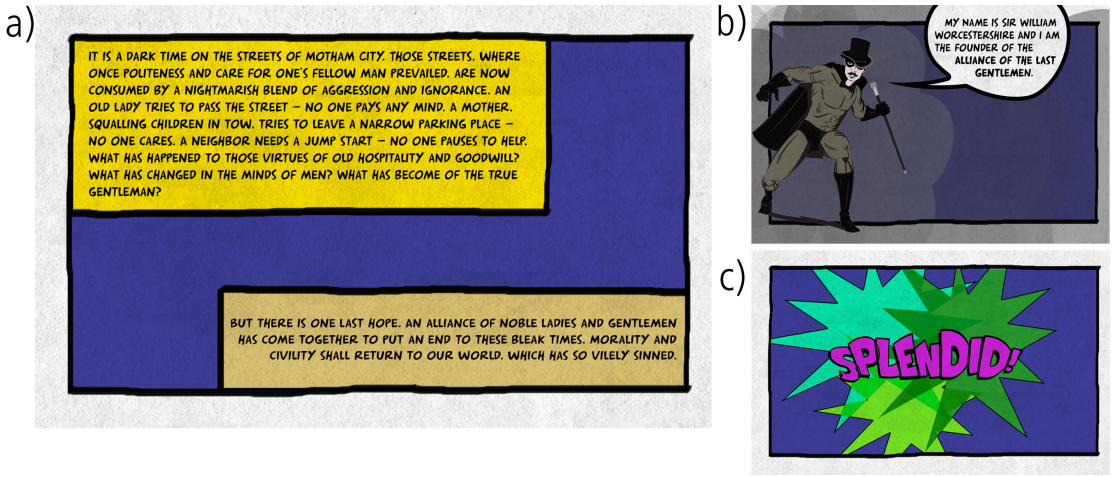

Figure 4.17: Screenshots of The *Last Gentlemen* system: a) the intruduction; b) Sir William Worcestershire; c) feedback figure from [KHM+13].

4.2.3 Designing the *Last Gentlemen* Experience Through Technology

Based on the Experience Story (see Section 2.3.2) "*Last Gentlemen*," , a prototype system to internalise considerate behaviour by addressing personal norms and principles was created. Compared to the other systems (see Sections 3.1, 3.2, and 4.1), the *Last Gentlemen* system reacts only to specific situations of considerate driving. Therefore, no storyboard was created because the interaction of the main system is distinct in displaying specific messages after considerate driving behaviour.

The Concept: The *Last Gentlemen*

The system is brought to life through the comic character of Sir William Worcestershire, who combines the aspects of a gentleman as a polite person with the clear norms and principles of a superhero, who acting idealistically by helping people without expecting any form of reward. Becoming a member of his alliance helps the participant internalise the prosocial behaviour. Hence, driving with this system becomes a positive experience.

Before the system is used for the first time on the road, the driver receives an introduction in order to strengthen the awareness of considerate driving (see Figure 4.17 Panel a)). In this example, it is the character of Sir William Worcestershire (see Figure 4.17 Panel b)) who tells about the aggressive situations on the streets nowadays and about people not helping each other. He declares the mission to bring helpfulness and consideration back unto the streets. The driver becomes a member of The Alliance of the *Last Gentlemen*, an honour, which expresses the prosocial attitude of the user, but also comes with duties, i.e., considerate driving behaviour. This defines the concrete task for the driver to live up to the ideals and principles by acting prosocially on the

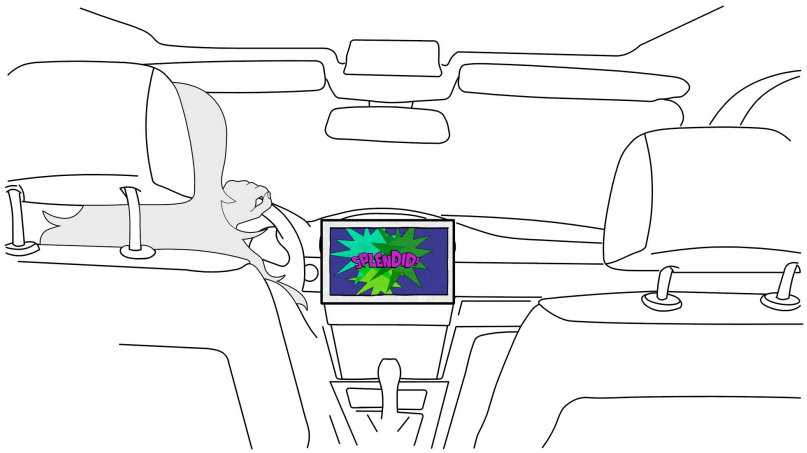

Figure 4.18: Position of the display mounted within the car interior (figure from [KHM+13], illustrated by Verena Voppichler)

road. Positive feedback after acts of prosocial behaviour (e.g., helping a "weaker" road member) shows the participant that the "Alliance" recognises the considerate behaviour. The interface for the system has a specific comic style, appropriate for a superhero on the road. This comic style,is also used for the "SPLENDID" or "MARVELOUS" positive feedback messages reminiscent of the original Batman TV series (see Figure 4.17 Panel c)).

The Experimental Prototype: The *Last Gentlemen* In Situ

In order to develop the concept of the *Last Gentlemen* in situ, an experimental prototype was implemented as an experience prototype (see Section 2.3.3), which means that the focus lies on the resulting experience and not on the prototype itself. To this end,the prototype was implemented as a Wizard-of-Oz (see, e.g., [GCMB11]) prototype without the ability to recognise the considerate situations through the car's built-in sensors. Thereby, the system was controlled by the observer sitting in the backseat of the car. To be able to display the messages from the Gentlemen system as described in the Experience Story, a touch-sensitive display was installed in the middle of the dashboard in the front of the car (see Figure 4.18), so that the driver can use the system via touch interaction in order to click through the introduction. During the trip, no user input was necessary nor possible. The examiner in the backseat triggered the feedback remotely through a laptop connected to the touch-sensitive display after each act of considerate driving performed by the driver.

4.2.4 Evaluating the *Last Gentlemen* Experience In Situ

Procedure and Metods

12 people were recruited, 4 females and 8 males, aged between 25 and 58 (mean = 34.2) to drive

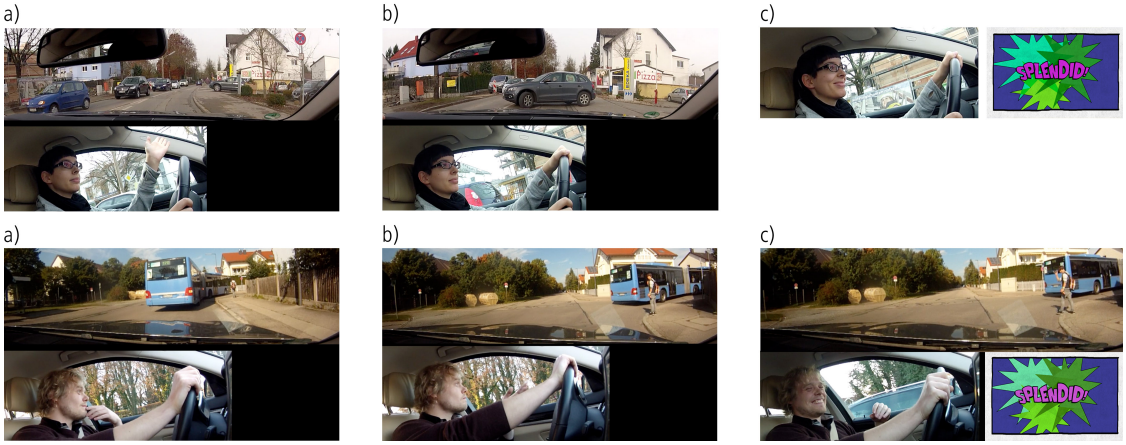

Figure 4.19: Examples of prosocial acts in traffic from the in situ study. Top row: Feedback of the system compensates for feedback of the other road member; Second row: Feedback of the system adds to the feedback of the other road member; a) the driver gives way to the other road member, b) the other road member takes way, c) the system provides feedback [KHM+13].

with the system for an average of 60 minutes on a trip of approximately 30 kilometres (i.e., 20 miles). A specific route in real traffic was set, with many potential opportunities for considerate driving. Hence the route offered narrow single-lane streets to provoke situations where the driver could possibly give way to a car coming from the opposite direction. Also, two residential neighbourhoods provided the possibility for situations involving pedestrians. Each trip was recorded on video (see Figure 4.19). After the trip, episodic narrative interviews were conducted. The interviews (see Section 2.3.1) were half-structured and focused on the participants' experiences in general, and then becoming specific according to their responses. As seen in Table 4.2, different situations were encountered and an average of 5.25 acts of prosocial behaviour were engaged in during the 60 minutes of the study, with a minimum of 0 and a maximum of 11 situations.

Findings and Interpretations of The *Last Gentlemen* Experience In Situ

As to the findings, the system was able to increase the motivation for considerate driving in 8 out of 12 participants. One of the participants stated, "It motivates you in situations in which you normally would drive on" (P2). Another participant mentioned,"Well, without the system, I probably wouldn't have stopped in this situation" (P11). 11 participants (of 12) argued that they would drive more considerately in the long term if using the system. Furthermore, the overall awareness through the system interaction increased as this participant described, "You are now more aware [of considerate driving]" (P2).

Positive emotions also manifested through the acts of considerate driving, as six participants argued, one of which mentioned, "After that I actually felt good. You feel glad that you have done this"(P12). These feelings were not triggered because of the positive feedback, but rather through

Participant	A	B	C	D	E	Sum
P1	5	1	-	-	-	6
P2	11	-	-	-	-	11
P3	7	1	-	1	-	9
P4	2	1	-	-	-	3
P5	4	-	3	1	-	8
P6	3	1	1	-	-	5
P7	2	1	2	-	1	6
P8	3	-	1	-	-	4
P9	2	-	-	-	-	2
P10	-	-	-	-	-	0
P11	4	-	1	-	-	5
P12	2	1	1	-	-	4

Table 4.2: Acts of prosocial behaviour in traffic from the *Last Gentlemen* user study. A: Give way to a car coming from the opposite direction on a one-lane road; B: Let a car from the opposite direction turn left; C: Give way to a car coming from the right; D: Let a pedestrian cross the street; E: Give way to a car pulling out of a parking lot; Sum: Total of all prosocial acts in the study per participant.

the act of considerate driving itself. One participant explained, "In any case you feel good when you help somebody" (P7). The the system was seen as compensating for missed positive feedback. On participant stated, "It was comforting when the other [driver] hadn't said thank you" (P4). Another participant mentioned, "Even when the other road user doesn't say anything, at least the system does" (P8). This shows that the system's feedback did not replace the positive feedback of the other road member but compensated for missing feedback and made it less negative when the feedback was missing.
Based on these findings, the experimental prototype of *Last Gentlemen* was successful in stimulating of prosocial behaviour in the in-situ user study. The participants drove more considerately through emphasising the beneficial nature of prosocial behaviour. Moreover, the system fostered the awareness of potential situations for prosocial behaviour in traffic.

