University of Erfurt
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The Use of Smartglasses in Everyday Life

A Grounded Theory Study

Dissertation

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Abstract

We live in a mobile world. Laptops, tablets and smartphones have never been as ubiquitous as they have been today. New technologies are invented on a daily basis, leading to the altering of society on a macro level, and to the change of the everyday life on a micro level. Through the introduction of a new category of devices, wearable computers, we might experience a shift away from the traditional smartphone. This dissertation aims to examine the topic of smartglasses, especially Google Glass, and how these wearable devices are embedded into the everyday life and, consequently, into a society at large.

The current research models which are concerned with mobile communication are only partly applicable due to the distinctive character of smartglasses. Furthermore, new legal and privacy challenges for smartglasses arise, which are not taken into account by existing theories. Since the literature on smartglasses is close to non-existent, it is argued that new models need to be developed in order to fully understand the impact of smartglasses on everyday life and society as a whole. This study thus aims to close this research gap by embarking on a qualitative journey which explores the application of smartglasses in the everyday life.

The qualitative grounded theory methodology has been used in order to find themes and patterns to understand how a total of 41 participants used these kind of devices over a period of one week. In order to gain a holistic view of the proposed topic, the participants had to wear the devices and were later interviewed about their experience. They were asked about topics such as the alteration of communication, privacy, reality perception, human-computer interaction, the perception of others and alike. Furthermore, the participants were asked to fill out a quantitative media diary throughout their time with the device, which provided an additional set of data which could later be used to verify some of the interview statements.

Based on these findings, a model has been proposed which specifically explains the situational use of smartglasses and their respective key influencers. The main outcomes however confirm that the usage of smartglasses is vastly diverging from the use of the smartphone and is highly situational. Since the main use of smartglasses is in public places, privacy issues for the individual as well as for the immediate surroundings arise, mainly due to the head worn camera and the constant location tracking. Adding to the notion of a new need for sensitization, new methods of input such as voice and gesture commands alter the way the technology is interacted with and provide an additional layer of complexity.

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I would like to thank a number of people. First, my mother and father for the moral and financial support as well as the encouragement during this dissertation. This is for you.

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Declaration of Authorship

I, Timothy Christoph Kessler, born on the 26th of May in 1986, hereby declare that the submitted dissertation with the title:

„The Use of Smartglasses in Everyday Life“

is my own unaided work. All direct or indirect sources used are acknowledged as references.

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1. Introduction

1.1 Study Background

The world we life in is increasingly dominated by mobile technology. Smartphones have altered the way our entire social system is organized and and how we organize ourselves. This brings an inherent change to the way we communicate and how we allow each other to pop in and out of each others lives (Campbell et al., 2014). With an increasing saturation of smartphones as well as other communication devices throughout society, our mentality is set to be "always on" by default. Mobile media are hence increasingly becoming true extension of men (McLuhan, 1964) and have reached a point of penetration never seen before in human history (Tully & Baier, 2006). New mobile devices are invented, sold and purchased at an increasingly faster pace and thus almost two billion people own either a regular phone or a smartphone (Gartner Research, 2015). However, this marks only the beginning of a new era of mobile communication.

Through the introduction of a new category of mobile devices, the wearable computer, society might undergo yet another (mobile) paradigm shift. While a lot of the current research has been done regarding mobile media and how it is embedded into everyday life (Hartmann et al., 2008; Höflich et al., 2010; Vincent, 2013) the field of wearable societal research is relatively uncharted to this day. Thus, this study aims to explore how smartglasses are appropriated and used in everyday life and how aspects like privacy, social etiquette and communication are altered accordingly.

The following chapters will explore the research rationale, the research objectives, the methodology applied in this study as well as the overall structure of this dissertation.

1.2 Research Rationale

Although the field of smartglasses as a consumer product is fairly new, research in this field has been going on for decades. Steve Mann, the "father of wearable computing" has dedicated a great part of his life to the development and testing of such devices (see also chapter Wearable Computing - "Historic Context" on page 16). However, this has been at a rather small scale and was not intended to have any implications for society at large, but rather for the researcher himself.

Through the release of the Google Glass device into the public realm, this could change. People are now able to buy a variety of different wearable computing devices and

integrate them into their daily lives. It goes beyond saying that wearable computing does not only incorporate smartglasses, but also smartwatches, fitness-trackers and all other technology that could be worn on the body and change everyday life. Although other devices will be partly mentioned and discussed in this dissertation, the main focus lies on smartglasses.

With the rise of the smartphone, an extensive body of literature on mobile computing has been created. Many aspects of mobile technology have been examined, from their meaning to everyday life (Höflich et al., 2010) to the emotional attachment the user has towards their device (Vincent, 2013). This research has been used in this study to create a comparison between the different technologies as they share some functionality such as camera, navigation, phone and so forth. Still, both technologies need to be distinguished from each other, mainly through the form factor as well as through the enhanced functionality head worn computers potentially offer.

There have been theoretical considerations as to what these kind of devices might imply for the embeddedness of mobile communication and everyday life (Campbell et al., 2014). Other research has been done, mainly in the medical field in order to examine how these devices can help doctors in their daily routine at the hospital, as well as the aid with certain illnesses such as Parkinson´s disease (Muensterer et al., 2014; Glauser, 2013; Feng et al., 2014; Albrecht et al., 2014).

Still, no empirical study has taken place which evaluates the validity of the these devices for the facilitation of everyday life and how they are embedded into a variety of social settings. Since one might argue that wearable computing is the next evolutionary step of technology (McNaney et al., 2014), it seems necessary to examine how these devices fit into the everyday life and what implications this may have for the individual as well as for society at large. Furthermore, with the rise of augmented reality applications, this novel form factor has the potential to change the way how the environment as well as reality is perceived.

This study is hence meant to explore these kind of phenomena and propose a model which is specifically build to close this research gap: the wearable computer "smartglass" and its role in the everyday life. In the subsequent chapters, the exact research goals will be formulated and a brief insight into the methodology of this study will be given. Lastly, an overview of this dissertation will help to understand what subjects were treated and how they are combined in order to construct a theory, grounded in the gathered data.

1.3 Research Goals

The general research aim of this dissertation is to examine how and to what degree smartglasses are used in everyday life. However, this research goal seems rather vague since everyday life is a complex setting of many different influences (Felski, 1999). Hence, more precise research goals had to be identified. These include the influencing factors of the use of smartglasses, a theoretical framework dedicated to technology in relation to the user as well as society, the connection of smartglasses to different places and attendees, the relation of smartglasses in the context of privacy and lastly, the creation of a model which allows to understand the use and the limitations of smartglasses.

The following list will provide an overview of the proposed research goals and explain to what extent they are of relevance to this study.

Objective 1: Analyze the influencing factors when using smartglasses

One of the main objectives of this dissertation is to examine what factors influence the use of smartglasses. Hence, the outcome of the study must elaborate what restrictions may apply to the use of such devices and which factors need to be taken into account when these devices are introduced into a society which is mainly accustomed to mobile but not to wearable technology.

Objective 2: Provide a theoretical framework in relation to technology

Through the qualitative methodology of this study, it is necessary to review an extensive body of academic literature which will help to better grasp how mobile communication technologies are adopted and used. Furthermore, the embedding of technology into a society needs to be examined in order to understand what research may relate to the topic of smartglasses. Since the field of inquiry is quite novel, the academic literature of a variety of different fields needs to be reviewed in order to classify the topic of smartglasses and related technologies.

Objective 3: Identify how smartglasses relate to different locations / attendees

Because the device is classified as a "wearable", meaning that it is supposed to be worn all the time, it seems necessary to further deepen the understanding how different places interact with this technology. This objective has hence been created in order to

see, which kind of alterations happen to the individual as well as a society through the constant wearing of smartglasses. In a more differentiated view, not only the relation to the locations, but also the relation to the variety of attendees that are present for the use, needs to be examined.

Objective 4: Elaborate how the privacy is affected when using smartglasses

In the recent years, the debate about informational privacy has become ubiquitous. It has affected the way people interact with all sorts of communication technologies and will continue to do so (Therrien, 2014). Through the introduction of new devices into societal systems, new risks for the privacy of the individual may be created. Hence, one of the objectives was to examine the partipants´ views on privacy and incorporate them into the bigger picture regarding smartglasses, which, through the head worn camera as well as through the location tracking capabilities have the potential to be additionally endangering to the privacy.

Objective 5: Identify differences between smartglasses and smartphones

Since there has been no other smartglass for comparison, this study aims to identify the parallels and divergencies of use between smartphones and smartglasses. Both devices offer the same basic functionality, hence it seems adequate to investigate whether the novel form factor leads the individual to use the devices for different purposes and / or for different applications.

Objective 6: Propose a grounded theory model regarding the use of smartglasses in everyday life

This last objective is meant to incorporate all the aforementioned research goals into one comprehensive model, which helps to understand the use of smartglasses in everyday life and what factors restrict as well as encourage the use. This needs to take into account the societal consequences which arise through the use of smartglasses, but also the consequences that the individual experiences.

The following chapter will thus continue to provide an overview of the used methodology and how it has been implemented in this study.

1.4 Methodology Overview

Generally, this study is built around the qualitative grounded theory methodology. Basically, the approach offers a set of tools which allows the researcher to construct a theory from the gathered data, which in case of this dissertation have been interviews, a focus group discussion as well as media diaries.

In a first step, a qualitative pilot study has been conducted in order to gain an initial understanding of the topic and to generate the questions for the main study. The pilot study featured ten participants, who wore the Google Glass device for seven days. After this week, one-on-one interviews have been held. In order to further refine the questions for the main study, a focus group interview has been held with five participants out of the pilot study in order to further deepen certain topics and to acquire information which might have been left out. After refining the questions for the main study and creating a media diary which the participants had to fill out during their time with the device, a pretest with one person was held. This was mainly in order to see if there were any problems while filling out the media diary or with the newly generated interview questions.

After refining the media diary, the main study took place with a total of 31 participants. Similar to the pilot study, the device had to be worn for seven days and the participants were asked for one-on-one interviews after the testing period. Through the simultaneous evaluation of the data as well as through the context of the interviews, the questions varied marginally from case to case. The following table will provide an overview of the entire data collection process, as well as the evaluation.

Through the lack of existing literature regarding smartglasses, the grounded theory methodology, in triangulation with the media diaries, is believed to have proven a valuable approach to examine the use of smartglasses in the everyday life of the participants. Although an initial literature research has been conducted, the researcher was able to initiate the study with a nearly blank mind, as proposed by the methodology. After the evaluation of the data, a thorough literature review has been done in order to be able to better compare the findings to the existing theoretical framework.

Part of Study	Output	Time
– Preparation – Initial Literature Review – Define Methodology – Procure Google Glass Devices	Pilot Study Questions	August 2013 - January 2014
Pilot Study	– Interviews – Transcript – Simultaneous Evaluation	January - February 2014
Focus Group Interview	Transcript	March 2014
Evaluation	– Pilot Study Findings – Focus Group Interview Findings	April 2014
Preparation	– Main Study Questions – Media Diary	May 2014
Pre-Test Main Study and Media Diary	– Interview Questions – Refined Media Diary	May 2014
Main Study	– Interviews (qualitative) – Transcript – Media Diary (quantitative) – Simultaneous Evaluation	June - September 2014
– Overall Evaluation – Comparison	– Main Study Findings – Media Diary Findings	September - December 2014
– Final Literature Review – Simultaneous Evaluation – Evaluation of Grounded Theory Criteria	– Comparison to Academic Literature – Finalized Dissertation	December - October 2015

Table 1: Time Frame of Implementation & Evaluation

2. Theoretical Context and Key Concepts

2.1 Introduction and Definitions

The theoretical framework is structured into three seperate parts - "Introduction and Definition", "Adoption and Use of Mobile Communication Technologies" and "The Embedding of Technology into Society".

This first chapter will focus on defining the basic terminology of this study. These include the different types of realities, wearable computing in general and smartglasses in specific. Lastly, a definition of the term "everyday life" will be given in order to understand how it relates to the topic at hand.

2.1.1 From Augmented and Diminished to Mediated Reality

This chapter will define the terms related to the subject of reality, augmented reality, diminished reality and mediated reality.

First, a basic understanding of the construction of reality and what constitutes the latter will be gained. However, the main focus in this thesis still remains on "Augmented Reality" (AR) as well as the related notions.

The following figure briefly illustrates how the different notions of realities align and how they can be classified.

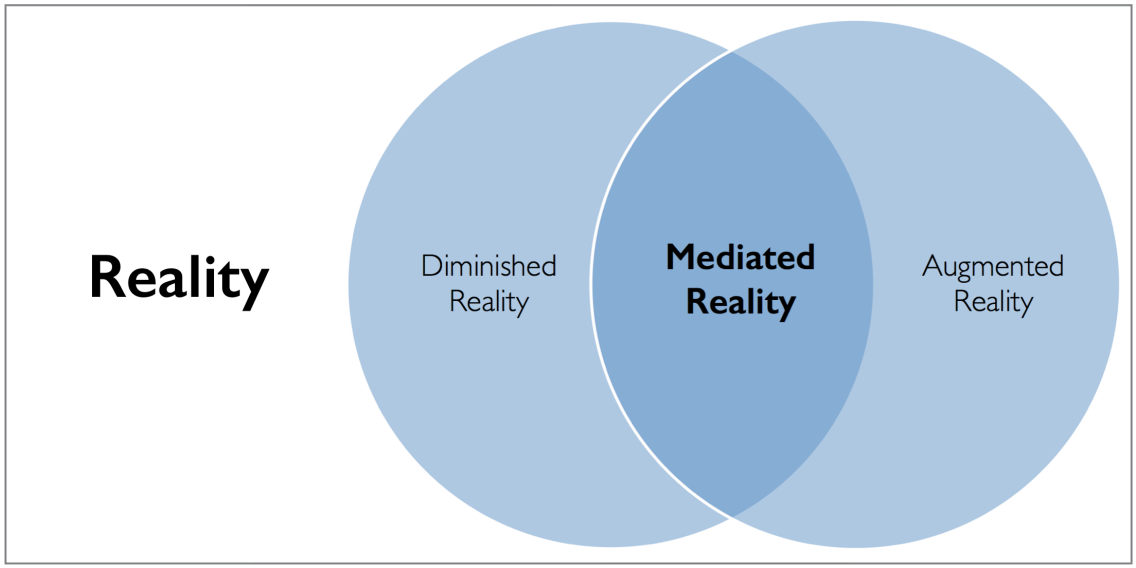

Figure 1: Reality Alignment (Own Illustration based on Mann, 2013, pp. 2-9)

As it is plain to see, the first level is formed by the real world as we know it (reality). This very absolute reality can be enhanced or diminished by digital content. If that happens one might generally speak of a "Mediated Reality", which is best defined as a proper superset of the digital realities (Mann, 2013). It consists of two separate, yet very close concepts - augmented and diminished reality which will be further explored in the following chapters.

2.1.1.1 Reality

The notion of reality might be one of the most difficult to define. Therefore, in a first step, it seems relevant to consult a dictionary in order to gain a very basic understanding of the term. The Oxford Dictionary (2013) defines "Reality" as follows:

"*1. the state of things as they actually exist, as opposed to an idealistic or notional idea of them (...)*

- *a thing that is actually experienced or seen (...)*
- *a thing that exists in fact (...)*
- *the quality of being lifelike (...)*

2. the state or quality of having existence or substance (...)

- *Philosophy: existence that is absolute, self-sufficient, or objective, and not subject to human decisions or conventions.*"

With this definition in mind it is safe to conclude that reality incorporates everything existing (past or present), including events, appearances as well as all types of structures. However, the main, ever ongoing argument regarding the topic of "reality" is between realism and constructionism. Weber (2002) asserts that therefore the main questions that arise are:

"Is reality a discovery or an invention? Do media reflect reality (exactly or distortedly) or do they construct it in the first place? Is the world a projection or a design? Do we represent something or are we (and always have been) constructs? Do we depict reality or build it up?" (Weber, 2002, p. 2). The following table will further clarify the different world views that the two strands represent.

Realist Terminology	Constructivist Terminology
Semantic field "depiction"	Semantic field "construction"
Depicting	Making
Representing	Constructing, generating
Copying, imitating	Planning, designing, producing, creating, (re)producing
Reflecting, projecting	Embodying, producing, building (up)
Discovering	Inventing

Table 2: Realism vs. Constructivism (Weber, 2002, p.2)

While this brief overview gives a valuable insight into the constitution of reality, as well as the two most concurrent notions, the focus in this dissertation will mainly rely on the *social construction of reality* which was first introduced by Berger and Luckmann in 1967. The main notion of their concept involves groups or individuals interacting with one another in order to create conceptual portrayals of their activities which will eventually be adopted by other members of the society, hence becoming a habit or being accustomed. This institutionalization of habits is thus deeply embedded into the society and are therefore responsible for the creation of knowledge and ultimately for the generation of reality (Berger & Luckmann, 1967).

In this context, language is defined as the most relevant tool for the construction of reality. Language is thus able to transgress everyday life and its corresponding realities by creating a variety of different realms of the latter (Berger & Luckmann, 1967). Hence, language is used to generate reality as we know it and can hereby be seen as the most essential system for the construction of reality.

In a more specific thought, the authors describe the reality of everyday life. It is argued that "compared to the reality of everyday life, other realities appear as *finite provinces of meaning*, enclaves within the paramount reality marked by circumscribed meanings and modes of experience" (Berger & Luckmann, 1967, p. 25). Hence the reality of everyday life can be seen as a supreme reality, a reality that we all share and is accepted as given. It does not need to be verified due to its simple presence and its self-explanatory nature (Berger & Luckmann, 1967). This argument was first used in the middle of the nineteenth century when the "everyday world" was seen as a scientific concept while the metaphysi-

cal concepts were falling apart and other explanations of the term "reality" were sought (Luhmann, 2000, p. 141).

The Kaluza-Klein-Theory or Fifth-Dimension-Theory (Kaluza, 1921; Klein, 1927) suggests a theoretical, additional dimension which is layered on top of the known three spacial elements as well as the time dimension (DePriest, 2012). In a more modern worldview DePriest (2012), states that a "fifth dimension" in correlation to augmented reality should be taken into account. In this context, the reality created through digital enhancement can be considered as an actual, separated space. Therefore it can be concluded that a "leap" into another state of consciousness can indeed happen, which in a modern world seems *inevitable* (DePriest, 2012).

Thus, the enhancement of everyday life via augmented reality can not only be seen as an alteration of the physical, real world but also as a very unique reality every human being experiences by using such new technologies. Hence, this "distorted" reality can be seen as a "leap" into another state of consciousness, experiencing another parallel dimension or reality.

2.1.1.2 Augmented Reality

The term Augmented Reality (AR) has been constantly redefined throughout the years. The main purpose of augmented reality however is to super-impose the actual real world with a digital layer. This allows the user to enhance his field of view and consequently his perception with additional information (Azuma, 1997). The fields of applications are nearly endless.

The perhaps most current and appropriate characterization of AR was given by Steve Mann (2013) who defines the phenomenon as follows:

> ***"Augmented Reality means to super-impose an extra layer on a real-world environment, thereby augmenting it. An "augmented reality" is thus a view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data." (Mann, 2013, p. 3)***

Furthermore Höllerer and Feiner define AR systems "as one that combines real and computer-generated information in a real environment, interactively and in real time, and aligns virtual objects with physical ones" (Höllerer & Feiner, 2004, p. 2). Several re-

searchers have enclosed three main characteristics that a system has to fulfill in order to be seen as a "true" AR implementation (Azuma, 1997; Kaufmann, 2003; Zhou et al., 2008): (1) combines real and virtual, (2) interactive in real time and (3) registered in 3-D.

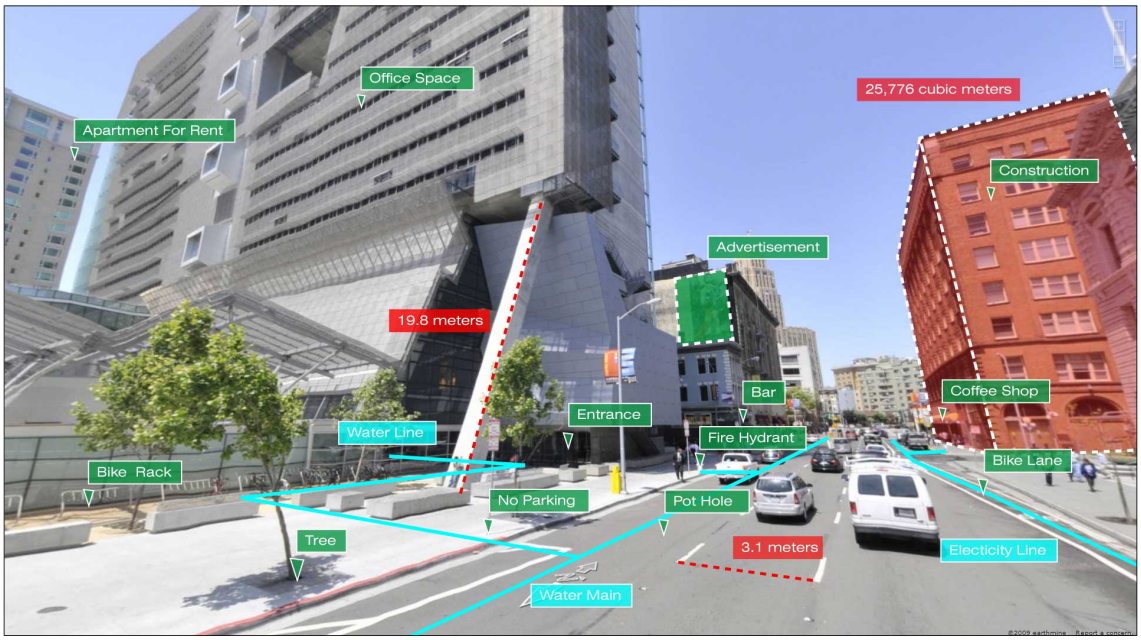

Figure 2: Earthmine Application (Takahashi, 2009)

This allows us to narrow down and differentiate between various systems and what exactly constitutes AR. Still, strictly speaking augmented reality is already a "Mediated Reality" (MR) since it deliberately modifies the users' vision in many different ways (Mann, 2013). For the complete definition of MR please refer to the chapter "Mediated Reality" on page 13. Nonetheless, for the sake of definition the term "Augmented Reality" will be treated as a separate entity in this dissertation.

In order to gain a further overview, AR can be seen as a subordinate part of "Mixed Reality", which is constituted of four different environments (Milgram & Kishino, 1994).

First, the "Real Environment" or "Real World", which is the world as we know it and are acquainted with. The complete opposite of course are the "Virtual Worlds" or "Virtual Environments" which are solely based on virtual objects and therefore do not rely on anything that is real. Hence, the content that the user is viewing is completely digital or computer-generated. In the literature this is also referred to as "Virtual Reality" (VR). In between these two rather extreme oppositions, two other types of realities can be found.

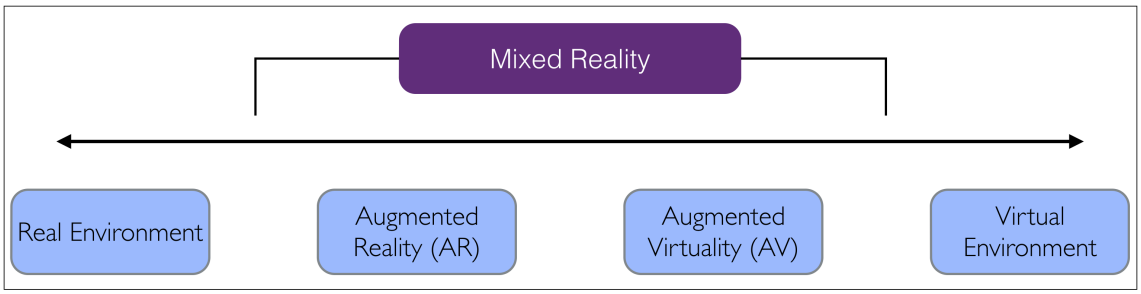

Figure 3: Reality-Virtuality Continuum (Milgram & Kishino, 1994, p. 3)

The "Augmented Virtuality" which can be found closer to the VR is constituted of more virtual elements than real ones and can thus be differentiated as a separate entity. This mainly applies to modern video games like "Second Life" or motion controlled games where the player controls his game-character with real life movements (Yuen et al., 2011).

It is worth noting that AR, although it seems further away on the scale, has a lot in common with VR or the virtual environment. Both are immersive, interactive and include sensitivity of information (Yuen et al., 2011). Furthermore, there are several reasons for researching the broad field of AR. Azuma et al. (2001) point out that AR permits an altered experience with the real world where the users' interaction, knowledge as well as perception is enhanced. Schmalstieg (2001) on the other hand argues that AR is potentially able to enhance the productivity of everyday tasks.

The research as well as the deployed development for the most recent applications involving AR is based on investigations that have been going on for the last four decades (Billinghurst & Henrysson, 2009; Yuen et al., 2011). According to Phan and Choo (2010) it has been possible to observe a vast growth as well as some significant technical progress of the AR industry in the recent years.

In general, there are two kinds of research areas surrounding AR. First and foremost, new technologies as well as new devices are one of the major aspects that are constantly being refined. This does not only include the different kinds of form factors i.e AR-Glasses, smartphones and so forth, but also the technology behind it such as the displays, tracking technologies as well as the input sensors which process the variety of data entering from the "real world" and alike. Secondly, the research investigates the development of applications which are making use of the already existing hard- and software implementations (Billinghurst & Henrysson, 2009).

2.1.1.3 Diminished Reality

While the main purpose of augmented reality is to enhance reality and therefore adding digital content to the real world, "Diminished Reality" (DR) wants to accomplish the exact opposite. Augmented reality can often add distraction to the perception since it appends information that at times seems disordered or not really necessary. Hence, augmented reality may also lead to an *information overload* (Mann, 2013).

Figure 4: Example Diminished Reality (Mann & Fung, 2001, p.8)

Thus, at times, it seems necessary to diminish or remove clutter instead of adding more and more information to an already confusing world. Diminished reality does exactly that. Unwanted information, e.g. unwanted advertising, can just be "overwritten" with any content the user would rather like to see (Mann & Fung, 2001). This is demonstrated in the above illustration where the user decides to blend in navigational information instead of an advertising.

This opens the possibility for not only adding content but to specifically remove information from the users perception. Hence, reality can be modified in order to decrease the increasing flow of information which the user is surrounded by.

2.1.1.4 Mediated Reality

Whilst having explored augmented as well as diminished reality, "Mediated Reality" joins both in one single concept. In contrast to the way augmented reality adds information whilst diminished reality removes clutter, mediated reality seeks to give the users complete control over the way they see and interact with their respective environment. Hence, a mediated reality device which is perceived as such, simultaneously adds useful content whilst removing the redundant information (Mann, 2013).

> *"Mediated Reality refers to a general framework for artificial modification of human perception by way of devices for augmenting, deliberately diminishing and more generally for otherwise altering sensory input." (Mann, 2013, p. 9)*

In general it is safe to assume that a mediated reality seeks to digitally modify the users´ entire reality. Having reached this conclusion, the way in which it is theoretically possible to enhance, diminish or otherwise alter our reality knows no limit. Through not only adding but deliberately blinding out unimportant or unwanted content, the way humans perceive "reality" might change in a yet unforeseen manner.

Having gained an overview of the different types of reality, the following chapters will continue to describe wearable computing in general and smartglasses in specific.

2.1.2 Wearable Computing

2.1.2.1 Definition in the context of Humanistic Intelligence Theory

The most important key characteristic that differs wearable computing from portable computers is the fulfillment of a different purpose. Whilst mobile computing (i.e. smartphones, tablets or laptops) are seen as a modern day, everyday life companion, the true target of wearable computing is to be inseparably merged with its porter in order to form a real Humanistic Intelligence compound. This also serves as the building block for the perhaps most predominant attribute: the constancy of interaction. Wearable computers are constructed and positioned on the human body in a way that both work together as a unit. Therefore the human mind is enhanced with digital information at a constant level, thus enriching the experience of complex, as well as everyday tasks (Mann, 2013). McLuhan (1964) argued that media, or in this case a medium, can be quite literally seen as an extension of man. He proclaimed that sight, hearing as well as haptic senses can be augmented via media through time and space. Mann (2013), in a more practical application, reaches a similar conclusion. He argues that wearable computers can be used as a prosthetic, which represent a "true extension of mind and body".

Steve Mann, the "father of wearable computing", has been researching this complex subject for over five decades now. He has not only been researching wearable, but also *bearable computing*, which is defined as technology that is implanted in the human body (Mann, 2013), which, for reasons of distinctions will not be further looked into in this dissertation. Nonetheless, he also defined the term wearable computing.

> *"Wearable computing can be defined as an emobodyment of, or an attempt to embody, Humanistic Intelligence" (Mann, 2013, p. 2)*

With this rather short definition it seems obligatory to briefly explore the framework of "Humanistic Intelligence". In comparison, the field of *Human-Computer-Interaction (HCI)* tends to consider the computer and the human as two separate entities, *Human Intelligence Theory* however, contemplates the computer as a "second brain". The in- and output devices are hereby seen as additional sensory facilities which merge with the wearer´s senses, thus forming one single entity. Contextually, wearable computers are often perceived as a "Sixth Sense" or as "Sixth Sense Devices" (Geary, 2002; Mann & Niedzviecki, 2001; Mann, 2001).

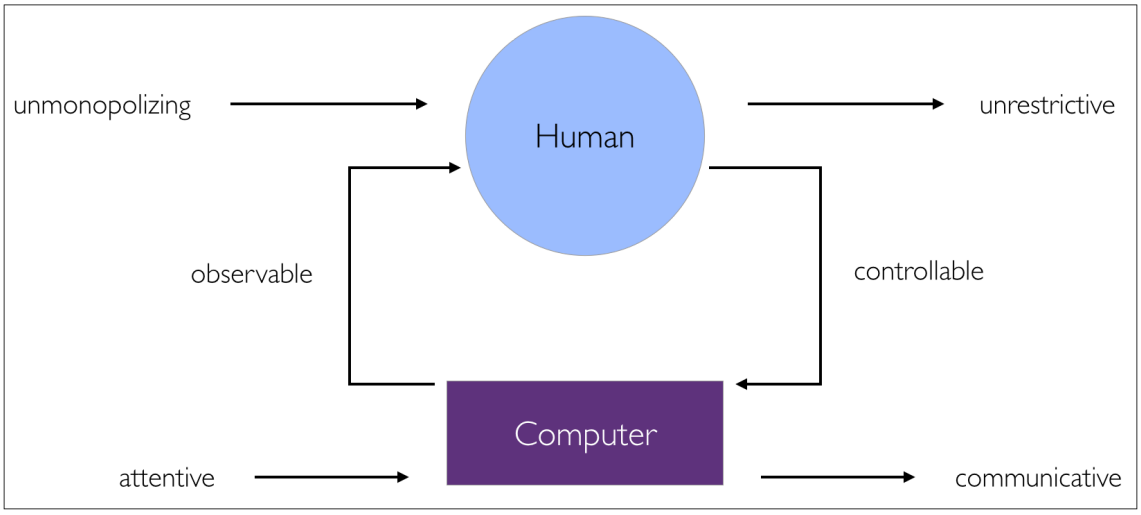

Figure 5: Humanistic Intelligence Theory, Mann (2001)

The above illustration schematically shows how HCI works in theory - a symbiosis of human and computer, mutually interacting with each other and influencing the way in which the world is perceived. In order to better understand this illustration, the key terms will be briefly explained in the following paragraph (Mann, 2001).

- **Unmonopolizing:** The user´s attention is not cut off from the outside world like in a virtual reality. The intention for the user is to fulfill other tasks, while the computer is seen as a second activity rather than the focus of attention. This way, the sensory capabilities can be enhanced and provide additional information.

- **Unrestrictive:** Liberates the user to attend other tasks, such as writing a message while jogging.
- **Observable:** The computer may get the attention of the wearer constantly if necessary. This always-on state gives the computer the ability to alert the user when a new message, event or location bound notification has come up.
- **Controllable:** The device can be controlled by the user at all times. An automatic process should hence be able to be prevented at all times.
- **Attentive:** The computer is always attentive to the environment through multi-sensory input.
- **Communicative:** Enables the user to communicate with the computer itself, or to communicate with others through this medium.

In order for an implementation of Humanistic Intelligence to function properly, the human mind ideally uses the computer as a peripheral and vice versa. This mutual, correlating relationship is the very essence of Humanistic Intelligence. (Mann, 1998; Mann, 2001; Mann, 2013; Knight, 2000).

2.1.2.2 Historic Context

While the last chapter defined wearable computing and what constitutes Humanistic Intelligence Theory, this chapter aims to provide a historic overview of where wearable technology came from and what exactly makes it novel. This has best been captured by Steve Brown (2013), a futurist working at the Intel Corporation, in the following statement:

> *"We've been adorning our bodies since the start of time, whether it was furs to help us go to northern climates and hunt animals, swords, shields, armor, pocket watches, wristwatches, eyeglasses, all of these things have been there to augment our capabilities and extend our reach and help us through life. What's new is that now they are becoming smart and they're becoming connected." (Brown, 2013)*

Essentially, wearable technology is not a new invention. To further understand the history of the latter, a timeline of the most important inventions will be presented in the fol-

lowing. Please note that this historic overview is not complete. For a full list please refer to Rhodes (2013), Knoblauch (2014) and Desjardins (2015).