The *Last Gentlemen*: Discussion and Conclusion

By addressing personal norms in the cover story and providing playful feedback in addition to or in place of missing feedback, the system The *Last Gentlemen* fostered considerate driving and increased awareness of potential prosocial acts in a first attempt.
The concept of the system is based on a pre-study, which gathered motivation and influences on prosocial behaviour in traffic as well as on general knowledge from existing literature (e.g., [BP03]).
To analyse the driving behaviour with the system in traffic, the system was built into a car for an in-situ exploration in real traffic. The findings were in accordance with the expectations, as the gathered insights showed that the system worked as a simple feedbacking system by which

personal norms and principles were addressed, making the participants more aware of prosocial behaviour in traffic. The feedback showed the participant that The Alliance of the *Last Gentlemen* recognised the actions. It did not replace the reason for acting prosocially (helping to make the streets more considerate) by rewarding the participant.
The *Last Gentlemen* system is only a first step in designing for prosocial behaviour on the road. This system and its evaluation as a first approach is far from complete. Rather, it and should provide a starting point for the development of further systems in this area to be analysed over the long term. Also, the potential user group is limited given the comic related cover-story and the masculine term "gentlemen" (despite the fact that this was not reported as a problem by the female participants in the study). Future systems should be more adaptive in order to reach a broader user group.

4.3 Essence of this Chapter

This chapter is based on the situation of driving alone on a well known road. Here the stimulation of the surroundings is less in comparison to driving in unknown areas, as seen in Chapter 3.
The first design case in this chapter, *keepClose*, is conceived as a system to help commuters feel more connected to their families at home. During the commute, both the commuter and their family receive a vague indicator of how close the commuter is to home, which increases the awareness of the commuter. Furthermore, as the commuter drives into the well-known area around home, the system provides a communication channel between the car and the family at home. Through this shared audio space, the commuter is enabled to take part in family rituals, e.g., meal times, even if only acoustically.
The final design case, *Last Gentlemen*, is about following personal norms and principles while driving, and thereby acting prosocially in traffic. The system makes the driver aware of their ability to help increase considerate behaviour while driving. This is achieved through a cover-story provided by the system and by comic-style feedbacks. Thereby, the driver receives positive feedback in addition to any potential feedback of the road member, thus acknowledging prosocial acts. The system makes the driver more aware of potential situations for considerate driving and helps to encourage personal principles of kindness and consideration.
These design cases are starting points for other systems of Experience Design for driving alone. This work concentrated on being related to loved ones outside the car and on following personal principles. There are many other scenarios to design for, e.g., connecting commuting friends or concentrating on a commuter's physical well-being.
The usage of the methods and tools from Chapter 2, which were applied through the design cases for designing experiences are further discussed in Chapter 5.

III

Recommendations and Discussion

Chapter 5

Best Practice and Recommendations for Automotive Experience Designers

The aim of this chapter is twofold. First, to present a best practice for the use of the methods introduced in Chapter 2 and applied in Chapters 3 and 4. Second, to discuss singularities and challenges of the application of Experience Design in the automotive industry that go beyond the methodology.
To this end, experience designers and researchers are provided with a guiding and a starting point for designing beyond the act of driving. Designing an experience is not primarily about methods but about shifting the mindset away from the product towards the human and their experiences while interacting with a product. This is not to be confounded with product experience, instead it is about the meaning behind the experience and its ability to fulfill specific psychological needs. Methods are, nevertheless, crucial for applying Experience Design. They help to focus on the experience during all design steps. Methods also support the designer to define the WHY of the experience, the WHAT of the functions, and the HOW of the interaction design.

5.1 Best Practice and Recommendations: Using Methods from WHY to HOW

In this work, different methods and tools are used to apply Experience Design in an automotive context (see Chapter 2). At the beginning of the design process, positive experiences are gathered. These are analysed as to psychological needs and emotions in order to gain in-depth information upon which an Experience Story is then composed. This Experience Story defines the experience to be designed for the first time. The experience, as represented by the Experience Story, is subsequently designed through technology, until the experience can be lived through interacting with an experimental prototype. Afterwards, the experience is evaluated and analysed in order to assess which essences of the experience were successfully designed.
In the following, the methods and tools used in the single design steps are described through examples of their practical application and their most important aspects are outlined in a summary.

5.1.1 Gathering and Analysing Past Experiences

In the first design step of gathering and analysing experiences, the goal is to understand the WHY, in the sense of why an experience is conceived as positive from the human point of view. Besides the most relevant methods described in the following, other methods to gather and analyse experiences were used as well. To take a single example, the Experience Diary [LK11] served as a method for the participants to take acoustic notes in the aftermath of meaningful experiences. It was mainly used in design cases that involved driving alone, e.g., commuting, so the notes helped the participants to remember the experience, which was afterwards gathered in an interview.

Using Narrative Episodic Interviews for the Analysis

general As learned from scholarly research (see Section 2.3.1) it is important to consider the atmosphere before beginning interviews. Therefore, it is crucial to avoid disturbing components and try to make a participant feel comfortable, e.g., by offering drinks and making small talk initially. The image of, "...two people sitting side by side paging through the family album of pictures," (p. 111 in [Joh02]) visualises the positive feeling essential for the gathering of experiences that include personal and emotional aspects, and it is these aspects that are important for understanding why an experience is conceived as positive.

application Memory activation based on Sheldon et al. [SEKK01] showed to be helpful. This work followed their lead by putting the participant in the right setting by prompting them to, "Think back to times when you were traveling by car, to situations, which are still on your mind, which you still remember sometimes, which were meaningful in that respective moment or afterwards." It is also important to start the interviews by generally asking about positive experiences in the intended context, in order to avoid focusing on a technology or product at this early point, that is, e.g., asking about experiences while traveling, and not about car related experiences.
Furthermore, the term "experiences" should be avoided as participants showed to have problems to

comprehend that term. The German term, "Erlebnis," urged the participants to narrate especially outstanding experiences instead of everyday experiences, which are the ones of interest here (a phenomenon also described in [KHL+12]). Therefore, "experience" was paraphrased as "meaningful situation," in the sense that participants were asked to speak about meaningful everyday situations. Similarly, being asked about psychological needs was ambiguous for the participants. Regarding this, the items in Sheldon et al. [SEKK01], which circumscribe the psychological needs, were used for better understandability, e.g., instead of being asked about relatedness, the participants were requested to think of situations in which they felt close to another person or felt as part of a group [KHL+12].
Moreover, what is important is to not interfere with the participant while recounting their experiences. A difficulty lies in getting the participant in the mood of telling details of a specific experience instead of only speaking about it generally. To this end, participants were asked questions such as, "Can you tell me step by step about the actual situation?" and, "What did you feel at that moment?"
A further challenge was to work with participants fascinated by the technology, insofar as discussing product experiences must be avoided and the focus kept on the human experiences.
Before starting the interview, a positive atmosphere should be created and the participant's memory be activated. In order to get a subjective account from the participant, the interview is conducted rather openly. The participant is first of all asked about the most important aspects of their experience and then eventually encouraged to go further into detail (here, a guideline based on the topics of interest might be helpful). The participant is supported to stay focused on their experience when they get lost in negligibilities. The experience is gathered step by step, and additionally, the timeline of the different actions is figured out. This information is helpful for the design later on. Terms and phrases, which are ambiguous (i.e., experience, psychological need) or demanding (e.g., "Why did you do that?"), should be avoided as well as a focus on technology. summary

Using the Need-Questionnaire Before the Design

The need-questionnaire (see Section 2.3.1) is a concrete method to accurately identify the WHY. general
It is convenient to use this questionnaire directly after a participant has recounted a positive experience because the participant should have the specific experience in mind while completing the questionnaire. If a participant tells more than one positive experience they should receive one questionnaire for every experience.
The questionnaire helps to categorise a single experience according to the corresponding fulfilled needs by indicating which psychological needs are important in the experience and which needs are not addressed. application
The need-questionnaire should be used directly after having gathered a relevant positive experience, while the memory of the participant is still activated. One Need-Questionnaire is needed for each specific experience. summary

Using PANAS Before the Design

The PANAS is a questionnaire that measures positive and negative affects (see Section 2.3.1), that is a person's inner reactions to the addressing and fulfilling of psychological needs. Like the general

Need-Questionnaire, the PANAS is applied directly after a positive experience has been gathered. As a result, the PANAS, on the one hand, shows the general positive and negative affects so as to ensure that the gathered experience is a positive one, and, on the other hand, measures affects in subscales, such as joviality, surprise, and others. Along with the psychological needs, these subscales thus reveal the emotional side of the experience, the understanding of which can be used to further analyse the specific experience as well as to compose the Experience Story upon.

application The PANAS is useful for differentiating between positive and negative emotions but is also challenging, since it consists of only ten positive affect items and is not very accurate. PANAS-X [WC99], on the other hand, includes 28 items for positive affects and emotions and is thereby more accurate. Neither of them, however, includes social emotions like "loving," "relaxed," and "gentle." In the design cases of this work, the PANAS, introduced in 1988 by Watson et al. [WCT88], was used in an extended version (PANAS-X) [WC99], in the German translation from 2003 by Röcke and Grühn [RG03].

summary The PANAS is used in the same way as the Need-Questionnaire, i.e., directly after having gathered a relevant positive experience. Additionally, the PANAS is used to gather information about the emotions for every single relevant experience. Because of its greater accuracy the PANAS-X is preferrable.

Using Affinity Diagram

general The Affinity Diagram (see Section 2.3.1) is a common method for analysing gathered information about a past experience. These diagrams can be used to classify statements of the participants, as in the design case *Last Gentlemen*, where the participants' perceptions of and attitudes towards considerate driving were collected and categorised with the help of the Affinity Diagram.

application Here, the participants' statements, triggered by videos and pictures of potential considerate driving situations, were written on post-it notes and afterwards classified according to their similarities. The following four topics emerged: (1) motivation, (2) influences on the behaviour, (3) importance of positive feedback, and (4) influence on the perception of the importance of positive feedback. The main interest in the use of the Affinity Diagram for *Last Gentlemen* was to group and classify the post-it notes regarding the motivation of acting prosocially. Two main topics hence emerged, showing that the motivation was based either on (1) social learning, or on (2) personal norms and principles (examples given in Section 4.2). This classification of the motivations was subsequently used to design the experience and provided a focus for the design.

The Affinity Diagram method is easy to use and offers a high degree of interpretation. Nevertheless, the results are not reproducable in detail. This shows that this method is insufficiently scientific in nature.

summary The Affinity Diagram is used to categorise statements and to further group the categories so as to determine the most essential topics, in this example, the main motivation.

Using Experience Pattern

general Different positive experiences can have the same underlying common practice, the experience pattern (see Section 2.3.2). Once identified these can be used to design various experiences through technology.

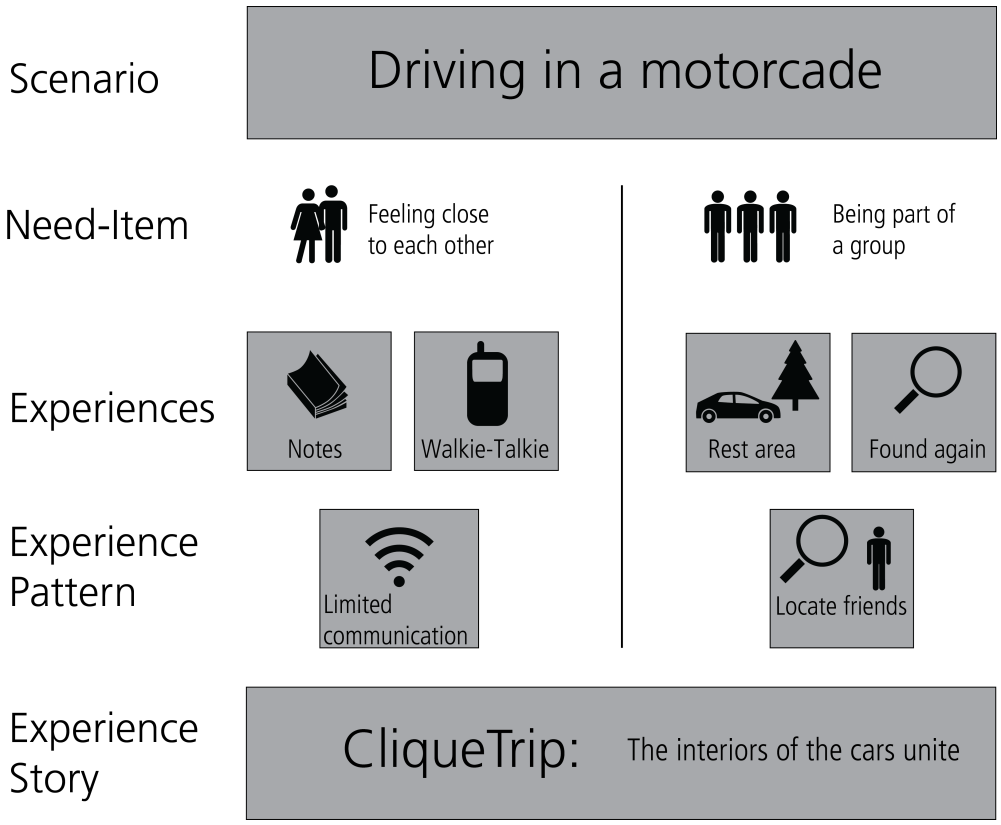

Figure 5.1: Application of experience pattern in the design case of *CliqueTrip*.

One possibility to identify an experience pattern is to analyse the underlying similarities of experiences and their motivation. To this end, experiences are first categorised according to the scenarios in which they take place.

In the design case *CliqueTrip* (see Section 3.1), the specific scenario was the motorcade, hence only experiences that took place in this scenario were analysed (see Figure 5.1). Within the category of this scenario, the experiences were then again categorised according to the results of the need-questionnaire (see Section 2.3.1). The need primarily fulfilled by the motorcade experience was relatedness. Here, the most salient need items (see Section 2.3) were, "Close and connected with other people who are important to me," and, "A sense of contact with people who care for me, and whom I care for." Some of the experiences had the similarity of involved communication. Participants tried to communicate in different ways, i.e., one group connected with one another via paper notes, which they held against the car windows, another group used walkie-talkies. In both situations, the participants played with the limitation of the communication channel, e.g., by varying the distance between the cars. Their statements showed that a limited communication channel was more valuable because of the effort that had to be made in order to keep the channel open. This practice of handling limited communication led to positive

application

experiences. It is further used as experience pattern to create an experience through technology. In the case of CliqueTrip, two different experience patterns were identified (see Section 3.1), upon which the Experience Story was composed.

summary Experience patterns can be identified to subsequently design experiences thereupon (see also Figure 5.1). These experience patterns are drawn from gathered experiences and based on their underlying practises. Experiences should be categorised, e.g., according to specific scenarios. Afterwards, they should be categorised again, e.g., based upon the most salient need item. Then the experiences should be grouped according to their underlying practice, that is, the experience pattern. The Experience Story, which is to define the experience, is then built upon the experience pattern, as this comprises the essences of the experience.

5.1.2 Creating an Experience with a Story

general An Experience Story is a representation of the technology related experience to be created. The Experience Story clarifies the WHY in order to create a proper WHAT and HOW in the design (see Section 2.2). Various input factors can be used to create an Experience Story. In the design studies presented in Chapters 3 and 4, these were: experience pattern (*CliqueTrip*), a remembered positive experience from a childhood memory (*ExplorationRide*), and design strategies drawn from positive experiences in the past (*keepClose*), and a design strategy based on the analysis of motivations for a specific act (*Last Gentlemen*).

In composing the story, emotional aspects gathered by the PANAS play a significant role. But most important of all, the WHY, that is the motivation for the experience, needs to be clearly defined through the specific associated psychological need. It is hence the need that provides a focus for the Experience Story.

application The actual composing of the Experience Stories in the different design cases were rather similar, although the input factors were different. The single steps of this procedure can be illustrated with the design case *CliqueTrip*. The first step is to describe the scenario where the story takes place (as discussed in Section 2.3.2.)

In the design case of CliqueTrip, the scenario is a motorcade, i.e., a group of friends driving in more than one car.

At the beginning of the story the group is introduced (see element the characters in Section 2.3.2). Then, it is touches upon the main psychological need that is to be fulfilled through the technology related experience, in this case, the need of relatedness:

```
Max, Sarah, Marianne, Martin, Monica, and Matthias have known each other for
ages.
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Not only is the psychological need be touched upon, it is also further clarified, in this example, as to why the friends demand this specific need in their context:

```
Lately, they don't spend time together as often as before.  But one event is
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always fixed: each year they visit their favourite city as a group Paris. As usual, they go there in two cars.

After the need for the experience has been conveyed, the system is introduced, but without any concrete technical solution:
This year, however, something is different. Max invites all to the trip via *CliqueTrip*, a new app he wants to try out. This app promises to make its users feel close to each other, even when traveling in two different cars.

The motivation for using the system is an important element (see element motivation from Section 2.3.2). Based upon the intended needs, the motivation here determines why the characters use the system:
All friends are excited to test *CliqueTrip* because they dislike the feeling of being separated during the trip.

Before actually using the system, conflict is built up to make the story compelling and to strengthen the specific intended need (see conflict element in Section 2.3.2):
It is time to depart. Max is driving one car, Sarah the other. Sarah is a very sporty driver (some say reckless) and Max drives very relaxed (some say painstakingly slow). Consequently, they tend to lose each other on the motorway, with Max getting more and more behind.

At the climax of the conflict the interaction with the system begins. To empathise with the character and to understand the interaction more easily, Max is made a main characters in this story:
But *CliqueTrip* helps out. It changes the navigation system so that Max (in the rear car) is guided towards Sarah (leading car). "Ah, taking the scenic route. Good choice," Max thinks. He announces, "I guess the others plan to visit the nice little café in the city centre of Reims. Let me try to catch up."

The interaction with the system solves the conflict (in this example, losing each other) through fulfilling the intended psychological need (in this example, feeling related with each other).
...and when the cars are close to each other, *CliqueTrip* opens a communication channel. They can now talk to each other, as if sitting in one car. "Hey," Max yells, "I hope you are not planning to have a first glass of Champagne already? I am driving!"

This example shows the elements of an Experience Story: the scenario, characters, psychological need(s), system, motivation, conflict, conflict solving, and need fulfillment. These elements have

helped in composing the Experience Stories in this work, however, story writing is a creative process, which, as Robert McKee states, "...is about principles, not rules" (p. 3 in [McK97]. Thus, the suggestion of the use of these elements in composing an Experience Story rather serves as an orientation for experience designers in their work.

summary The principles of how to create an Experience Story can be summarised as follows. First, the scenario is depicted. To do so, the context is imagined including time and place, so to offer orientation for the audience. 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, the psychological need(s), which will later on motivate the use of the system, are addressed for the first time. Then, the system is introduced, but not from a technical point of view, rather without presenting any concrete technical solution so that the focus of the story stays on the human experience. In the next step, the conflict is built up through the context and the characters. Here, the psychological need(s) are again addressed. At the climax of the conflict, the system interaction takes place. In order to enable the audience to empathise with the character during the interaction, focus is placed on one main character. Finally, the conflict is solved through the interaction of the main character with the system, whereby the intended psychological need(s) are fulfilled.
The focus of the Experience Story is constantly on the experience and the intended psychological need. It is only in the design step following the composing of the Experience Story that technical solutions are set up to enable participants to live the experience defined in the Experience Story.

5.1.3 Designing Experiences through Technology

By designing the experience through technology, the WHAT and the HOW come into focus. Throughout this step, the Experience Story representing the experience and its intended psychological need can be used to maintain focus. The Experience Story can be broken down into single interaction steps, which are then sketched out in a storyboard so as to define the interaction with the system in detail.

Using Storyboard

general A storyboard illustrates the WHAT in detail, namely through single interaction steps and the appropriate functions to go with each step. It is not technology that is shown in detail (e.g., interfaces), but functionality.
As the Experience Story's focus is on the need(s) to be addressed and fulfilled in the experience, the focus of the storyboard is on the use of the system while the experience is created. Single frames represent the single interaction steps and serve as additional texts (see Section 2.3.3 for more detail), describing the interaction in the experience in detail, as shown in Figure 5.2.

application In the design case of *keepClose* (see Section 4.1), a storyboard was created. To begin with, the single interaction steps of the experience were extracted from the Experience Story, e.g., for the commute back home from work, the steps of the main character's interaction with the *keepClose* system are:

1. When leaving work the mother, Maggy finds a message awaiting her. She recognises something is there for her on the device in the car.
   Even before its actual use, through a state change, the system displays that a message has arrived through a state change.

2. Maggy receives a message from home.
   The message sent from the loved ones at home is displayed by the system and recognised by the commuter.

3. Maggy starts to drive home.
   The system updates her position status.

4. The father, Steve and the children, Emma and Ben, look at the device at home and find that their Maggy has started her drive.
   The start of the commute is indicated to the loved ones to inform them that the commuter is on her way.