- **1286**: First record of eyeglasses by Roger Bacon
- **1510**: Invention of the "Nuremberg Egg", a wearable timepiece which is seen today as the ancestor of the pocket watch
- **1762**: Invention of the pocket watch by John Harrison
- **1963**: Hugo Gernsback invents the "TV Glasses" - a television set that is worn like regular eyeglasses
- **1966**: Claude Shannon and Edward Thorp invent a wearable computer - a shoe that has been used to predict the outcome of roulette
- **1966**: First computer based Head Mounted Display (HMD) invented by Sutherland
- **1977**: First calculator watch by Hewlett and Packard
- **1981**: Steve Mann invents a backpack computer that can control cameras
- **1994**: Steve Mann introduces a camera that can transmit images to the Internet
- **2002**: Nokia introduces the first bluetooth headset
- **2006**: Nike invents a shoe with an integrated fitness tracker tethered to an iPod
- **2009**: Fitbit introduces the first wrist worn fitness tracker, being able to track movement, steps, calories, sleep and so forth.
- **2013**: Google introduces Glass, the first commercially available smartglass
- **2014**: A variety of smartwatches by Motorola, Samsung Apple etc. are introduced

As the history shows, wearable technology dates back to the 13th century and has been constantly evolving ever since. Through new possibilities of miniaturization and the ongoing development of new technology, the field of wearable computing will continue to grow (ABI Research World Market Forecast 2013 to 2019, 2013). The following graphic will further help to understand the evolution of wearable devices, from analog to digital, from single function to multi-function, from sometimes connected to always connected.

Analog	Digital	Single Function	Multi Function, unconnected	Multi Function, Sometimes Connected	Always Connected, Smart
1511	1972	1975	1990s	2000s	2012 - present
Pocket Watch	LED Watch	Calculator Watch	Multifunction devices	Multifunction, sometimes connected devices	Smart devices

Figure 6: Evolution of Wearable Computing (Pitzer, 2013)

It is worth pointing out that wearable technology and wearable computer are not the same. Wearable technology can be any piece which is worn on the body i.e. clothing or glasses, while wearable computers have to have some kind of mechanic i.e. a watch. The following chapter will briefly define the term smartwatch as it has been mentioned in the historical context and will also be part of a question in the empirical study.

2.1.2.3 Smartwatches

The definition is especially reviewed here because the term has been used in the empirical study as a comparison to smartglasses. First, the term itself will be explained and, in a second step, the functionality.

Bendel (2014) defines a smartwatch as a digital, intelligent wristwatch which usually features a flat, round or square display, similar to a modern day smartphone. Furthermore, it can be tethered to the latter via bluetooth or near field communication (NFC). It can show the time, count the user´s steps, measure the wearer´s heartbeat and show notifications of all kind, usually e-mail or SMS alerts. Although being able to display information, it can also be used to actively retrieve knowledge like the weather report, stock information, flight data, the newspaper and so forth. Similar to a smartglass the smartwatch belongs in the category of *wearables*.

Bendel (2014) also names the main functionalities of smartwatches. Central to the smartwatch is the integrated display, usually a touchscreen, which functions as the in- and output device. Furthermore, the devices possess an audio in- and output in order to con-

trol music and the integrated virtual assistant, like the iPhone´s Siri. The build-in senosors capture data from the user´s environment and can hence act accordingly. The wearer can customize the user interface by downloading additional software or individualizing the watch-face itself. Through the ability to communicate with the Internet, the basic functions of the watch are expandable. Since the watch is thus part of the Internet of things, it can be described through the human-computer-interaction approach as well as through humanistic intelligence theory.

2.1.2.4 Cyborgs

Haraway (1991) defines the term cyborg as "a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction. Social reality is lived social relations, our most important political construction, a world-changing fiction" (p. 149).

Generally there are different kinds of definitions of the term. Zimmerli (2000) asserts that every human being who is surrounded by technology lives in symbiosis with the latter. This means that a cyborg is someone who drives a car or is wearing a pair of regular glasses. Spreen (1998) however states that a cyborg is much more than that. In his definition, a real symbiosis between human and technology has taken place which only takes place if the human body and the technology have merged in one way or another i.e. through a prosthetic leg or a pacemaker.

In the feminist literature, the cyborg is a symbol, a political entity, which stands for equality. A cyborg is hence neither male nor female. They can not be categorized into certain forms of lifestyle. In many ways cyborgs have been used to demonstrate that there is no such thing as male or female behavior. In this context, gender roles are constructed and properties of the other gender may also be attributed to the own gender without becoming disallowed (Haraway, 1991).

In the context of wearable computing, the merging of technology and the human body is crucial. Through the individualization and personalization of technology, suited to be a permanent part of the user´s body, the wearer is put in the center of the designing process and becomes increasingly crucial for the development of new technologies and alike (Oudshoorn & Pinch, 2005). Inevitably, this also applies to smartglasses.

2.1.3 Smartglasses

2.1.3.1 General

Eyewear Computers are expected to be the "next big thing" in the in the evolution of mobile computing (McNaney et al., 2014). The first device to actually be commercially available was "Google Glass". The device has been designed with the intention to replicate normal eyeglasses as much as possible.

Figure 7: Google Glass (Photo: Torborg, 2013)

Essentially the device is a Head Mounted Display (HMD) with an integrated computer which features a variety of motion and eye tracking sensors similar to the ones found in a modern day smartphone, which include an accelerometer, a compass and a gyroscope. Furthermore, a camera, a microphone as well as a capacitive touchpad can be found in the device which rounds up the hardware functionality (McNaney et al., 2014). The key difference between a smartphone and the device is the form factor as shown in figure 7.

While a handheld Smartphone is defined as a mobile device which is carried with the user, the Google Glass computer is worn like traditional eyeglasses and hence falls into the category of *wearables*, as the name suggests. This enables the user to activate most of the functionality by voice as well as through touch commands, thus enabling the user to interact with the device "hands-free". Through the integrated bone-conduction speaker the device is able to provide an audio output.

The visual output is achieved via the small display which is located at the wearers outer field of sight. This makes it possible to project a digital layer upon the real world, making it an augmented reality device in the broadest sense. From a technical perspective the device needs to be connected via Bluetooth to a smartphone or, for stationary applications via Wifi (McNaney et al., 2014). Furthermore, the device is available in five different colors: red, blue, grey, black and white.

In order to be able to install applications on the device a smartphone or a regular computer is needed. Furthermore, in order for the device to be provided with an internet connection, a smartphone needs to be connected to the device at all times, thus making it not able to function on its own.

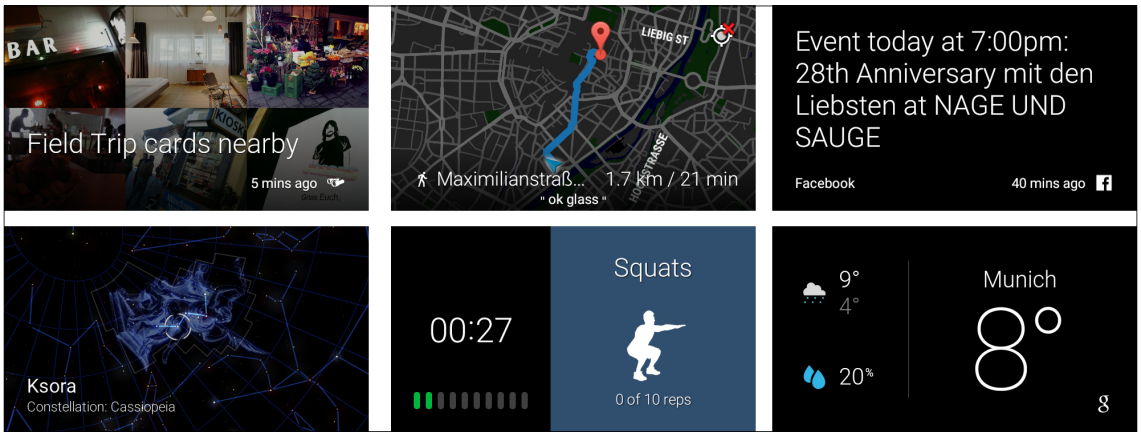

Figure 8: Screenshots of the Google Glass Software (own illustration)

The next chapter will provide a detailed list of the technical specifications of the device. Since the specifications for the hardware are only listed to see what is theoretically possible with the device, a list of actual, already developed applications is provided in the chapter "Google Glass Applications" on page 23.

2.1.3.2 Technical Specifications

In order to understand what Google Glass can do from a technical perspective, it is crucial to understand what hardware specifications the device embodies. This also provides an insight of the possibilities that are presented to third party developers in order for them to create applications for the device.

The hardware prerequisites of Google Glass are very similar to the technical specifications of a modern day smartphone. The following list will provide closure of what the version of the device that was used for the implementation of the study is technically capable of (Torborg, 2013; Google Inc., 2013a; "Sensors on Google Glass", 2013).

- A **five megapixel camera** that is also capable of recording 720p video
- A high resolution **LCoS display** capable of a maximum resolution of 640x360 pixels
- **Wi-Fi** 802.11
- **Bluetooth**
- **16 Gigabyte of storage**, 12 Gigabyte of usable storage in total
- **682 Megabyte of RAM**
- **3 axis gyroscope**
- **3 axis accelerometer**
- **3 axis magnetometer** (compass)
- **Proximity sensor**
- **Ambient light sensor**
- **Bone conduction** audio transducer
- Custom made **touchpad on the side of the device**
- **Microphone**
- Operating system **Android 4.4**

The prism is meant to be placed above the eye so it does not intrude the normal vision of the wearer but instead can be looked at when desired. The device itself embodies a projector which sends an image through the prism right into the eye of the user as illustrated in figure 9.

Since the device features a see-through display, a digital image can get overlaid onto the actual reality and make the user believe that the digital information he receives are part of the real world. Since the images are not aligned with the physical world, one might not speak of an augmented reality but rather of a Heads-Up-Display (HUD).

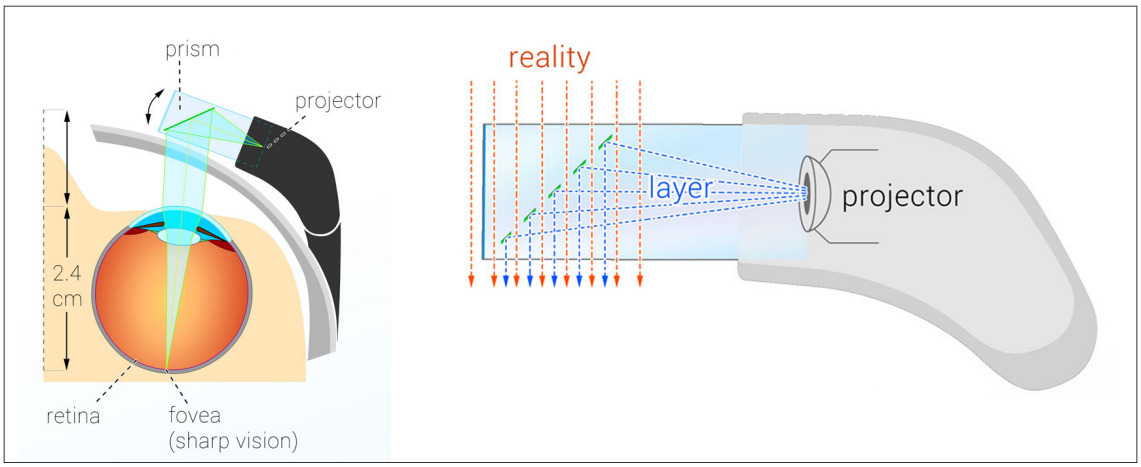

Figure 9: Mechanics of the Google Glass Prism (Mißfeldt, 2013)

Although Google Glass has the capability of delivering augmented reality, most of the applications, at least at the time tested, did not make use of this technology. Therefore, one might speak of an information display or in a more common term of a "smartglass", rather than Augmented Reality Glasses. The following chapter will look further into the applications that were available at the tested time.

2.1.3.3 Google Glass Applications

It is crucial to understand that, although Google Glass has a basic set of preinstalled applications such as phone calls, SMS, e-mail, camera, navigation etc., the functionality of the device can be altered by installing third-party applications similar to the way a user would on a modern day smartphone. In order to understand what can be done with the device as well as its limitations, it seems necessary to give an overview of the existing applications.

The following list summarized all "apps" that were available to the participants of the pilot study sorted alphabetically. A short explanation of the respective functions will be given accordingly. Although it is possible to download and install third-party application on the devices that are not available via the official Google Glass Appstore, the participants were asked not to do so, as it might undermine the overall evaluation of the implementation. For an updated list of the applications that are available for Google Glass, please refer to the corresponding website[1].

1. http://www.google.com/glass/start/what-it-does

Application	Main Functions
Allthecooks Recipes	Can deliver recipes.
CNN Breaking News	Lets the user watch news videos.
Compass	A simple compass.
Concur	Take photos of receipts and add them to your expense.
Elle	Fashion updates.
Evernote	Lets the user take cloud based notes.
Facebook	Upload photos or videos to the social networking site facebook.
Fancy	Find products with matching colors.
Field Trip	Additional information about nearby landmarks, architecture and local shops.
Gmail	Lets the user read and write emails.
Golf Sight	GPS data for golf players.
Google Now	Will get information around the wearer such as traffic information and places nearby. Also used to display current calendar entries, sport scores etc.
Google Play Music	A music player exclusively for subscribers of the Google Play Music service.
Google Plus	Lets the user share content on Google´s social net working site.
Hangouts	Video calls.
IFTTT	Automatic notifications based on preference.
Jewish Guide for Glass	Finds nearby kosher restaurants, prayer time deadlines etc.
KitchMe	Gets recipes for cooking.

Lynxfit	A fitness application which can be used for workouts. Makes use of the internal sensors and can therefore count the repetitions i.e. sit-ups.
Mashable Velocity	Data Mining engine that tells the user which articles on the Internet are going viral.
Mini Games	Five small games (Tennis, Memory etc.)
Path	A social network.
Spellista	Word game that lets the user design a puzzle for a friend.
SportsYapper	Sport game notifications.
Stopwatch	A simple stopwatch.
Strava Cycling	Additional information for cyclists such as distance, time and calories.
Strava Run	Additional information for runners such as distance, time and calories.
Swingbyte	Analyses Golf swings via the built in sensors.
The New York Times	Reads the latest news to the user.
Thuuz Sports	Sport game notifications.
Timer	A countdown timer.
Tumblr	A blogging tool.
Twitter	A social network.
Umano	Reads the news to the user in a human voice and not in a computer generated way.
Video Voyger	A social video network that sorts the takes videos based on location.
Vodo	Access to Google Drive cloud service.
Weather Alert	Real time weather alert for the US territory.
Winkfeed	News and feed updates.

Word Lens	An augmented reality translator, which will overwrite any typography with the corresponding translation.
Word of the Day	One word including definition sent to Glass every day.
YouTube	Can upload videos taken with Glass to YouTube.

Table 3: Application list for Google Glass available in the Pilot Study

Since the pilot study and the main study have taken place three months apart, it seems adequate to explore the applications that were added to the existing list in order to understand how the functionality of the device has been broadened. It also serves the purpose to see how Google Glass could have been used differently by the two groups. The following, alphabetical list includes all apps that were added and hence at the disposal of the participants in the main study.

Application	Main Functions
94fifty Basketball	Learn basketball.
Battery Checker	Checks the current battery status of the device.
Bee Invasion	A mini game.
Bike Finder	Finds nearby bike sharing stations and tracks the speed as well as the distance of the ride.
Captioning on Glass	Allows to hearing impaired people to see the world with subtitles.
Chess for Glass	A Chess game.
Chords	Used to learn Chords for the Guitar.
Cinkciarz.pl for Glass	Real time currency exchange rates.
City Spot	Parking spot finder for some cities in the US and Canada.
Color Detector	Finds color and the corresponding hex code of the thing the user is looking at.
Dawn Data	Visitor statistics for web page owners.

Duolingo	Language learning.
Glossaic	A social network.
Goal.com	Soccer notifications.
Foursquare	Used to find local restaurants and bars. Also provides function to check in and meet with friends nearby.
Google Calendar	Lets the user check his calendar.
GuidiGO	Guided city tours.
Hangman	A word guessing game.
iGaranti	Garanti bank customers can check their credit card limit.
Livestream	Broadcast a live stream from Google Glass.
Light Meter	Photographers can evaluate the ambient light and get recommendations for shutter speed.
Magnify	A magnifying glass.
Marketing Land	Marketing news.
Memoirs	Take notes.
Mind Meister	Take notes.
Monocle for Reddit	An interface for the Reddit webpage.
Moody Bird	A mini game.
Musixmatch	Can identify the song played nearby and be used to learn said song.
Mvelopes	Manage receipts.
My Radar Weather	Weather radar.
Opentable	Make restaurant reservations.
OV Giude	Entertainment videos.
Pandora	Internet radio stations.
Poster Boy	Can be used to post pictures. When another Glass user walks nearby where the picture was taken, it shows up.

Preview	Recognizes movie posters and plays the according trailer.
QR Lens	QR code reader.
Red Laser	Barcode reader that lets the user compare prices with online retailers.
Refresh	Collects data of people in order to gain background in formation on a person before a calendar meeting.
Runtastic Collection	Fitness application for planning and exercising workouts.
RTA	Measures audio frequencies for sound engineers.
Sema Connect	Allows drivers of electrical vehicles to find the nearest charging station.
Shazam	Identifies music played nearby.
Shop X	Create shopping list via voice commands.
Sky Map	Augmented reality application to view stars and get additional information.
Sky Shooting	A mini game.
Social Radar	Connects social network accounts and shows when friends are nearby.
Soundtracker	A music application that lets the user listen to a variety of stations sorted based on location.
Star Chart	Augmented reality application to view stars and get additional information.
SPG	Lets the user search and book hotels via location.
Sydney Morning Herald	News application.
The Guardian	News application.
The Traveler	Creates albums of photos taken during a travel trip.
Trackendo	Can find Google Glass by tracking the device to its last known location.

Trip It	Travel organizer including flight alters for delays, gate changes and alternative flight options.
View Tube	Youtube viewer.
Watchup	News reader.
WBUR	Stream the WBUR radio station.
Whats´s Around	Augmented Reality application that shows nearby land marks and aligns them with a compass.
Zombies, Run!	Jogging App which displays virtual Zombies to run away from.

Table 4: Application list for Google Glass added in the Main Study

It might be useful to add that these are all the officially available applications for Google Glass at the tested time. In comparison to the Apple App Store and the Google Play Store, both of which have over 1.5 million Apps available ("Number of apps available in leading app stores as of July 2015", Statista, 2015), the total amount of 110 applications for Google Glass seems fairly low. This is of course due to the fact that the device, at the tested time, is still in its early beta stage and is not a product that is ready to be released into a mass market.

From a technical perspective the applications have to be installed onto the Glass device via the Smartphone companion application or the web interface which is provided by Google. An Installation of the applications on the device itself was not possible at the tested time.

2.1.3.4 Technical Restrictions

Google Glass in its current state has certain technical restrictions since the device was still in an early beta development stage at the tested time.

Since the smartglass has to be connected via a bluetooth connection to a mobile phone, there are certain limitations of the basic functions depending on the platform the mobile user is on. While Android users had access to the full functionality of the device including reading and writing SMS as well as e-mails, the iPhone (iOS) users did not have these options.

Another difficulty was presented since an account for the social network "Google Plus" was needed. Many participants did not have an account since for most of them the social network "facebook" was the preferred choice. Hence only the sending and receiving of messages from the Google network was an option, since there is no facebook application that allowed a communication method through the social network directly. Together with the messaging application "Whatsapp", which in most cases was preferred over the traditional SMS, two essential communication channels were not available. Therefore the only traditional communication channel that was available was the phone call option.

Lastly, the speech recognition could not be set to German. In most cases this did not present a problem, but still is listed as a restriction since the participants could not enter German street names via voice. Also, the Google search option was limited to English which was particularly difficult when searching for the direction of a specific restaurant or a local store.

It is worth mentioning that some applications such as "Weather Alert", "Bike Finder" and others are meant to be used either in the US or in certain cities. Therefore territorial restrictions apply for some applications and makes said functions useless in Germany or other parts of the world.

Other technical difficulties presented themselves during the testing period which are not listed here since these are not given but were rather revealed during the study. Therefore they are not listed here but in the presentation of findings which can be found in the chapters "Technical Restrictions" on page 115 and "Technical Restrictions" on page 150.

2.1.4 Everyday Life in the context of Smartglass Use

In the context of definitions, it is inevitable to briefly elaborate the term "everyday life", which is often taken for granted. The term is usually associated with the ordinary and the habitual - a continuum of prosaic activities (Felski, 1999).

Lefebvre (1984) asserts that the notion of everyday life has become a particularly important subject of reflection in the nineteenth century due to the industrialization and capitalism. Moore (1996) argues that the concept of everyday life is democratic and worldly. Democratic due to the fact that every human being, rich or poor, has to fulfill everyday needs such as sleeping, eating and defecating amongst others. Worldly since the

term is not associated with the extraordinary or the magical - it will more likely be connected to the repetitive actions, the routine.

Essentially, there are three key components to the notion of everyday life: space, time and modality (Felski, 1999). These aspects have led to a definition of the the same author, which grasps all facets and combines them into a unified description.

> *"The temporality of the everyday [...] is that of repetition, the spacial ordering of the everyday is anchored in a sense of home and the characteristic mode of experiencing the everyday is that of habit." (Felski, 1999, p. 18)*

The definition features three elements which are used to describe the dimensions of the everyday life: repetition, home and habit. Repetition is related to the concept of temporality. The notion does not refer to the extraordinary but to the repetitive activities that take place from day to day. In a broader sense, there are also larger intervals of repetition: weekends, holidays and alike. Lefebvre and Levich (1987) distinguish between cyclical and linear time. While a linear concept of time is characterized by the moving forward, a cyclical notion of time is suited to describe the daily life since changes rarely occur. Hence, the everyday life is seen as an alignment of repetitive, rhythmic circles over time. Felski (1999) however argues that this does not necessarily have to be negative. Creativity and innovation are not prevented but enabled through repetition, since the organization as well as the routine of everyday life build the foundation for the latter. The concept of time in everyday life is hence more complex than it seems at first. On the one hand, *circles of time* are aligned day after day and constitute the "everyday", while through the experiences gained in these circles, as well as through processes like aging, time is also moves forward in a more linear manner.

Although everyday life is connected to a particular concept of time, it may include a variety of spacial aspects. Due to the missing borders of everyday life, no clear boundaries of space can be defined. Still, the home as such is often defined as a "fixed point in space, a firm position from which we proceed [...] and to which we return in due course" (Heller, 1984, p. 259). It hence creates a safe heaven, from which it is secure to explore the world. It is a not only a physical location in space but also a mental place which is es-

sential to the everyday life. Thus a "home" may be every frequently visited place which becomes an allegorical confirmation and augmentation of the self (Felski, 1999).

Both aforementioned dimensions of everyday life, time and space, share a particular feature: both concepts in this context are closely related to the theme of familiarity. Felski (1999) writes: "The everyday is synonymous with habit, sameness, routine; it epitomizes both the comfort and the boredom of the ordinary" (p. 26). This is mainly due the fact that habits are usually performed in a subconscious, automatic way. Although often connoted with negative attributes, Heller (1984) argues that the repetition of certain tasks, thus making them a habit, is necessary in order to be able to innovate and create new ideas.

Concluding, the everyday life is seen as a process of the ordinary which is lived by all human beings. For the implementation of this study, it is crucial to understand that the everyday life is the time, place and habit where the use of smartglasses takes place. These dimensions will later be an integral part when examining the actual adoption of smartglasses in the users´ daily lives.

2.2 Adoption and Use of Mobile Communication Technologies

The second part of the theoretical framework is concerned with the adoption and use of mobile communication technologies, since one of the objectives is to investigate how the user appropriates and consequently uses innovations.

The first three subchapters will focus on the topic of adoption, hence examining the "Innovation-Decision Process", the "Technology Acceptance Model" and the "Theory of Domestication". The last two subchapters will focus on the use of mobile communication technologies, especially how they are used in a variety of different situations and how the privacy of the individual might be endangered through the use of (1) mobile technology in general and (2) wearable technology in detail.

2.2.1 The Innovation-Decision Process

In this first chapter, the aim is to gain a basic understanding of how the user adopts new innovations. One of the most influential authors on this subjects is Everett Rogers who published "Diffusion of Innovations", originally in 1962.

Rogers (2003) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system. Diffusion is a special type of communication concerned with the spread of messages that are perceived as new ideas" (p. 35).

In order for the diffusion process to function properly, social systems in general, and more specifically the users, undergo a variety of decision phases. The "Innovation-Decision Process" is constituted of different stages which an decision-making unit or an individual goes through when confronted with an innovation. The process follows a variety of steps over time in order for the user to evaluate whether a new technological advancement will be adopted or rejected. In its essence the prospective user tries to cope with the uncertainty whether or not to embed an innovation into his or her daily practice. The key difference between this process and other processes of decision making is the perceived newness of an innovation, which possesses a character of uncertainty (Rogers, 2003).

The model proposed by Rogers (2003) has a total of five different stages the user passes through when deciding if the innovation will be adopted or rejected. These stages will be examined in this chapter, hence creating an overview of the Innovation-Decision Process and the choices a user has to make.

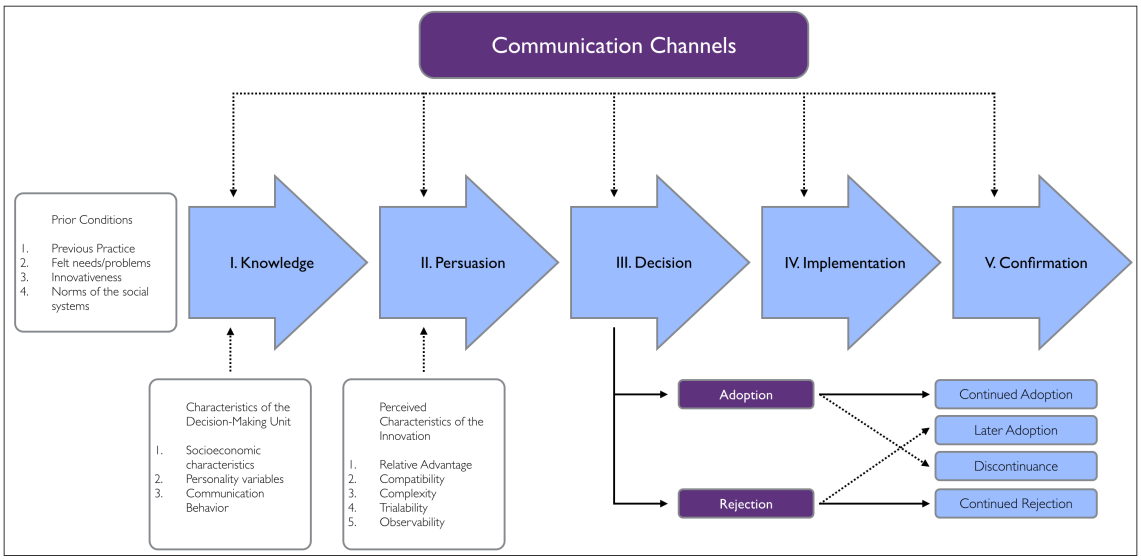

Figure 10: Innovation-Decision-Process (Rogers, 2003)

Knowledge Phase

In this first step an individual or unit of adoption is confronted with the existence of an innovation and understands the basic functionality and what benefit it might provide.

Generally, an individual can gain knowledge through an active and a passive way. From an active perspective the individual exposes him- or herself to a variety of communication channels that are in concordance with their needs an concerns, hence actively seeking information about new innovations that they might be interested in. This selective exposure happens consciously or unconsciously since the individuals tend to discard the messages that do not seem of interest to them. The passive way however does not involve an active involvement, so the individuals stumble upon new ideas and innovations "by accident" (Rogers, 2003).

In this context it seems useful to briefly explore how needs are created. A need is defined as "a state of dissatisfaction or frustration that occurs when an individual´s desires outweigh the individuals´s actualities" (Rogers, 2003, p. 172). Needs can be created in two ways. First, if an individual learns about a novel innovation, a need can emerge. Hence, innovations may lead to the creation of needs, but it can also function the other way (Rogers, 2003). Thus, change agents can create a need for an innovation by pointing out the benefits for the individual. There is no clear answer as to whether an innovation or a need comes first in the process. However, for many consumer innovations such as cloth-

ing and electronic products it is believed that an innovation triggers the need for something new or more convenient (Rogers, 2003).

Persuasion Phase

In the second phase, an individual or a unit of adoption decides whether the innovation is useful, hence creating an opinion in favor or against the new technology.

The user becomes involved at a psychological level, and thus actively searches for information about the innovation. This process also involves the decision of what messages to believe and how the information is perceived. The individual applies this novel technology to possible future scenarios asking questions about how it might get integrated into the daily life and what exactly will happen if he or she choses to adopt this particular innovation. Hence, the information about an innovation is gathered and evaluated which ultimately leads to a favorable or unfavorable opinion towards the innovation. If this opinion is in favor of the innovation, the user will continue to the decision phase (Rogers, 2003).

Decision Phase

The individual or unit of adoption employs in actions which either lead to the adoption or rejection of an innovation. In this context adoption is the decision to fully use the innovation, which would be the best case scenario. Rejection is simply defined as the choice which leads to the non-adoption of an innovation (Rogers, 2003).

In order to better understand the mentioned uncertainty of an innovation the user is bound to try the novel invention and evaluate whether there is a real benefit. There are of course exceptions which do not permit the user to try out the innovation hence leaving the user no choice but to either reject or adopt it. Generally, when an innovation can be tried out, the rate of adoption will be faster. Through demonstrations, especially through opinion leaders, the diffusion process can be expected to be speeded up (Rogers, 2003).

The overall process however can only lead to an rejection or an adoption. It is worth mentioning that every point in the process can potentially lead to a rejection. It is possible for the individual to simply forget about the innovation in the knowledge phase, or to not keep using the innovation after already having adopted the latter. Also, the sequence of

these phases, knowledge, persuasion and decision, may vary depending on the culture the researcher is examining (Rogers, 2003).

Implementation Phase

This phase mainly consists of the individual or unit of adoption implementing the innovation into their daily practices.

Until this phase, the decision making process has primarily took place in the individual´s head trying to decide whether to reject or adopt the innovation. The actual implementation follows the decision phase rather directly. However, the decision to use an innovation, and actually integrate it into the daily life has to be classified as two different steps. Problems of use and appropriation may arise at this stage. Through the rather high degree of uncertainty, the consequences of an innovation can be unexpected for the user. Depending on the kind of innovation, this phase may take a rather long amount of time, but eventually the point where an innovation becomes normal is reached. At this point the implementation stage has come to an end and the confirmation phase will begin (Rogers, 2003).

Still, it is possible for an innovation to be re-invented. In this context is defined as "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (Rogers, 2003, p. 180). Re-invention can occur for a variety of reasons. Generally, the reason lies in the innovation itself, since it passes from adopter to adopter finding aspects that can be optimized. Through the constant re-invention of an innovation it is believed that the rate of adoption is faster and the innovation will show a higher degree of sustainability (Rogers, 2003).

Confirmation Phase

In this step the individual or unit of adoption seeks a form of confirmation even though the decision is made. However, it is possible to retract from the decision if the user is confronted with messages that conflict the users knowledge about the innovation (Rogers, 2003).

Generally, the user tries to avoid the state of dissonance which might lead to a lower state of well-being while interacting with the innovation. Usually the user hence changes the behavior in order to enter a coherent relationship with the innovation. This is due to

the fact that it can be difficult for the individual to change the decision of adopting or rejecting the innovation. Thus the user searches for information that confirms the decision. These can include supportive messages of all kinds in order to avoid a possible dissonance (Rogers, 2003).

Another phenomenon can occur in the confirmation phase. Discontinuance is the choice to subsequently reject the innovation. This can happen in two ways. First, through replacement, which changes the innovation for another, probably better artifact, which is more suited to the users needs. The second, disenchantment, happens when the user is unsatisfied with the innovation. This can also occur when the user does not perceive any sort of befit through the innovation (Rogers, 2003).

2.2.2 Unified Theory of Acceptance and Use of Technology

Over the years a variety of models that intent to predict the users behaviors and acceptance toward new technologies have been proposed. The "Theory of Reasoned Action" (TRA) suggests that the behavioral intention can be predicted through the subjects attitude as well as the previous behavior (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980). Secondly, the "Theory of Planned Behavior" (TPB), which has been derived from the TRA, suggests three factors which are responsible for the change of human behavior: normative, control and behavioral beliefs (Ajzen, 1985; Ajzen, 1991). Although the TPB incorporates a variety of properties that are part of the later discussed "Technology Acceptance Model" (TAM), it does not intent to explain the usage of information systems in particular (Surendran, 2012). Lastly, the Mobile Phone Appropriation Model (MPA Model), which is based on the TPB, intents to predict the adoption of mobile phones in specific (Wirth et al., 2008). The MPA Model unifies a variety of theories such as innovation diffusion theory (Rogers, 2003), TPB (Ajzen, 1985; Ajzen, 1991), frame analysis (Goffman, 1974; Höflich, 2003b), cultural studies (Silverstone et al., 1992; Haddon, 2006) as well as the uses and gratifications approach (Rosengren, 1974), and intents to illustrate reality by combing all the aforementioned theories into one visualized summary. Through a variety of factors, namely functional, symbolic, normative and restrictive evaluations, the model does not seem to simplify the appropriation process but rather complicate it and will hence not be reviewed in detail here.

The focus in this chapter thus lies on the TAM and in successors, which are partly based on the TRA (Surendran, 2012). The TAM was originally developed by Davis (1985)

in his PhD thesis, and published later in 1989 (Davis et al., 1989). The general intention of this model is to find factors which explain the use or non-use of technology.

When the first TAM was developed, two aspects were taken into account: the *perceived usefulness* as well as the *perceived ease of use*. The first being the subjective sentiment of a person if a technology increases the users performance. The perceived ease of use describes the notion of a person how simple it is to learn about the new technology and to ultimately integrate it into the workflow. Furthermore, the *behavioral intention of use* is dependent on the *perceived usefulness* as well as the *attitude towards using* (Davis et al., 1989). The following illustration shows the TAM in its first iteration.