5. Maggy watches her progress on the device as she comes closer and closer to home.
   Displaying the progress on the one hand provides orientation, and on the other hand informs the commuter about the information the home device provides to the loved ones.

6. Emma and Ben watch their Mom's current progress.
   The commuter's vague progress displayed to the loved ones at home.

7. Maggy sees her distance to the home area on the device.
   The system divides the commuting route in two areas, and the approximation to the home area is displayed for the commuter as well as for the family at home.

8. Emma and Ben see on the device that Maggy is near.
   The status change of the commuter entering the home area is also displayed at home.

9. Maggy is happy to be in the home area, where she can communicate with her children before arriving (see Figure 5.2, Frame 9).
   After entering the home area a communication channel is established between the devices.

10. The children chat with their Mom until the communication stops while the father is cooking (see Figure 5.2, Frame 10).
    The system closes the communication channel shortly before the commuter arrives.

11. Emma and Ben recognise on the device that their Maggy is coming (see Figure 5.2, Frame 11).
    The system's interface shows that the commuter is arriving.

12. Emma and Ben are welcoming their Mom (see Figure 5.2, Frame 12).
    The system fades into the background and the physical contact among the family members comes into focus.

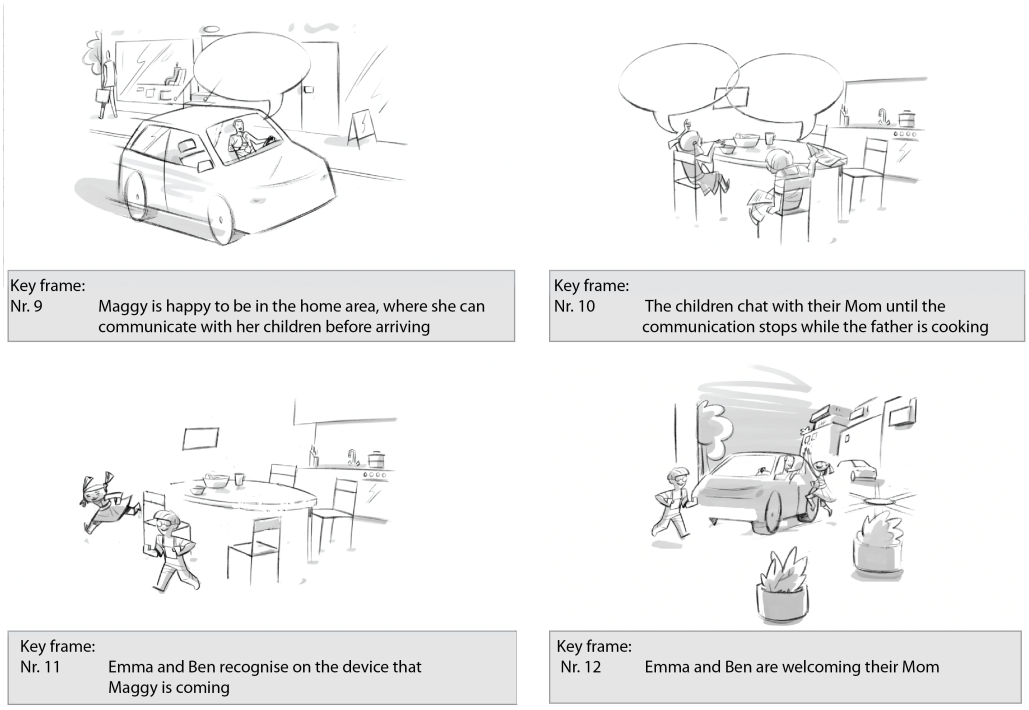


Figure 5.2: Maggy is coming home: frames from the storyboard of the *keepClose* experience (illustrations from the Folkwang University of Art, Marc Hassenzahl, created by Frank Josten).

This example shows how the storyboard helps to structure the functions over time according to the single interaction steps, thereby clarifying the experience to be designed in detail.

summary To summarise, the storyboard defines the WHAT of the experience. Besides the experience as lived by the characters of the Experience Story, the storyboard also shows the functions of the technical representation of the experience, which is to be designed based upon its representation in the Experience Story. For creating storyboards the interaction steps are extracted from the Experience Story. This includes the interaction steps of addressing as well as fulfilling the intended psychological need(s). A graphical representation is created for each interaction step to offer possibilities of functions for the technology-related experience to be designed. To avoid obscurities each graphical representation also contains a description. The graphical representations should not determine specific technical solutions, such as concrete interfaces, rather they should serve as starting points for different possible implementations.

Once the WHY is defined through the Experience Story and the WHAT through the storyboard, the next step is to define the HOW in detail. This leads to the creation of mock-ups.

Figure 5.3: Mock-up from the design case of *CliqueTrip*: a) controller and display of the distance indicator between the cars; b) controller of the audio channel with acoustic feedback; c) controller of the display of the friends in the other car; d) controller and indicator of the direction of the other car; e) controller and indicator of the navigation towards the front car.

Using Mock-ups

Mock-ups allow the elaboration of technical solutions in detail, without needing to implement a fully functional prototype. The mock-up brings the story to life in specific aspects. In comparison to the fully functional experimental prototype, the mock-up is focused only on parts of the experience, so as to set up elements of the interaction in detail and then refine them. Mock-ups are a first realisation of the design solutions found in the first step of the analysis, hence they are based on the elements that were the inputs for the Experience Story. general

In applying mock-ups, analyses were conducted to test possible technological interactions towards the fulfillment of the intended psychological need in an experience. An example of a mock-up is shown with the design case *CliqueTrip* (see Section 3.1). application

In this case, the experience was about the fulfilling of the need of relatedness. On the one hand, the information about the localisation of the other car in the motorcade should foster the feeling of being one big group despite being separated in different cars. On the other hand, a limited communication channel should foster the feeling of closeness within the group. The purpose of the mock-up of *CliqueTrip* is to display different possibilities to devise the functions defined in the storyboard, which were based on the motivation from the Experience Story. The aim is

not to display the interaction steps (as seen in the storyboard), but to make specific functions experienceable. Through this, insights are gained and an optimised prototype can be designed later on. The mock-up for *CliqueTrip* was implemented as a web interface using mainly Adobe Flash. This enabled fast and easy implementation and testing of different functions. As seen in Figure 5.3, different interfaces show how close the different cars of the motorcade need to be in order to be able to communicate with each other. With the radio button on the bottom of the figure, different interfaces can be selected to be displayed in the top right. With the radio button b) different possibilities for the limited communication channel are tested, e.g., by varying the volume depending on the distance. Button c) shows how the friends in the other car are displayed in the system. In this screen-shot, pictures of the friends are displayed in a symbolic car. Button d) helps withorientation, e.g., an arrow in the top of the screen points towards the other car, as by the needle of a compass. To make the mock-up dynamic the two sliders e) represented by little cars, can be used to reduce or increase the distance between the cars, which is displayed in the middle of the screen. After the mock-up is built, it is tested and discussed in the design team, where everyone interacts with it. Through the mock-up, different versions of the functions are analysed so that the mock-up can be refined. Subsequently, adjustments can be introduced to the system to better match the Experience Story. One example of an adjustment in this design case is the indicator for the distance, as in Figure 5.3 a) on the top right side, which was replaced so as to better match the Experience Story, by using a less technical-appearing solution (described in Section 3.1).

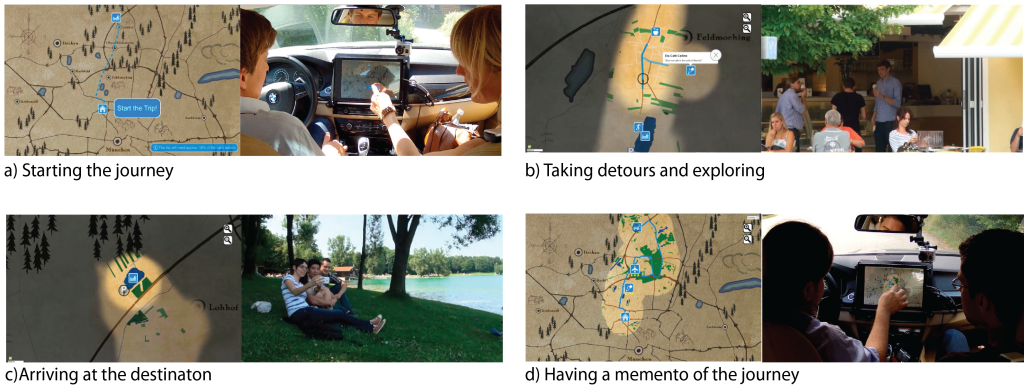
summary In summary, to apply mock-ups for the designing of experiences, the first step is to analyse the elements of the experience to be elaborated through a testing. This interaction is implemented in a mock-up with the focus on specific functions of the later implemented prototype. The mock-up makes different possibilities for the technical solution experiencable. If the proposed technical solution does not match well with the Experience Story, new solutions have to be elaborated for the prototype.

Using Prototyping to Deliver Experience In Situ

general To be able to analyse a designed experience in situ, an experimental prototype is devised. The prototype should enable the participants to live through the designed experience.

All the representations of the experience from the design come together in the prototype, that is, from the Experience Story to the storyboard and the mock-up. To be able to analyse the outcoming experience, the prototype has to contain all the functions necessary to live the experience, especially those that are directly connected to the fulfilling of the psychological needs, as results from the Experience Story. To apply prototyping in the designing of experiences in the automotive industry, the environment, namely the car, also needs to be considered. The experimental prototype should work in a real environment, i.e., on the road. Only those aspects that are not connected to the fulfilment of the intended psychological need must not necessarily work in situ.

application In the design case *ExlorationRide* (see Section 3.2), the settings of the destination and theme were implemented in the prototype of the system and could not be changed by the participants. Also, the invitation to the trip was not sent by the system. On the contrary, every function linked to the need fulfillment of the experience, as described in the Experience Story (i.e., fostering exploration and relatedness as well as enabling mementos), had to function throughout the designed experience.



a) Starting the journey
b) Taking detours and exploring
c)Arriving at the destinaton
d) Having a memento of the journey

Figure 5.4: Prototype of *ExlorationRide* during the in-situ user studies.

In Figure 5.4, selected aspects from the *ExlorationRide* experience are depicted in their implementation in the experimental prototype. In Panel a) of Figure 5.4, the group of friends start the journey together when everyone is sitting in the car, which illustrates relatedness and group belonging. Panel b) of Figure 5.4 displays how the system provides additional intermediate destinations, and Panel c) shows the vague guiding in order to foster the joy of exploration. Finally, as shown in Panel d), the system provides a memento at the end of the trip.
Before the experimental prototype is tested in situ, it can additionally be improved through agile refinement. In the example of *ExlorationRide*, the guiding was improved through an agile testing before the user study (see Section 3.2). Thanks to the experimental prototype, the experience can be analysed in situ to reveal which elements of the experience are working and which ones are not, in order to enhance relatedness and stimulation.
In summary, to apply experimental prototyping to Experience Design, all elements of the experience somehow connected to the need fulfilment have to be implemented and should imperatively work in situ. A function does not have to be fully integrated in the environment unless it is indispensable to the experience. summary
If parts of the experience are not implementable, e.g., because of technical reasons, the participants should, however, have the feeling that they interact with the system, and not with the observator. To this end, Wizard-of-Oz techniques can be used, that is, the user interacts with a system that seems to be autonomic but that really is operated by a human in the background (e.g. [Bux07]).

5.1.4 Evaluating Designed Experiences

After the experimental prototype is implemented, the designed experience is tested in a non-laboratory environment, so that the participants live the experience in a real-life environment. The evaluation is an analysis of how the participants live the experience while interacting with the system. This analysis is based on the aspects of the Experience Story. Additionally it includes the impact of the system in the real environment. The evaluation should be critical and elaborate on

the reasons for non-working aspects in the experience. In order to gather the relevant information in a holistic way, narrative episodic interviews are again used.

Using Narrative Episodic Interviews for Evaluating Experiences

general As in the design step of the analysis, the focus of the narrative episodic interviews applied in the evaluation is on the participants' narratives (see Section 5.1.1). The aim of the interviews is to gather the experience as lived by the participants in detail, so to be able to compare them with the intended experience.

application Before beginning the interview, the experience of the participants must be properly completed. For example, after a group of participants tested the *ExlorationRide* experience (see Section 3.2), they got to their final destination. There, they were given time to arrive and reflect upon their experience, before the interviews were conducted. This helped to keep up a positive atmosphere. To activate the memory (see Section 2.3.1) the interviews were conducted in the car, on the same seat the participant was placed in while using the system. The interview was recorded by audio and video for later analysis, so as to not disturb the interview, and by taking notes. In the design case of *CliqueTrip* (see Section 3.1), participants used the system in two cars driving in a motorcade. Each car had one interviewer. For conducting the interviews, the interviewers switched groups in order to be perceived as a neutral person (by not interviewing the persons they drove with). The interview was started very generally and based on specific personal experiences during the use of the system, as in the analysis (see Section 5.1.1). While gathering the experiences, abstract terms like "experience" and "relatedness" were avoided, as in the design step of the analysis (see Section 5.1.1). The aim was to let the participant tell their experience, hence interference was avoided. If the participant skipped an important element or did not speak about specific elements, the interviewer repeated their statements and asked if the participant could explain them again in more detail. All of the experiences were further gathered quantitatively using the need-questionnaire and the PANAS (as in the design step of the analysis in Section 5.1.1). After gathering the general experiences, the interview became more specific, and a guideline was used to focus the interview on the different elements of the designed experience. Thereby, the questions became increasingly open-ended. In the example of *ExplorationRide*, these were, e.g., "Did you feel restricted in the exploration because of the guiding suggestions?" or "How was the atmosphere during the trip?" These questions helped to analyse the different aspects of the system later on. Afterwards, the gathered experiences were compared with the Experience Story and the design solutions were analysed as to whether they matter to the participant's experience with the prototype and what kind of effect on the experience they have.

summary To summarise, when applying narrative episodic interviews as a method of evaluation, it is important to let the participants complete their experience while using the system. Conducting the interviews in the car helps to activate the memory. It is also important to not interfere with the participant's telling of the story. Skipped parts can be triggered afterwards through open-ended questions. After gathering each specific experience qualitatively, additional quantitative data is collected by the Need-Questionnaire and the PANAS. Specific questions about the used systems help to analyse the experience afterwards. These questions are focused on the different aspects of the experience, which are implemented into the system. Finally, the gathered experience while using the prototype is compared with the Experience Story in addition to a discussion about the

effect of the different design solutions on the experience.

Using the Need-Questionnaire to Evaluate Experience

The need-questionnaire gathers the quality of the fulfilment of psychological needs for a specific experience of the participant. Thereby, this questionnaire can verify if the intended need has been fulfilled while the participant lived the experience with the prototype. The need-questionnaire, as discussed in Section 2.3.1, is applied after the experience with the prototype was gathered by the narrative episodic interview. Since driving in a car is a multi-facet situation, not only the intended psychological needs but also other psychological needs are analysed, in order to differentiate the sources for positive emotions. general

As seen in the design case of *CliqueTrip* (see Section 3.1) the psychological needs of stimulation and competence play a special role in car-related experiences. The need of stimulation was always salient in the evaluation when participants used systems for the first time. This is in line with the concept of "enjoyment from the mere novelty of the product" (p. 35 in [KHL+12]). Competence was salient in the user studies by the drivers of the car [KHL+12]. This could be elaborated in design cases of common experiences in groups. It was further helpful to analyse psychological needs that were in contrast to the intended one, like competition when relatedness was intended, as this can reveal misuse of a system. application

To summarise, the need-questionnaire is applied directly after gathering a specific experience of the participant after using the system. It is important to gather more than just the intended psychological needs because of the multi-facet situation while driving in a car. The need of stimulation is more salient when using a system for the first time, and the need of competence is more salient for those who drive the cars while using the system. The analysis of needs in contrast to those intended can show the misuse of a system. summary

Using PANAS to Evaluate Experiences

Like the need-questionnaire, the PANAS, or in these examples, the German translation of the PANAS (see Section 2.3.1), is applied directly after gathering the participants' experiences while using the prototype. The scales for Positive Affect (see (PA) in [WCT88]) indicate if an experience was perceived as a positive one. The Negative Affect (see (NA) in [WCT88]) is included to detect if the system was not triggering the positive emotions to the need as intended. general

Therefore, in the design case *CliqueTrip* (see Section 3.1), the PANAS was not only used to analyse if an experience was a positive one and which positive affects were gathered, but also to detect if someone felt alone or left out [KHL+12]. application

To summarise, the PANAS is applied directly after gathering a specific experience during the interaction with the prototype. The scales of Positive Affects and its subscales are used to analyse whether the gathered experience was a positive one. The scale of Negative Affects and its subscales are used to detect where the system was not able to create positive emotions. summary

Using IPA (Interpretative Phenomenological Analysis) to Analyse the Impact of a Prototype

The IPA was applied only in the design case of *keepClose* (see Section 4.1) for measuring the general

impact of the prototype in a longer-term study. In order to more precisely measure the impact of the different design decisions in a real environment, it was applied multiply over time.

application In the design case of keepClose, the prototype aimed to affect the daily routines of commuter families. Here, the goal of the system was to foster relatedness between the family members. The analysis of the system's impact on the families using it was based on interviews with the mothers and fathers of the families. The interviews were focused on the situation before using the system, after one week of usage, after two weeks of usage, and finally one week after the usage. The interviews were video and audio recorded for a detailed analysis.

The approach was similar to that described in Section 2.3.4, but was used for large samples, as there were more than six interviews conducted.

The emphasis was placed on the key themes of a whole group, looking for patterns and connections between the individual interviews. Because of the focus on the impact over time, these key themes were sought out among the participants of one family, beginning with the first interview, then the second interview, and so on. Redundancies were also analysed, but, due to the small number of participants, on an individual basis for each statement instead of only by counting statements. After each set of family interviews was analysed, the impact was studied based on the findings. Furthermore, the approval of the system over time and the requirements for the impact of such a system was discussed. IPA also takes hermeneutics into account (see Section 2.3.4), by analysing not only the statements of the participants, but also the manner in which they speak about them. However, the interviews used for the IPA contained no mentionable insights based on hermeneutics.

summary To summarise, after gathering the interviews, the results (in this case more than six interviews) are searched for key themes. When using IPA for measuring the impact over time, the interviews of the different participants (of each group seperately when there are different groups of participants, as in the case of *keepClose*) are analysed for each set of interviews based on the specific time of system usage. After analysing the data, a general discussion is followed up, including a discussion on all the data based upon the impact of the system. Furthermore, the approval of the system over time and the requirements of the impact can also be discussed.

5.2 Experience Design in the Automotive Context Beyond the Methods

Designing automotive experiences comes with many challenges. One is the gathering and analysing of experiences, as delineated in Section 5.1.1, with the methods described in Section 2.3.1. This step of the analysis is time-consuming, especially when compared with a technology-driven approach where a new technology replaces an older one. Notwithstanding, the analysis is worth the effort as it is the basis for creating more meaningful positive experiences with the help of psychological needs. Yet, to work with psychological needs in design is all the more a challenge in an environment focused on user needs instead of psychological ones. In Section 5.2.1 the distinction of user needs and psychological needs is clarified. In Section5.2.2, the evaluation, in some cases rather analysis, of experiences as well as of the prototypes, which mediate these expe-

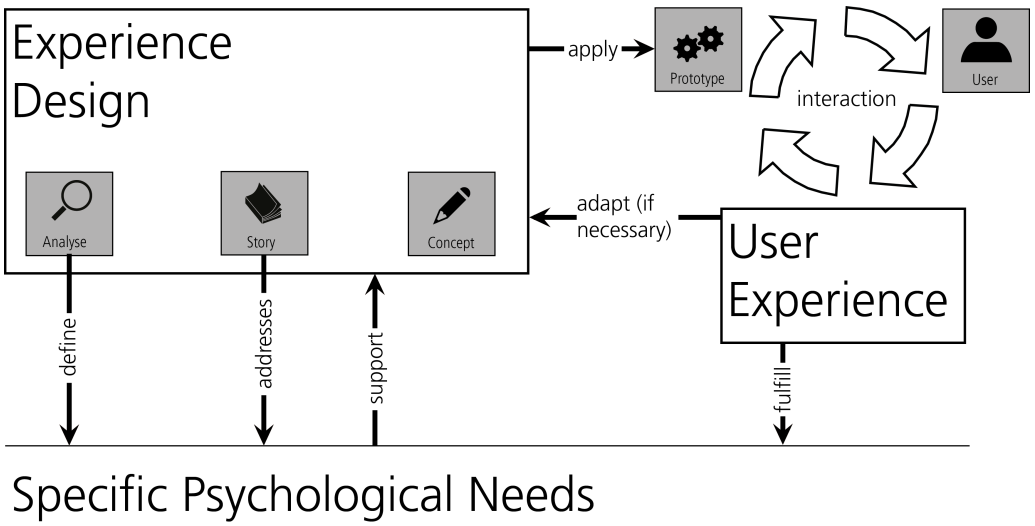


Figure 5.5: Psychological needs in the application of Experience Design.

riences, are elaborated. In Section 5.2.3, the challenges of designing for automotive experiences are outlined.