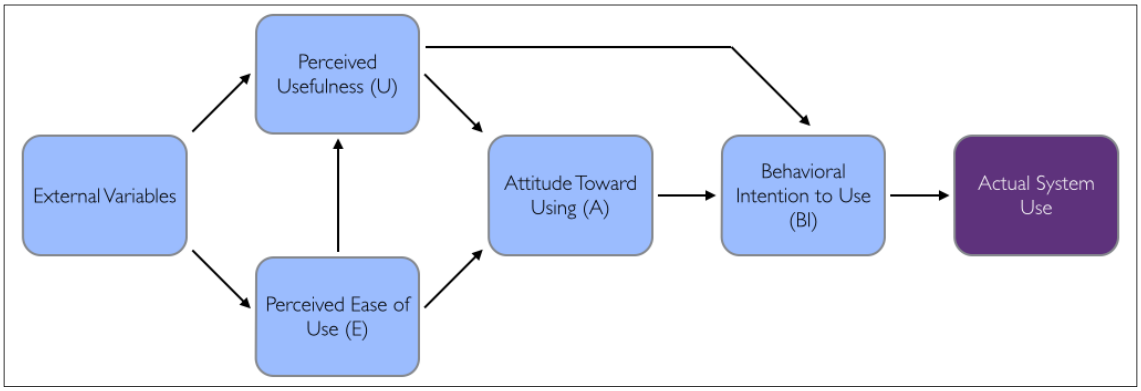

Figure 11: Technology Acceptance Model (Davis et al., 1989)

Throughout years of research the model was developed further and expanded with other dimensions. The TAM 2 (Venkatesh & Davis, 2000) sought to further elaborate the missing aspects and has been an intermediate stage in the developing process of the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), which is presented in figure 12.

The model clearly shows that a variety of aspects have widened the theory over the years. These aspects will be further explained in the following (Venkatesh et al., 2003). Besides the self explanatory factors like gender, age and (previous) experience, a variety of other factors influence the use behavior. The *voluntariness of use* describes the degree to which users believe that the decision to adopt a technology is non-obligatory. The *performance expectancy* is defined as the extent to which the user thinks that the technology in question will help him to increase his job performance. The *effort expectancy* describes the degree to which a a new technology is easy to learn. The *social influence* of others

play an important role in the acceptance of technology. This aspect is hence defined as the extent to which the user is influenced by his or her peers and if they think that the user should use the new technology. The *facilitating conditions* further support the decision of using a new technology, since it is the degree to which a user believes that a technical and organizational eco-system is already in place (Venkatesh et al., 2003).

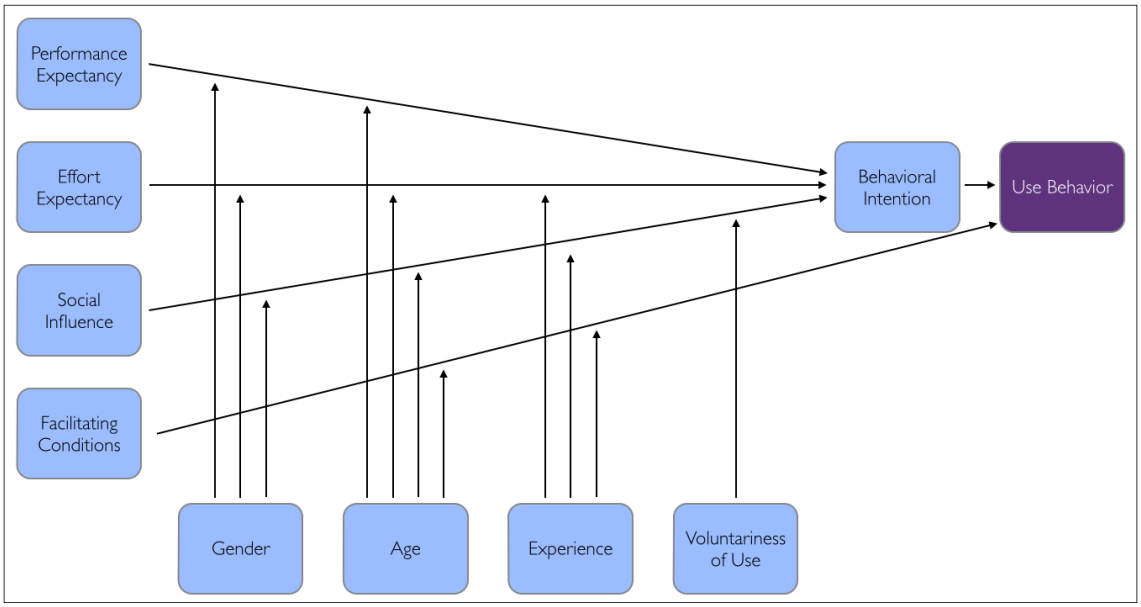

Figure 12: UTAUT (Venkatesh et al., 2003)

As seen in the illustration, the voluntariness of use, the performance expectancy as well as the social influence are directly impacting the *behavioral intention*, which is defined as the degree to which the user has planned concrete actions to use or not use a technology in any future endeavors.

Bagozzi (2007) criticized this model since there are too many independent variables in order to predict user behavior and acceptance to the stage where it might be seen as chaotic and confusing.

2.2.3 Domestication Theory

2.2.3.1 History

Domestication theory, in its essence, defines how the user incorporates technology into his or her everyday life. In the literature, two major strands can be found when discussing the term. The first being the UK point of view which is majorly represented by Sil-

verstone et al. (Silverstone et al., 1992; Silverstone, 2005) and the second being the Norwegian strand, which can be found in the writings of Lie and Sørensen (1996). Although both strands are concerned with technology and the incorporation into the everyday life of the user, Silverstone and his colleagues describe media technologies and their use in households, while Lie and Sørenson widened their concept of domestication to other technologies (i.e. smart-homes and cars), as well as to other contexts of use such as outside of the home.

Still, both strands share similar attributes. Hence, domestication is a theoretical concept which tries to gain an initial understanding of media technologies and how they are used in a variety of complex settings. The term traduces to "taming the wild", hence working out a way to integrate a new technology, especially information and communication technologies (ICTs), into the daily life, or rejecting said technology (Haddon, 2006). The attention is especially drawn to the interpersonal relationships, the social backgrounds, continuities and changes, but as well, in more recent research, how different types of media connect among each other and the increasing approximation of different technologies. The focus of domestication lies on the use as well as the consumption of media since it pursues the establishment of meaning from its initiation to the actual (non-)use of a new technology and the coherent meaning. Domestication hence tries to find the transient where the user and the technology collide and eventually (or not) adapt to each other (Haddon, 2006).

One of the most central aspects to the domestication theory is the attempt made by the user to consciously or unconsciously apply a new technology to the environment in which the user lives, in order for it to become "invisible" and / or adjusted to the user. For this process to work, both the technology and the user need to mutually adjust to each other (Haddon, 2006).

2.2.3.2 Framework

In the literature, four "non-discrete elements" or aspects of domestication can be found: appropriation, objectification, incorporation and conversion (Silverstone et al., 1992; Haddon, 2006). One aspect that has been discussed in the context of appropriation is the non-adoption. Non-adoption can happen for a variety of reasons, which include that a technology was not suited for a certain target group, financial constraints, the lack of support from a relevant social network and so forth (Haddon, 2006).

1. Appropriation

In this phase of the domestication process the acquisition of a desired object is key. Once a new technology is acquired and hence possessed by a household, the research suggests that it begins to be domesticated. Still, other factors need to be taken into account when examining the adoption. In most cases the interaction and the resulting negotiation between the members of a household can lead to tension and does not necessarily involve the reaching of a general consensus. Furthermore, the rules by which a new technology is integrated into a household, as well as into other domains of everyday life have to be defined by the member of the household or a society at large. This hence leads an individual to interact with a technology within the limitations of a set of norms in a wider social context. Consequently, the individual tries to control a technology and the use of the latter, by managing the place the innovation takes in his or her life. In this context, the user generally also tries to dominate how others use a technology. One conclusion that is drawn from this the appropriation phase is hence the type of life and the resulting identity an individual wants to adopt when appropriating a new technology (Silverstone et al., 1992; Haddon, 2006).

2. Objectification

Within this phase of the domestication process the expression of taste, style and values of an individual are seen as a key element. Two aspects can be identified in order to further explain the objectification process. First, the temporal component which not only refers to the quantity of disposable time, but also how this time is managed. Limitations of time may partly arise from the social obligations, which also correlate to the time invested in other social peers (Haddon, 2006). Secondly, and more central to objectification, following the argumentation of Silverstone et al. (1992), a spacial component which refers to the arrangement of objects in a certain space. This provides a level of comfort for the owner as well as a possible way of identifying with a given object.

Especially in domestication studies about mobile phones, the spacial aspect of domestication is given a more prominent role. ICTs may provide a certain amount of meaning outside the home and can be used to make a public statement (i.e. a phone as a fashion item). The expectations of how to behave properly by other members occupying the same social space however are more strict and less ambiguous than in a private place (Haddon, 2001; Ling, 1997). Therefore one might argue that households and homes are

only part of a wider field of domestication research which takes certain parts of non-domestic social relationships into account (Haddon, 2001). This may include a set of altered regulations such as the prohibition of mobile phones in certain public spaces as well as a deeper integration into the daily lives of the users (Wood, 1994).

3. Incorporation

In the incorporation phase the temporal aspect is given more attention. This part of the process focuses on the actual usage of an ICT and how much time is spent with the object. In order for an artifact to be incorporated into the daily practices of an individual or an entire household, it has to be actively used, generally to perform, facilitate or alter a certain task (Silverstone et al., 1992).

An object´s level of functionality determines how it is used in the daily life of an individual. Usually, a new technology is chosen due to a specific purpose which has to be fulfilled in order for the user to incorporate it. Still, it may happen that a new artifact does not perform as intended, leads to the rejection of the technology, hence a non-incorporation (Haddon, 2006).

4. Conversion

Through the constant use a new technology it ideally becomes part of the individual´s daily life and at some point in time is seen as "taken for granted" or invisible, hence has been converted into an object that is used without questioning it (Haddon, 2006). Haddon (2006) argues that one has to ask not only what people do with ICTs and how they react to them, but also what is changing in their everyday lives. Silverstone (2005) states that it is generally a two-way process, where the use and the space of a new technology is influenced and shaped by the user and vice versa. Thus, a technology may shape the users life and enhance as well as alter the way the everyday life is experienced.

In this context, one might have to pay more attention to the social consequences that ICTs have on the process of domestication: the digital divide, gender identities as well as media richness and media poorness. A different aspect of the consequences have been discussed under the umbrella- term *technological dependency*. Haddon (2006) states:

> *"Once people have adjusted their behaviour over time to assume the availability of certain ICTs. these technolgies can become suffiently integrated in people´s lives that it is difficult for them to imagine going back to a stage without them." (Haddon, 2006, p. 198)*

Generally, the process of domestication is neither closed nor linear. The members of a household or an individual determine how a new technology is incorporated in the physical space as well as into their temporal routines of the everyday life. In this context the meaning of a new technology may change over time through the effort that people put into them, as well as through the applied cultural practices that influence the practical use. Through the non-linear nature of the overall process, re-negotiations take place which might lead to another assigned space, time and use over a certain amount of time (Silverstone, 2005).

While the above chapters explored the adoption of new technology into the everyday life, the following chapters will further examine how technology is used in different situations and which are the key aspects that need to be taken into account when discussing the topic of privacy in the context of wearable computing.

2.2.4 Situational Media Use

2.2.4.1 The Concept of Situation

Perhaps one of the most basic definitions of situation is "a locus in time and space" (Belk, 1975, p. 429). The problem with defining the term situation is that, although the concept is rather widespread, it is not universally accepted. Over years many scholars have tried to grasp the notion of a situation and what key factors it contains.

Thomas (1931) was the first researcher to intent to define the term situation. His interpretation assumes that: "The situation in which the person finds himself is taken as containing the configuration of the factors conditioning the behavior reaction: of course, it is not the spatial material situation which is meant, but the situation of social relationships. It involves all the institutions and more - family, gang, church, school, the press, the movies, and the attitudes and values of other persons with which his own come in conflict or cooperation." (pp. 176-177). This includes three aspects. (1) the social norms by which every individual consciously or subconsciously acts; (2) the already existing mindset which influences the actual behavior of an individual or a group in a certain situation and (3) the definition of a situation which emphasizes the given circumstances of a situation.

A different approach has been made by Buba (1980) who criticized the definition of Thomas since it does not explain if a situation is constituted of single actions of behavior or complex sequences of operation. Furthermore it is not made clear in which manner the individual clusters his or her mindset and how decisions are made as a consequence. This led Buba (1980) to assert his own definition of situation which will be used in this dissertation. In his words, situation is "the relation to a certain subject which is an isolated part of a sequence of actions in the context of a certain system of typecast (in the from of meaning and rules) and the parameters of behavior" (p.154)[2]. This means that the situation is the relation between the named aspects, which can be analyzed as a subjective and objective, a concrete and abstract phenomenon, as well as a structure and a process. Since the goal here is to gain a basic understanding of the term situation, these distinctions will not further be pursued in this dissertation.

2.2.4.2 Framework

With media becoming more portable, the situations in which media can be used are increasingly distinct (Ito & Okabe, 2005). While the physical situation, hence the location in which media are used, seem to be given (Zhang & Zhang, 2012), Goffman (1965) adds the dimension of communication and personal relationships. Furthermore Ito and Okabe (2005) recognize technology as an aspect which is used to define a situation. Zhang and Zhang (2012) hence use the physical, social and technological environment in order to define a situation. They further add the personal psychologies (uses and gratifications) of the user to the situation-related conditions in which media is used. For all full description of the needs and gratification approach please refer to the following chapter.

The scholars which today are labeled as the "situated action" school (Greeno, 1989; Lave, 1988; Suchman, 1987) believe that the behavior displayed by the user is largely influenced by the situation (together with the cognition), when determining the actions taken. The theory of technosocial situations, introduced by Ito and Okabe (2005), had the purpose of summarizing the traditional aspects of situations, together with the influence of technology on the latter. Zhang and Zhang (2012) define situation as "a non-user component that shapes media usage behaviors" (p. 1885). In this context the non-user compo-

2. Translated by Timothy Kessler (2015). Original Citation: "... ein durch den Bezug zu einem bestimmten Thema abgegrenzter Teil einer Handlungssequenz im Kontext eines bestimmten Systems von Typisierungen (in Form von Bedeutungen und Regeln) und den Rahmenbedingungen des Handelns."

nent does not mean a situation without users, but rather a comparatively pre-determined component which enforce certain restrictions upon the user and his respective actions. Their model proposes that user behavior in regard to mobile media is influenced not only by the situation related context, but also by the personal psychologies. According to this model it is not only of interest "what people do to media" or "what media do to people", but "how media and users influence each other in situations" (Zhang & Zhang, 2012, p. 1885).

Since the situations in which media are used vary vastly, it is expected that this mutual influence is demonstrated in a number of different situations. In some social situations norms may apply thus only allowing for a limited use of media in this specific context. This might be in a restaurant with social peers or in a theater where the use of mobile phones is forbidden. On the other hand, there might be some situations e.g. an emergency call which has to be made regardless of the users current situation, where the gratification determines if the media use is appropriate (Zhang & Zhang, 2012).

Karnowski and Jandura (2011) incorporate Zhang et al.´s (2010) thoughts into a comprehensive model which adds one more dimension to the use of mobile services. They include are a variety of restrictions which might reflect on the users' behavior. These boundaries can be financial, technical, temporal or cognitive (see figure 13).

The scholars summarize the situational determinants from Zhang and Zhang (2012) under the term location-bound factors. The physical environment, which describes the place in which the media usage takes place. This can be at home, in public places, in cars and so forth. Secondly, the access to media that are available in those locations i.e. the situation of using a mobile phone might differ vastly from using it in a public place or at a friend´s home. The third aspect, the social environment and the corresponding social norms, derived from Goffman (1965), may influence the media behavior. These norms can be social etiquette of any kind which makes the media consumption inappropriate or unkind in certain situations. It might be useful to add that the user is not always expected to behave according to the social norms of a situation.

The personal psychologies are compiled under the expression "user-bound factors". Personal needs however can also be seen as a user component because the user can behave accordingly to their specific needs in any given situation and re-evaluate the latter (Zhang & Zhang, 2012).

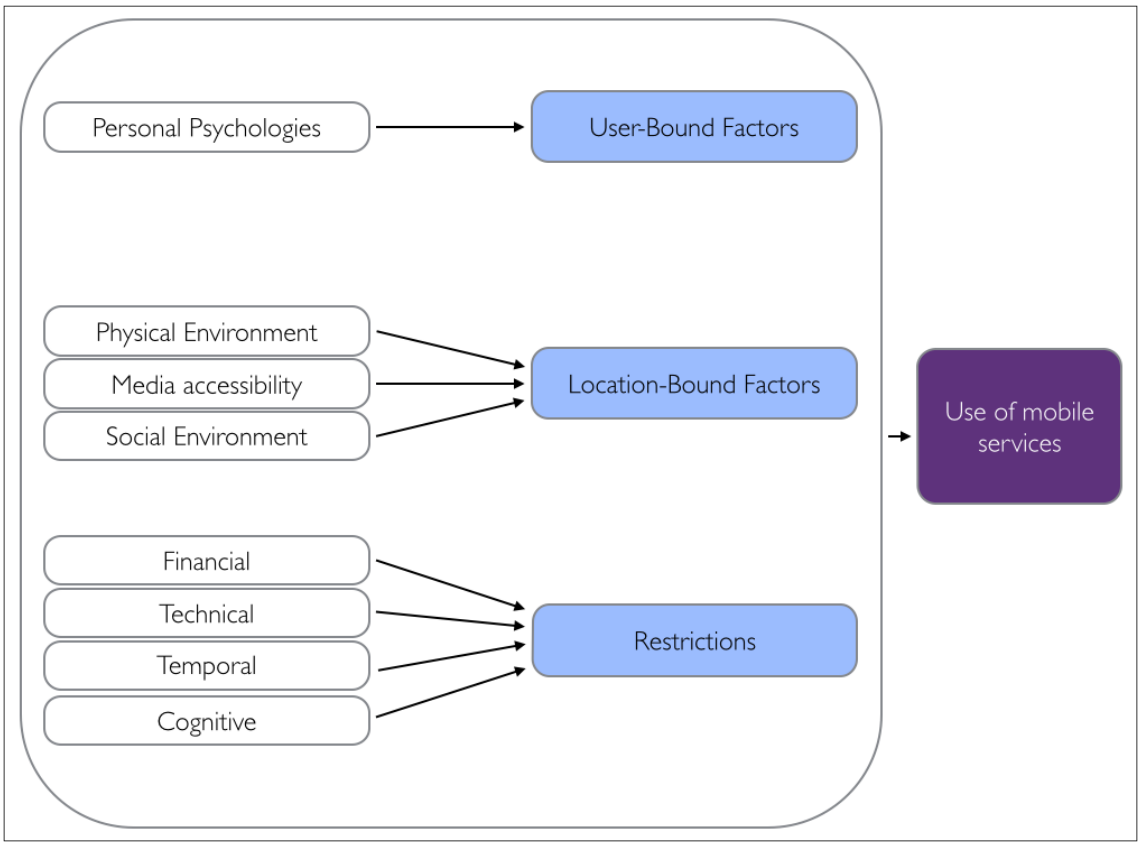

Figure 13: Situational Factors of Media Usage (Karnowski and Jandura, 2011)

Concluding, the situation in which media is used depends on a total of seven factors, which have been explored above. In this study, it is crucial to understand that there are a variety of factors that influence the media behavior of the user, specially when using a technical innovation such as Google Glass. The empirical study will illustrate which factors influence the behavior of the user and what dimensions are parallel or diverging form the here proposed models.

2.2.4.3 Uses and Gratifications Approach

The uses and gratifications approach has originally been developed by Rosengren (1974). In this context however, uses are defined as "one important personal psychology that shapes new media behaviors" (Zhang & Zhang, 2012, p. 1884). Palmgreen (1984) states that the uses and gratifications approach related to media considers that the users are aware of their psychological and social needs and hence look for media which can actively help them achieve the latter. These needs can lead to passive and active use of media. Passive uses generally are defined as frequent and perpetual, while active uses are

elective and goal oriented (Rubin, 1984). Media gratifications may include sociability, escape, arousal, companionship, surveillance and so forth (Zhang & Zhang, 2012).

In more recent writings, scholars have been occupied with the uses and gratifications approach in relation to digital technologies and new media in general (Newhagen & Rafaeli, 1996; Rubin & Bantz, 1987). In the present day, the analysis of the satisfaction and motivation of media use becomes increasingly important since the users are confronted with an ever growing choice of new technologies (Ruggiero, 2000). In this context the scholars Papacharissi and Rubin (2000) assert that the dominant motives for the use of computers are entertainment, passing time, information seeking, interpersonal utility and convenience. In contrast to mass communication as well as more traditional channels of communication, computer mediated communication has a higher level of gratification for the user in social bonding, problem solving, personal insight, status, relationship maintenance, play, information retrieval, leisure, learning and persuasion (Flanagin & Metzger, 2001). Four aspects by which the use of the Internet is compelled have been identified and are listed as the primary motives: socializing, fun seeking, surveillance/information gathering and diversion/escape (Wei & Leung, 2001). Karnowski and Jandura (2011) have examined and identified the essential motives for the use of smartphones: status, entertainment, research information, reachability and the maintenance of social contacts. These motives have been used later as a comparison in this study in order to to examine the factors of smartglass use.

2.2.5 Privacy

2.2.5.1 Framework

In the context of the adoption of mobile communication technologies, the term privacy will be defined and further explored in conjunction with wearable use.

Perhaps one of of the most important scholars regarding the topic of privacy is Alan Westin. He asserts that "no definition of privacy is possible because privacy issues are fundamentally matters of values, interest and power" (Westin 1995, cited in (Gellman, 1998, p. 194)) However, various scholars, including Westin, have tried to define the term. In the following a variety of different definitions will be summarized in order to understand the difficulty of defining the term privacy.

In an earlier note, Westin (1967) states that privacy as the extent to which people choose to expose themselves in a certain situation. Bloustein (1964) asserts that privacy is

meant to conserve an indivudual´s dignity, integrity, independence as well as the personality. Gavinson (1980) defines three dimensions of privacy: anonymity, solitude and secrecy. Moreover, the status of privacy may be lost through a certain behavior or through the activity of a third person. Although the Calcutt Committee (1997), named after chairman David Calcutt, states that they could not find a desirable definition of privacy, they still defined the term in order to be legally adopted.

> *"The right of the individual to be protected against intrusion into his personal life or affairs, or those of his family, by direct physical means or by publication of information" (ibid., p.7)*

According to Banisar and Davies (Banisar & Davies, 1999, p. 6) four spheres can help to further isolate the different elements that constitute privacy.

- **Privacy of communication** is meant to secure the the privacy of all forms of electronic and non-electronic communication which include telephones, e-mail, regular mail among other means of communication.
- **Bodily privacy** involves the protection against all forms of physical intrusion into an individual´s life. These include drug testing, body searches and other forms of close intrusive proximity.
- **Territorial privacy** protects the individual against the invasion of an individual´s home as well as other locations such as public spheres or the workplace.
- **Information privacy** involves the formulation of laws which are concerned with the handling as well as collection of personal data. This data may include banking information, medical records and other forms of private information.

Concluding, privacy has a variety of different dimensions and definitions. However, in order for the broad masses to accept a certain form of surveillance and privacy intrusions by governmental as well as private institutions it is inevitable that these same institutions can be held liable for their respective actions (Taylor, 2002).

2.2.5.2 Wearable Computing Privacy

This chapter will further examine the term privacy related to wearable computing. Since at the point of the dissertation the technology has been fairly new, no resume of specific, existing laws, rules or regulations will be given.

However, the office of the Privacy Commissioner of Canada has published a report (Therrien, 2014) with possible implications for privacy in regard to wearable computing. In the following the main challenges will be named and elaborated in order to gain an understanding of the challenges that wearables have on privacy.

New options for surveillance

Many wearable computers have the ability to record location, photos, videos and sound. Also, they are able to track the general environment around the wearer producing a vast amount of data which can be stored and analyzed. However, for many devices, mainly for smartglasses, the built in camera is mostly associated with issues regarding privacy through the ability to instantly record and even stream data to the Internet (Therrien, 2014).

Furthermore, devices like fitness trackers and smartwatches are often able to track body temperature, movement, blood pressure and so forth. Health and insurance companies are already marketing these kinds of products to companies in order save on medical bills. The smartphone is hereby used as the main computer which processes and evaluates all the data (Therrien, 2014).

New model of consent

Through new possibilities to combine data from a variety of difference sensors in devices like mobile phones and fitness trackers or smartglasses, it is not always transparent what the user has given his or her consent to. Furthermore, if third-party companies can access this data, a new set of rules and regulations needs to be established in order to either restrict the access to this data or to handle them with care (e.g. through a responsibility agreement) (Therrien, 2014).

New authentication methods

Although new methods of authentication like a fingerprint sensor (e.g. Apple iPhone), face recognition (e.g. Google Nexus 5) and other biometrical data is practical for the user and can improve upon the security of the user´s personal data, privacy issues need to be taken into account. Wearable computers might create profiles of movement in order to authenticate the user hence leading to new challenges (Therrien, 2014).

Combination of data

Through a variety of third-party applications, it is often confusing for the user to make the "right" choice when it comes to disclosing personal information. Moreover, only a portion of the users is actually informed about how their data is being used and evaluated. Through an additional sensory input of wearable devices, the collected data becomes more personal. The problem of aggregating said data and collectively analyzing it is believed to further enhance the hardly understandable and comprehensible collection of data. Furthermore the constant processing and sending of personal information could create certain risks for privacy depending on who has access to this data (Therrien, 2014).

Context collapse

Usually, the users intent to maintain their different networks (i.e. social and work) separate. Through the use of social media, the barriers are already decreasing, diminishing the private and public spheres. This phenomenon has been referred to as "context collapse". Through the additional input of sensors found in wearable devices it is believed that this process could be accelerated and further distorted (Therrien, 2014).

Concluding, there are a variety of challenges for privacy concerns regarding wearable computers. Most significantly through the additional sensory input as well as through head worn cameras, new privacy issues arise. Furthermore, the ongoing collection of data and the combination and evaluation of various sources may lead to new methods of surveillance. Wearable computers are here seen as an additional challenge in a world which still has to find a balance between information privacy and proper regulations.

2.3 The Embedding of Technology into Society

The last chapter of the theoretical framework will examine how technology gets embedded into a society. Initially, an overview of the influence that technology has on society will be given in order to understand how new innovations emerge. Secondly, the most relevant concepts related to mobile societies will be reviewed. They include the "Communicative Mobility", "Location Based Services" as well as how smartphones are embedded to society and how smartglasses have a potential influence on society.

In order to see how technology is shaped by society, the following chapter will elaborate a variety of theories such as "The social shaping of technology", "The social construction of technology" and "Technological Determinism". After, the "Co-construction of Users and Technology", as well as the "Actor-Network-Theory" and the notion of "Mediatization" will be addressed in order to gain an understanding of how the society is related to technology.

2.3.1 The influence of technology on society

This chapter will explore the influence of communication technology on society and how it changes the latter. McLuhan (1964) states that all media, which in his definition is everything that possesses cultural meaning and is interpreted as such, are essentially "extensions of man" and hence an addendum to our senses. He further concentrates on how the environment is experienced rather than what is experienced. Hence in this context the focus does not lie on the content, but rather on the medium through which the content is experienced. With each new medium and each novel technological innovation the boundaries which have been reached by earlier media are exceeded and further add to social change (McQuail, 2010).

The following illustration provides an overview of how technology influences society. It also shows that the technology itself is very unlikely to directly affect society. In general, the effects of a new technology are mediated through communication institutions, which adapt to new forms of technology over time (McQuail, 2010). Stöber (2004) emphasizes that the technological change is largely related to the improvements that innovations provide in comparison to existing forms of technology.

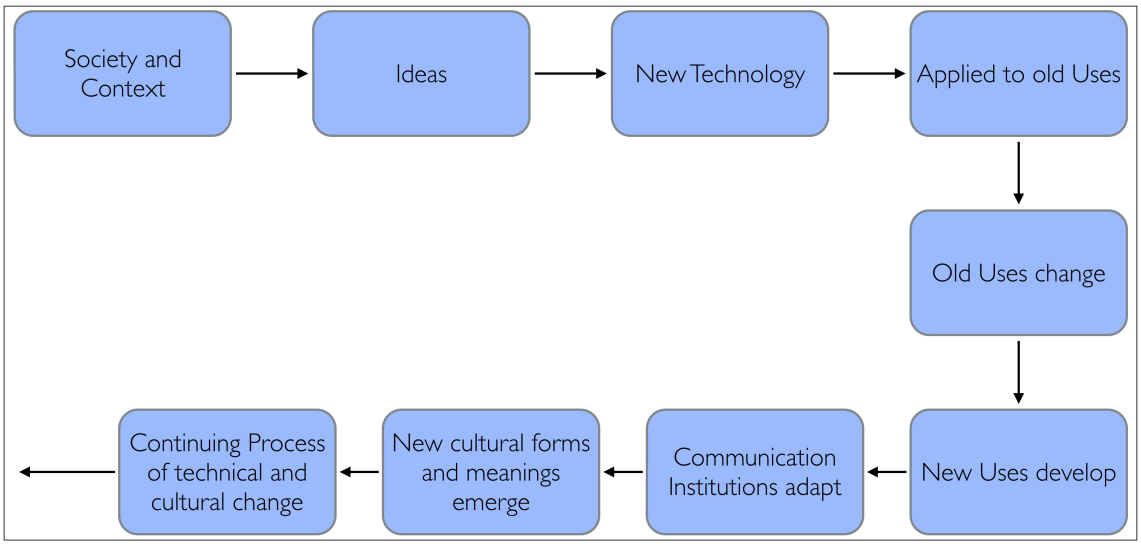

Figure 14: Interactive sequence of technological change (McQuail, 2010, p. 127)

Hence, if an innovation succeeds in providing the necessary improvements over existing technology, the above illustrated process starts. Firstly, the new technology is applied to the uses that an existing technology already provides i.e. a mobile phone adopts the function of a regular phone. Over time, the old uses change and new uses develop. This phenomenon can be observed when examining the use of smartphones. While they can still be used as a telephone, most people will use them for a variety of other functions which have been developed over time (Vincent, 2013). With the development of new uses, communication institutions adapt and provide special applications for the new platforms i.e. newspapers can be read on Smartphones. This process continues until new cultural forms and meanings develop i.e. people tend to read news on their Smartphones, rather than in a traditional newspaper. Hence, technologies emerge in societies and can have different types of influence, depending on the scheme of utilization (McQuail, 2010).

2.3.2 Mobile Societies

Society nowadays is largely influenced by mobile media. In this context one might speak of a *mobile society* (Tully & Baier, 2006). One of the most crucial considerations of their work is the statement that "the mobility of modern man was never as extensive as today" (Tully & Baier, 2006, p. 15). They differentiate between three kinds of mobility: Informational Mobility, Social Mobility and Spatial Mobility, which describe the movement of an individual over a certain period of time in an spacial environment.

Urry (2007), in a more differentiated view, also asserts that society is increasingly moving towards a mobile society. In the following citation, he distinguishes between five kinds of mobilities, that are interrelated and which hence form and re-form social life and the resulting different shades of the latter (Urry, 2007, p. 47):

- "The **corporeal travel** of people for work, leisure, family life, pleasure, migration and escape, organized in terms of contrasting time-space modalities (from daily commuting to once-in-a-lifetime exile)
- The **physical movement** of objects to producers, consumers and retailers; as well as the sending and receiving of presents and souvenirs
- The **imaginative travel** effected through the images of places and peoples appearing on and moving across multiple print and visual media
- **Virtual travel** often in real time thus transcending geographical and social distance
- The **communicative travel** through person-to-person messages via messages, texts, letters, telegraph, telephone, fax and mobile"

It is crucial to understand that the approach by Urry (2007) focuses on the complex arrangement between the different types of mobilities. They are not separated but correspond as a unified network, all of them linking to a different type of mobility.

2.3.2.1 Communicative Mobility

An approach related to the subject of mobile societies has been developed by Andreas Hepp (2008). The concept of *communicative mobility* examines the relationship between mobility and media at a more abstract level.

The first, "getting mobile of communication devices" includes all communication technologies used for interpersonal communication (laptops, MP3 Players, mobile playstations and wearable computing devices). The second, "mobility focus of stationary media" refers to CCTV cameras which capture people on the go, technologies that help people to stay connected over long distances such as e-mail, and lastly, mass media. The counterpart, local mobility, is also split into two separate dimensions. The "situative local mobility", which includes all mobility that happens in everyday life such as commuting, shopping and other

activities that require moving around physically. The second, "biographical local mobility" is used to explain the mobility of one´s life, like moving to another city or country.

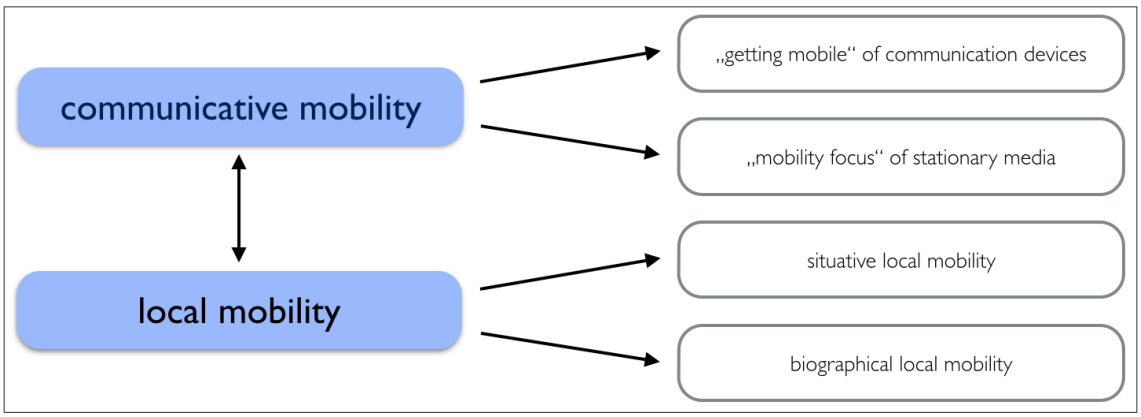

Figure 15: Communicative and Local Mobility (Hepp, 2008, p. 138)

As seen in figure 15, the local mobility and communicative mobility are hence interrelated. As Hepp (2008) states:

> *"A communicative mobility perspective would emphasize how people make use of media in their everyday lives, concentrating more on how they use a range of different media to manage the problems and conflicts of increasingly mobile societies and cultures." (Hepp, 2008, p. 138).*

Moreover, the approach can be used to explain the connection between media and the increased local mobility. Crucial to this approach is the notion that research can not simply focus on mobile media as a separate entity, but rather needs to incorporate stationary media as well in order to fully understand the societal context.

2.3.2.2 Location Based Services

When examining the aspect of mobilities, the term "location based services" needs to be investigated more closely since it can be seen as one of the key drivers for the shift into a mobile society. Schiller and Voisard (2004) define location based services as "a recent concept that denotes applications integrating geographic location (i.e., spatial coordinates) with the general notion of services" (p.1). Applications may include navigation systems, social networks, dating networks and alike.

In a more advanced definition, Edwardes (2007) asserts that the notion of locative media is an ambiguous term:

> *"It refers not only to the continuously changing position of a user, but also to their relation to the places, things and people that interweave across space, time and scale in the course of interacting with the world. [...] Location as a 'thing', geometrically bounded, is a very different concept to location as a milieu created ephemerally through social interaction or to location as a setting for the performance of different types of activities" (Edwardes, 2007, p.2)*

Furthermore, Buschauer and Willis (2013) assert that the changing landscape of locative as well as mobile media are related to an altered "sense of place". Thus, locations which are encountered nowadays are spheres of "messaging, searching meeting and tagging" which are "layered with digital systems". Given these properties, mobile and locative media not only describe a "sense of place" but rather "places with sense" (Buschauer & Willis, 2013, p. 31). Furthermore, Stefan Günzel (2013) states that location based services are related to augmented reality. In his definition, "spacial mediality" as well as the space of a given medium behave almost mirror-imaged. Today, many places are already enhanced with a digital layers of information (tags), but could potentially be augmented increasingly through the addition of photographs, videos and digital information which can, if seen through an augmented reality device, be displayed above physical objects, places and alike.

2.3.2.3 Smartphones in Society

In the context of mobile societies, it is crucial to understand the process of *embedding*. This term refers to the fact that mobile communication has become embedded in the daily life of the user and consequently, through the reaching of a critical mass, in society in general (Campbell et al., 2014). Nowadays mobile communication is crucial in expression, coordination and the exchange of digital information. Throughout this development the user becomes increasingly dependent on mobile technology and even constrained to it (Vincent, 2006). This leads to the expectation that someone has to be available at all times. The "Katz Principle" (Katz, 2008) states that in recent times, if people could not be reached via mobile communication, it was *their* problem, while today it is *our* problem. Ling (2012) builds on that principle by stating that mobile communication, at a societal

level, is more and more taken for granted and hence expected. It is increasingly difficult to live without any form of mobile communication and it becomes harder to function as a part of society (Campbell et al., 2014).

From a psychological perspective, through the embedding into a social system, mobile communication becomes embedded into the self. Campbell (2008) asserts that it even becomes an integral part of the user. This is due to the fact that most of the social experience is mediated through mobile communication which composes the self. "In that sense, the self is a social construct" (Campbell et al., 2014, p. 27). In order to grasp the position of mobile communication in the daily life of the user, subconscious processes need to be taken into account. LaRose (2010) asserts that a lot of the media consumption nowadays can be categorized as habitual. Contextual cues are responsible for the triggering of certain media behavior, which means that conscious as well as unconscious processes need to be taken into account when examining media consumption. Through the repeated use of mobile technological artifacts patterns of use emerge which account for most of the unconscious use of mobile media (Oulasvirta et al., 2011).

Through a variety of different cues habits of mobile use can be created. Generally, mobile devices can trigger a vast range of cues - from vibrating to ringing. These cues are responsible for the subconscious processing of the information a mobile device provides. When now drawing a parallel, it becomes clear that mobile communication has moved from a foreground commodity to an utterly integrated part of society, similar to how it has shifted from consciousness to the subconsciousness (Campbell et al., 2014).

2.3.2.4 Potential Implications of Smartglasses on Society

Having gained an understanding of mobile communication in general and how it is embedded in society and the phycological realm, this chapter will explore the implications a technology like Google Glass may have for the user and society at large. Due to the novel character of the technology, the case for Google Glass is different from traditional means of mobile communication as well as existing mobile devices (Campbell et al., 2014).

In order for a new technology to be "taken for granted", it first needs to reach a critical mass of users (Ling, 2012), which at the time of this dissertation has not been the case. Furthermore, the distinct attributes of the device open up new possibilities for psychological as well as social processes and may lead to new proportions of embeddedness (Campbell et al., 2014). Through the display which is mounted in front of the eye, the

user is not looking down at his or her smartphone but through the display of the device which serves as a third eye. This can be used to track the user´s environment, share the view with social peers or take a picture for later reviewing. Campbell et al. (2014) state that "just as the technology keeps an eye on the physical environment, the user keeps an eye on the mediated environment with a small display that is implanted in his or her field of vision" (p. 32). In other words, a greater integration of mobile devices into the physical world takes place since both, on- and offline realities, are weaved together and interact with each other. Smartphone users already incorporate distant peers into their reality by picture or video sharing. Google Glass, precisely because of the new form factor and the new possibilities it brings, has the potential for interlinking both social environments even further (Campbell et al., 2014).

Younger people are increasingly accustomed to divide their mental capacities between the two worlds. Through the use of a mobile phone they allow others to be part of their present situation by appearing and leaving virtually whenever they see fit (Lenart et al., 2010). This arrangement hence restructures the social etiquette which, while being accepted in younger social groups, has often been considered as rude behavior by older demographic groups (Lenart et al., 2010). Through a device like Google Glass these norms may be rearranged again. Through a new visual focus the concept of being absent or present is different and thus, what is accepted and considered as rude might be altered as well. By joining the visual capacities it becomes increasingly easy to be present in both worlds at the same time. It could be argued that a user does not have to browse two distinct social presences, but only one which is layered (Campbell et al., 2014).

The layering of wearable technologies is potentially the starting point for an even closer proximity of habitual cues. Since the technology is physically much closer to the wearers senses, the number of interactional steps is reduced and hence tightens the communication with the device and consequently with others. Cues could thus become a habit and moreover, be acted on with gestures or voice control. This conditioning of habits has the potential to change the way humans interact with technology in an even greater way than modern day smartphones. Through the two-way process as seen in Humanistic-Intelligence Theory on page 15, cues may come from the wearer as well as from the device. Since the device has the potential to analyze certain parts of the environment, a variety of processes may become more automated and move into the background, thus becoming embedded and lead mobile communication to accelerate (Campbell et al., 2014).

This embeddedness is further supported by the way the wearer interacts with the device. Since Google Glass is mainly controlled via voice and gesture commands and requires less attention than a smartphone the device is embedded in to the users daily life in a more seamless manner. Thus it can be argued that the device is a lot more personal and mobile communication becomes an integral part of the users identity. This is also reflected in the way the device is interacted with; through voice and gesture commands the communication between the wearer and the device becomes a lot more like humans interact with each other: it is looked at, talked to and gestured to, which could be seen as a form of body language. Since the operating system of the device is mainly controlled via voice, the overall experience of using Google Glass is mediated through the latter. Furthermore, the device is given a name which embeds it more in the subjective than the objective domain (Campbell et al., 2014).

Although not exclusively applicable to Google Glass, Reeves and Nass (1996), assert that "Individuals' interactions with computers, television, and new media are fundamentally social and natural, just like interactions in real life" (p. 5). Höflich (2003a) further elaborates the notion of interaction between a human being and a machine.

> ***"The computer is not only medium, but also 'machine'. Therefore one can refer to a broadly defined notion of interaction, which can be understood as reciprocal. This includes a human-machine-(computer-/software-)relationship - or even only the imagination of reciprocity like seen in the parasocial form of interaction. This is meant when talking about an interaction with a computer." (p. 90)***[3]

The term "parasocial interaction" has originally been coined by Horton and Wohl (1956). It refers to the phenomenon where people respond to characters on the TV screen as if they were standing right next to them. This notion has further been researched and broadened to other aspects of media such as characters in computer games and other types of virtual actors (Klimmt et al., 2013).

3. Translated by Timothy Kessler (2015), original citation: "Der Computer ist nicht nur Medium, sondern auch 'Maschine'. Dementsprechend kann auf einen weit gefassten, als Wechselseitigkeit verstandenen Begriff von Interaktion Bezug genommen werden. Dies schliesst eine Mensch-Maschine-(Computer-/Software-)Beziehung - oder sogar nur die Imagination von Wechelseitigkeit, wie bei der parasozialen Interaktionsform mit ein. Dies ist gemeint, wenn von der Interaktion mit einem Computer gesprochen wird."

With all this aforementioned information, Campbell et al. (2014) conclude "that Google Glass and other integrated form factors will fuel the trend toward heightened expectations for accessibility, while also introducing new dynamics to the relationships between self, other, technology and society" (p.36). These kind of devices indeed have the potential to change the daily life of its wearer because of certain automatisms that leave the wearer free to do other things (Campbell et al., 2014),

In a critical thought of the overwhelming embeddedness of technology, Turkle (2011) argues that humanity and society at large are already relying too much on new technologies i.e. mobile phones and computers, and not on each other.

2.3.3 The Social Shaping of Technology

This chapter will examine a variety of theories which are related to the umbrella-term "The Social Shaping of Technology" (SST). All of the here presented theories help to understand how technology and society are connected in an interactive process.

While social research in general has focused on the impact of technology from a societal perspective, which includes its effect, its meaning and so forth, a constructivist or a social shaping perspective describes technology as a product of social interaction (Hynes & Richardson, 2009). In this context Wajcman (2004) argues that technology is never something exclusively social or technical. It can rather be understood as a socio-martial product, a portion of the social fabric that unites society - "a seamless web or network combining artefacts, people, organizations, cultural meanings and knowledge" (Wajcman, 2004, p. 106).

One of the central aspects of the SST perspective are choices that can be related to the design of a technology and their respective systems, and / or in the trajectory or direction an innovation may take (Williams & Edge, 1996). Hence, if a technology does not follow a pre-made logic, one might speak of innovation as a "garden of forking paths" (Williams & Edge, 1996, p. 866). Through the availability of different choices, the technological outcome will most likely be different, depending on the route it takes. Furthermore, every choice which is taken will have different implications for special social groups or society at large. The following graphic will illustrate this process: the emerging of a technology, the choices and the variety of different outcomes.

The SST approach raises two questions. The first is related to the *negotiability* of technology, which in this context is defined as the domain for certain social groups who shape and re-shape technology for them to work, hence leading to different social and technological outcomes (Cronberg, 1992). The second which is questioned in the SST approach is the *irreversibility* of technology - the degree to which a choice may be prevented (Collingridge, 1992). Both of these aspects are actively shaping the way technology will be used in the future since the early choices are consequently responsible for later (technological) development (Rosenberg, 1994).

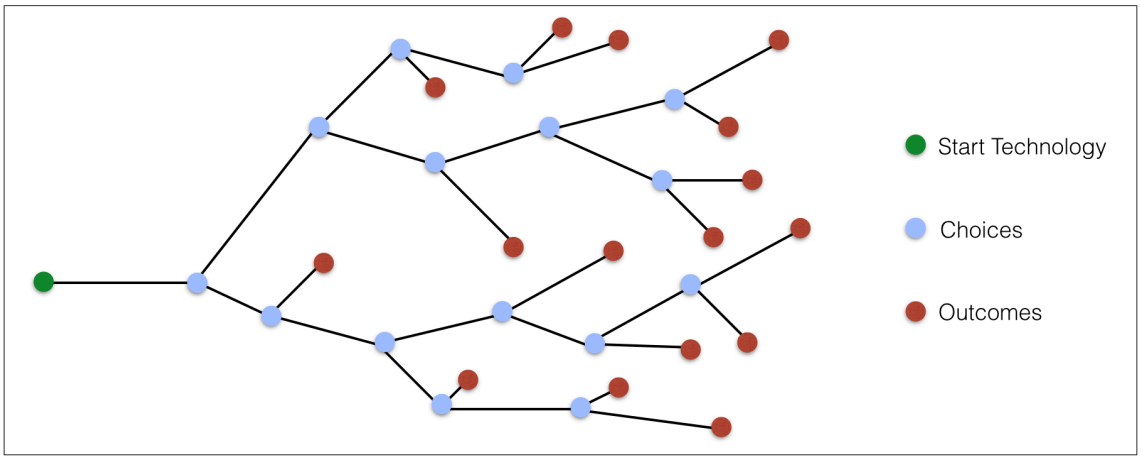

Figure 16: Own Illustration based on Williams & Edge (1996)

SST further critiques linear models since they usually organize innovation into a variety of different stages (Fairclough, 1992). Williams and Edge (1996) point out that SST much more likely will look at the interaction between these phases and the resulting transformation of technology from the initial draft to a finalized product which is ready for mass market production.

The SST approach emerged from a long lasting critique of "hard" technological determinism perspectives (Edge, 1988). This mainly refers to two points. First, that technology and the route it takes is predetermined and secondly, that the impact of technology on society was "necessary" and certain. With this in mind, the following chapter will look into the technological determinism perspective and examine why it was critiqued as a theory of technological change.

2.3.3.1 Technological Determinism

In a technological determinism perspective it is assumed that the change technology causes, is an autonomous aspect, influencing society from the outside although having direct effects on the latter. Hence, the approach is focused on how to adopt technology and not how to actively shape it. The determinist view suggests that the invention of new technology possesses the potential to change society, and even more, determines the development of social systems (MacKenzie & Wajcman, 1999).

This approach has been criticized and defined as mistaken by many other scholars. Silverstone (2005) states that history provides the necessary proof in order to understand that technology does not just simply appear and emerge. The users have to accept and welcome technology as something useful or relevant for them to incorporate it into their everyday lives. In this context Beck (1992) calls for "reflexive modernization", which instead of accepting modernization simply happening as a process, society should be actively able to democratically shape and evaluate it.

Donna Haraway, perhaps most famous for her writing on cyborgs (for a full explanation and meaning of the term please refer to the chapter "Cyborgs" on page 19), also comments on the very subject of technology, science and society. The feminist author believes that through the power of technology it is possible to create new entities, new meanings and, in a more abstract perspective, new worlds (Haraway, 1991). She further goes on to describe how hard it can be to predict the effects of technology on society, but that technology may continue to produce (good) surprises (Haraway, 1997).

2.3.3.2 Social Construction of Technology

The social construction of technology perspective, which has been established by Bijker and Pinch (Bijker, 1995; Bijker et al., 1987) focuses on the fact that every technology is socially constructed and created through the interaction between different relevant social groups. In this context, the term "interpretative flexibility" of technology has been coined. This concept is an expression for the involvement of different social groups that interact with technology. To be more precise, the approach emphasizes the different understandings a relevant social group may have of a technology and its respective characteristics. Different social groups may attribute a variety of different meanings to a technology since interests as well as problems differ from group to group. Furthermore, the meaning of a technology can later be altered by the user as well as the development as such (Wa-

jcman, 2000). For the authors, the perspective of different social groups has long been left out in the literature and hence adds a new dimension to the social shaping perspective. The authors try not to describe the failure or the success of a technology, but instead state that a new technology "works" because a social group has adopted it. At some point in time, the interpretative flexibility disappears and a prevalent use as well as a dominant meaning is established (Bijker & Pinch, 1987; Bijker, 1995).

Furthermore, the exclusion of relevant social groups from empirical studies may lead to distorted results. This often happens with ethnic minorities, women and manual workers. MacKenzie and Wajcman (1999) support this notion by stating that it would be "foolish" to think that women are irrelevant to the development process of technology, only because they have not been involved directly. They further emphasize that there is no formula of how to examine the effects of technology in the context of exclusion, but that it should be a present factor when conducing a study of this kind.

2.3.4 Co-Construction of Users and Technology

This chapter will introduce a variety of concepts which focus on the user and consequently on society as the center of attention in the process of creating new technological artifacts.

The first approach that will be examined here is the process of "configuring". Woolgar (1990) asserts that the design process of a new technology constrains the flexibility of the potential users, as opposed to the SCOT approach (see chapter "Social Construction of Technology" on page 61) where a variety of different social groups negotiate the flexibility as well as the meaning of a new technology. In the design process itself, the user is defined and therefore the way he or she interacts with a machine is limited. Once the user is characterized, the resulting machine will only provide a certain type of use. The approach hence focuses on the user who is portrayed by the designer who "forces" a predetermined use on the consumer. This approach has often been criticized for assuming that the designer-user-relation only works one-way. Mackay et al. (2000) imply that "designers configure users, but designers in turn, are configured by both users and their own organizations" (p. 752). Oudnhoorn and Pinch (2005) suggest that through a variety of contractual agreements as well as powerful entities within an organization, the designer itself is constrained since i.e. the testing of prototypes is often only allowed for people who are part of the organization.

The second approach that will be discussed here is the "concept of script". In its essence, the notion intents to describe how technologies limit or enable the relationships between humans and the exchange between humans and objects. The name emerged from the comparison made by Akrich (1992) since, "like a film script, technical objects define a framework of action together with the actors and the space in which they are supposed to act" (p. 208). Scripts are created in the design process of a technology since the need, motives, skills and behavior of the consumer are defined. These attributes are incorporated in a product, which consequently contains a script of actions for both the technology and the user. Thus, new technologies have the potential to build a new set of actions or to alter or increase current ones. The approach is challenging social constructivist notions in which only humans are seen as actors (Akrich, 1992).

Both approaches, the concept of configuring and the concept of script, are connected to their mutual interest in how designers imprint their vision of a user onto a new technology. Still, the approach by Akrich (1992) in particular is much more aware of the users role in the creation of a new technology. Since both approaches can be misunderstood as technological determinism (see chapter "Technological Determinism" on page 61), Akrich (1992) suggests that "we cannot be satisfied methodologically with the designer´s or the user´s point of view alone. Instead we have to go back and forth continually between the designer and the user, between the designer´s projected users and the real users, between the world inscribed in the object and the world described by its displacement" (p. 209). In order to further capture how the script approach assigns a more central role to the user in the design process, Akrich and Latour (1992) defined the concepts of subscription, de-inscription and antiprogram.

- Subscription / De-Inscription: The reaction of people and technologies to the intended use and the resulting denial or bargaining
- Antiprogram: The course of action of the user which is opposed to the designer´s vision (and vice versa)

The script approach, compared to the configuring concept, draws more attention to the user and gives both designers and users an active role in the creation of new technologies (Oudshoorn & Pinch, 2005).

Still, both approaches state that the failure or the success of a product is determined by the designer´s ability to appropriately predetermine the users needs and behaviors. Users are hence the "objects of innovators´ strategies" (Oudshoorn & Pinch, 2005, p. 15). This leaves the user only one option: the adoption or rejection of the designer´s predetermined use. These semiotic approaches leave out the ability of the user to define new meanings of a technology as well as new uses hence making the user an active part in the development of new technologies (Oudshoorn & Pinch, 2005).

An opposing point of view can be gained from cultural and media studies which assert that it is inevitable to examine the users at the beginning of the design process. Central to this view is the thesis that new technologies have to be adopted by society in order to be defined as functional (Oudshoorn & Pinch, 2005). Baudrillard (1988) states that users are not passive agents but rather active ones that are involved in the shaping of identities and social relations, due to the mutual relation of consumption and production. In this context, the process of domestication (see "Domestication Theory" on page 39) takes the user as a staring point, rather than the designer. Domestication theory hence classifies the user as part of a much greater set of different dynamics: social, economic and cultural (Silverstone & Haddon, 1996). By asserting this point of view, the risk of objectifying the designers notion of a user is reduced and the focus is shifted away from a pure user-designer relationship (Oudshoorn & Pinch, 2005).

2.3.5 Actor-Network-Theory

In the context of co-construction of society and technology, a brief overview of the actor network theory (ANT) will be given.

The concept was originally developed by Michel Callon and Bruno Latour in the early 1980s and has later been summarized by Latour in the late 1980s (Latour, 1987). The theory is meant to explain technical and scientific innovations. ANT has gained recognition since, in contrast to many other social theories, it does not view the social as something that happens only between humans, but rather includes non-human actors in the equation. The method is of "material-semiotic" nature, which means that it shows connections between things (material) as well as between concepts (semiotic). Both human actors and non-humans actors (sometimes "actants") can hence form networks and act as a single entity i.e. an organization is made of people, knowledge and things and can, if desired, act as a single, representing identity. Generally, these networks do not last long since

they are constantly altered and reinvented which means, that some of the relations have to be repeated in order to keep the network alive (Latour, 1987).

Still, the user is mostly uncharted by actor network approaches. Cowan (1976) argues that the user is a much more suitable staring point in the analysis of a new technology than the technologist or the technical object itself. He hence states that the consumers standpoint is of great interest when researching networks. Oudshoorn and Pinch (2005) assert that the social and cultural mechanisms which enable or delimit the user´s antiprograms are mostly left out in the actor-network methodology. Still, other scholars have widened the actor-network approaches in order to explore "subject networks" which are meant to investigate the attachment that are created between things and people; mainly for disabled members of society and the respective technologies that help them to facilitate their daily life i.e wheelchairs, hearing aids and alike (Moser & Law, 1998; Moser, 2000).

2.3.6 Mediatization

When examining media in the context of the societal change, it seems inevitable to examine the theory of *mediatization*. Essentially the concept seeks to explain how different technologies are embedded into daily life of the users and what implications they have for the resulting mediated communication (Hepp & Krotz, 2007). The following definition tries to grasp the various properties of the concept.

> ***Mediatization is understood as a long term meta-process of media change, which develops non-simultaneously and variably in different cultures as well as historical phases over time. Also, in its essence, mediatization approaches the resulting chances and problems for the human being. As a process of processes mediatization accompanies the human kind and will continue to accompany it and in its trajectory will change culture as a grid of meaning construction as well as society, everyday life and identity (Krotz & Hepp, 2012, p. 38).***[4]

4. Translated by Timothy Kessler (2015). Original Citation: "Wir verstehen Mediatisierung - in einer Erweiterung der der einleitend angeführten Einfachdefiniton - dementsprechend als einen lang andauernden, übergreifenden, in den verschiedenen Kulturen und historischen Phasen ungleichzeitigen und unterschiedlich sich entwickelnden Metaprozess eines Wandels von Medien, von deren Bedeutung sowie von den Chancen und Problemen, die sich daraus für die Menschen ergeben. Als Prozess von Prozessen begleitet Mediatisierung die Menschheit und wird sie auch weiter begleiten, und in ihrem Verlauf werden sich auch Kultur als netz von Sinnbildungsprozessen sowie Gesellschaft, Alltag und Identität etc. verändern."

There are two angles from which mediatization can be analyzed. The first one, the qualitative perspective, inherently describes the role of media in the process of shaping social, technical, and communicative alterations in society. Secondly, from a quantitative point of view, the theory examines the spacial, temporal and social implications for the appropriation of media as well as the increasing number of technical artifacts in modern society (Hepp & Krotz, 2007).

The starting point for this theory was not set out by digitial media. It rather began with the first sign language - the first mediated content, since the receiver of the message did not necessarily need to be present in order to learn about the message. Consequently it can be thought of as mediatization when the communication or the communicative actions change through the use of media. Thus, a variety of elements are constructed through the use of communication. These involve reality, knowledge, identity, social relationships and alike (Krotz & Hepp, 2012).

In the context of this dissertation, it is crucial to point out that the cultural and social processes are responsible for mediatization and not, as often assumed, the technical innovations. These processes create the the need for communication in the first place, which lead people to construct new types of media from the usage of existing communication approaches in different manners. Furthermore, through the creation of demand the production of new technologies is initiated which may later be transformed into media (Krotz & Hepp, 2012).

One might hence argue that, media are increasingly integrated into daily life as we know it. One application is the usage of augmented reality in order to alter the perception of reality thus mediating it. Through the additional input of data which is layered onto the real world, the perception of an environment can be changed through the use of adequate technology (Krotz & Hepp, 2012). Augmented Reality can thus be seen as a form of altered communication not only with others, but with the physical environment as well (see also chapter "Augmented Reality" on page 10).

2.4 Chapter Summary and Conclusion

This chapter concludes the theoretical framework which has been addressed in three different subchapters, providing a holistic overview of the theories that can be applied to the field of societal smartglass research.

The first part was meant to define the most important terms related to smartglasses. Consequently, the terms that are very closely related to wearable computing have been addressed. These include the different kind of realities such as *augmented, diminished and mediated reality*. This overview of the distinct kinds of reality hence explored the theoretical possibilities that the novel technology of smartglasses offer.

In a next step, the chapter has focused on the main aspects of which *wearable computing* is constituted, especially smartglasses and smartwatches, thus leaving out terms such as the Internet, old media, new media and alike, since for the overall study these notions are only of marginal importance. Through the different definitions of *cyborgs*, reviewed at the end of the chapter, one might argue that in the case of smartglasses, a cybernetic organism is formed, since the device is meant to be worn at all times.

Since the implementation of this study has used the wearable computer *Google Glass*, the actual functionalities have been addressed in order to examine how the theoretical possibilities differ from the practical applications. The chapter is concluded through the definition of the term *everyday life*, since one of the main objectives is to examine how these kind of devices are embedded into the daily life of the user and furthermore into different kinds of situations and social settings. Hence, a definition was needed to create a common understanding of the term.

The second part of the theoretical framework has addressed the adoption and use of mobile communication technologies. The first topic that has been examined is the *Innovation-Decision-Process*, which is structured into five different phases: knowledge, persuasion, decision, implementation and confirmation. One of the most crucial aspects in this process is the creation of needs, which will later be examined in the empirical study. Furthermore, the process of rejection and adoption is necessary to understand in order to see how innovations get redesigned and hence, shaped by society.

However, this model is of descriptive nature to the adoption process, which is why a predictive model was need in order to further shape the questions for the empirical study and hence intent to understand what to expect from the usage behavior. Thus, the *tech-*

nology acceptance model has been reviewed, in order to examine by what aspects the use of technology is influenced and how the latter interlink.

The next chapter, through the review of the *theory of domestication*, a spacial component was added. Following the argument made by this approach, the first place where a novel technological artifact is starting to be "tamed" by the user and embedded into everyday life, is the household. The adoption is here clustered into four phases or elements: appropriation, objectification, incorporation and conversion. While this process in practice is usually not closed or linear, an important learning has been that throughout the course of time, the meaning of an ICT may change, depending on the use. Through the different applications of smartglasses it will be interesting to see what uses will prevail over time, which one will be altered and if there is a state where these devices become embedded into the users life to the degree, where it is difficult to go back to a state without them.

Since, as mentioned above, smartglasses have a variety of different uses in a variety of different settings, the next chapter examined the (1) *concept of situation*, and consequently (2) what factors influence the *situational use of media* in general and what factors, including the *uses and gratifications* approach, exist that influence the latter. Three themes could be identified that are also believed to be applicable to smartglasses: user-bound factors, location-bound factors and restrictions. These themes are central to to this study, since they will be examined and compared to the final model later in this dissertation.

In a concluding thought regarding the adoption, the topic of *privacy* and the consequent *challenges for wearable computing* have been examined. Through different technologies of location tracking, new models of consent, new methods of combining data as well as new authentication approaches, it becomes increasingly difficult to regulate the invasion of privacy through different governing entities. Since smartglasses are designed to be worn at all times, thus assuming the constant presence of the device, these challenges, if not regulated correctly, can potentially become an increasing danger for the user.

The last part of the theoretical framework addresses the embedding of technology into society. Hence, in a first step, the *influence of technology on society* has been examined. The main finding here is that technologies arise and are embedded into a society through a series of steps as seen in the *interactive sequence of technological chang*e, which in the case of smartglasses have not been completed at the time of this dissertation, since barely new uses have been developed and is thus still in progress.

The Google Glass device, although technically not seen as a mobile device like a smartphone or a laptop, but rather as a wearable device, falls within the umbrella definition of mobile technology. Hence, the different kind of *mobilities* have been explored, including the corporal as well as the communicative travel, both which will be of importance later in this study. The concept of *communicative mobility* has been taken into account since it emphasizes how people make use of media in their everyday life in increasing mobile societies. Lastly, the term location based services have been addressed, because (1) the Google Glass device features many applications which are dependent on the constant tracking of the users location, and (2) because its theoretical augmented reality applications may alter the perception of the environment.

In a more specific thought, (1) the *implications of smartphones in society* have been reviewed as a comparison and (2) the *theoretical considerations of smartglasses* on society have been examined in order to be able to identify parallels and divergencies from the findings in this study. The main aspects that are emphasized is the embeddedness of mobile technology in society, how this embeddedness could be further advanced through the use of smartglasses and lastly, how the interaction with technological artifacts is increasingly similar to the way, humans interact - through voice and gesture input.

The following chapter is regarding the *social shaping of technology*, and its related terms. The perspective emphasizes how technology is never something exclusively social or technical but is rather constructed by both. In this sense it rejects *technological determinism* which asserts that technology influences society "from the outside". In the context of smartglasses, one might assert that they are also constructed both from a technological as well as form a societal perspective, or, from a *social construction of technology* perspective, through the negotiation of different social groups, which determine whether a technology "works" or not, though its adoption.

The next chapter is concerned with the user and its role in the product development process as well as human and non-human actors. Although both concepts, "configuring" the user as well as the "concept of script" describe how the designer "forces" his vision of a product onto the user. The central learning of this chapter is that a new technology needs to be accepted in a society in order to be defined as functional. Hence, if smartglasses are in fact not socially accepted then the designer has to improve on the existing design, hence assigning the user a central role in the process.

In this context, a widened concept of the *actor network theory* can be applied since the user can develop and increasing attachment to a technology, hence forming a subject network and consequently becoming a unit, similar to *humanistic intelligence theory*. as reviewed in the definitions chapter of this framework.

In order to further deepen the understanding of how media are embedded into everyday life, the last chapter has addressed the concept of *mediatization*. Important for this study is the notion that it is not the technological innovations that are responsible for the latter, but rather the cultural and societal processes. Furthermore, in the context of smartglass research it was important to see that the notion of mediatization becomes particularly applicable to augmented reality devices since not only the communication with the environment can be altered through new technology, but also the consequent perception of, the latter.

This concludes the theoretical framework and its relation to the topic of smartglasses. The following chapter will explain the methodology of this study and examine how it has been implemented.

3. Methodology

This chapter explains what research methodology was chosen and elaborates the overall approach used in this study and specifically in the implementation. In a more specific inquiry the choice of the selected *Grounded Theory Methodology (GTM)* will be explained. The chapter will not only look into the advantages of GTM but also state its limitations and the researchers position in it. In a concluding thought the research design will be explained in order to understand how the study was conducted.

3.1 Choice of Methodology

In this particular dissertation the qualitative Grounded Theory Methodology (GTM) was chosen. Qualitative social research primarily wants to explain the living environment from the point of view of a human being who acts in this world, and therefore contribute to a better understanding of the social reality. The subjective view of the participants, their perspective and their patterns of depiction are seen as important sources of data which are later interpreted in the analytical process. Perceptions and influences of the researcher are not a source of distortion but, through continuous reflection, become a source of knowledge (Legewie, 1987). Therefore qualitative research is enabling the generation of hypothesis and happens primarily through the intensive analysis of situations, processes and personas. These individual cases are later analyzed and searched for patterns that may explain certain behaviors or social phenomena (Denzin & Lincoln, 2011). The reasons for choosing this particular methodology will be explained in the following chapters[5].

The implementation has been structured into a purely qualitative pilot and a methodologically mixed main study. In order to further deepen the understanding of the actual usage of the Google Glass device, a quantitative element in the form of semistructured media diaries has been added to the methodology in the main study. This triangulation of methods further helps to verify the found results and supports the research since errors of measurement can be reduced through the additional data.

Initially, the research design of this study was meant to be designed as a mixed methodology with quantitative and qualitative elements. In this scenario, there would have

5. Please note that due to rich body of literature on the subject of qualitative methods, other qualitative approaches will not further be explained. For an overview of current qualitative methodologies please refer to the "Sage Handbook of Qualitative Methods" (Denzin & Lincoln, 2011).

been a qualitative pilot phase in which the participants would have been interviewed about their experiences with the wearable computer Google Glass. The the second, qualitative part, a survey based on the interview outcomes, would have been designed in order to measure whether changes to the everyday life occur.

After having conducted the pilot study as planned, the interviews revealed a vast variety of different experiences and use cases, which a purely quantitative main study could not provide in this manner. The depth of the interviews showed that it was more adequate to pursue a mixed approach over a purely quantitative approach. Another aspect was the simple expectation of the outcome of such a study. Whilst investigating a relatively new topic of research, it seemed rather unsatisfying to quantitatively elaborate i.e. if the participants took more photos with a wearable computer than with a smartphone.

3.2 Grounded Theory

3.2.1 Historic Context

This chapter will look into the history as well as the overall mechanics of the grounded theory methodology (GTM).

> *"If someone wanted to know whether one drug is more effective than another, then a double blind clinical trial would be more appropriate than grounded theory study. However, if someone wanted to know what it was like to be a participant in a drug study, then he or she might sensibly engage in a grounded theory project or some other type of qualitative study." (Strauss & Corbin, 1990, p. 37)*

This quote tries to grasp the mere concept of the grounded theory methodology and in which scenario it is most useful to apply. Stern (1994, p. 30) points out that "the strongest case for the use of grounded theory is in investigations of relatively uncharted water, or to gain a fresh perspective in a familiar situation".