5.2.1 Psychological Needs and User Needs in the Design

The term "user needs" and "psychological needs" are often used synonymously. However, the meanings are quite different. The term "user needs" defines what the consumers wants (the WHAT according to the theory of Hassenzahl, see Section 2.3). The term "psychological needs," on the other hand, answers WHY a consumer wants to interact with a specific product. The following outlines the terms in their practical application in the automotive industry.

The Use of Psychological Needs in Experience Design

To begin with, the impact of the psychological needs in the application of Experience Design is clarified.

As seen in Figure 5.5, the psychological needs support every step of Experience Design. In the design step of gathering and analysing past experiences, the intended psychological needs are identified. They provide a focus for the whole design. Based on the insights from the analysis, the Experience Story is created, in which the intended psychological needs are addressed. The psychological needs motivate the product interaction within the story. The Experience Story defines the experience that is to be designed, which is then further elaborated through storyboards and mock-ups. The interaction design is focused on the fulfilling of the intended psychological needs. The experience through technology is implemented into a prototype. Also during the implementation, the psychological needs offer a focus for the design. Through the user's interaction

with the prototype, the phenomenon of user experience comes into focus. In an evaluation, or analysis, the fulfilling of the intended need is observed. Depending on the results, it is further elaborated, and the experience through the technology is refined.
In the example of *CliqueTrip*, the specific psychological need of relatedness was recognised through the design step of gathering and analysing past experiences. This psychological needs were addressed in the Experience Story. Afterwards, the psychological need of relatedness was the focus throughout the whole Experience Design, especially until the *CliqueTrip* prototype was created. Through the in-situ study the participants interacted with the system and the phenomenon of user experience appeared. This experience should fulfill the intended psychological need of relatedness. If there was a lack in the fulfillment of the specific need at this point, then the concept was further adapted and the prototype was either changed or redeveloped.
In summary, psychological needs are the tool that determine the focus throughout the whole design, and hence the resulting experience.

User Needs

In contrast to psychological needs, which describe WHY a user wants to experience something (the WHY layer of Hassenzahl's model seen in Section 2.2.2), user needs describe requirements for future products in the field of user-centered design [CB05]. Therefore, they effect the WHAT and the HOW level. In the field of industrial automotive research, the design cases are developed according to user-centered design as a common approach. Hence, the term "needs" is used differently from the Experience Design work environment.

User Needs in Experience Design

In this work, the term "user needs" was never used explicitly, but common user needs from the automotive industry were taken into account. They did affect the technical solutions, but only if they were in line with the intended psychological needs and the Experience Story. If in line, then they could affect the solution of the prototype, as seen in Figure 5.6.
One example from the design cases is the communication channel of the *keepClose* experience (as seen in Section 4.1). A supposed demand of the user, that is the user need, might be the communication between the commuter and the family. The user need (or demand of the user), has to match the intended psychological need in order to be considered. In the design case of keepClose, the supposed user need of communication did match the intended psychological need of relatedness, hence it was considered in the design, even if not explicitly designed for. The psychological needs thus motivate the fulfilling of the user needs, as far as they are matching the psychological needs. Consequently, the psychological needs mediate between the product and the user with their demands. User needs describe WHAT the user wants, but not WHY (which is what psychological needs do). Therefore, user needs are not able to define HOW to design an interaction product according to the WHY.

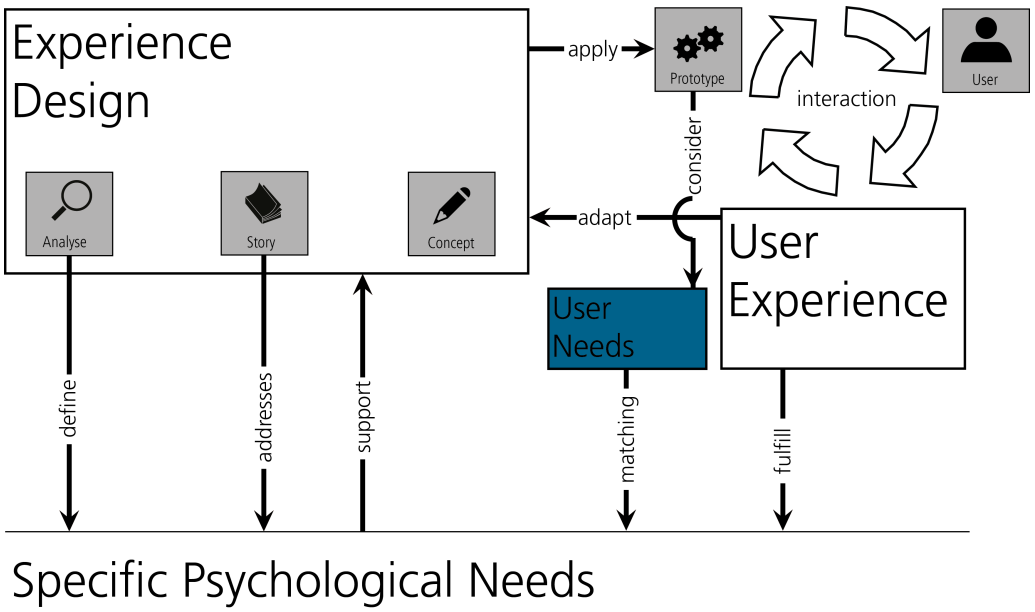


Figure 5.6: Psychological needs and user needs in the application of Experience Design.

5.2.2 Analysing an Experience and the Prototype

User experience is gathered by the users while living the designed experience. But so far the evaluation of user experience, in the form of analysing the intended experience, lacks specific methods that put the focus on the experience to be designed.
As to the analysis of the fulfilling of the psychological needs, the need-questionnaire based on Sheldon et al. [SEKK01] was used (seen in Sections 2.3.1 and 5.1.4). Concerning the identification of emotions that appeared during the experience, the PANAS was used (seen in Sections 2.3.1 and 5.1.4). But these tools were not explicitly made for either Experience Design nor for the application in the automotive context.
The Need-Questionnaire is not focused on human-machine interaction. Hence, several of the needs it includes do not fit the automotive context, such as the need of "money/luxury." On the other hand, psychological needs that are especially important for Experience Design are missing in the need-questionnaire, such as the need of competition. Likewise, the PANAS, with its focus on positive and negative affects, is not sufficient for Experience Design. As Experience Design has its sole focus on positive affects, the PANAS with only 10 items for positive affects (or 28 in the case of the PANAS-X), lacks social emotions (like "gentle" or "loving") and detail for this application.
Because of the lack of specific evaluation methods for Experience Design, Melanie Lamara developed the ECHO, a questionnaire, which combines psychological needs and emotions and which she especially adapted for Experience Design in the automotive context. The questionnaire was applied in different versions in the design cases from Chapters 3 and 4 with the aim of

elaborating this new tool.

ECHO: Characterising the Experience in Detail

With the intention of gathering past experiences in a more holistic way, Lamara presented ECHO (Experience Characterisation Objective) in 2013 [LDHK13]. As a not yet published validation of this method, the author and her team proved the satisfying quality of its measurement. The field of application for this questionnaire comprises, on the one hand, the shaping of a Experience Story with the aim to focus the story on specific psychological needs and emotions, and on the other hand, the evaluation of an experience with the aim of a summative analysis focused on psychological needs and emotions. Lamara et al. conducted positive emotion and psychological needs scales. 34 need-items are categorised in 11 psychological needs (see Table 5.1). The 11 psychological needs, based on Sheldon et al. [SEKK01], Reiss and Havercamp [Rei04], and Hassenzahl [HDG10], encompass: "autonomy," "competence," "friendship," "belonging," "physical thriving," "security," "stimulation," "status," "collecting," "idealism," and "competition." According to Lamara et al., this new collection of needs was created to fit the human-machine interaction context. The items of the 11 needs are used to analyse the fulfillment of specific needs. They are used similarly to the Need-Questionnaire by Sheldon et al. [SEKK01]. The rating scale of the ECHO ranges from: not at all, a little, moderately, considerably to completely. Examples of the need-items are: "...deciding to do things my own way" (one item for autonomy) or "...having something in common with others" (one item for belonging). The same ranking scale is used on 68 emotions, (e.g.: "loving," "relaxed," and "gentle"). These provide an overview of the emotions that possibly arise during an experience. For the future work in Experience Design, the objective is that the analysed emotions may be correlated to one specific need.
Compared to common tools, such as the PANAS (see Section 2.3.1), the ECHO questionnaire helps to gather more detailed information about an experience mediated trough technology. Tools like the ECHO help to gather experiences optimised for the application in Experience Design and for a specific context.

Interaction Criticism

As mentioned in Section 2.1, the focus of Experience Design is on the experience itself. The technology is only the creator and mediator of the experience.
However, the technology, which in this case is the prototype and its interaction design, should be analysed as well. This analysis was implemented here with a critical reflection on the interaction design of the respective technology. This critical mindset is adopted from Jeffrey and Shaowen Bardzell who argue in their work from 2008 that human-computer interaction (HCI) lacks interaction criticism [BB08a]. By interaction criticism they mean, "...rigorous, evidence-based interpretive analysis that explicates relationships among elements of an interface and the meanings, affects, moods, and intuitions they produce in the people that interact with them; the immediate goal of this analysis is the generation of innovative design insights" (p. 2463 in [BB08a]).
Thus, the critical self- or external reflection of Interaction Criticism should help to take a step back from the concept and question it from a critical point of view. This reflection was applied in the evaluation of the design cases introduced in Chapters 3 and 4. Thereby, it was reflected upon the

Psychological Need	Need-Item
Autonomy	… doing things autonomously. … deciding to do things my own way. … doing what I think is right.
Collecting	… drawing it on for a long time. … being remembered of something personal from my past. … indulging in special reminiscences.
Friendship	… spending intimate moments with others. … understanding each other intuitively "without words". … staying with people I like. … having a close relation to someone who is close to me.
Belonging	… being approached by other people, because they appreciate me. … having something in common with others. … being appreciated and liked. … being surrounded by like-minded people. … being connected to others.
Idealism	… being able to achieve something for the community. … helping others.
Competence	… completing difficult tasks successfully. … fulfilling demanding requirements. … being competent.
Physical thriving	… perceiving my body consciously. … feeling every muscle fiber of my body. … in a good physical condition.
Security	… having everything go its usual way. … following pleasant routines.
Status	… getting attention because of my possessions. … having something to show that I get recognised for. … being admired for my status by others.
Stimulation	… satisfying my thirst for knowledge. … experiencing new things. … collecting new impressions.
Competition	… surpassing others. … being better in comparison with others. … longing to compete with others.