Hence, one of the main objectives of the GTM is to generate a new theory from the collected data. Besides this attribute, the GTM shares many similarities with other qualitative methods. According to Marshall and Rossman (1999, p. 3) these characteristics are:

- Set out in a natural setting
- Involves multiple methods (interactive and humanistic)
- Emergent and not tightly typified
- Focus on interpretative essence

The GTM was originally developed in the 1960s by Barney Glaser and Anselm Strauss and is a method for generating theory inductively (Patton, 1990). The first publication that set a mayor mile stone for the methodology was "The discovery of grounded theory" (Glaser & Strauss, 1967). Over the years the two researchers deployed different approaches to the original concept. Glaser defines grounded theory as "a method of analysis linked with data collection that uses a systematically applied set of methods to generate an inductive theory about a substantive area" (Glaser, 1992, p. 16), while Strauss and Corbin (1990) believe in a approach that is more pragmatic and linear in comparison to Glaser´s version.

Over time, other approaches have been developed, leading to a total of four different GT models (Fernandez, 2012). This includes the classic grounded theory (CGT) (Glaser, 1978), the Straussian grounded theory or qualitative data analysis (QDA) (Strauss & Corbin, 1990), the constructivist grounded theory (Charmaz, 2000) as well as the feminist grounded theory (Wuest, 1995). Of course, other, less significant approaches to GT exist, but the above named are the most applied approaches in academic publications.

The question of when to actually use the grounded theory methodology has been answered by Birks and Mills (2011, p. 16), who state a variety of criteria in order to identify whether GT is appropriate for the study at hand.

- Little is known about the area of study.
- The generation of theory with explanatory power is a desired outcome.
- An inherent process is embedded in the research situation that is likely to be explained by grounded theory methods.

The following diagram developed by Charmaz (2014) is a visual representation of the GTM in order to better understand the overall research mechanic.

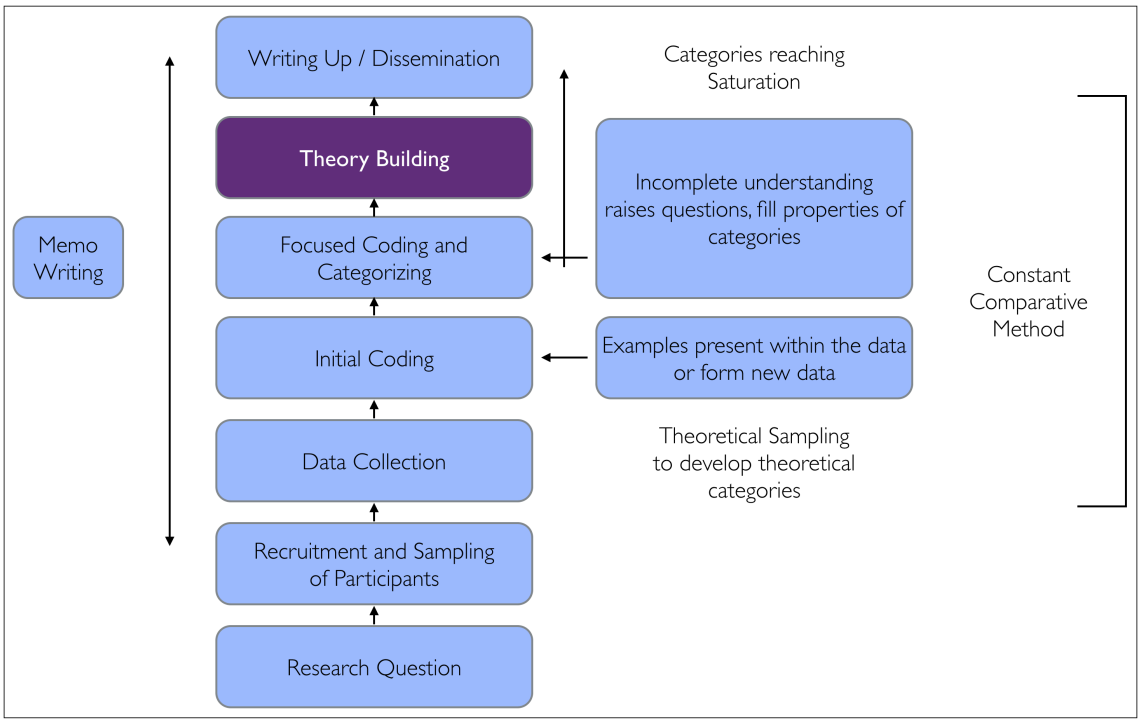

Figure 17: A visual representation of grounded theory (Charmaz, 2014)

Initially, a research question is proposed which leads to the careful selection of possible participants and the consequent data collection, which in this study, as well as generally in the GTM, is mainly done through the conduction of interviews. The methodology suggests an initial set of coding followed by the summary of these codes into focused codes. When the data seems incomplete or questions arise throughout the research, the GTM suggests another set of interviews until the data reaches saturation. This happens when no new codes can be assigned to the data and all initial research questions are answered (Charmaz, 2014). Although not mentioned in the illustration above, Strauss (1987) suggests that axial coding helps the research by comparing the codes among each other and hence building a theory. Throughout the whole process the results are compared constantly in order to see whether the data is missing one or various aspects that are important to the overall outcome. In addition to the constant comparing, memos are expected to be written in order to analyze the data and codes early in the process (Charmaz, 2014).

Concluding it seems adequate to define the term "theory" since it is the very essence of what this study aims to generate. Charmaz and Thornberg (2012) describe theory as relationships among concepts which seek for a deeper understanding of the subject area.

Abend (2008), from a positivist point of view, defines theory as "a general proposition, or logically-connected system of general propositions, which establishes a relationship between two or more variables" (p.177).

Charmaz (2014) furthermore compares the interpretative and the positivist definition of theory, as well as the constructivist and objectivist approach. The positivist approach asserts that the created theories are generalizable, while the interpretative concept assumes a variety of different, fading realities in which social constructs are seen as processes. The constructivist approach, which has been used in this study, shares similar attributes with interpretative theories and sees the generated data as well as its analysis as a shared experience between the researcher, the participants and other sources of data. The objectivist approach however, is similar to the positivist concept and and asserts that data is a series of fixed, defined facts.

Since the above is meant as a brief overview of the historic context of the GTM, the following chapters will further seek to explain the various stages of coding, as well as the memo writing process.

3.2.2 Coding

The coding of the gathered interview data is the first analytic step towards a grounded theory. In this part of the overall process the researcher is required to stop the data collection and ask analytic questions about the collected data. It is, simply put, the mere definition of the data. The researcher is meant to learn about the actual meaning of the captured experiences and the consequent acting of the participants on the latter. The aim is to abstract particular statements and turn them into an interpretation of the gathered data (Charmaz, 2014).

There are several levels of abstraction giving each different technique of coding a specific purpose. First, there is "open coding" or "line by line coding", which was introduced by Glaser (1978), also known as "initial coding", as Charmaz (2014) defines it. In this step, almost every line is assigned a code. This helps to identify the main themes that are important to the interviewee. In general, the assigned codes are related closely to the actual interview transcript, describing the said words, or use the participants own words, which is known as an "in-vivo code". This phase helps the researcher grasp the initial concepts of the transcribed texts and and see it from a new, yet unknown angle. The use of initial, sensitizing questions is recommended in order to see what the data might be suggesting.

This includes questions like "What are the actors´ definitions and meaning of these phenomena or situations?" or "Who are the actors involved?" (Strauss & Corbin, 1998, p. 77).

The next step in the overall coding process is known as selective coding (Strauss, 1987) or focused coding (Charmaz, 2014), which in its essence, is a more abstract process, since the most significant and / or most assigned initial codes are summarized in order to understand the data. This step determines which codes are the most sensible ones. The researcher is hereby meant to choose the most relevant codes in order to outline the interviewee´s meaning. Hence, the open or initial codes are used to start, while the focused codes aid the process by clarifying the aptness of the proposed concepts that were developed by the researcher. These codes are later compared among each other, in order to verify their validity, meaning and possible patterns (Charmaz, 2014).

Strauss and Corbin (1998) suggest an additional step in the coding process called axial coding and define it as "the act of relating categories to subcategories along the lines of their properties and dimensions" (Strauss & Corbin, 1998, p. 123). This phase is meant to deepen the understanding as well as to add structure to the already created categories. For the full explanation of what constitutes a category and how these are created please refer to chapter "Categories" on page 76. Axial coding is hence utilized to explore the circumstances or situations as well as the consequent actions which are occurring in the interviews (Strauss & Corbin, 1998). Charmaz (2014) adds that axial coding rearranges the codes provided by the earlier steps in order to make sense of the data. Still, she also does not agree with the notion of axial coding since it constrains the analysis of the data through the application of a too formal structure. She instead suggests a more informal method by contemplating on the existing (sub-)categories and consequently create connections between them.

Glaser (1978) suggests an even more abstract phase of coding called theoretical coding which is meant to explain the relationships established between the proposed categories. He also states a variety of "analytic coding families" or rules in order to establish an sophisticated evaluation of the data.

3.2.3 Categories

The next step in the overall process which is executed when developing a (grounded) theory, is the generation of categories. When the initial or open codes, also known as concepts (Strauss & Corbin, 1998), have been assigned, the subsequent step is to identify

codes that present a variety of similarities in terms of their characteristics which can be linked to one another and consequently build a category. These later form the foundation of a theory.

Glaser (1978) states that a category has to merit its right to be seen as a theory that is emerging. The methodology usually does not make use of the quantification of data in order to be identified as important, but a ranking can still prove useful to determine the importance of the topics for the participants. Strauss and Corbin (1998) note that categories can present properties and dimensions. Per definition a property is a "characteristic of a category, the delineation of [the category] and gives it meaning" (Strauss & Corbin, 1998, p. 101). The dimension is simply defined as the range of variability of a property, i.e if the property is "time" the variance would range from long to short.

The goal of this process is to define a core category (Glaser, 1978; Strauss, 1987; Strauss & Corbin, 1990), which encapsulates the essence of the observed phenomena presented in the earlier created categories. Strauss and Corbin (Strauss & Corbin, 1990) define the term as the crucial element which includes all other categories. A core category is identified when all properties and categories connect to a variable, that is frequently occurring (Birks & Mills, 2011).

3.2.4 Memoing

A vital aspect to the grounded theory methodology is the writing of memos. Clarke (2005, p. 85) defines the latter as "intellectual property in the bank". Simply put, memos are the recording of all thoughts, insights, ideas and feelings the researcher had while developing a theory. This process starts at the planning phase and accompanies the researcher until the completion of his work and is seen a non-optional asset. A memo is never to be thrown away since it is unclear at any point during the research if it becomes important later on in the analysis. The preservation of memos also helps to chronologically revisit the research process and can additionally be used to be reflected upon at a later stage. With memos the researcher can potentially raise questions and make sense of the interview data and compare the different conceptual ideas among each other as well as to the body of existing literature (Birks & Mills, 2011).

Memos can not be scheduled since the timing of an occurring idea can not be foreseen. This also implies that the writing of memos should be given priority above any other work in the research process. Whenever an idea sparks, the researcher is hence encour-

aged to stop on whatever he is working on and write down his thoughts. Glaser (1978) defines this as his "prime rule". Concluding, memos are "the most significant factor in ensuring quality in grounded theory" (Birks & Mills, 2011, p. 40). Other criteria for the quality of a valid grounded theory study will be explored in the chapter "Criteria for GT studies" on page 79.

3.2.5 Substantive and formal theory

The grounded theory methodology constructs a theory from the data which has been collected and is hence founded or grounded in said data. In the field of GTM two variations of theory can be found, one being substantive and the other being formal.

Strauss and Corbin (1998) state that a substantive theory seeks to explain a certain area or a specific context while a formal theory provides a theoretical interpretation of a more abstract and general area of study which can later also be deployed to a broader setting and explain more common problems. Charmaz (2014) points out that a variety of substantive grounded theory studies can form a formal theory, since every new study adds to the existing body of knowledge and is hence of great importance to the inquired field. She also advocates that the majority of studies done with the grounded theory method develop substantive theories since the focus lies on a very specific context or a substantive field of research.

In this particular study a substantive theory has been developed since the interpretation of the data has been focused on the use of the wearable computer Google Glass and the participants perspectives on the matter. It does not seek to be generalizable and hence be transformed into a formal theory, although, with the growing field of wearable computer research and the growing markets of technical innovations it might be added to a more formal theory in the future. Since Google Glass has been used for the implementation at a very early development stage, other head mounted displays might lead to different results. Nevertheless, this study can still be used to be compared to other, similar inquires and is hence still a valuable contribution for the overall body of knowledge.

3.2.6 Objectivist and constructivist approaches to GTM

The "Discovery of grounded theory" (Glaser & Strauss, 1967) states that a "blank mind" is required in order to start the research without any preconceptions. This includes of course the existing literature on the topic or area of study. Simply put, the researcher is

not to review other sources him- or herself before starting the actual development of a grounded theory in order to be seen a genuine inductive study. This also implies that the theory is found in the generated (interview) data and has to be "discovered" through the thorough analysis of the latter. A crucial point in this particular understanding of the GTM is the assumed same perspective that every individual shares. Consequently, different researchers will end up with similar results. The role of the researcher is hence assumed as passive while the theory rises from the data, which in the literature is described as a positivist or objectivist approach (Charmaz, 2000; Bryant, 2003)

Charmaz (2014) in contrary is one of the strongest representatives of constructivist grounded theory. The "constructivist turn" is an approach where the focus lies on the experience of the participants and their constructed view of reality. The outcome is therefore constructed by the participants as well as the researcher and does not aim to "discover" the data but rather to analyze and interpret the evidence which is found in the respective context of research.

As seen in the chapter "Historic Context" on page 72 Glaser and Strauss´ approaches to grounded theory began to drift apart in the 1980s. Glaser´s (1992) view has not changed much from the original, objectivist idea of grounded theory which is stated above. Strauss and Corbin (1990, 1998) however believe that the researcher has to actively seek for a theory that is grounded in the data. Therefore, the expectation of the outcome is fundamentally different since each researcher will emphasize other issues of the data, because every individual has a diverging set of values and believes.

Charmaz (2000) critiques both Glaser´s as well as Strauss and Corbin´s proposal of grounded theory since only one external, objective reality is assumed, while her approach postulates multiple, social realities. Furthermore, she remarks that realities are co-created or constructed between the researcher and the interviewees rather than "discovered" as proposed by Glaser and Strauss (Charmaz, 2014).

3.2.7 Criteria for GT studies

Charmaz (2014) lists a variety of criteria which a grounded theory study should fulfill in order to be seen as valid. She states that a combination of originality and credibility further advances the other two main aspects resonance and usefulness, and therefore the overall value of the contribution. The following list of main criteria together with their re-

spective questions will further deepen the understanding of what constitutes a valid grounded theory study (2014, p. 337):

1. Credibility
   - Has the research achieved the sufficient amount of familiarity with the topic?
   - Is the data sufficient to merit the claims?
   - Have systematic comparisons between observations and categories been made?
   - Do the provided categories treat a wide range of empirical observations?
   - Are there strong connections between the collected data and the argument and analysis?
   - Has the research provided an sufficient amount of evidence in order for the reader to agree with the proposed claims?

2. Originality
   - Do the categories provide new insights?
   - Does the analysis offer new conceptual renderings of the data?
   - What is the social and theoretical contribution of this work?
   - How does the provided grounded theory extend, challenge or refine existing concepts and ideas?

3. Resonance
   - Do the categories illustrate an holistic view of the studied experience?
   - Has the research addressed unstable and taken-for-granted meanings?
   - Does the analysis provide deeper insights about the participants lives?
   - Has the analysis drawn links between larger institutions and individual lives?

4. Usefulness
   - Does the analysis explore interpretations that are useful to people in their everyday lives?
   - Do the analytic categories help to understand generic processes?
   - Can the analysis be the starting point of other potential research?
   - How does this work contribute to the body of scientific knowledge?

In the chapter "Evaluating the Grounded Theory Criteria" on page 227 these criteria are reviewed. It will continue to explore how the above named criteria have been addressed and met by this study.

3.2.8 Limitations of Grounded Theory / Qualitative Methods

Like all methodologies, grounded theory has a variety of limitations. This becomes particularly clear through the rather complex and time intense overall process of memoing and coding (Allan, 2003). For the most part, this can be avoided through the use of special coding and organization software, which helps to keep the data in order as well as analyze it. Still, with a rather large sample, a lot of chaos and noise is to be expected in the data (Allan, 2003).

Although the data collection as well as the overall approach in this study was guided by Charmaz (2014) as well as Strauss and Corbin (1990, 1998), it seems difficult to settle for one specific approach as well as the justification of such. Hence, the tension between Glaser (1978, 1992) and the other approaches seems like an additional complication for the novice researcher. This leads to the difficult decision whether the huge amounts of data as well as the developed categories are saturated and a valid theory can be proposed, since other researchers might come to a different conclusion. That makes the grounded theory methodology a highly subjective process which is based on the researchers skills and experience. Although experience is asked for the methodological part, Glaser believes that the researcher should have no pre-existing knowledge about theoretical ideas since it might lead to a biased view of the data as well as the overall outcome of the study (Allan, 2003). Although this seems like a valid notion, it is simply not possible in real life research, even less for the work on a PhD thesis, starting with the application that needs to be approved by the responsible committee. Additionally Stern (1994) points out that the label of GTM is often applied to the mixture of different methods like phenomenology and ethnography by a variety of researchers in order to justify the analysis of their respective findings.

The following chapters will explore the use of the GTM in this study, the research design including the generation of interview questions, the sample size as well as the data collection.

3.3 Research Design

3.3.1 Overview

The grounded theory methodology provided a valuable guideline for the data collection as well as the overall analytic process implemented in this study. Per definition, the method suggests an ongoing, cyclical approach in order to shape the findings for later analysis.

In a first inquiry, a pilot study, with a total of ten participants, was conducted in order to grasp the concept of wearable computers, specifically the head mounted display Google Glass (see also "Pilot Study" on page 85). Five of those participants agreed to partake in a group discussion or focus group, which was meant to further verify or falsify some initial concepts (see also "Focus Group Interview" on page 89). After a careful evaluation of the data, a media diary was developed in order to broaden the scale of the overall research area and to be able to evaluate an additional set of data thus expanding the overall outcome of the proposed research aims (see also "Media Diary" on page 94). After a successful pre-test of the newly arranged questions and the proposed media diary (see also "Media Diary Pre-Test" on page 96), the main study, with a total of 31 participants, took place. Questions that have been left unanswered were reformulated and readdressed; other questions that showed no significant results have been taken out. For further details about the sample sizes, data collection methods and the creation of the interviews questions please refer to the following chapters.

Initially, the open coding method was applied in the pilot study interview data using the aid of the software "F4". The software has been of great help to sort and organize the initial concepts and was also used for the initial coding of the main study interviews. The initial codes also served as a foundation for the focused codes. Axial coding, as well as theoretical coding has not been applied in this this study because of their descriptive nature of seeking to define properties and dimensions for each category, which ultimately did not support the analysis of the data, since an analytical frame would have been applied making the research unnecessarily "cumbersome" (Robrecht, 1995). This study follows the approach of Charmaz (2014), who suggests a comparison between all the gathered and constructed data. This includes the interviewees´ statements, codes and categories, which are less restricted since the researcher is not "forced" to analyze the given data in a matrix of properties and the resulting dimensions.

The most influential scholars of the grounded theory methodology have not yet reached a conclusive consensus when to review the existing academic literature. Although one of the founders of GT suggests not to use the literature until the end of the analytic process (Glaser, 1978), this study used the approach of Charmaz (2014), who advocates an initial review of the existing literature before the actual implementation. There are several reasons for approaching the literature review this way. First and foremost, a PhD thesis needs to make a meaningful contribution to the selected area of study and hence the researcher is obligated to define a research gap. Secondly, in order to be able to apply for a PhD thesis, an exposé of the proposed research has to be created, leaving the applicant no choice but to conduct an initial literature review. In order to keep track of the results and the authors thoughts on the latter, memos have been devised. These can be found as separate marked digressions throughout the pilot study.

In a first step, the following chapters aim to explain why Google Glass was chosen and elaborate the used time frame of this study. Further, both the pilot study and the main study will be explored in order to gain a deeper insight into the chosen sample, the interview questions, the group discussion, the media diary, and the process of coding and constantly analyzing the data.

3.3.1.1 Reasons for choosing Google Glass

There are numerous reasons as to why use Google Glass for the implementation of the research. The main reason was availability. At the time of this dissertation, Google Glass was not available freely on the market, but the company made the wearable computer available through their "Explorer Program", which gave potential costumers the opportunity to purchase a device through an invitation sent by Google. Those invitations were not sent to anyone but people had to apply for it. At the time this dissertation was written no other product was available on the market. In a very complicated process the researcher was able to obtain three devices through these invites, which had to be purchased in the United States of America and then be sent to Germany via courier service.

But the availability was not the only reason to choose this specific device. Similar devices did not offer the same amount of applications and some are not even made for everyday use but more for very specific industrial applications like the "Vuzix Glasses" or design purposes such as the "META Pro Glasses" or the "Microsoft Hololens". Furthermore, all of the above named products were still in development at the tested time and

were hence not considered for the actual implementation of the study, due to the lack of availability.

3.3.1.2 Time frame of the Implementation and Evaluation

This rather brief chapter will give a quick overview of the proposed timeframe of the overall implementation.

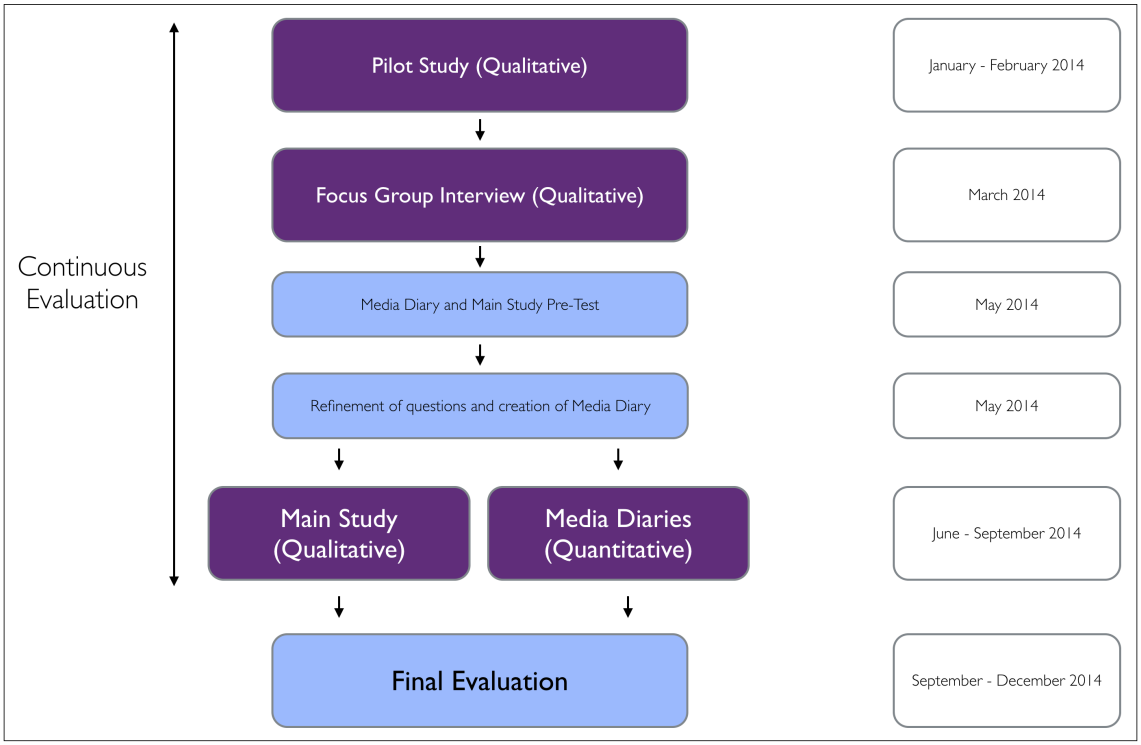

Figure 18: Time Frame of Implementation & Evaluation

The total amount of time needed including the evaluation was twelve months. This of course included the acquisition as well as the timely organization of all participants. Please note that throughout the whole process the "memoing" technique was applied. As already seen in the chapter "Methodology Overview" on page 5, the following table will provide an overview of the timeframe as implemented in this study.

Essentially the implementation consists of four main anchor points. The Pilot Study interviews, the Group Discussion, the main study interviews as well as the media diary kept by the participants of the main study.

3.3.2 Pilot Study

3.3.2.1 Sample

The participants of the pilot study were mainly selected by gender and age in order to conduct the study with a relatively homogenous group. The age ranged from 26 to 29 years with a mean age of 27,5 (*SD=1,27*), with a gender distribution of 50 % female and 50 % male. The participants all worked in an office and none of them were engaged in manual labor. Furthermore, the participants were also selected based on their technological savviness in order to further compare the ease of use of the device as well as possible problems with the initial learning curve.

In the pilot study no differentiation was made between the mobile platform used. Hence only one male participant was using an Android phone while the rest, including all females, were using an iPhone running the iOS platform. This implied some restrictions of usage which can be found in the chapter "Technical Restrictions" on page 29.

It was also made sure that all major mobile German mobile phone networks (T-Mobile, Vodafone, O2 and E-plus) were represented. The main purpose of this was to see whether the experience of the testing was restricted due to difficulties with the mobile reception.

The sole information they were given was that the study will involve using Google Glass. None of them has ever touched the device before and had no prior knowledge about the use of it. Furthermore, the participants were assigned codenames in order to stay anonymous and to protect i.e. the companies they worked for since some of them were forbidden to wear the devices at work. The code names were assigned in the following manner:

- P = Pilot Study
- M / F = Male / Female
- Number of the order the interview was taken

This leads to the following codenames: PM-01, PF-02, PM-03 etc. The schematic sorting of the participants also serves the purpose of a better overview when later comparing the interviews among each other and help avoiding confusion with unisex names.

3.3.2.2 Data collection

The data collection in the pilot study has been a straight forward process. The participants were asked for an appointment in order to introduce the device itself and perform an initial setup.

Figure 19: Flowchart of the data collection process in the Pilot Study

Since the according companion application was not available in the German Google Play Store nor the German Apple App Store at the tested time, the app had to be installed via a variety of backdoors, which requires a certain amount of technical knowledge. However, this was done by the researcher in order to avoid confusion. It also serves the purpose of controlling that the right application was installed and that the connection between the device and the Smartphone worked properly.

In some cases a Google Plus Account had to be created since, as mentioned earlier, some of the participants did not use the social network and therefore did not have an account. The participants were also informed that the device is able to track the current location of the user at all times. However, this did not present a problem for any of the participants.

After making sure that the connection between Google Glass and the participants Smartphone was working properly, the participants were asked to wear the device for a total of seven weekdays. Ohly et al. (2010) suggest that in a traditional diary study the minimum required amount of time is five days. In the case of this study, a full workweek seemed more appropriate since the aim was to see how the device was used during a regular workweek as well as on the weekend for entertainment purposes.

The participants were asked to use the device as pleased and try to use it in the most natural way possible. The only application they were asked to install was Google Now, which can deliver additional information about the wearers surrounding, like nearby restaurants as well as, depending on the preference of the user, results from sporting events etc., without actively searching for it. Other than that, the participants had no re-

strictions whatsoever. They were asked to do sports, wear the device at work, in stores, when with friends - basically in every situation possible in order to gain a holistic experience for the final interview.

When the testing period of one week ended, the participants were asked for another date in order to conduct the final one-on-one interview with the researcher. After the actual recording of the interview the devices were reset to factory settings, which implies a complete elimination of all personal data, such as photos, videos, SMS and e-mails. This also implies that the respective Google Plus account was unlinked from the device in order to be able to be connected to the next participants´ account.

3.3.2.3 Interviews

The pilot study was meant to create a first exploration of possible topics. Four main themes as well as a variety of sub-themes have been identified and hence the resulting questions circled around those topics as seen in the following illustration.

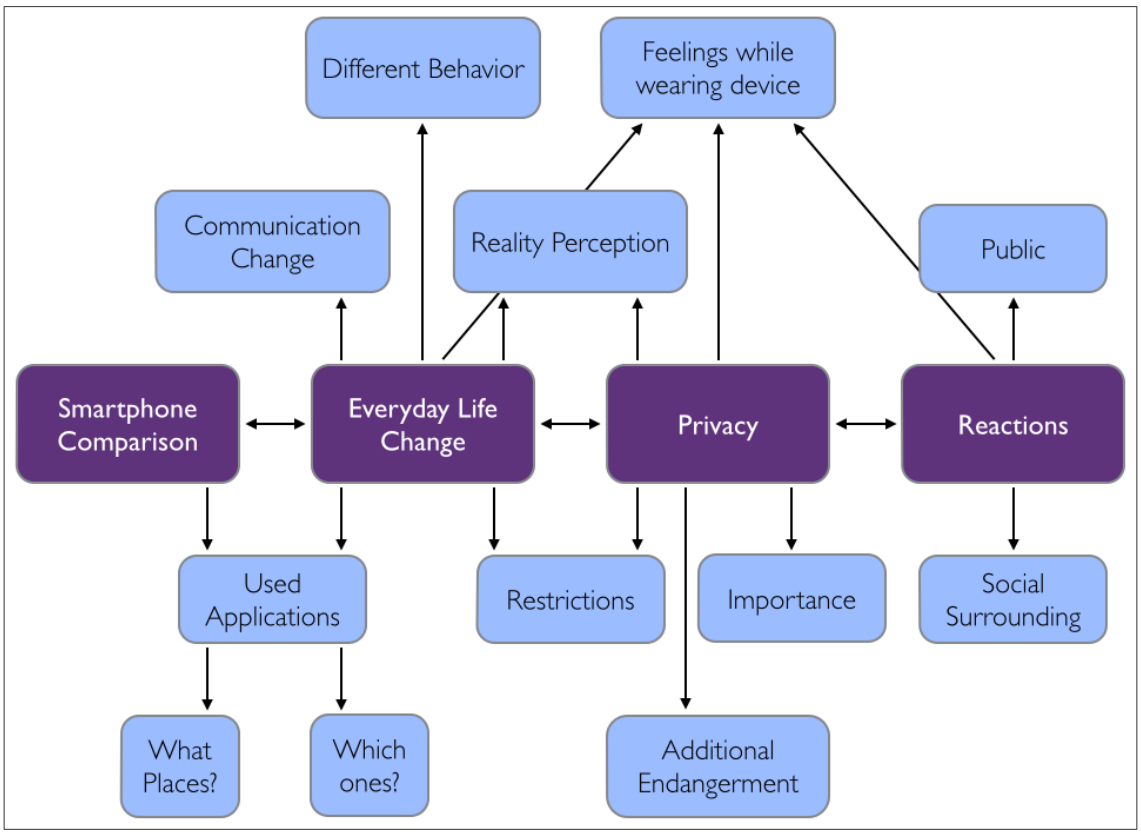

Figure 20: Interview Themes

A main concern was the change of everyday life which can be seen as the main theme of the overall interview. Other topics such as privacy concerns, a comparison with the traditional smartphone and reactions to the device have also been identified as main themes. Consequently, in-depth questions have been developed in order to further explore the experience the participants have had with the device. The interviews all took place in a closed, quiet one-on-one environment. The participants had the option to either answer in German or English, although that only applied in one case since the interviewee was from US American decent (PM-01)[6].

The interviews were of exploratory and semi-structured nature, since this part of the study was meant to identify possible patterns through the change of everyday life and was meant as a preparation for the main study. The following list intends to give an overview of the proposed initial questions that were asked in the pilot study.

- What was your experience with Glass?
- Would you say that you behaved differently in any situation than without the glasses?
- Would you say that your everyday life was changed or facilitated at some point?
- Did you at any point of time perceive reality differently?
- So how did your social surroundings react to Glass?
- Did any stranger talk to you about Glass? (On the subway etc.)
- Did you communicate differently with your partner or social surrounding whilst wearing Glass?
- How often and where did you use Glass?
- How did you feel doing it?
- How did you use the device at work?
- Which functions did you use most?
- Where and how do you use your Smartphone?
- Are you a very tech-savvy person?
- Would you say that you used your Smartphone less in the time you had Glass?
- Would you say that Glasses of this kind could replace your Smartphone?
- Did you at feel restricted any point? (Sports, Cinema…)
- Did you experience technical difficulties at some point? Which?
- How important is privacy to you?
- Do you see any additional endangerment of privacy?
- How would the world change if everybody would wear Glasses like these?

6. Please note that the corresponding citations later found in this thesis were all translated by the researcher, except for the interview with PM-01, which has been held in the English language.

- Were your initial expectations towards Glass met?
- Is there anything you would miss not having Glass anymore?

The pilot study has been proven to be a very helpful exercise for the researcher because he could familiarize himself with the methodology and the use of the device. Also, initial learnings were later applied to the main study which took place three months apart. Consequently the questions have been refined, reorganized and partly taken out. Additional questions have been added in order to further deepen certain subjects that have been left unanswered in the pilot study.

3.3.3 Focus Group Interview

After the pilot study, a group discussion was held. This included five participants from the pilot study, three females and two males with a mean age of 27,4 (*SD=1,52*). The purpose was to further refine the questions for the main study, by exploring if there were topics that have been left out in the initial interview questions.

Generally a focus-group interview is less structured than a traditional interview, due to the difficulty to structure a discussion in a group. Still, a group discussion people might develop notions or thoughts that would not have occurred to them on their own (Preece et al., 2002). A group discussion is usually held after a series of interviews with several individuals in order to find reasons to explain the remarks of the single participants (Shneiderman & Plaisant, 2005).

The advantages in comparison to traditional one-on-one interviews are many. The utmost important for this study are the wide range of topics that could be discussed. As a sole researcher it might be difficult to get a holistic view of the discussed topic while a group can provide additional input by discussing with each other. Through a relaxing atmosphere the probability of spontaneous expressions of feelings as well as an enhanced participation rate is a lot higher. Furthermore a longer time frame provides the opportunity of detecting emotional backgrounds as well as latent opinions (Lamnek, 2005a).

The disadvantages include a change of subject, a blocking of opinions through other (lead-)participants and a change of opinion which reduces the chance of replicability.

In this study, the researcher started the discussion with an open question. Whenever a subject was finished by the total silence of all participants a new question was proposed. Also, whenever the group got of topic the researcher intervened by getting the group

back on track. The focus group interview was held primarily to further deepen the understanding of the pilot study interviews as well as to refine the questions and the overall methodology of the main study. This, together with the proposed media diary as seen on page 94, adds a triangulation of methods to the overall research approach.

3.3.4 Main Study

3.3.4.1 Sample

A total of 31 participants with a mean age of 27,3 (*SD=6,98*), consisting of nine female and 22 male participants, took part in the main study. Please note that the participants of the main study are different people that the ones that participated in the pilot study.

The grounded theory methodology seeks saturation through constant evaluation of the data to the point where no new codes are discovered (Strauss & Corbin, 1990). This was the case after the 29th interview and hence a stop was put to the research. In order to confirm the code-saturation two additional interviews were held.

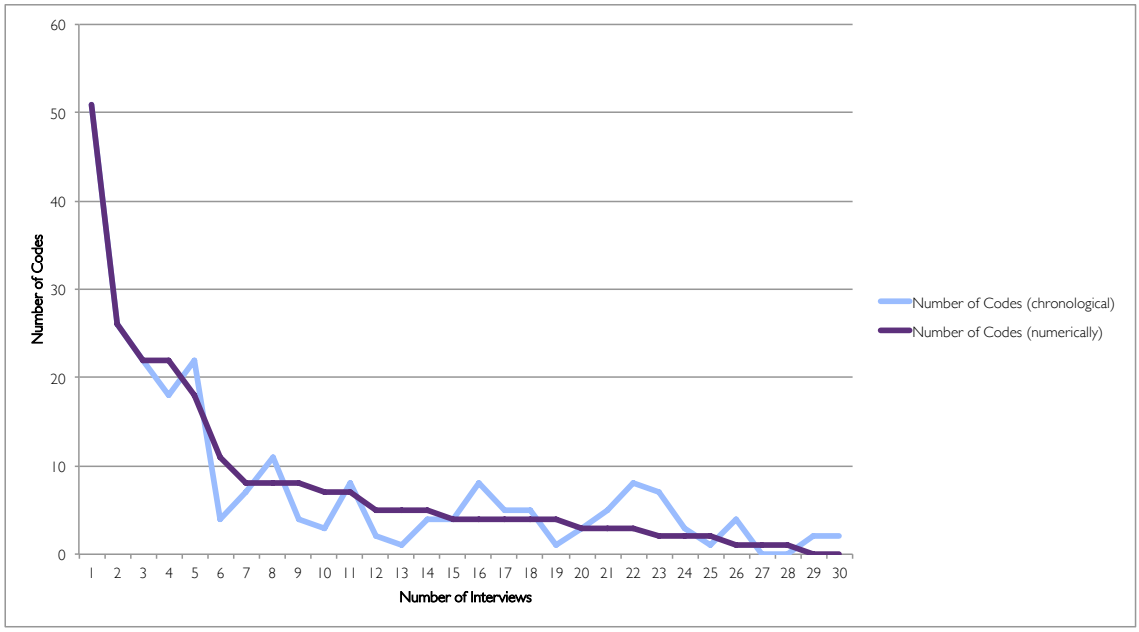

Figure 21: Code distribution of the Main Study

The above figure illustrates an overview of the code distribution. The blue line represents the chronological order, while the purple line represents the numerical sortation of the assigned codes. Guest et al. (2006) suggest that six to twelve interviews are enough for most studies. In their paper they had created a 92% of codes assigned in the first

twelve interviews. In this particular study 74% of the codes were measured in the first twelve interviews. This does not include the pilot study which has not been measured here since its only purpose was to prepare the questions of the main study.

One of the most relevant changes applied in comparison to the pilot study was that only users of an Android phones were accepted. This had the simple background that the participants of the iPhone users pilot study had a lot of technical complaints. Also the full functionality of the Google Glass device is only given with the use of an Android phone. For a detailed description please refer to the chapter about "Technical Restrictions" on page 29. Again, the participants were assigned code names to protect their identity. These codes are assembled as follows:

- **M** = MainStudy
- **M / F** = Male / Female
- **#** = Number of the order the interview was taken

This consequently leads to a descriptions like: MM-01, MF-02, MM-03 etc. This is mainly used to differentiate the participants amongst each other, as well as from the pilot study.

3.3.4.2 Data collection

Similar to the pilot study all of the participants were asked for an appointment in order to perform an initial setup. Again, most of the mobile phones had to be prepared with an external installation of the Google Glass companion application, since it was not available in the official Google Play Store[7].

Additionally, to the interviews the participants were explained the above mentioned media diary which had to be filled out immediately after using a function on the device. The diary surveys were handed out to the participants in a blank, printed version and expected back at the end of the testing period. In the main study, similar to the pilot study, the participants were also asked to wear the device for a whole week, since most partici-

7. At the end of July 2014 the application was made available in the German Google Play Store hence saving the researcher as well as the participants the trouble of installing it via backdoor methods (Barczok, 2014).

pants explained that it was enough time with the device and that there was nothing more to explore.

Within this study, the participants were also asked to activate Google Now, since it has more functions with an Android phone such as the display of calendar events, sporting events and so forth and also serves as a comparison to the pilot study. Other than that, the participants were only asked to actually wear the device in as many situations as possible. They were not given a list of specific situations on purpose since the aim was to compare as many different daily routines as possible. It is also believed that a saturation of codes would have been reached a lot earlier if it were always the same situations and not different ones. Again, no restrictions applied to any specific activity meaning that the participants were able to use the devices whilst practicing sports, driving a car or bike, going to the cinema and alike.

This way, a holistic view could be gained of a regular workweek and the spare time on weekends which is no less crucial since one aim was to see if the device has a "serious" use or is rather utilized for entertainment purposes.

As already explained in the pilot study chapter about "Data collection" on page 86, the devices were reset to factory settings in order to delete all personal information saved during the tested period.

3.3.4.3 Interviews

Similar to the pilot study the interviews were held in a private, closed environment in order to avoid disturbances as well as unwanted noises for the later transcription. There was one participant who preferred to answer the questions in English since she was of Italian descent (participant MF-09). Again, all citations later used in this thesis have been translated by the researcher.

The development of the actual interview questions compared to the pilot study was seemingly different. Some initial concepts such as the different perception of reality amongst others could not be confirmed and had hence been taken out. Other concepts such as the change of communication with the social surrounding have been broadened in order to understand more about these notions.

Charmaz (2014, p. 66) proposed a variety of sample questions to use in grounded theory studies some of which have been adopted and added to the question catalogue.

This included questions about typical days with the smartphone as well as Google Glass, a changed point of view after, advice for others and so forth.

Another aspect which has been addressed was the inquiry about the actual market. This required the participants to answer questions about their personal feeling towards the device, such as if they would wear the device outside the study, if they would buy it, if the would rather buy a Smartwatch and so forth. It was important for the researcher to get an insight into this particular subject since the device was not available to the public at the tested time and it was unclear if the participants would use such a device outside the study or just wanted to "play" with the device out of curiosity. Also, an insight into the market readiness could be gained as well as an impression whether people were ready to wear these kinds of devices or not.

The following provides an overview of the final interview questions. The made alterations in comparison to the pilot study, will be explored in detail in the chapter "Summary Focused Codes and Implications for Main Study" on page 131.

- What were your experiences with Glass?
- How did your everyday life change or eased up?
- What could have been changed?
- Was there a Situation or more Situations in which you acted differently than without Glass? Which?
- How did your social surrounding react to Glass?
- How did the public react?
- Did you communicate differently with your social environment whilst wearing Glass?
- Did people talk differently to you?
- Would you say that Glass in a normal conversation is rather a help or a distraction?
- What were the main applications you used?
- How did you use Glass at work?
- Which applications did you like better on Glass than your Smartphone?
- Is there a location in which Glass is especially helpful?
- What kind of role does a known environment play whilst using Glass?
- Did you fell awkward in any social situation?
- Did you experience some sort of restrictions?
- Did you have any technical difficulty whilst using Glass?
- Would describe yourself as a tech-savvy person?

- How and where do you use your Smartphone?
- Could you describe a typical day with your Smartphone?
- And now a typical day with Glass.
- Please compare Glass to your phone. Name the biggest differences and similarities.
- Were there situations in which you preferred Glass over your Smartphone and consequently used your Smartphone less?
- How important is privacy to you?
- Do you see an additional endangerment of your privacy through devices like Glass?
- Do you think that Glasses like these could one day replace your smartphone?
- Would you rather wear a Smartwatch?
- How did your point of view change after your week with Glass?
- Which advice would you give to somebody who wants to try or buy Glass?
- What was the most important lesson you learned with Glass?
- Would you wear such a device?
- Is there something you would miss now that you do not have Glass anymore?
- Should I know anything we have not discussed?

With the proposed questions it was possible to cover a wide range of possible subjects including the change of everyday life, the situational use, the altered communication, the typical days of mobile users, the current market situation as well as a variety of different points of view regarding privacy.

3.3.5 Media Diary

The media diary has been part of the main study (as seen in chapter "Time frame of the Implementation and Evaluation" on page 84) and can best be understood as an approach which helps to determine the appropriation of media and their respective contents. In the diary, central phenomena are recorded in a timely manner and therefore give an insight to what a participant does with media, how his or her medial world looks like and how the media usage is co-created and perceived by other actors (Böhm, 2012). As seen in Figure 22, Böhm (2012) proposed a media diary, which served as a guideline for the development of the media diary used in this study.

The diary provides a "mostly authentic angle on the participants and their acting with media" (Schorb & Theunert, 2000, p. 57). In this context the diary is a form of elicitation

in which, through the close use along the actual media usage, the daily routine as well as the subjective perception can be gathered (Schorb & Theunert, 2000).

The time of day was recorded first. The second part describes the activity that was performed. The third row was used to describe the mood before the media usage. The forth row was used to record if there has been an actual media use during the performed activity and if so, what media were used. The fifth row was meant to explore the social situation the participant was in. The sixth and final row was used to describe the mood after the actual media usage. It is crucial to understand that the media diary proposed by Böhm (2012) was used as a mere guideline and adapted to the purpose of this study in order to find out how the participants were using the Google Glass device.

Montag, den .....

Uhr-zeit	**Tätigkeiten**	**Stimmung vor medienbezogener Tätigkeit**	**wenn medienbezogene Tätigkeit → bitte konkretes Medienangebot benennen!**	**soziale Situation**	**Stimmung nach medienbezogener Tätigkeit**
6 Uhr					
7 Uhr					
8 Uhr					

Figure 22: Media diary (Böhm, 2012)

One fundamental change that was made in comparison to the proposed diary by Böhm (2012) was the design of the actual diary. It is believed that the motivation to provide data is significantly higher if the participants only have to check the boxes rather than to fill them out.

The constellation of the media diary used in this particular study consists of a variety of different parts. Firstly the captured time, which is crucial in order to understand when the participants used certain applications i.e. on their way to work, at work, in their spare time etc. Furthermore the used application was of utmost importance since the researcher wanted to determine which applications where used most, when and if preferred to the smartphone. The functions listed in this diary emerged from the evaluation of the pilot study. The most used functions from the pilot study were hence listed and believed to also be used most in the main study. Since the participants could not use the SMS function due to the technical restriction of the mobile platform iOS, it was added to

the list in order to name another communication channel besides the phone call. Of course, they also had the option to check "other" and add other applications.

Time	Used Function	Duration	Social Situation / Place	Attendants	Motive
	☐ Camera ☐ Watch ☐ News ☐ Phone ☐ Google ☐ Navigation ☐ SMS ☐ Other:	☐ 1-2 Min. ☐ 2-5 Min. ☐ 5 + Min.	☐ At Home ☐ Workplace ☐ Public ☐ Friends house ☐ Restaurant ☐ Other: _____	☐ Alone ☐ Acquaintances ☐ Strangers ☐ Colleague ☐ Partner ☐ Other: _____	☐ Status ☐ Contacts ☐ Entertainment ☐ Reachability ☐ Research ☐ Other: _____

Figure 23: Media diary before Pre-Test

Furthermore the duration of the usage was logged in order to see whether the applications were used only for quick information pulling or if the use was rather prolonged and extensive. One main similarly to Böhm (2012) is the row "social situation", which in this case is used to define the place the participants were at while using an application or function, and, logged in a separate column, the attendees.

The last row was used to determine the motive of the usage of Google Glass. This scheme was used by Karnowski and Jandura (2011) in their study about mobile phone usage. The background of using their categories was to have a basis to later compare their results with the ones in this study. They proposed five possible motives, namely: Status, contacts, entertainment, reachability and research. This diary was then tested by one participant in order to determine whether something was missing, unclear or simply not worth eliciting.

3.3.5.1 Media Diary Pre-Test

One participant, which is not counted as part of the main study, was used to pre-test the developed interview questions as well as the proposed media diary. As expected the questions did not provide a problem at all and the questions could be answered with ease. Still the last remark about the media diary was crucial for the data collection of the main study.

> *"I would also survey the feelings of the participants. If it is pleasant or unpleasant. Because at the beginning it was rather unpleasant for me. That depends on the person. If I am somebody who does not care at all about people starring at me or if I am a rather shy person - that is a totally different story. I do not know how many people you are still going to interview but there will probably be people who will feel rather unpleasant." (PTM-01, paragraph 72)*[8]

Hence the media diary had to be broadened in one aspect: a well-being scale. A Likert scale ranged from one to six, one being very comfortable while six being very uncomfortable, was used. The reason for choosing an uneven number was to avoid non-committal answers since a forced choice will deliver more precise results due to the inability to choose a neutral state of comfort.

In the later evaluation correlations could not only be established between places, apps and social situations but also with a new dimension of feelings, which in retrospective is believed to be one of the most crucial aspects of the outcome of the overall implementation. The following media diary represents the final version which has been used in the main study. Please note that the original version was used in German and has been translated for this text.

Name: _____ / **Day:** _____

Time	Used Function	Duration	Social Situation / Place	Attendants	Motive
Well-Being Scale ☐☐☐☐☐☐ 1 2 3 4 5 6 ☺ ☹	☐ Camera ☐ Watch ☐ News ☐ Phone ☐ Google ☐ Navigation ☐ SMS ☐ Other:	☐ 1-2 Min. ☐ 2-5 Min. ☐ 5 + Min.	☐ At Home ☐ Workplace ☐ Public ☐ Friends house ☐ Restaurant ☐ Other: _____	☐ Alone ☐ Acquaintances ☐ Strangers ☐ Colleague ☐ Partner ☐ Other: _____	☐ Status ☐ Contacts ☐ Entertainment ☐ Reachability ☐ Research ☐ Other: _____

Figure 24: Final version of the media diary

8. Was ich noch miterfassen würde, wäre wie man sich dabei fühlt sozusagen. Also ob es angenehm oder unangenehm ist. Weil am Anfang fand ich es echt unangenehm. Das kommt auch auf den Menschen drauf an. Wenn ich jemand bin dem das alles egal ist wenn einen alle anschauen, oder wenn ich so ein kleines Mäuschen bin und auf einmal starren dich alle an - dann wird das wahrscheinlich noch mal ein anderes Kaliber sein. Von den Gefühlen her. Ich weiss nicht wie viele Leute du noch interviewst - da wird es wahrscheinlich auch noch Leute geben, denen das eher unangenehm ist.

The final layout as seen in figure 24 could be fitted four times onto a single A4 page (see "Appendix" on page 258). The pages were printed from both sides with a "name" and a "day" line as a header. The participants were then asked to fill out the pages as they were using the device. Ideally a participant had about eight entries a day in order to reconstruct the daily use.

A distribution via an electronic medium such as a smartphone or tablet would have presented an additional complication since the participants would have to get out his or her smartphone or tablet, unlock it, open a web browser, log in to a certain page and a then fill out the form. This could also not be realized since an internet connection would have been required at all time. Also, the purpose of this diary was a prompt inquiry of the media used at any given time.

3.3.6 Analysis of findings

All the qualitative interview data from the main study was then compared to the qualitative data from the media diaries. This triangulation of methods was used to evaluate the overall findings and further deepen the understanding of the proposed theory[9].

Through the process of constant comparison between the collected data and their ongoing evaluation, the findings could constantly be reviewed. This process was further used to develop the final theory. During the entire process a variety of tentative theories have been generated, which could be supported or discarded through the additional collection of data. Charmaz (2014) argues that the most meaningful theory is developed by repeating this process until the gathered data is fully interpreted. In a concluding chapter, the findings were compared to the existing academic literature in the chapter "Discussion and Analysis of Findings" on page 189. The final results of this study are consequently presented in the chapter "Conclusions" on page 224.

9. Please note that the interview data gathered in the pilot study as well as the group discussion is not directly related to the overall outcome since the main purpose was to further shape the interview questions, as well as to make certain decisions, i.e. which mobile devices to use, in the main study.

3.3.6.1 Use of software for data analysis

In both the pilot and the main study, a variety of different softwares have been used to facilitate the research process and help keeping the data organized[10].

In this particular study, Microsoft Word has been used for writing down and organizing memos. The word processor has always been open in the background, even when not working on the actual dissertation in order to be able to write down every memo that came to mind very quickly. Another application for taking notes has been used on the authors smartphone. Both memo lists have later been merged and organized in Microsoft Word. Also, the interview questions and tables have been created in this word processor. Microsoft Excel has been used to initially analyze and draft diagrams such as the distribution of codes. Also, Excel was used for the initial analysis of the media diary survey. The software "F5" is a software particularly designed to transcribe interviews and offers a variety of benefits in comparison to more simple audio players such as the advanced setting of velocity and so forth. The tool "F4" was used to analyze the transcribed data. The software is specifically designed for qualitative data analysis and helps the researcher assign codes to interview texts and other data. It also lets the user compare these codes among each other, as well as measure the frequencies of the latter. The final result of the analytic body of work can also be exported in text form or as tabular data.

When compared to the pen and paper method, it becomes clear that the software was of great help since it shortened the analysis of the data significantly. It also helped to manage, reassign and rename the codes and keep and overview of the current frequencies.

10. For a full list of benefits using software, please refer to Weitzman (2000, p. 805)

3.4 Chapter summary and conclusion

In this chapter the reasons for choosing a qualitative approach, specifically the grounded theory methodology is explained. The three phases of data gathering have been explored in careful detail. This includes the sample consideration, the data collection, the development of interview questions along with other methodical considerations for both the pilot and the main study. Furthermore the design of the quantitative media diary is explained as well as the resulting triangulation of methods through the latter.

The grounded theory methodology has been chosen in order to explain the usage of the wearable computer Google Glass. The interview questions are meant to explore the views on typical days with the device, the reactions from strangers and acquaintances, the comparison to the relation of the participants´ smartphones as well as the very personal views on digital privacy. Through the cyclical process of the GTM, the continuous data collection as well as the analysis have been facilitated significantly. Although this study features a rather large sample, the developed theory still does not aim to be a "formal", but is rather classified as a "substantive" theory, which explores a very specific area of inquiry.

In the following chapter, "Presentation of Findings", the data collected in all three major phases of the implementation will be discussed - this includes the pilot study, the focus-group interview and the main study together with the media diary.

4. Findings

In this chapter the findings of both the pilot study as well as well the main study will be presented. This includes the presentation of the elaborated themes (as seen one page 87) and their respective initial and focused codes. Furthermore, the focus group discussion will be explored which, together with the initial findings, has been used to refine the interview questions for the actual main study.

Along with the main study, the participants were asked to fill out a media diary. The results support the proposed final grounded theory categories presented in the chapter "Final GT Categories" on page 185.

Please note that the actual analysis of the data will not be discussed in this chapter but rather in the chapter "Discussion and Analysis of Findings" on page 189, since the sole purpose of this chapter is to present and illustrate the findings of all the above named parts of the study. All citations of german interviews have been translated. Thus, the original citations can be found in the respective footnotes.

4.1 Pilot Study Findings

The pilot study study was meant to gain an initial impression of the Google Glass device, as well as further evaluate and refine the main study. An equally distributed group of ten participants, five being male and five being female, has been asked to wear the device for an entire week, hence a total of seven days.

Since the aim of this study is to find patterns that emerge through a variety of interviews, all codes that have only been assigned once have been discarded. This allowed the researcher to gain a more holistic insight of the expressed notions and the hence developed themes that have been proposed in chapter "Interviews" on page 87. The purpose of this approach is to learn about the initial codes and their respective frequencies, the times a code got mentioned, which allows the examination of patterns in the data.

4.1.1 Initial Themes

4.1.1.1 Reality Perception

One aim was to find out whether the participants perceived the real world differently in any way. Since the original assumption was that an "augmented reality" might led to an altered perception of the real world the question was developed in order to verify this

notion. Only three out of ten participants claimed that their reality perception has been different whilst wearing the device.

Reality Perception	Frequency absolute	Frequency normalized
normal reality perception	7	100
altered reality perception	3	42,9

Table 5: Initial Codes - Reality Perception

The general notion was that the reality perception has been the same for most of the participants, similar to the use of their smartphones.

> *"No, I did not have the impression that I would leap out of reality. Instead of looking at my phone I would look at the glasses" (PF-04, paragraph 11)*[11]

Hence, the notion of an altered reality perception did not lead to any promising results which is why focused codes were not created for this theme. Therefore the question was taken out of the catalogue and was not further pursued in the main study.

4.1.1.2 Outside Reactions

4.1.1.2.1 Initial Codes - Outside Reactions

Another aim was to find out how the social surroundings of the participants as well as strangers would react to the device. The novelty as well as the new form factor of the device was a reason to assume that the reactions to it would be different somehow to all known devices such as smartphones, tablet and laptops. Another purpose was to see how new innovations get embedded into a societal context. The following table will give an overview of the initial codes for the theme outside reactions.

11. „Nein, ich hatte nicht das Gefühl aus der Realität „rauszuzappen". Ich habe eher anstatt auf mein Handy auf die Brille geschaut."

Outside Reactions	Frequency absolute	Frequency normalized
irritated looks from strangers	18	100
conversation starter	12	66,7
social surrounding positive	10	55,6
people assume constant recording	10	55,6
asked to take off	9	50
social surrounding curious	8	44,4
strangers curious	8	44,4
positive reaction from stranger	4	22,2
skeptical people	4	22,2
people avoid glass	2	11,1
seen as toy	2	11,1

Table 6: Initial Codes - Outside Reactions

First and foremost the participants all noticed irritated looks from strangers in public. The overall notion was that the surroundings are not used to such devices and were hence looking irritated at the wearer, since the glasses attract a lot of attention. Others felt like "outsiders" wearing the device because it is not common enough.

> *"Most of the time I felt very observed. People are always looking at me - it is a little like going to the "white party" dressed in red. One really stands out even though the construction of the glasses is relatively decent." (PM-03, paragraph 17)*[12]

The attention that is drawn by the device is not necessarily negative. Most participants stated that strangers as well as the closer social surroundings are overwhelmingly positive and curios which led the people to ask and find out more about the device. This curiosity

12. „Die meiste Zeit jedoch habe ich mich sehr beobachtet gefühlt. Die Leute schauen immer zu mir - es ist ein bisschen so als ob man auf die „fete blanche" geht und sich rot anzieht. Man sticht eben sehr raus. Obwohl die Brille ja doch relativ dezent konstruiert ist."

was not restricted to a certain age or target group and generally encouraged strangers as well as the social surroundings to engage in a conversation about the device.

> *"Generally one could say rather positive. Questions more like: "Is that Google Glass?", "Where did you get them?", "Is it working right now?", "Can I try it?", "What does it display right now?", "Why are you wearing them?". These were always asked. There has been no one who wanted to slap them off my face. The people were positively surprised." (PM-05, paragraph 12)*[13]

Although most of the surroundings as well as strangers reacted very positive and curious when confronted with the device, most participants state that the people assume a constant recording of photos and videos which leads to a certain fear regarding their privacy. Some participants even noticed people deliberately avoiding the device.

> *"Can they look? Are they being filmed? I was under the impression that my social environment did not know what was going on. I believe that they were thinking that I am filming the whole time. Hence, the stares emitted a sort of chiraptophobia. This happend with strangers in the subway as well as on the street." (PF-06, paragraph 10)*[14]

Another purpose of this inquiry was to investigate how new innovations get embedded into a societal context and if this consequently leads to any kind of distortion in the communication. In a variety of scenarios, business and private, the participants were asked to take off the device by their counterparts. Some participants stated that the barrier created through this new technology was confusing or even intimidating to their respective conversion partner. Others stated that it was simply not polite to wear the device in a face-to-face conversation, due to the strict rules of social etiquette.

13. „Durchweg könnte man sagen eher positiv, also mehr so Fragen wie "Ist das jetzt Google Glass?", "Woher hast du die?", "Funktioniert die gerade?", "Kann ich sie auch mal aufziehen?", "Was zeigt dir die grade an?", "Warum hast du die gerade auf?". Das kam eigentlich immer. Es war jetzt keiner dabei, der sie mir sofort runterschlagen wollte. Eigentlich waren die Leute positiv überrascht."

14. „Dürfen sie schauen? Werden sie gefilmt? Ich hatte das Gefühl, dass mein Umfeld in erster Linie überhaupt nicht wusste was das ist. Ich glaube die dachten, dass ich meine nächste Umgebung die ganze Zeit filme. Und dementsprechend haben die Blicke eine gewisse Berührungsangst ausgestrahlt. Sowohl von den Fremden in der U-Bahn als auch auf der Strasse."

> *"During conversations of private matters yes, even more if you have to concentrate or a very strict set of social rules apply." (PM-08, paragraph 34)*[15]

> *"In a meeting at work I was told to take them off [...] because he felt uncomfortable and could not get used at all to the feeling that a certain kind of barrier was between us" (PF-04, paragraph 37)*[16]

The following chapter will summarize the initial codes and provide a deeper insight of how the focused codes for the theme "outside reactions" have been created.

4.1.1.2.2 Focused codes - Outside Reactions

The above listed and elaborated initial codes led to a total of three focused codes which have been created for the theme "outside reactions".

need for sensitization
positive curiosity
social convention / take off

Figure 25: Focused Codes - Reactions

First, the "need for sensitization" which is extracted from the initial codes "irritated looks from strangers", "people assume constant recording", "skeptical people", "seen as toy" and "people avoid glass". This focused code summarizes the need for a broader understanding of this new technology by the masses. The devices are too novel to be already integrated into society and hence the people react to it with stares, curiosity and even fear.

15. „Bei Konversationen im privaten Bereich ja, gerade wo man sich drauf konzentrieren muss oder es relativ strikte elitäre Regeln gibt."

16. „In der Arbeit wurde mir in einem Meeting gesagt, dass ich sie abnehmen soll [...] weil er sich unwohl gefühlt hat und sich überhaupt nicht an das Gefühl gewöhnen konnte dass so eine Art Barriere zwischen uns war."

The second focused code "positive curiosity" which is derived from the initial codes "social surrounding positive", "social surrounding curious", "strangers curious", "conversation starter" and "positive reaction from stranger". This focused code represents the overwhelmingly positive and curious reaction from strangers as well as the social surroundings, which, as the initial codes show, prevail in comparison to the negative reactions regarding the device.

Thirdly, the code "social convention" is derived from the codes "asked to take off", "skeptical people" and "people avoid glass". This result shows that the wearer of such a device should and has to be aware of his or her surrounding and needs to be conscious as to when to wear such a device and in which situation it might be inappropriate. This is also due to the fact that the wearer as well as others might feel uncomfortable when the device is worn.

4.1.1.3 Communication

4.1.1.3.1 Initial Codes - Communication

The theme "communication" was designed to examine any alterations that happen to the participants while in a face-to-face conversation. This chapter does not include the changes regarding digital communication such as phone conversations or texting.

The following table will give an overview about the most mentioned codes regarding the change of face-to-face communication.

Communication	Frequency absolute	Frequency normalized
device advocates isolation	7	100
did communicate differently	6	85,7
people talking differently to wearer	5	71,4
in the way of communication	2	28,6
not talking differently to people	2	28,6
people did not talk differently to wearer	2	28,6

Table 7: Initial Codes - Communication

The most assigned code was "device advocates isolation". This refers to the instances where the participants felt that they have been distracted through the device in a manner that they had difficulty following the conversation they were having. This distraction advocates the isolation of the wearer from their social surrounding since they are not fully, mentally present and the attention is constantly split between the real and the digital world.

> *"That also stroke my attention when a friend told me something and I forgot it two minutes later. Even though one could only see the clock and nothing of actual interest." (PM-08, paragraph 14)*[17]

The device did not only support the act of isolation in face-to-face conversations but also in other situations. Although this phenomenon does not affect the face-to-face communication directly, it shows that, through the wearing of the device, a constant distraction is indeed happening and is hence not only in the way of communication, but also of other everyday life activities.

> *"I find it difficult when using the navigation [...]. As a consequence one does not pay attention to the environment. I found this a little difficult in the beginning, since one almost bumps into people or, what almost happened to me, cross a red light." (PM-08, paragraph 4)*[18]

When examining the actual communication, the participants noted that they, as well as their social surroundings, did talk differently when the device was worn. The codes "did communicate differently" and "people talking differently to wearer" imply that this phenomenon is taking place on the sender and the receiver side of the conversation.

17. „Das ist mir auch aufgefallen, als mir meine Freundin was erzählt hat und ich zwei Minuten nicht mehr wusste was sie gesagt hat. Obwohl nur die Uhr zu sehen war und nicht irgendwas interessantes."

18. „Grad bei der Navigation finde ich es schwierig. [...] Dadurch achtet man auch nicht mehr so wirklich auf seine Umwelt. Das fand ich so ein bisschen schwierig am Anfang, weil man fast mit Leuten zusammenstösst oder, was mir fast passiert wäre, über eine rote Ampel läuft."

> *"I always noticed it when I was wearing the glasses and also through my conversation partner. Either he was looking at the glasses or I noticed that he talked differently to me." (PM-05, paragraph 4)* [19]

> *"When I was sitting next to my girlfriend, I talked to her but I was also always looking at the upper right. That is the way I talked to her. Face-to-face did get a whole new meaning." (PM-05, paragraph 10)*[20]

The code "in the way of communication" supports the above mentioned findings. The participants noticed that a barrier has been created through the device whilst being in a conversation.

> *"Sometimes the glasses appear to be in the way. That was a little like a wall in a conversation." (PF-04, paragraph 19)*[21]

Since only a minority of the participants did not notice any alterations while wearing the device, the codes "not talking differently to people" and "people did not talk differently to wearer" have not been taken into consideration for the focused codes in the following chapter.

4.1.1.3.2 Focused Codes - Communication

When generalizing the initial codes, two focused codes emerge from the data regarding the theme of "communication".

The first being "isolated through the device", which was derived from the most dominant code "device advocates isolation". The general notion of the interviews imply that through the constant wearing of the device, the participant was not only distracted but isolated from his or her social surrounding and the "outside world".

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19. „Ich habe immer gemerkt, dass ich sie aufhabe und auch immer an meinem Gegenüber gemerkt, dass ich die Brille aufhabe. Entweder hat er mir immer auf die Brille geschaut oder ich habe gemerkt, dass er anders mit mir spricht."
20. „Als ich neben meiner Freundin saß habe ich zwar mit ihr gesprochen, aber immer nach oben rechts geguckt. Und so habe ich auch mit ihr gesprochen als ich ihr gegenüber saß. Face-to-face hat das irgendwie eine ganz neue Bedeutung bekommen."
21. „Manchmal kam mir die Brille ein bisschen so vor als wäre sie im Weg. Das war zum Teil ein bisschen wie eine Mauer beim Gespräch."

isolated through the device

device in the way of face-to-face communication

Figure 26: Focused Codes - Communication

The second focused code "device in the way of face-to-face communication" incorporates a variety of codes: "did communicate differently", "people talking differently to wearer" and "in the way of communication". The barrier created through the device leads the wearer as well as the social surroundings to communicate differently in comparison to a normal face-to-face conversation and is hence seen as something that is in the way, since it offers an additional channel of distraction.

Memo Social Etiquette

It might be useful to further inquire about a possible new social etiquette which could be established through devices like Google Glass. Apparently these devices advocate isolation and are in the way of social interaction, which could be considered as rude or impolite. This may also be an indicator that new social norms may replace the old ones since a paradigm shift already happened in the case of smartphones (Lenart et al., 2010). People are allowing others to enter and exit their social reality through smartphones and other mobile devices. A question that arises is hence if smartglasses will further support this kind of behavior or, reduce it since the technology is closer to the senses. The developers of the Google Glass project believe that the device will cause less distraction than a traditional smartphone since the wearer is not looking down at a device, but can rather see his or her environment (Topolksy, 2013).

This would also mean that although the technology is *in the way*, it could also be less obtrusive than other forms of communication devices like smartphones or tablets, thus creating new behavioral rules of what is acceptable and how technologies may be used in social interactions.

Figure 27: Memo Social Etiquette

4.1.1.4 Privacy

4.1.1.4.1 Initial Codes - Privacy

This chapter will treat the theme of "privacy". In this context the digital privacy that may be endangered through new technology, will be discussed. It will elaborated whether the participants believe that devices like smartglasses present an additional endangerment of their privacy, as well as if privacy is of importance in their daily use of electronic devices such as smartphones.

Privacy	Frequency absolute	Frequency normalized
privacy endangerment	11	100
privacy important	5	45,5
privacy control important	5	45,5
privacy problem with text recongition in public	4	36,4

Table 8: Initial Codes - Privacy

First, the code "privacy endangerment" has been assigned most, which implies that most of the participants believe that devices like Google Glass create an additional endangerment of their privacy.

> *" [...] I think that an endangerment of privacy is automatically given with every new technology and every possibility of cross-linkage of data. But I can not grasp it because I have to little knowledge. My fear of this is too small in order for me to be worried. (PF-02, paragraph 46)*[22]

Although most of the participants believe that devices like Google Glass represent an additional endangerment of their privacy, only half consider their digital privacy as important. To four out of ten participants the control about their privacy settings is very impor-

22. „[...] ich glaube, dass mit jeder neunen Technologie und jeder Venetzungsmöglichkeit von Daten eine Gefährdung von Privatsphäre automatisch dabei ist. Aber ich kann das nicht greifen, weil ich da zu wenig Wissen habe. Meine Angst ist noch zu klein davor, als das ich mir Sorgen machen würde."

tant. This includes knowing what content is uploaded to the internet and the ability to immediately delete or censor this content if necessary.