Table 5.1: The psychological needs and their need-items from [LDHK13].

potential user for the designed experience and upon its limitations, which appeared through the experience.
In the design case of the *keepClose* experience (see Section 4.1), the users were commuters with families and young children. As this limits the group of users, the reflection focussed on what other users were able to use this technology for and what the outcome experience could be for them. Furthermore, it was considered how the content of the Experience Story was transferred through the interaction.
In the design case of keepClose, where the family's daily routines and habits are part of the interaction concept, it was mainly these routines that triggered the interaction, hence the interaction triggered by the user was reduced. If the users acted differently from these routines, this affected the interaction and thereby the resulting experience. Beyond that, the interaction design and the interface were deliberated upon. In the design case of *keepClose* the interface design is very reduced, so as to not have stimulation as the focus of the interface but the elements of the experience itself, like the communication of the location of the commuter to the family at home. This mindset of interaction criticism (seen in [Bar11], [BBL10], and [BB08a]) also helped while designing to develop a "...cultivated awareness of the critic's own direct sensual, emotional, and intellectual experience engaging with the work/example, including what the critic felt and learned as well as how she or he changed (or might have changed) as a result of engaging with the work." (p.606 in [Bar11]).

5.2.3 Challenges of Experience Design in the Automotive Industry

Experience Design is an approach for the designing of interaction products. Therefore, it is about creativity and has a focus on the qualitative aspects of the human.
Working in the automotive domain with the focus on human experiences is unusual. The designing of experiences that go beyond the mere act of driving is even more unusual. Co-workers trained according to usability to build and evaluate their concepts on effectiveness and efficiency often do not take the work in this area seriously. This Section outlines some of the reasons.

Working with Experience Design in a Traditional Usability Environment

Designing for experiences other than simply driving is unfamiliar in the automotive environment where usability leads the evaluation of new concepts and concentrates on task completion. Many valid methods are available to evaluate usable products. These methods measure efficiency and effectiveness (e.g., interacting with a product while solving a standardised driving task). Thus, usability is easy to measure in a quantitative manner, so that it is easy to tell whether a new concept or feature is "better" (in regards to usability) than the existing one. With the particular field of Experiences Design this is different. As discussed previously, not many valid methods are available to evaluate the designed experience. It is mainly qualitative methods that support the results of the designed experience. These results indicate whether, through the applied technology, the design was able to create a similar experience to that intended. Thus, no quantitative statement can be made on whether the technology that mediates the experience is better than one of a purely technological or functional approach. Moreover, Experience Design often does not add new functions,

as it mostly condenses already existing ones in a more meaningful way. Consequently, this makes it difficult to evaluate the technological aspects of Experience Design. However, this actually is not the contribution of Experience Design, which aims to deliver positive experiences to the users. The different mindsets of usability on the one hand and Experience Design on the other result in difficulties in comparing the applied methods. From the work experience gathered over a period of three years, five challenges for usability experts to work with Experience Design were realised:

1. *Feeling an undermining of usability skills*
   With usability as a "hygiene factor" in Experience Design, other skills are demanded. Due to these different skills, the trained usability expert might feel less competent than usual in Experience Design projects. The Experience Design projects undertaken evidenced that usability experts tended to refuse the Experience Design approach.

2. *Falling back on to common structures*
   While working on an Experience Design project, usability specialists tended to fall back onto their common mindset. One example is the focus on aspects that are easy to prove with a usability evaluation.

3. *Oversimplifying Experience Design*
   In practice, usability experts tried to adopt Experience Design directly into their usability approach. Thereby, they first designed based upon usability and then tried to integrate various needs, whereby psychological needs and user needs were mostly used synonymously.

4. *Technology focus*
   In the automotive context, innovations are mostly technology-driven. When new technologies come out on the market, these are adopted for the automotive context, in which they then replace common technologies. If the new technology is "better" according to usability, then the idea will be directly transferred from research to development. An experience-driven approach takes a step back from technology and focuses on the experiences of humans first. Whereas the technology-driven approach starts immediately with the concept design, the experience-driven approach can be time-consuming before actually starting to design the concept. Hence, co-workers used to the technology-driven approach tended to lose their patience when focusing on the experience before designing the concept.

5. *Driving safety and Experience Design*
   Designing interaction for cars is, for good reason, focused on driving safety. Interaction with secondary tasks should not disturb the overall task of driving. While this safety paradigm holds up for all interactions in the car, it is important to design open-mindedly before taking driving safety into account, which will be discussed more in detail in the next paragraph.

Experience Design Along with Driver Safety

Human-machine Interaction (HCI) in the automotive domain is focused on driving safety. New systems, for example, are analysed with eye-tracking in order to measure usability aspects, in that case the visual distraction (e.g. [KMC+10]). New systems are mostly added as additional functions in the car. One example is the Adaptive Cruise Control, which controls the longitudinal acceleration [EKHS12]. This function is isolated from other functions in the car but this "feature" has a strong impact on the perception of the car [EKHS12]. Here, Experience Design can help to clarify why the driver should or might use a feature. The answer could lead to a meaningful combination of different functions, such as a well-being mode, as an example. Also, passengers might use or "misuse" a set of functions to address or fulfill specific psychological needs. A combination of functions, which mediate an experience, can be examined and adapted towards driver safety.

But the passengers do not interact with their cars based solely on safety reasons. They also listen to audio books or call friends while driving. Commuters, for example, spend a lot of time in their cars and might want to feel related to friends or family. They can use systems integrated in the car or even other devices that enable meaningfully designed experiences and thereby fulfil specific needs. Having designed these experiences, the technology that mediates the experience still has to be tested according to usability criteria in order to secure driving safety.

However, in order to create such new experiences, driving safety should not be an argumentative impediment beforehand. Rather, Experience Design should lead the design first, and afterwards usability can optimise the driving safety.

Chapter 6

Conclusion

The conclusion begins with a summary of the theoretical foundation and the practical application of the work. It then proceeds to outline the main contributions addressed within this work. Afterwards, it discusses the ways in which this work is generalisable for other contexts. Moreover, approaches for future work are sketched out, including areas other than the automotive domain. Finally, the thesis is concluded with a closing remark.

6.1 Summary

In 2010, Hassenzahl pleaded for "Experience Before Product," [Has10] defining a new mind-set in the Human-Machine Interaction, which places the human first. The presented thesis is based on the mind-set of "Experience Before Product" and pursues the aim of designing experiences mediated by technology in the automotive domain. Whereas the focus of design in this area has so far been on the driving experience and thereby on the machine, this work aimed to create experiences beyond the act of driving, thus fostering positive emotions for the driver and for all other passengers in the car as well.
The work is made up of three parts.
The first part is about the understanding of designing experiences in the automotive context. After an introduction into the field of Experience Design in the automotive context in Section 1, an overview of established approaches and methods is presented in Section 2. In Section 2.1, different perspectives on user experience are reviewed, starting with user experience regarding product experiences and going beyond. Two approaches for designing experiences are then discussed in detail in Section 2.2. The first one is John McCarthy's and Peter Wright's, "Technology as Experience," an approach, which offers a framework to understand the facets of experiences with technological artifacts. The second approach is, "Experience Design" by Marc Hassenzahl, which puts the human into the focus for designing experiences through technology. This approach provides a model of goals, which not only helps to determine the WHAT and HOW to design, but

also helps to understand WHY an experience triggers positive emotions. Therefore psychological needs are used which further support the design process. It is this practical approach that is used for the design of experiences in this thesis. This is due to Hassenzahl's focus on the human and his reasoning that in design, experience comes before technology, which is exactly the aim of this thesis, to step back from a mere technological devising in order to design for experiences.
Section 2.3 is about the application of the Experience Design approach. For this purpose, different methods from existing research are consulted, such as storyboarding, story writing, narrative semi-structured interviews, and the PANAS. Out of these methods, four design steps are formed: (1) gathering and analyzing experiences, (2) creating an experience with a story, (3) designing experiences through technology, and (4) evaluating the designed experience.

In the second part of this work, Experience Design is applied to design for experiences other than the act of driving . Four selected design cases are presented where Experience Design is implemented with the introduced methods and in the mentioned design steps. The scope of these experiences are classified into the contexts of: (A) Group Drives for Pleasure, and (B) Commuting Alone. The first two design cases, presented in Chapter 3, take place in context (A), the second two design cases, presented in Chapter 4, take place in context (B).

- **The *CliqueTrip* Experience (Context A)**
  The first design case of *CliqueTrip*, described in Section 3.2, is about driving in a group of friends split up in different cars in a motorcade with a common destination. Here, in the first design step, past relatedness experiences of participants are gathered and analysed. Two aspects are identified as being crucial. One of these aspects is the importance of communication, which helps the whole group to feel close to each other even though they are driving in separate cars. Hereby, it is especially noted that a limitation of the communication leads to a rising value of the communication channel. The second decisive aspect consists of the importance of localising the group in the other car as this fosters the feeling of being part of one joint group. In the design step following the analysis, an experience is created through a story, which is built upon the most salient psychological need gathered in the analysis, in this case relatedness. The *CliqueTrip* Experience Story describes the positive experience of driving in a motorcade using the *CliqueTrip* system, which enables a communication channel once the different cars of the motorcade are in close proximity, and which provides a navigation from the rear car to the front car, locating the friends ahead. Based this Experience Story, in the third design step the *CliqueTrip* experience is realised with the help of an experimental prototype. The system is then implemented in two cars and tested with real groups of friends driving in a motorcade on a joyride in traffic. The last design step of evaluating the experience of the participants while using the system shows that the need of relatedness was addressed. The two aspects of communication and locating

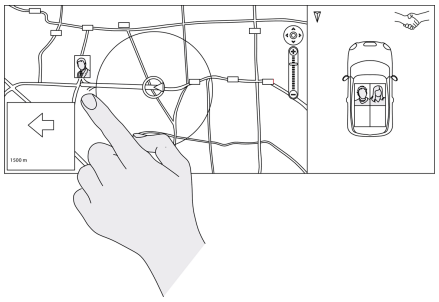


Figure 6.1: The *CliqueTrip* system.

the friends in the other car are reported as the factors which make the *CliqueTrip* experience a positive one.

- **The *ExplorationRide* Experience (Context A)**
  The second design case *ExplorationRide* presented in Section 3.2, deals with the conjoint exploration of an unknown area. Here, a past exploration experience is used as a starting point for the design. The analysis of this experience in the primary design step brings various aspects into focus, which help to foster a positive exploration experience. First, for relatedness within the group, the analysed experience should be started together so that no one feels excluded. Second, there has to be a trade-off between getting lost and finding new routes, as it is important to leave known areas without having the feeling of getting lost. The third aspect is about collecting mementos while exploring, which can happen by labeling and marking explored places, remembering the event together and sharing it with others. In the second design step, an Experience Story is created so to define a positive exploration experience while using the *ExplorationRide* system, a system, which enables a common exploration ride for a group of friends. Here, friends are invited by a member of their group for an exploration ride according to a chosen theme (e.g., skiing or swimming) and start the trip together on an appointed day. The system provides a vague guiding to a destination area based on the selected theme, but at the beginning of the trip the map is covered and it is only while driving that points of interests appear in the surroundings of the chosen road according to the chosen theme (e.g., an ice-cream parlor when the friends plan to go swimming). Thereby, the friends are encouraged to take detours so that they may discover unknown areas. After each stop on the way and also after arriving at the final destination the system provides mementos, as this is the experience described in the story. In the next design step the experience is realised through technology as an experimental prototype in a car, and is afterwards used in an in situ user study in order to accomplish the last design step of analysing the experience with a real groups of friends exploring conjointly through the *ExplorationRide* system. The results of the user study show that the experience while using the system is a positive one and triggers relatedness, balances the trade-off between getting lost and finding new ways, and provides mementos.

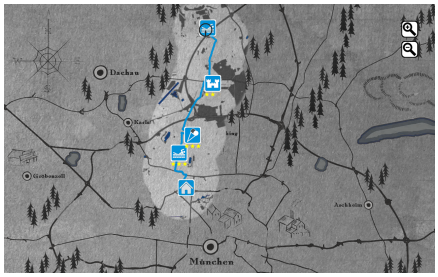


Figure 6.2: The *ExplorationRide* system.

- **The *keepClose* Experience (Context B)**
  The third design case, *keepClose*, delineated in Section 4.1, aims at promoting relatedness for families in commuting situations. In the first design step, past positive experiences in the context of commuting are gathered and analysed. Out of the analysis and literarary research, three strategies are selected to foster relatedness while commuting. The first strategy is to provide the commuter's family with an approximation of the commuter's position to foster the feeling of group belonging to the family at home as well as the commuter. The second strategy is to provide a limited communication channel when the commuter is in

the surrounding area of the home so that the commuter is able to join common conversations and has a heightened sense of anticipation. The final strategy is to enable the family to sent gifts to the commuter's car, which the commuter receives before starting the trip back home. These strategies are taken into account while creating the Experience Story in the second design step, describing the positive experience while using the *keepClose* system within a commuting drive, a system, which is made up of the above mentioned strategies. In the next step, the *keepClose* prototype is implemented. It is based upon the Experience Story and consists of one device in the car and another device, located in the communal area of the home. The prototype is provided to families to analyse the impact of the *keepClose* system over time. The fourth design step, an analysis of the participant's experiences while using the *keepClose* system, shows that the positive impact of the system depends on the families' structures and routines and on their getting used to a system that influences their rituals. If the family is used to the system and if the structure of their daily routine is not especially strict, they had positive experiences while using the system. Under these circumstances, positive experiences appear thanks to the strategy of locating the commuter and the communication when nearing the home. However, the strategy of gift giving was not used by the families, which may be due to this strategy's non-stimulative nature.

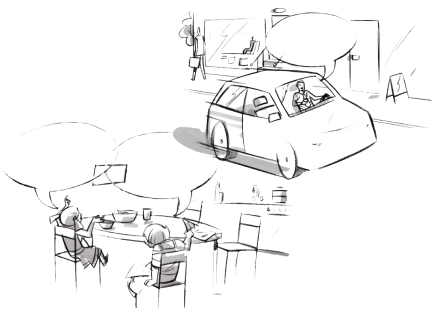


Figure 6.3: The *keepClose* system.

- **The *Last Gentlemen* Experience (Context B)**
  The final design case of *Last Gentlemen*, depicted in Section 4.2, intends to encourage prosocial behaviour in traffic. It creates a positive experience by helping people to act according to their personal norms. A pre-study is conducted in the first step to gather and analyse reasons and sources for positive emotions due to prosocial behaviour on the road. Two important topics emerged: first, social learning, second, personal norms and principles. According to these topics, the *Last Gentlemen* Experience Story is created in the next design step. In the Experience Story, the *Last Gentlemen* system invites the user to become a member of the "Alliance of the *Last Gentlemen*", which wants to bring morality and civility back to the streets. The system provides feedback to the driver each time when having acted in a prosocial way, which is then recognised by the Alliance of the *Last Gentlemen*. In the third design step, a prototype is created, providing the feedback to the driver. In the in situ user study of the concluding design step, the *Last Gentlemen* experience is analysed. This shows that almost

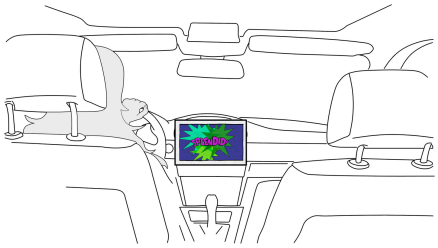


Figure 6.4: The *Last Gentlemen* system.

all participants did act prosocially in the user study, which these participants ascribed to the intended topics of social learning and acting according to personal norms and principles.

In these design cases, Experience Design is applied with the methods introduced in Chapter 2.

As a third and final part, a best practice is established through describing in detail the application of the methods of the four design steps. Also, each method is exemplified by its application in one of the design cases. Additionally, the difference between psychological needs (which create positive emotions when fulfilled and describe WHY a user wants to interact) and user needs (which are demands of the user and describe WHAT a user want) is discussed. Moreover, the challenges of the evaluation are outlined, that is, of evaluating the experience where common validated methods are rare, and of evaluating the prototype where more criticism should be addressed. Finally, the challenges of automotive Experience Design are outlined as they relate to the traditional usability environment and the necessity of driving safety.

6.2 Main Contribution

In Section 1.4, the targeted contribution of this thesis is outlined as (1) Understanding and Insights of Applying Experience Design, and (2) Design Cases in the automotive domain beyond the act of driving. The insights and the knowledge gained in this work are to provide a deeper understanding of automotive Experience Design. The here elaborated best practice is to help others to follow the presented application of Experience Design. By creating experiences in actual cases, the application of designing experiences in the automotive context is clarified.
As to the findings of the work, the contributions are summarised as follows:

1. **Understanding and Insights of Applying Experience Design**
   Best Practice:
   Thanks to the practical implementation of Experience Design, a best practice for creating experiences beyond driving is specified, which provides a guide to the designing of experiences in the automotive domain, thus supporting designers and researchers concerning this task.
   Discussion of the Challenges:
   Through a discussion of the challenges relating to the application of Experience Design, insights are provided as to designing in a field with a predominant focus on usability and driving safety. These insights into what challenges appear in an industrial environment support the work of designers beginning to design automotive experiences in as well as that of researchers working on Experience Design.

2. **Design Cases**
   The design cases constitute initial approaches of applying Experience Design in the automotive industry for designing experiences other than the act of driving. Design implications

are analysed and tested and show stories of success so that they serve as practical examples of designing automotive experiences for interaction designers. They also provide insights for researchers on the specific contexts in which the designed experiences of this work take place.

6.3 Generalisability

Since practical examples of the application of Experience Design in an industrial background are still rare, the work at hand shows how new possibilities are found by applying Experience Design. The "detour" to experience in designing interaction products helps to successfully design experiences through technology and allows for the creation of positive emotions among a product's users. Because of the analyzing of the motivation of the user (the WHY), the functions carried out by the technology can be made more meaningful. In this work, Experience Design is applied to designing experiences beyond the driving task in the automotive domain. Nonetheless, its implications are useful beyond this area. The design cases of this work take place in specific scenarios, that is, driving in a motorcade, exploration with the car, commuting, and considerate traffic. The analysed insights gathered to design for positive experiences within these scenarios can be used outside the automotive industry (e.g., common exploration). Even though the functions and the explicit implementation might differ, the WHY, which describes the motivation and hence explains why an experience is a positive one, retains similarity in other contexts.
The depicted methods can also be used in other domains, but need to be adapted to the specific possibilities and challenges within each domain. The practical recommendation on the use of methods presented as a best practice regards challenges that might appear in other domains as well. The insight drawn from the practice concerning how to utilise user needs and psychological needs and how to adapt in an overall usability-orientated surrounding is of importance for everyone working with Experience Design in a usability-focused environment. Furthermore, the recommendations regarding the evaluation are useful for everyone working in Experience Design, no matter what field, since the lack of evaluation methods is not restricted to the automotive industry.

6.4 Future Work

From this thesis, different directions for future work can be conceptualised. Although Experience Design in this thesis is implemented within the industry, it is in a research department where this work takes place. Due to this research surrounding, the outcome of the design cases are experimental prototypes used by limited groups of participants for in situ user studies. Future work should add the development of interaction products that are constructed to stages beyond prototyping and that can be built in larger numbers so as to be used by more individuals. Consequently, it is in and beyond the automotive domain that future work can contribute to elaborating on Experience Design in industrial work environments, further improving methods for their application in the industry, as well as providing more precise knowledge on Experience Design in real work environments.

6.4.1 Within the Automotive Domain

Designing more Experiences in other Scenarios: Additional design cases in further scenarios can help to enhance the knowledge about practices that create positive experiences through technology. A collection of these practices can be used as a starting point for experience designers in that area. Beyond that, designing various experiences methods and their application can be further elaborated.

Further Enhancing Methods: Through additional design cases and an ongoing use of Experience Design, methods can be further enhanced as every application can provide insights using specific methods for this purpose. Also, methods from other domains can be developed to design for experiences beyond the driving task.

Enhancing Designed Experiences: Producing technology in a larger number can create an understanding beyond that enabled by a user study. Through a larger number of individuals using the product in different contexts in daily life, experiences through technology can be enhanced and further improved.

Long Term Studies: As the elaboration over time of the design case *keepClose* has shown, the individuals' usage of products changes over time. Whereas in the user studies of this work the impact in real life could only be estimated, studies over several months can generate a more profound understanding of the impact of the designed experiences through technology and the changing of usage over time.

6.4.2 Beyond the Automotive Domain

Extending Experience Design into Real Work Environments As field design cases on Experience Design, especially from within the industry, are still rare, an extended application of Experience Design in industrial work environments can show how to best adapt and integrate the here presented methods into industrial fields beyond the automotive domain.

Experience Across Different Interaction Products: As the cases *CliqueTrip* and *keepClose* show with their designed experiences being implemented in the car as well as on a mobile device, the integration of different interaction products can make the experience more persuasive, hence facilitating the user to immerse even deeper in the experience. Consequently, different industries can work together to design future experiences through complementary technologies. For this purpose, the Experience Story can be used as an overall comprehensible medium to articulate the experience to be designed.

6.5 Closing Remark

Experience Design is a design philosophy that puts the human into the centre of the design. The designer starts with the experience, the technology comes last. Through this new focus Experience Design enables advanced innovation (such as the patent [KS12]). However, due to the change in the design approach, the application of Experience Design in a usability-driven domain comes with many challenges. Nevertheless, taking experiences into account before designing technology is worth the effort as Experience Design can help to design meaningful products by creating positive experiences. With this thesis I hope to have shown that experiences other than just the act of driving are also to be put into the focus of automotive design.

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