> *"My consent in regard to the uploaded data is very important to me. I stand by it. I am very restrictive with the things I do not want to see online." (PM-05, paragraph 44)*[23]

Others have a problem with the immediate surrounding hearing what the wearer is doing on the device. Since the device is mostly voice and gesture controlled and does not offer an alternative text input, the participants had to perform Google searches and the writing of text messages by voice. This led some participants to feel uncomfortable in certain social situations.

> *„Anonymously haven my data taken from me is OK but in social situations it would be weird. Talking to Glass and everyone hearing exactly what I am going through and the fact that other people control my device just by saying the trigger words." (PM-01, paragraph 39)*

Only one out of ten participants does not see an additional endangerment of privacy through the device. The reason for this statement is that it does not matter if a smartphone or Google Glass is used since both devices track the user´s location data and hence no difference should be made.

> *"No because i.e. my smartphone also tracks me. It really does not matter if I google something via Glass or my smartphone. Google is Google. On my smartphone, Google knows my exact position or e.g. knows my history of searches. Thus, not really." (PF-09, paragraph 46)*[24]

This opinion has not been taken into account in the following chapter since this study aims for generalizability rather than particularity.

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23. „Mir ist aber wichtig, dass die Inhalte von mir willentlich hochgeladen wurden. Dazu stehe ich auch. Und bei den Sachen von denen ich nicht will, dass sie online sind, bin ich sehr restriktiv."

24. „Nein, weil z.B. auch mein Handy mich ortet. Es ist ja egal ob ich jetzt etwas über Glass google oder mein Handy google. Google ist erstmal Google. Auch Google auf meinem Handy weiss meinem Standort z.B. oder kennt meine History was ich gegoogelt habe. Von da her eigentlich nicht."

4.1.1.4.2 Focused Codes - Privacy

In this chapter, two focused codes have emerged from the interview data, which summarize the general notions of the theme "privacy".

additional privacy endangerment privacy importance questionable

Figure 28: Focused Codes - Privacy

The first focused code that has been developed was "additional privacy endangerment", which has been constructed of the initial codes "privacy endangerment" and "privacy problem with text recognition in public". Generally, it refers to the common feeling of the participants that devices like Google Glass represent an additional endangerment of their digital privacy. The thought that has been most quoted throughout the interviews was that through the additional connection of yet another digital, head-worn device, the privacy has to be further endangered.

The second code "privacy importance questionable" is derived from the initial codes "privacy important" and "privacy control important". Only half of the participants consider their privacy as important, while five out of ten participants believe that the control of their data is important. This led to the understanding that digital privacy endangerment is an aspect that the participants are willing to sacrifice in order to gain the benefit that smartphones and other devices such as smartglasses have to offer.

4.1.1.5 Restrictions

4.1.1.5.1 Personal Restrictions

a) Initial Codes - Personal Restrictions

The chapter about restrictions is separated into two sub-chapters. Firstly, personal restrictions which will present all findings related to the personal feelings of the participants while wearing the device in a public or private environment. The second part will treat the subject of technical restrictions, which are all topics related to technical issues during

the actual usage. The following table will give an overview of the initial codes related to the personal restrictions the participants encountered when using the device.

Personal Restrictions	Frequency absolute	Frequency normalized
looks ugly	4	100
exhausting	4	100
feel uncomfortable	3	75
learning curve	2	50
outsider feeling	2	50
no restrictions	2	50
distracted	2	50

Table 9: Initial Codes - Personal Restrictions

Mostly the female participants stated that the look of the device is giving them a feeling of embarrassment in public places. The code "looks ugly" is closely related to the code "feel uncomfortable" which represents an uneasy state of mind when wearing the device. Although this seems like a minor problem, it still contributes to the overall experience and the decision to not wear the device at all times.

> ***"Furthermore you certainly want to look good at some days, even more on a day when you are tired and the device looks very technical and does not necessarily go with your look." (PF-04, paragraph 23)***[25]

As mentioned above, the code "feel uncomfortable" relates to unpleasant situations which were generated through the device. Mostly the situations involved a social interaction, which made the wearer feel uncomfortable through the reactions of their close social surroundings or strangers.

25. „Weiterhin ist es natürlich so, dass man an gewissen Tagen einfach gut aussehen möchte, gerade vielleicht an einem Tag wo man ein bisschen müde ist und das Ding dann sehr technisch aussieht und es dann nicht zwingend so passt was den Look angeht."

> *"When skeptical people were standing there and I noticed that they are in fear of being filmed then I felt rather uncomfortable" (PF-10, paragraph 22)*[26]

The other code that stood out was "exhausting", which relates to the overall experience the participants had in the tested time. The prolonged use of the device made the wearers feel exhausted due to the technical construction of the device (e.g. small display) and due to the technical problems such as the weak connection with their phone. Although these are technical issues, it is still listed under personal restrictions since other participants did not feel as strongly about these problems.

> *"At the end of the week it got drastically reduced and also a little exhausting." (PF-04, paragraph 3)*[27]

The other patterns that have been found will not be discussed here but rather in summarized into focused codes in the following chapter.

b) Focused Codes - Personal Restrictions

Only two participants experienced no personal restrictions which are not taken into account in this chapter, since it only affects the minority.

Still, a total of two focused codes have been created, the first being "feel uncomfortable", which is derived from the initial codes "feel uncomfortable", "exhausting", "learning curve" and "outsider feeling". The focused code represents an overall unpleasant feeling whilst wearing the device related to uncomfortable situations, that the device creates. This is closely related to the outsider feeling the participants get through the device. Also technical restrictions such as the steep learning curve compared to a smartphone and the feeling of exhaustion due to the design of the device are incorporated into this code.

26. „Wenn da halt total skeptische Leute standen, wo ich gemerkt habe, dass sie jetzt Angst haben, dass ich sie filme, dann habe ich mich schon eher unwohl gefühlt."

27. „Zum Ende der Woche wurde es dann wesentlich weniger und zum Teil auch ein bisschen anstrengend."

feel uncomfortable design not satisfying

Figure 29: Focused Codes - Personal Restrictions

The second focused code, "design not satisfying" is deducted from the initial codes "looks ugly", "exhausting" and "distracted". All of these codes are believed to play an important role of the overall decision to actually wear the device over a prolonged period of time and is hence seen as a crucial personal restriction.

4.1.1.5.2 Technical Restrictions

a) Initial Codes - Technical Restrictions

As mentioned above the second sub-chapter regarding restrictions will present all findings related to the technical difficulties that the participants encountered. The by far most applied code related to technical restrictions was "technical problems with use", which was applied whenever a participant had a technical issue with the device.

Technical Restrictions	Frequency absolute	Frequency normalized
technical problems with use	23	100
headache	5	21,7
menu unorganized	4	17,4
english language barrier	3	13

Table 10: Initial Codes - Technical Restrictions

The main technical complaints included the weak battery life, the position and visibility of the display as well as weak connection with the tethered smartphone. These issues restricted the daily use of the device and led to a certain frustration among the participants, since most of them wanted to use the device over a longer period of time.

„I have a lot of technical complaints. Battery life is terrible. It´s so bad I wish I could plug it in all the time. I charged it to 100% and didn´t even use it and it´s down to 30% just on standby. [...] The display itself keeps changing the brightness which confuses me at first because I want it to be as bright as possible because I can´t look at it. If there is a colored background behind Glass, I can´t really read too much." (PM-01, paragraph 33)

Another issue presented itself during the actual use of the device. Half of the participants complained about getting a headache, which partly led the wearer to take off the device and not use it over a prolonged period of time.

"The only thing was that I got a headache when I used it over a prolonged period of time. Even more when playing games - I had to take them off after ten minutes." (PM-08, paragraph 18)[28]

Other issues included the unorganized menu and the fact that the language setting of the device was only able to handle English. Since the study took place in Germany, problems arose with e.g. the language recognition of street names, restaurants and alike.

b) Focused Codes - Technical Restrictions

The evaluation of the initial codes led to two focused codes. The first being "many technical restrictions", which incorporates all of the initial codes as seen in the previous chapter. The vast technical restrictions make the device very difficult to use over a prolonged period of time. This is due to the problematic connection with the smartphone, the weak battery life and the visibility of the display.

many technical restrictions

restricted use of applications

Figure 30: Focused Codes - Technical Restrictions

28. „Das einzige ist, dass ich irgendwann Kopfschmerzen bekommen habe, wenn ich länger irgendwas probiert habe. Gerade bei den Spielen - nach zehn Minuten musste ich sie dann abnehmen."

The second focused code, "restricted use of applications" is closely related to the first focused code. Due to a variety of technical issues the applications used by the participants during the tested time could sometimes not be executed properly and presented problems during the actual usage. This included problems with i.e. the navigation, the phone functionality and so forth. From a technical point of view, the use of the device is very restricted, since some applications did simply not work, according to the participants. Although the personal and the technical restrictions are treated as two different entities in this chapter, both are closely related and examined in order to understand that the use of the device is still problematic for a variety of reasons.

Memo Restrictions

It seems important to further examine the restrictions that apply to to use of smartglasses. Besides personal and technical boundaries a legal framework must be taken under consideration. The restrictions also closely relate to the situational use of the device since they define the very parameters under which the device can or can not be used. Hence the research must include a widened view of the different restrictions that apply and further elaborate these in the main study. Furthermore restrictions might correlate with other future categories such as privacy, social etiquette and the use of the device in different places. The following illustration shows what kind of restrictions may apply to the use of smartglasses.

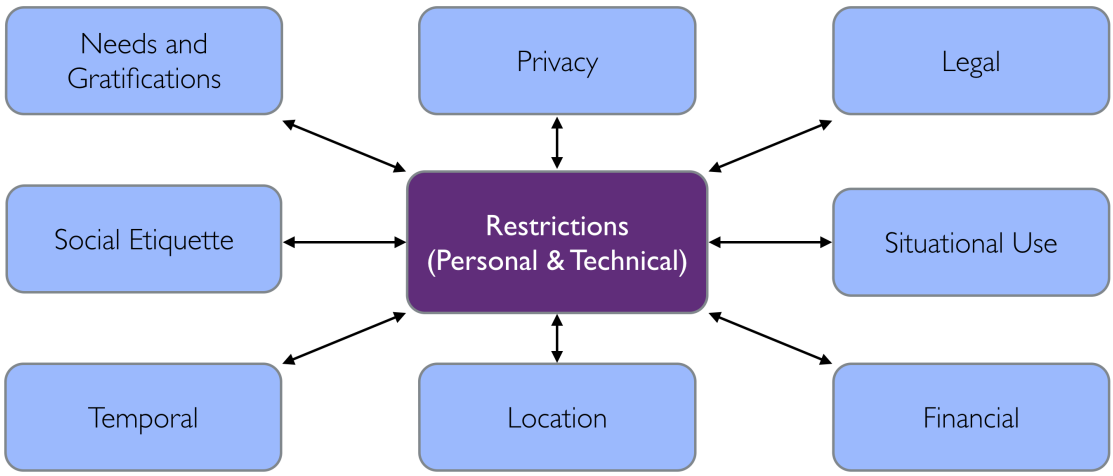

Figure 31: Memo Restrictions

4.1.1.6 Application Usage

4.1.1.6.1 Initial Codes - Application Usage

The theme "Application Usage" was designed in order to see how the device would actually be used in everyday life. The most used applications on Google Glass were "camera", "clock", "news", "phone", "google" and "navigation". The following table of initial codes gives an overview of the most used applications with their respective frequencies.

Applications Used	Frequency absolute	Frequency normalized
missing applications	13	100
used for photos	10	76,9
used as clock	10	76,9
used to read news	7	53,9
want to use more	6	46,2
used as telephone	5	38,5
used for google	5	38,5
used for navigation	5	38,5
used for nearby places	2	15,4

Table 11: Initial Codes - Applications Used

A very dominant code is "missing applications" which was also the general notion found in the interview data. Most of the participants stated that they wanted to use the device more but were not able to do so due to the very restricted offer of applications. This disappointment however was still seen with a certain amount of optimism, since most of the participants evaluate the lack of applications as a natural process of technological innovation.

> *"I also had the first iPhone before there were any apps. Somehow it s a little comparable. Of course there is a huge potential and in 20 years probably everybody will wear some kind of device like this."(PM-05, paragraph 32)*[29]

29. „Ich hatte ja auch das erste iPhone bevor es die ganzen Apps gab. Irgendwie ist das so ein bisschen

Still, some applications were used more on the device than on the traditional smartphone. Generally speaking, most of these applications were "hands-free" applications such as the camera, the watch, the phone and navigation. In this context a "hands-free" application is defined as a functionality which is assumed to be more convenient to use on the form factor "Glass" than on a traditional smartphone.

> *"For me, one of the main functions that I would rate as positive was the constant display of the clock." (PM-08, paragraph 20)*[30]
>
> *„Of course the camera. I was taking pictures of so many stupid things.“ (PM-01, paragraph 21)*
>
> *"Taking calls or making calls was very useful." (PF-09, paragraph 6)*[31]

The above named examples are meant to illustrate that, although the functionality was limited at the tested time, the basic smartphone functions could already be replaced to a certain extend.

The following chapter will summarize and explain the focused codes based on the initial findings.

4.1.1.6.2 Focused Codes - Application Usage

A total of three focused codes, which capture the essence of the theme "application usage" have been developed.

The focused code "missing applications" which has been directly derived from its identical initial code as well as from the code "want to use more". It was not only the most assigned code but also the prevalent opinion amongst the participants.

The second code "used to replace basic smartphone functionality" stems from the actual use of applications. When examining the used applications along with the frequency of use, it becomes clear that no uses in comparison to the smartphone have been devel-

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vergleichbar. Natürlich hat das wahnsinnig Potenzial und in 20 Jahren wird wahrscheinlich jeder, wie auch immer geartet, mit so einem Gerät rumlaufen.“

30. „Was bei mir ein wichtiger Punkt ist war, dass ich die Uhrzeit immer da hatte. Da war eine der Hauptfunktionen, die ich positiv empfand.“

31. „Gespräche annehmen oder auch jemanden anrufen, was ganz praktisch war.“

oped or used yet. Hence the application usage is still very closely related to the use of the smartphone.

missing applications

used to replace basic smartphone functionality

situational use

Figure 32: Focused Codes - Application Usage

The third focused code, "situational use", is extracted from the different situations the device was used in. Due to a variety of restrictions (see chapter "Restrictions" on page 112) it is not possible to use the device as a complete replacement of the traditional smartphone. Hence it is used to replace the smartphone in certain situations with applications such as navigation, phone calls, clock etc., and not as an "all-day-device".

4.1.1.7 Smartphone Comparison

4.1.1.7.1 Initial Codes - Smartphone Comparison

Although the inquiry was mostly about the implementation of the Google Glass device into the everyday lives of the participants, it was also important to see how the smartglass compares to a regular smartphone and how the usage of the latter changed while wearing it.

Smartphone Comparison	Frequency absolute	Frequency normalized
heavy smartphone usage	10	100
will replace smartphone	7	70
less smartphone usage	6	60
same smartphone usage	4	40
will be complimentary	3	30

Table 12: Initial Codes - Smartphone Comparison

Firstly, the established smartphone usage of the participants was examined in order to gain an insight into the existing behavior of mobile communication. This observation showed that all of the participants are heavy smartphone users. In this context "heavy usage" is defined as a steady, "always on" behavior and implies that the smartphone is very integrated into the users life for all kinds of activities ranging from the basic functionally such as the phone and other means of communication to more advanced applications such as cooking, sports, notes and so forth. No difference of use could be found between female and male participants.

> *"A lot. Everywhere. At home, when working out, at work, as an alarm, as the first tool of communication. My battery doesn´t even last one day. I would dare to say that I use my phone four hours a day." (PF-02 paragraph 26)*[32]

When comparing the smartphone and the Google Glass device, two findings can be drawn. First, most participants used their smartphone less than usual when using the device. It is important to point out that the changed usage refers to certain applications or situations, in which Google Glass was the preferred option compared to the smartphone.

> *"Yes, precisely for things like navigation - how I walk to work or how excatly I get to a certain location. I use "directions" on my smartphones, but not as much as with Glass since it was so interesting to see what was nearby in order to get a "big picture". I did not use my smartphone for pictures at all." (PF-04, paragraph 33)*[33]

The second finding explores if the participants would wear or buy such a device. This does not necessarily refer to the Google Glass device, but rather if smartglasses with another design and more functionally could replace the smartphone in the future. Most of the participants could see themselves wearing a more advanced version in the future.

32. „Viel. Überall. Zu Hause, beim Sport, bei der Arbeit. Als Wecker. Als erstes Kommunikationsmittel. Mein Akku reicht noch nicht mal einen Tag. Ich würde mich trauen zu behaupten, dass ich mein Telefon vier Stunden am Tag benutze."

33. „Ja, also gerade eben für so was wie Navigation, wie ich zur Arbeit laufe oder wie ich genau wo hin komme. Ich benutzte „Directions" zwar auch auf meinem Handy, aber nicht so häufig wie mit Glass, auch weil es so interessant zu sehen war was so in der Nähe ist und eben um so eine Art „big picture" zu bekommen. Für Fotos habe ich mein Handy gar nicht mehr benutzt."

> *„I´m hoping they do. I don´t really want a cellphone anymore. I´m desperately hoping that they work on the next versions of these things which I would then buy but 1500 $ is just too expensive for something that's half of a cellphone." (PM-01, paragraph 29)*

Others could see themselves wearing a device like Google Glass, taking into account that the device will not replace the smartphone but rather exist as a complementary device, that can be used in certain situations for certain tasks.

Memo Location / Influence Form Factor

It might make sense to look at the location of use more closely. What relation do smartglasses have to a certain place? How will they be used? How does the form factor influence the use of apps and the resulting behavior?

All participants have smartphones, which are an integral part of their lives. Glass does not have as many applications, and most of them, at least the most useful ones, are designed to be executed outside the house. These include all fitness apps but also all "near me" applications. The glasses hence might be able to replace in smartphone in certain situations due to the "hands-free heads-up display" form factor which can deliver additional sensory input. In this scenario a paradox would arise since the low social acceptance might influence the way the device is used in public although the main use might be outside the home. This paradox might trigger certain behavioral alterations since the device is a non-integrated part of everyday life.

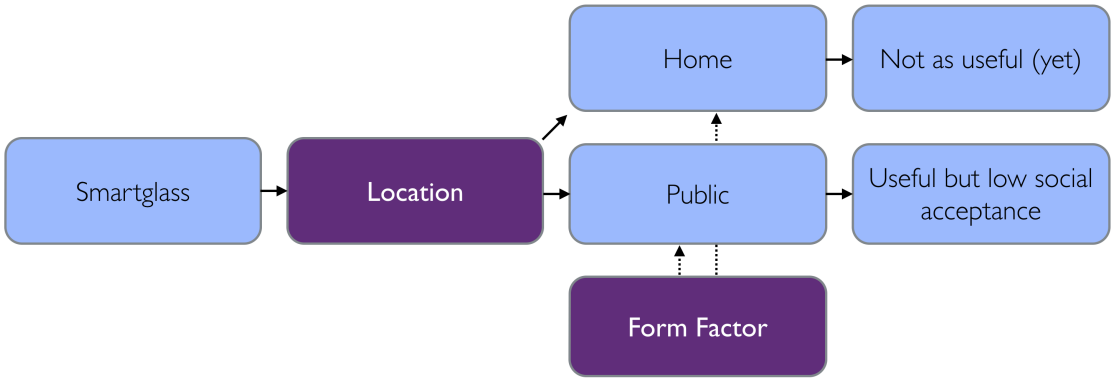

Figure 33: Memo Location / Influence Form Factor

4.1.1.7.2 Focused Codes - Smartphone Comparison

The above presented initial codes generate two focused codes, which summarize the general notions of this theme.

possible smartphone replacement less smartphone usage

Figure 34: Focused Codes - Smartphone Comparison

First, "possible smartphone replacement", which was the general statement of the participants regarding the future of the device and derived from the initial code "will replace smartphone". The implication being that most participants believe that devices like this possess the potential to replace the existing smartphones and ultimately the way the user interacts with technology. Furthermore, it outnumbered the code "will be complimentary".

Secondly, the code "less smartphone usage", which has been created from the identical initial code, implies an decreased usage of the phone in the tested period. It has been made explicit by the participants that the device can only replace the smartphone in some aspects of everyday life. Hence, the usage of the latter was only declining when fulfilling tasks Google Glass can replace.

Since the initial code "heavy smartphone usage" has only been used in order to explain the behavior of the participants in regard to their mobile devices, no focused code has been created.

4.1.1.8 Everyday Life Change

4.1.1.8.1 Initial Codes - Everyday Life Change

One of the main aims of this study is to elaborate how devices like Google Glass are used and if they have the potential of changing the routine of the everyday live. In this case a change is defined as something the user would not normally do with his or her smartphone. This also includes activities that the users performed more often than with their smartphones.

The initial code "Everyday Life Change" was applied with a total frequency of 25, which was hence the most used code in the pilot study. There are various examples of how the device altered the everyday routine of the participants. As already discussed in the chapter "Application Usage" on page 118, most of the alterations occurred when using "hands-free" applications such as the camera, the watch, watching the news. the phone or the navigation.

> *"You have to fish less for your smartphone. Actually I believe in these hands-free devices. I think that this is the future." (PF-02, paragraph 6)*[34]

Although the application variety was very limited at the tested time compared to a smartphone, there are other applications that had an impact on the participants.

The application "Google Now" is an application which retrieves information without having to specifically ask for it as the user would have to in a traditional search engine. The information is displayed based on the users preferences, location and other personal data. The application is able to display sport results, calendar entries, nearby points of interest and so forth. Although the application already exists on traditional smartphones, some participants stated, that viewing the content on the novel form factor as well as the additional functionality make it unique on Google Glass.

> *„'Google Now' was probably way better on Glass than on any other medium. [...] It does it differently than "Google Now" does on my phone. It says a specific time on the phone but on the Glass it's a countdown timer. So it says the game starts in two hours vs. at a specific time so I can plan my day around this a little bit differently." (PM-01, paragraph 7)*

Another aspect of everyday life that has been changed during the tested period is how the participants interacted with technology during activities such as sports. The device features a variety of applications designed to support the wearer during the daily workout. This includes activities such as biking, jogging and other exercises. The form fac-

34. „Man muss halt weniger nach seinem Handy kramen. Ich glaube auch irgendwie an diese Hands-free-devices. Ich denke, dass das die Zukunft ist."

tor makes it possible to use the sense of vision and hence provide a heads-up display which displays additional information.

> *"The glasses tell your average speed and say if you have slowed down or if you need to step on it [...]. Through the extended sense, the visual sense, I could see through the touch of my finger how I was running and that is incredibly motivating". (PF-02, paragraph 40)*[35]

The following example shows how everyday life can be facilitated through the use of head worn displays. In this scenario the participant was able to get a recipe and prepare a meal, without having to touch the device.

> *"I was cooking and able to get a recipe, which was quite nice. All that without getting my hands dirty or rather without getting my device dirty." (PM-01, paragraph 5)*

Through the constant "always on" state, the participants expressed that certain tasks, such as taking photos have been performed more often. Others state that they performed actions they usually do not carry out on their smartphones.

> *"What I really liked, what is usually hard for me, is to read the news on a daily basis, since I simply don´t have that much time. In the morning, when I was in the metro or when I walked to work, I watched a video of the news on CNN. That was pretty cool." (PF-04, paragraph 9)*[36]

The following chapter will summarize the main findings that are related to the change of everyday life and elaborate the created focused codes.

35. „Die Brille gibt dir die Durchschnittsgeschwindigkeit an und redet dir auch ins Ohr ob du jetzt langsamer geworden bist oder ob du ein bisschen mehr Gas geben musst. [...] Durch den erweiterten Sinn, den man nutzt, dem Sehsinn, konnte ich durch einen Fingerklick sehen wie ich laufe und das hat unglaublich motiviert."

36. „Was ich besonders cool fand, was mir normalerweise schwerfällt, ist die Nachrichten täglich zu lesen, weil ich einfach nicht so viel Zeit habe. Wenn ich morgens in der U-Bahn sitze, oder zur Arbeit gelaufen bin, habe ich mir die News als Video von CNN angeschaut. Das war ziemlich cool." (PF-04, Absatz 9)

4.1.1.8.2 Focused Codes - Everyday Life Change

The chapter about the alteration of everyday life routines features only one initial code: "everyday life change". Still, when inspecting the interview findings, two focused codes have been developed. This is due to the fact that the initial code presented is a general notion which has been used to detect the change of everyday lives in the interview findings. It still has to be broken down in order to understand what implications can be drawn from this theme.

situational use triggers unknown needs

Figure 35: Focused Codes - Smartphone Comparison

First, the focused code "situational use" has been generated. As seen in this chapter, as well as in the chapter "Smartphone Comparison" on page 120, the device can be useful in certain situations, but has not yet the capacity of replacing the smartphone. Hence, parts of the everyday life experience can be changed or enhanced through the use of the devices like Google Glass, but the participants state that it is not yet meant to be used all day like a smartphone.

The second focused code, "triggers unknown needs" refers to another aspect of change. The alterations that have been made through the device are not only achieved through new or "hands-free" applications, but rather through "old", common functionality which is either not used frequently or not used at all. Hence, the innovation triggers unknown desires to use these applications more than on the smartphone i.e. to take more photos.

This concludes the findings of the pilot study. The next chapter will explore the findings of the focus group discussion, which together with the findings of the pilot study were used to create the questions for the main study as seen in the chapter "Summary Focused Codes and Implications for Main Study" on page 131.

4.2 Focus Group Discussion Findings

This chapter aims to elaborate the held focus groups discussion. The discussion has been used as a tool to further discover new notions that have not been discovered in the pilot study interviews with the ultimate goal of further refining the questions for the main study.

This particular discussion has been held with five participants plus the researcher. The interviewed group has been a part of the pilot study and includes the participants PF-02, PM-05, PM-07, PF-09 and PF-10. As the designated numbers indicate, the group has been constructed of three female and two male participants with a mean age of 27,4 (*SD=1,52*). At the time the interview was held, three of participants worked at an office, one was a student and the other one was an airplane pilot.

The following chapter will further explore the newly assigned initial codes and their meaning for the creation of the proposed questions for the main study.

4.2.1 Findings

4.2.1.1 Initial Codes - Focus Group Discussion

While most of the initial codes remained the same as in the pilot study, a variety of new initial codes have been assigned. Please note that the codes which have also been assigned in the pilot study have not been listed here since the chapter aims to explore notions that have not been discussed previously. Furthermore, all codes that have only been assigned once have been discarded, similar to the pilot study. For a full list please refer to the appendix.

The new codes can partly be explained through a new set of questions, but also through the dynamic of the discussion. Through the participation of five individuals, other topics arose which led to the following table of results.

The first initial code "missing AR applications", with a total frequency of 15 implies that the participants felt that the device is missing augmented reality applications for the use in everyday life. A variety of examples have been named by the participants in which the smartglass would have a significant advantage over a smartphone. These include guided city tours, navigation with overlaid information and testing new hairstyles.

Focus Group Discussion	Frequency absolute	Frequency normalized
missing AR applications	12	100
information easily accessible	6	50
distraction same as with smartphone	6	50
rather use smartphone	5	41,7
social etiquette important	4	33,3
would rather wear smartwatch	3	25
becomes normal at some point	3	25
content sharing important	3	25
would rather wear glass than smartwatch	2	16,7

Table 13: Initial Codes - Focus Group Discussion

Although not always mentioned as an advantage over smartphones, the code "information easily accessible" implies that the data which is accessed through the device is more convenient to obtain. This can be an advantage when being alone, but disturbing when in a social environment. The code "social etiquette important" is directly related to this notion since there is no set of social rules which applies to this new technology yet. Google itself made an effort to define an etiquette guide in order to avoid uncomfortable situations when in public or with friends (Google Inc., 2013b).

The code "distraction same as with smartphone" implies that the participants felt that the level of distraction is the same for both devices. Since the device offers the same basic functionality, the participants would prefer using their smartphone over the smartglass.

When asked if the participants would rather wear a smartwatch, three of them inclined towards wearing the wrist-computer, while two participants would wear a smartglass, since the possibilities of use cases are potentially higher. Although a watch is more socially accepted at the given point in time, the code "becomes normal at some point" implies that the device did not disturb the participants and the number of uncomfortable situations has been decreasing.

Another topic that was discussed is the sharing of content. A smartphone offers the possibility to show the desired content to the person next to the user. The code "content

sharing important" implies that the device does not offer this possibility and is hence more difficult to manage in a social situation.

4.2.1.2 Focused Codes - Focus Group Discussion

This chapter summarizes the focused codes for the focus group discussion, which will later in this study be compared to the focused codes of the pilot study in order to refine the questions for the main study.

The first focused code "missing augmented reality applications", with a total frequency of twelve, is directly derived from the equally named initial code. The code implies that the participants would wish for more "real" augmented reality applications which can provide a benefit for their everyday lives. For a definition of "true" augmented reality please refer to the chapter "Augmented Reality" on page 10.

The code "smartphone preferred" is derived from the initial codes "would rather wear glass than smartwatch", "would rather wear smartwatch", "becomes normal at some point" and "rather use smartphone". Although the participants had different opinions on what wearable device to use, and even though they become "normal at some point", all of them would prefer their smartphone at this point.

missing augmented reality applications

smartphone preferred

social etiquette important

content sharing important

Figure 36: Focused Codes - Smartphone Comparison

The focused code "social etiquette important" is constructed from the initial codes "social etiquette important", "information easily accessible" and "distraction same as with smartphone". The code implies that the participants believe that, although the device makes the access to information more convenient, one has to be aware of the social envi-

ronment since the device is constantly worn. Still, this does not only apply to wearable devices, but, according to the participants, to smartphones as well.

The last focused code "content sharing important" is derived form the equally named initial code. The sharing in this context does not refer to the uploading and sharing data online, but rather to the situation when the participants wanted to show a photo or a video to a friend but could not, since the device is only suited for one viewer at a time.

Memo Situational Use

The situational use of these devices might be one of the key factors which need to be examined more extensively in the main study. Hereby it seems to be of value to ask the participants to describe their daily life with a smartphone as well as with Google Glass in order to see how these differ from each other. Furthermore it is possible to gain a more thorough insight into the situations in which the devices are used. Charmaz (2014) proposed a variety of questions that further add to the notion of exploring the daily life more carefully. Through the very limited choice of applications on Glass, the question remains whether there is one "killer-application" which makes the use of the device appealing to the masses. Initially certain industries such as the logistics and maintenance as well as the healthcare might profit even more from this kind of technology than the common consumer.

The media diary will be helpful in this context since a precise situational as well as temporal sampling takes place, which reduces the causes of probable measurement errors.

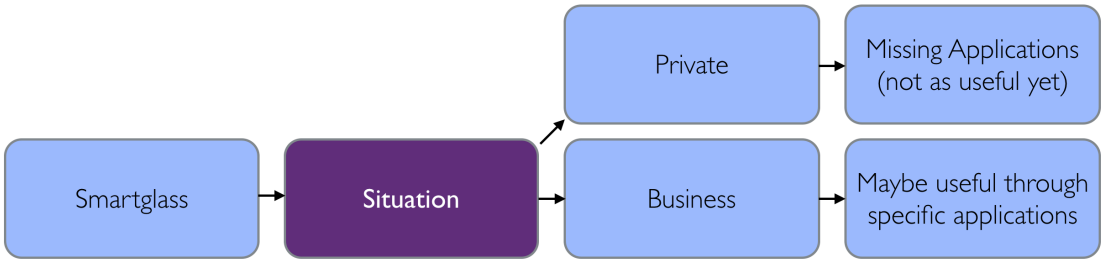

Figure 37: Memo Situational Use

The following chapter will explain the connection between the until now proposed focused codes and the creation and refinement of the proposed questions for the main study.

4.3 Summary Focused Codes and Implications for Main Study

This chapter aims to explain how the interview questions got changed from the pilot to the main study using the focused codes from the pilot study as well as the focused group discussion.

The following table displays the generated themes together with their focused codes.

Everyday Life Change	Smartphone Comparison
– situational use – triggers unknown needs	– possible smartphone replacement – less Smartphone usage
Personal Restrictions	**Technical Restrictions**
– feel uncomfortable – design not satisfying	– many technical restrictions – restricted use of applications
Privacy	**Communication**
– additional privacy endangerment – privacy importance questionable	– isolated through the device – device in the way of face-to-face communication
Outside Reactions	**Application Usage**
– need for sensitization – positive curiosity – social convention / need to take off	– missing applications – used to replace basic smartphone functionality – situational use

Focus Group Discussion
– missing augmented reality applications – smartphone preferred – social etiquette important – content sharing important

Table 14: Summary Focus Codes Pilot Study and Focus Group Discussion

As already briefly discussed in the chapter "Interviews" on page 92, the questions for the main study have been refined, taken out and added mostly because of the findings that these pilot study and group discussion focused codes provided. Still, many of the questions that have proven valuable have been adopted for the main study.

The following questions have been reformulated in order to be easier to understand and to pursue more specific aspects. In the following list, the first questions are the ones as asked in the pilot study, the second, reformulated versions, as asked in the main study.

- Did any stranger talk to you about Glass? (On the subway etc.) => How did the public react?
- How did you feel doing it? => Did you feel awkward in any social situation?
- How often and where did you use Glass? => Is there a location in which Glass is especially helpful?

Although a reformulation of the questions was very helpful to further define the overall goal, some of the questions have been taken out since they did not promise any further results. Hence some of the initial concepts have not been confirmed and were therefore not further pursued in the main study. These questions are:

- Did you at any point of time perceive reality differently?
- How would the world change if everybody would wear smartglasses?
- Were your initial expectations towards Google Glass met?

A variety of questions have been added in order to confirm some new concepts or to further inquire some of the initial notions. These questions have been designed based on the above named focused codes.

- What could have been changed?
- Did people talk differently to you?
- Would you say that Glass in a normal conversation is rather a help or a distraction?
- Which applications did you like better on Glass than your Smartphone?
- What kind of role does a known environment play whilst using Glass?
- Please compare Glass to your phone. What would be the biggest differences and similarities?
- Would you rather wear a Smartwatch?
- How did your point of view change after your week with Glass?
- Would you wear such a device?

Lastly, Charmaz (2014, p. 66) proposed a variety of grounded theory sample questions which can be adopted to the topic at hand. For this study, a few of these questions have been evaluated as useful and have been adopted accordingly to for the purpose of this study.

- Which advice would you give to somebody who wants to try or buy Glass?
- What was the most important lesson you learned with Glass?
- Could you describe a typical day with your Smartphone? And now a typical day with Glass.
- Should I know anything we have not discussed?

With the altered questions in mind, the following chapters will present the findings of the main study. An analysis as well as a discussion of these findings will be held in the chapter "Discussion and Analysis of Findings" on page 189.

4.4 Main Study Findings

The following chapters will further explore the different themes as well as their initial and focused codes which later in this study will be used as a foundation of the generated categories.

The structure of all subsequent chapters will follow the same composition as the pilot study. First, the initial codes together with their respective frequencies will be displayed in order to understand what the most mentioned notions were. The graphic representation of the data also serves the purpose of identifying possible patterns within the results. Furthermore a variety of quotes from the interviews will be included in order to underline and justify the most crucial findings.

Subsequently, the focused codes that emerged from the interview findings will be mentioned and explained for each theme. These codes are later summarized in the chapter "Summary Focused Codes" on page 174, and further analyzed and evaluated in the chapter "Discussion and Analysis of Findings" on page 189 for the purpose of finding a core category which is connected to all other categories and consequently to generate a (grounded) theory.

The following list will give an overview of the identified themes that emerged from the main study interviews:

- Outside Reactions
- Communication
- Privacy
- Personal Restrictions
- Technical Restrictions
- Application Usage
- Smartphone Comparison
- User Experience
- Market
- Places
- Everyday Life Change

Please note that all codes that have only been assigned once have not been taken into account since this study aims to find patterns and does therefore not incorporate particularities. For a complete list of initial codes please refer to the appendix.

4.4.1 About the participants

This chapter will give a brief overview of the participants that took part in the main study. The sample featured an average age of 27,3 years (*SD=6,98*), with most of the participants being between the age of 21 and 29 at the tested time. Five participants between the ages of 33 and 52 have been added to the sample as a control group in order to verify whether the results also apply to an older demographic group. The sample of the main study was hence meant to be more heterogenous than the sample of the pilot study. The focus here was hence the search for diverging cases, which could support the final theory of this dissertation (Lamnek, 2005b).

The sample featured a total of 22 males and 9 females. 23 of them are heavy smartphone users and technological savvy, while 8 participants did not use their smartphone as often and were not as interested in technology. "Medium smartphone usage" in this context applies to the participants who only use their smartphone´s basic functionality, rather than a broad spectrum of applications.

> ***"Actually only to make calls, write SMS or maybe to track music. If I need to go somewhere and have no idea how to, then I actually look at the maps." (MM-22, paragraph 38)***[37]

Furthermore, to 13 participants their digital privacy is very important, 15 claimed that it is only "medium" important and three participants stated that it is not important to them. "Medium" important in this context was applied to the participants who theoretically care about their privacy, but are not willing to give up the benefits that the loss of privacy offers, such as social networks and so forth.

37. „Eigentlich nur zu Telefonieren, SMS schreiben oder vielleicht Musik tracken. Wenn ich irgendwo hin muss und gar keine Ahnung habe, wie ich da hinkomme, dann schaue ich wirklich auf Maps nach."

> *"Difficult question. Theoretically very important, in practice you can´t do anything about it. Of course you can choose not use facebook and alike but the really important thing aren´t on facebook or anywhere else. Everything I put on facebook is not important to me. [...] Theory and practice are two different things." (MM-18, paragraph 46)*[38]

The following table will give an overview about the above presented participant demographics and will help to understand the overall sample of the main study including their technological savviness and their relation to privacy.

Gender	Frequency
Male	22
Female	9
Smartphone Usage	
heavy smartphone usage	23
medium smartphone usage	8
Technological Savviness	
tech savvy person	23
not tech savvy	8
Privacy Importance	
privacy very important	13
privacy medium important	15
privacy not important	3

Table 15: Participants Demographics

The following chapters, similar to the pilot study, will examine the initial themes of the main study and discuss the initial and focused codes for each theme in detail.

38. „Schwierige Frage. Theoretisch sehr wichtig, praktisch kann man nichts dagegen machen. Natürlich kann man sich abkapseln von facebook usw. aber Sachen die wirklich wichtig sind stehen nicht auf facebook oder sonst wo. Alles was auf facebook steht ist mir nicht so wichtig. [...] Theoretisch und praktisch sind das zwei paar Schuhe."

4.4.2 Initial Themes

4.4.2.1 Outside Reactions

4.4.2.1.1 Initial Codes - Outside Reactions

Similar to the pilot study, the participants were asked about the reactions from their close social surroundings as well as from strangers in public. This inquiry was continued in the main study since one of the aims was to examine how the innovation is perceived by the outside world. The following table will display the most mentioned initial codes.

Outside Reactions	Frequency absolute	Frequency normalized
public staring	48	100
social surrounding positive / curious	46	95,8
need for sensitization	42	87,5
public curious	22	45,8
strangers ask about Glass	17	35,4
social sourrounding disinclined	13	27,1
public medium reaction	11	22,9
did not get asked about Glass by strangers	10	20,8
public disinclined	9	18,8
social sourrounding disinterested quickly	7	14,6
mixed reactions	5	10,4
social sourrounding worried	3	6,3
would expect more attention with Glass	2	4,2
social sourrounding didn´t know Glass	2	4,2

Table 16: Initial Codes - Reactions

The most assigned code, "public staring", implies that strangers in public places such as streets, stores or public transport have been staring at the wearer. This notion might stem from the notion that the participants were more aware of their environment while wearing the device, and hence perceived more irritated stares. Still, the general feeling was that an increase of strangers staring did indeed happen while being in a public place.

> *"The everyday life got changed through the constant stares of people." (MM-08, paragraph 4)*[39]

Other codes such as "public curios" and "strangers ask about Glass" add to the notion of a general curiosity by strangers in public places. Although the device triggered negative reactions, the overwhelming response was positive and curios, which was noted by the participants through a variety of interested questions that have been asked about the device.

This did not only happen in public but also when presenting the device to their known social surrounding. The code "social surrounding positive / curious" has been assigned a total of 46 times and is hence seen as a dominant code for this theme compared to the code "social surrounding disinclined" with a frequency of 13.

> *"Very positive. Everyone was equally enthusiastic. Everybody wanted to try it and everybody wore it. It was rather the excitement for the technology than people viewing the subject conservatively. Actually no one." (MM-16, paragraph 10)*[40]

The code "need for sensitization" was assigned to all instances where the participants experienced some kind of uncomfortable situation because of the reactions of their social surrounding or strangers in public. These reactions can mainly be tracked back to the novelty of the device and the consequent social acceptance, which was not given at the tested time according to the interview results.

The participants stated that many people were not familiar with the device and hence reacted reluctant. Codes such as "public disinclined", "social sourrounding disinclined", "social surrounding worried" and "social sourrounding didn´t know Glass" add to this notion by illustrating that some people answered with fear to the device which consequently led the participants to behave accordingly.

39. „Der Alltag wurde verändert dadurch, dass man immer komisch angeschaut wird"

40. „Sehr positiv. Durchweg waren alle von der neuen Technik begeistert, jeder wollte sie ausprobieren jeder hatte sie an. Es war eher Begeisterung für die Technik und weniger Leute die dem konservativ gegenüber standen. Eigentlich gar keiner."

> *"I think it is extremely unpleasant. It think it is weird to reach for your head and touch Glass. Interestingly, if I used Glass in public I only interacted with it through my smartphone. Somehow it is the more accepted gesture. (MM-12, paragraph 26)*[41]

The following chapter will explain the created focused codes for the topic "outside reactions" and elaborate their meaning related to the initial codes.

4.4.2.1.2 Focused Codes - Outside Reactions

A total of two focused codes have been generated for the topic "outside reactions" as the following summary illustrates.

positive curiosity need for sensitization

Figure 38: Focused Codes - Outside Reactions

The first focused code "positive curiosity" is constructed from three initial codes. These are "social surrounding positive / curious", "public curious" and "strangers ask about Glass". The code implies that the overwhelming reaction to the device was positive and generally not disinclined and that the social surroundings as well as strangers reacted with great curiosity in regard to the new technology.

The second focused code that emerged from the initial codes was "need for sensitization". The codes that have been taken into account for the construction of this focused code are "public staring", "need for sensitization", "social sourrounding disinclined", "public medium reaction", "public disinclined", "mixed reactions", "social sourrounding worried" and "social sourrounding didn´t know Glass". All of these notions imply that the people the wearers interacted with did not really know about the device and often reacted with fear. Hence, "need for sensitization" implies that the broad masses still have to be educat-

41. „Ich finde es einfach extrem unangenehm. Ich finde es schon seltsam zu seinem Kopf hoch zu fassen und an der Glass rumzutippen. Wenn ich die Glass in der Öffentlichkeit bedient habe, dann eigentlich fast nur über mein Handy interessanterweise. Das ist irgendwie die akzeptierte Geste."

ed more regarding this new technology in order not to worry when interacting with a wearer of the device.

Some initial codes did not fit into a category and were simply outnumbered by the corresponding opposite code such as "did not get asked about Glass by strangers", "social sourrounding disinterested quickly" and "would expect more attention with Glass".

4.4.2.2 Communication

4.4.2.2.1 Initial Codes - Communication

Following up with the pilot study, the topic "communication" further investigates the alterations that happen in a face-to-face conversation while wearing the device. Again, no changes of the digital communication (phone, SMS etc.) are discussed in this chapter, since the inquiry focuses on the personal conversation and how the device gets embedded into a personal social context.

The following table will give an overview about the most allocated codes and their respective frequencies.

Communication	Frequency absolute	Frequency normalized
social sourrounding did not communicate differently	27	100
distraction in normal conversation	23	85,2
wearer did not communicate differently	19	70,4
Glass topic of conversation	17	63
did communicate differently	6	22,2
help in normal conversation	4	14,8
indifferent about help / distraction	3	11,1
not a distraction in normal conversation	3	11,1
social sourrounding did communicate differently	3	11,1
different communication with stranger	2	7,4

Table 17: Initial Codes - Communication

The most assigned code for this theme was "social surrounding did not communicate differently" with a total frequency of 27. Initially the question was designed to verify the assumption that a barrier is created through the device which leads the people who are talking to the wearer to communicate differently. Most participants stated that this did not happen. The code "social sourrounding did communicate differently" in comparison was assigned only three times throughout the entire main study. The only alteration that has been noticed by the participants was that the topic of the conversation has often been changed to the device itself, which most likely can be tracked back to the novelty of it. Also, most of the participants stated that they did not communicate differently either.

Still, the device presents an additional distraction in a normal conversation due the fact that, in order to use is right, it is constantly present unlike a smartphone which can be put away at any given time.

> *"I think, a lot of people already feel insulted when one puts the smartphone on the table during a meal. I think if one was to wear such glasses all the time and the conversation partner doesn´t know if one is googleing something rather than listening - I think that it is disturbing during a face-to-face conversation." (MM-28, paragraph 16)*[42]

However, a few participants stated that the device might even be helpful in a normal conversation when i.e. wanting to get a quick glance at their notifications or when searching for a specific type of information. In order to further verify if this proves to be a valid point, the testing period would have to be longer and the device would have to work more reliantly.

> *"I had a conversation with a friend of mine about something and then I said "OK Glass, google...". From that point of view it is helpful." (MM-25, paragraph 16)*[43]

42. „Ich glaube viele Leute sehen das ja jetzt schon als Beleidigung an, wenn man sein Smartphone auf den Tisch legt beim Essen. Ich glaube, wenn man jetzt noch so eine Brille die ganze Zeit aufhat und der andere weiss nicht, ob man was googlet oder so anstatt im zuzuhören - ich denke schon, dass es bei face-to-face Kommunikation störend ist."

43. „Ich war aber auch mit einem Kumpel im Gespräch und es ging um irgendwas und dann habe ich halt gesagt: "OK Glass, google...". In der Hinsicht ist es hilfreich."

When examining the above table of initial codes, notions like an altered communication have been discarded since the counterparts to the codes "did communicate differently", "not a distraction in normal conversation", "social sourrounding did communicate differently" and "different communication with stranger" outmatch the latter.

4.4.2.2.2 Focused Codes - Communication

For the theme "communication" a total of three focused codes have emerged through the revision of the initial codes.

The first focused code "device represents a distraction in normal conversation" has been created from the initial code "distraction in normal conversation" which implies that the device has been distracting to the wearer and / or his partner of conversation which includes close social contacts as well as strangers. The respective counter-codes have been discarded since they have not been assigned as much. This includes the initial codes "help in normal conversation", "indifferent about help / distraction" and "not a distraction in normal conversation".

device represents a distraction in normal conversation
people did not communicate differently
device topic of conversation

Figure 39: Focused Codes - Communication

The second focused code, "people did not communicate differently", consists of the codes "social sourrounding did not communicate differently" and "wearer did not communicate differently". As the code implies, the communication while wearing the device has not been altered. The corresponding counterparts of the here used initial codes, "did communicate differently", "different communication with stranger" and "social sourrounding did communicate differently" have not been assigned as much and have been discarded for the purpose of generalization.

The last focused code for this theme, "device topic of conversation" originated from the initial code "Glass topic of conversation". It implies that, when wearing the device, al-

though it did not represent a distraction as such, the topic of the conversation would at some point change to the device itself. This can be explained mainly due to the novelty of the device, but still needs to be taken into account when talking about the topic of communication.

4.4.2.3 Privacy

4.4.2.3.1 Initial Codes - Privacy

This chapter aims to explore all factors related to the privacy issues that the participants encountered during their testing period. It is worth pointing out that to more than half of the participants their privacy is either medium or not important (compare chapter "About the participants" on page 135). Still, they were asked about a possible additional endangerment of their privacy and the consequent control loss of their personal data that the device embodies.

Privacy	Frequency absolute	Frequency normalized
additional endangerment of privacy	27	100
privacy of others endangered	10	37
take photos unnoticed	8	29,6
no additional endangerment	7	25,9
benefit form privacy loss	3	11,1
less privacy control	2	7,4

Table 18: Initial Codes - Privacy

By using the device the user agrees to certain terms that are not optional. This, among other terms and conditions, includes the constant uploading of pictures to Google´s social network as well as the constant ability to locate the device and hence the user himself (Google Inc., 2013c). The following citation is taken from the *Terms of Use*:

> *"Google will determine and use your location, photos and videos taken on your Device will be added to your Google+ Auto Backup album, and your Device will display information sent to devices that are synced with it (such as text messages)." (Google Inc., 2013c)*

In order to be able to participate in this study, all participants had to agree to these terms. The most dominant code with a frequency of 27 is "additional endangerment of privacy", which indicates that most participants believe that the device represents an increase of privacy loss. This refers to the wearers digital privacy. Through the *terms of use* of the device, some participants felt that they had less control over their privacy settings as they can not be regulated in the same way as with a smartphone.

> ***"One does not know where the pictures go. I wouldn´t film or photograph embarrassing things with Google Glass. I am very aware that everything I photograph with my smartphone is vulnerable. An additional endangerment only happens when one is aware that there is something that could film constantly und unnoticed. The thing with Glass is the constant und the unnoticed." (MM-15, paragraph 46)*** [44]

Another dominant code for this theme is named "privacy of others endangered". Some participants felt that their own privacy is not restricted as much, but rather the privacy of other people since the device and respectively the camera of the device was pointing at the surrounding and not at themselves. This is closely related to the code "take photos unnoticed", which refers to all instances where the participants took photos of strangers or friends without their permission or knowledge.

> ***"What scares me is the speed with which is possible to endanger the privacy of other people and send it to Google - to post a picture of a person on facebook or on Google, simply through the blink of an eye. (MM-05, paragraph 59)***[45]

Others do not feel like their privacy is invaded by devices like Google Glass and hence do not see an additional endangerment of their privacy, although when comparing the fre-

44. „Man weiss halt nicht wo die Bilder hinkommen. Peinliche Sachen würde ich jetzt nicht mit Google Glass filmen oder fotografieren. Ich bin mir aber durchaus bewusst, dass alles was ich mit dem Smartphone fotografiere auch mit dem Smartphone abgreifbar ist. Es entsteht nur eine Mehrgefährdung weil man wahrnimmt, dass da was ist, was permanent und unbemerkt filmen kann. Also diese Unbemerkte und Dauernde."

45. „Was mich auch abschreckt ist die Schnelligkeit, wie man anderer Leute Privatsphäre an Google schicken kann. Einfach mit einem Augenzwinkern, das Bild von einer Person das Bild von einer Person auf Facebook oder Google posten."

quencies, it is a rather minor group. They instead see the benefits that this new technology can bring to their lives and are hence willing to sacrifice their entire or at least part of their digital privacy in order to take advantage of that.

> *"I am at a point right now where the use, the benefit and the fun is higher for me. Therefore I would take that risk. (MM-01, paragraph 46)*[46]

The next chapter will summarize the initial codes and elaborate the two focused codes for the theme "privacy".

4.4.2.3.2 Focused Codes - Privacy

For the theme "privacy", a total of two focused codes have been created from the initial codes.

additional endangerment of privacy (wearer and surroundings)
new laws / regulations / controls needed

Figure 40: Focused Codes - Privacy

The first focused code "additional endangerment of privacy (wearer and surroundings)" has been created from the initial codes "additional endangerment of privacy", "privacy of others endangered", "take photos unnoticed" and "less privacy control". The code implies that the participants of the study felt that their privacy would be additionally endangered through the wearing of such a device. This notion can be traced back to the privacy regulations of Google as well as the constant fear of being tracked by the company or other governmental institutions. Additionally, some of the participants mentioned that they are not worried about their own privacy but about the privacy of their surroundings since the device is able to take photos in a very discrete way without the other people

46. „Und da bin ich momentan an einem Punkt wo ich sage, dass der Nutzen, der Mehrwert und der Spass für mich grösser ist. Dafür nehme ich das Risiko in Kauf.“

noticing. These notions outmatched the corresponding counter-code "no additional endangerment" since it was only assigned with a total frequency of seven. Other participants argued that there would be a "benefit from privacy loss", which has also not been assigned enough to be further investigated in this study.

The second focused code "new laws / regulations / controls needed" is constructed from the same initial codes as the first focused code. The notion that a new system of regulations is needed emerged throughout the interviews. According to some participants, the privacy of each individual is restricted more with every new technology. In order to counter this, a new set of laws is needed to redefine what is allowed with wearable technology, specially regarding the taking of photos in public spaces. Also, from a technical point of view, the devices themselves should incorporate a mechanism which makes it visible to the surrounding when a video or a photo is taken. Hence, a focused code has been created in order to capture the notion of a new definition of privacy.

4.4.2.4 Restrictions

4.4.2.4.1 Personal Restrictions

a) Initial Codes - Personal Restrictions

Similar to the presentation of the pilot study findings, this chapter is two-fold. First, all personal difficulties that the participants encountered will be discussed. Secondly, the technical restrictions that influenced the usage will be presented in a separate sub-chapter. The following table will give an insight into the most assigned codes together with their respective frequencies.

Personal Restrictions	Frequency absolute	Frequency normalized
uncomfortable situation	39	100
want to take off	27	69,2
familiar surrounding important	27	69,2
asked to take off	23	59
closed public room uncomfortable	20	51,3
no restriction	17	43,6
Glass normal at some point	16	41

social etiquette important	14	35,9
forbidden to use at work	8	20,5
familiar surrounding not important	7	18
no uncomfortable situation	4	10,3

Table 19: Initial Codes - Personal Restrictions

The most assigned code for this theme was "uncomfortable situation", with a total frequency of 39. In comparison, the code "no uncomfortable situation" has only been assigned with a frequency of four. In this context "uncomfortable situation" is classified as a subjectively perceived state of discomfort and hence a personal restriction.

In most cases these uncomfortable situations took place in open public locations or in the presence of strangers. Coded separately in this inquiry was the code "closed public room uncomfortable" with a total frequency of 20. This refers to all instances were the participants experienced an uncomfortable situation in a restaurant, a café, the subway and closed public rooms alike.

In many cases, this led the participants to take off the device by themselves, mainly because they got an uncomfortable feeling when wearing it in public places or when having private conversations. The code "want to take off" refers to the instances the participants had difficulties talking to the device in public or other social situations where it seemed inappropriate to wear the device. An often mentioned code in this context was "social etiquette important", which implies that it might be rude in certain situations to keep wearing the device i.e. in a face-to-face conversation.

> ***"Always in the presence of strangers. Among my acquaintances it´s only once like that. They know what is happening then. There is always a certain level of discomfort, when being amongst strangers." (MM-28, paragraph 27)*** [47]

Hence, for most participants a familiar surrounding is very important when using the device in order to avoid these kind of situations. The code "familiar surrounding impor-

47. „Immer wenn halt fremde Personen zu gegen waren. Unter Bekannten ist es halt einmal so. Aber die kennen das ja dann. Immer wenn man vor fremden Leuten damit ist, ist schon ein gewissen Unbehagen dabei.“

tant" was assigned with a frequency of 27, compared to "familiar surrounding not important" with a frequency of two. Still, for more than half of the participants the device became "normal" at some point during their testing period. This means that they got used to the feeling of being stared at or that they did not perceive this sensation as much.

> *"One notices that already within a week, the feeling decreases. One gets used to it, or put in another way - one is a little more jaded and says:" It is like that. I wear it on my head now." (MM-01, paragraph 8)* [48]

The code "asked to take off" refers to the instances where the participants were asked to put the device away. This happened mostly in two different situations: firstly, a conversation partner that felt uncomfortable or annoyed through the technology, and secondly, in department stores where recording is not allowed. Another instance where some of the participants where asked to take off the device was at the workplace, mostly due to the confidential data that they were working with.

> *"I went to the Apple-Store once, because I thought that a lot of tech-savvy people would be there. A security guard intervened though, asking me to take the device off because of the camera." (MM-06, paragraph 10)*[49]

More than half of the participants did not notice any restrictions by themselves, nor did anyone ask them to take off the device.

> *"Nobody said anything - at a restaurant, at the gym and when going out in the evening. Of course people asked me about it etc. but it didn´t get prohibited." (MM-03, paragraph 34)*[50]

48. „Man merkt aber auch schon innerhalb einer Woche, dass das Gefühl abnimmt. Man gewöhnt sich dann dran, oder auch andersherum gesagt - man ist ein bisschen mehr abgestumpft und sagt sich: "So ist es halt. Ich hab das jetzt auf dem Kopf".“
49. „Einmal bin ich noch mal in den Apple-Store gegangen, weil ich mir dachte, dass da viele technikaffine Leute sind. Da ist dann aber ein Security hergekommen und hat gesagt, dass ich sie abnehmen muss wegen der Kamera.“
50. „Im Restaurant, im Fitnessstudio, auch unterwegs am Abend hat keiner was gesagt. Also ich wurde drauf angesprochen was das ist usw. aber es wurde mir nicht verboten.“

Concluding, there are some personal restrictions created through this novel technology which led the participants to take off the device either because they felt uncomfortable or due to others pointing out that they felt uncomfortable or annoyed through the smartglasses.

b) Focused Codes - Personal Restrictions

Summarizing, four focused codes have been generated for the theme of "personal restrictions".

Firstly the code "asked to take off device", which is constructed of the initial codes "asked to take off" and "forbidden to use at work" refers to all instances the participants where asked by their close social surroundings or strangers in public to take off the device. It also includes all instances when the participants were asked to take off the device in their work environment as well.

asked to take off device

want to take off device

familiar surrounding initially important

social etiquette important

Figure 41: Focused Codes - Personal Restrictions

The second focused code that has emerged is "want to take off device". This notion is constructed from a variety of initial codes. Firstly, "want to take off" which refers to the situations when the participants were not asked to, but wanted to take off the device by themselves. The code therefore also includes the initial codes "uncomfortable situation" and "closed public room uncomfortable" since the participants mainly wanted to take off the device in these kinds of situations.

The next focused code, "familiar surrounding initially important" is constructed from the initial code "familiar surrounding important" and "Glass normal at some point". This implies that initially a comfortable surrounding of close social contacts is very important

when introducing the device into the users social circle. Over time, the wearer of the device becomes more comfortable and hence, takes the device for granted.

The focused code "social etiquette important" has been created from the equally named initial code and implies that it is important to the participants to evaluate in which situations the device is appropriate to wear.

4.4.2.4.2 Technical Restrictions

a) Initial Codes - Technical Restrictions

The second part of this chapter treats the topic of all technical issues that occurred to the participants while wearing the device. It is worth noting that the device at the tested time was still a "beta product", meaning that the device is not a product that is ready to be released into the mass market due to a variety of technical difficulties that still have to be sorted out by the manufacturer. Nevertheless, the most common technical restrictions are still listed here to gain an impression of the overall experience the participants had.

Technical Restrictions	Frequency absolute	Frequency normalized
technical difficulty with apps	36	100
battery too weak for seriuos use	14	38,9
Glass gets hot	13	36,1
technical difficulty with connection	10	27,8
display viewing problem	7	19,4
technical refinement needed	6	16,7
technical difficulty with speech recognition	6	16,7
technical difficulty with audio	3	8,3
restriction of sight	3	8,3
headache	2	5,6
technical difficulty with touchpad	2	5,6
difficulty with UI	2	5,6
needed resetting	2	5,6

Table 20: Initial Codes - Technical Restrictions

By evaluating the above listed initial codes, it can be asserted that the participants encountered a lot of technical issues. Most of the technical difficulties have been encountered while using different kinds of applications. In this context no difference was made between the applications, since this study aims to evaluate the entire experience rather than focusing on problems with specific applications. Another issue which has presented itself during the tested period was the weak battery that made a prolonged use of the device nearly impossible.

> *"Yes, now and then, little things. Apart from the poor battery and the reduced battery duration of my smartphone - things like the device turned itself off all of a sudden. I could open the apps the way I wanted to. I had to try a little until it worked again. The glasses didn´t understand some things and I had to repeat them. Thus always little things - it does not run quite smoothly just yet." (MF-14, paragraph 32)*[51]

Other participants stated that the device got very hot during the actual usage. This is a major technical restriction which was very frustrating to the participants since a prolonged use of the device was not possible because the device needed to cool down. The participants stated that the device overheated to the extend that it caused a headache and became unusable until it cooled down again.

> *"I hate the phrase: "Glass needs to cool down to function properly". If you record a three minute video the device simply gets hot. You can forget about it if it is plugged in and you want do something, since it also gets hot." (MM-27, paragraph 34)*[52]

Other technical issues included the faulty connection between the device and the users´ smartphone, the sometimes failing speech recognition, the hearing of the audio

51. „Ja, schon immer mal wieder, so Kleinigkeiten. Mal ganz abgesehen von der nicht sehr langen Akkulaufzeit und der deutlich verringerten Akkulaufzeit von meinem Smartphone, so Sachen, dass sie zwischendrin mal ausgegangen ist. Dass ich die App manchmal nicht aufrufen konnte so wie ich das gerne gehabt hätte, dass ich so ein bisschen rumprobieren musste bis sie wieder funktioniert hat, die Brille manche Sachen nicht so astrein verstanden hat und ich es dann wiederholen musste. Also immer mal wieder so Kleinigkeiten - es läuft noch nicht so ganz rund."

52. „Ich hasse den Satz: "Glass needs to cool down to function properly". Wenn du ein drei Minuten Video machst wird das Ding einfach heiss. Wenn es angesteckt ist und du irgendwas damit machen willst, kannst du es eigentlich vergessen, weil es auch heiss wird."

output, problems with the touchpad and a restricted line of sight. All of these technical issues contributed to the overall experience of the participants with the device and made it very difficult to properly compare to a state-of-the-art smartphone. Still, with certain limitations, a comparison is still possible due to the actual usage that took place in the tested period.

b) Focused Codes - Technical Restrictions

A total of two focused codes have been created for the theme "personal restrictions".

hardware / software not suited for all-day / prolonged use
technical refinement needed

Figure 42: Focused Codes - Personal Restrictions

The first code "hardware / software not suited for all-day / prolonged use" is constructed from the initial codes "battery too weak for seriuos use", "Glass gets hot", "headache" and "restriction of sight". All of the named initial codes imply that the device is technically not ready to be used all day long and contributes to the notion of a restricted use.

The second focused code "technical refinement needed" is constructed of the initial codes "technical difficulty with apps", "technical difficulty with connection", "display viewing problem", "technical refinement needed", "technical difficulty with speech recognition", "technical difficulty with audio", "technical difficulty with touchpad", "difficulty with UI", "needed resetting" and implies that the device still needs technical work in order to be a fully usable product. Both focused codes assert that the device at the tested time is not ready to be released into a broader market.

4.4.2.5 Application Usage

4.4.2.5.1 Initial Codes - Application Usage

This chapter captures the application usage of the participants. The most used applications in the main study will not only be listed and discussed but also compared to the pilot study in order to measure the alterations that happened. These changes mainly refer

to the study design since all participants in the main study were required to use an Android phone (see chapter "Sample" on page 90). Also, a variety of new applications have been launched since the pilot study which are taken into account as well (see chapter "Google Glass Applications" on page 23).

The following table of initial codes will give an overview of the interview results regarding the application usage. In order to acquire this information, the participants had to answer the question which applications they used most in their testing period. These results will later be compared to the outcome of the media diary inquiry (see chapter "Media Diary Findings" on page 176).

Application Usage	Frequency absolute	Frequency normalized
function navigation	22	100
function camera	19	86,4
function news	16	72,7
main usage try out	15	68,2
missing functions	14	63,6
function phone	13	59,1
function Google	13	59,1
function e-mail	10	45,5
function watch	10	45,5
function games	8	36,4
function SMS	8	36,4
function Google Now	8	36,4
missing AR applications	6	27,3
function video	4	18,2
function language learning	4	18,2
function star map	4	18,2
office usage	4	18,2
function field explorer	4	18,2

function social network	3	13,6
function calendar	3	13,6
function fitness	3	13,6
function watch video	2	9,1

Table 21: Initial Codes - Application Usage

The most used function, as the initial codes suggest, was the navigation with a total frequency of 22. This is due to the fact that a minimal change was made by Google to the user interface between the pilot and the main study, which allowed the user to enter the desired destination by typing it in their smartphone and then being able to get the directions directly on the smartglass. This change allowed the participants to navigate German streets which were not understood by the device´s voice recognition.

Ranking second in the list is the camera function, which in the pilot study was named as the most used function. This includes the taking of photos and videos and is, according to the participants, one of the most desired "hands-free" functions.

In both studies the news function was the third most used application. In this context is is worth noting that there is not one, but a variety of news applications which have been summarized here as "news". This includes the most popular news-channels such as the "New York Times" and "CNN" but also more dedicated magazines such as "ELLE", in the fashion segment, or "Winkfeed" which lets the user built an entirely customized stream of news.

> ***"I watched the news more often. I thought it was interesting to simply watch little clips of film." (MF-23, paragraph 20)*** [53]

Almost half of the participants stated that the main usage during their testing period was to try out the device and the functions it offers. Also, almost half of the participants complained about missing functions in comparison with their smartphones, which is yet another technical restriction which limits the use of the device (see chapter "Technical Re-

53. „Ich habe mir öfter mal die Nachrichten angeguckt. Einfach mal so kurz durch und ein paar Filmchen darauf angeguckt weil ich das ganz interessant fand.“

strictions" on page 115). Other participants complained about missing augmented reality applications, since they expected the device to feature more applications which would align a digital image with the real world, and hence enhance the experience of their everyday lives, by adding this kind of information to their field of view.

Similar to the pilot study, the function "phone" occupies the forth spot of the most used functions. The device in this scenario is used to replace a standard headset like it is already commonly known from a modern day smartphone.

The same usage was documented for the search function of the device, which in comparison to the pilot study was more popular in the main study.

The following applications, which are meant to gain quick access to information, e-mail and watch, are in the fifth spot. In the pilot study the watch was ranked two, while the e-mail function did not work for most of the participants since they were using iOS. Hence there is no value for comparison.

Other functions like games, SMS, language learning, star map, field explorer, social networks, calendar and fitness applications are more of niche applications at this point and might increase in popularity over time, when they work more reliantly and add more functionality.

Generally, all applications that could be used hands-free and replace the basic functionality of a smartphone were the ones used most.

> ***"Facilitated because I can, amongst others, navigate with the device, fetch the news, watch videos while I am walking or sitting somehwere without having to get my smartphone out of my pocket. I am hands-free. Of course that is a big advantage and I thought this was very comfortable. This means less smartphone. One is also able to do stuff at the same time if one is able to multitask." (MM-01, paragraph 4)***[54]

Although there are some applications that are used more frequently than others, the general use of the device is very fragmented. This implies a strong situational use of the device which will be further discussed in the chapter "Everyday Life Change" on page 169.

54. „Erleichtert erstmal dahingehend, dass ich ein Gerät habe mit dem u.a. navigieren kann, mit dem News abrufen kann, mit dem ich Videos anschauen kann während ich laufe oder irgendwo sitze ohne, dass ich ein Gerät aus der Tasche holen muss. Ich bin hands-free. Das ist natürlich ein grosser Vorteil und das fand ich sehr angenehm. Heisst also weniger mobile. Man kann Dinge, wenn man Multi-Tasking fähig ist, auch nebenher machen.“

4.4.2.5.2 Focused Codes - Application Usage

For the theme of "Applications Usage" a total of three focused codes have been created and complied.

missing applications
hands-free applications popular (navigation / camera / phone)
fragmented use of applications

Figure 43: Focused Codes - Application Usage

The first focused code "missing applications" has been created from the initial codes "missing functions" and "missing AR applications". Both codes refer to the fact that during the tested time, the device did not offer a lot of alternatives in terms of available applications when compared to a smartphone.

The second focused code "hands-free applications popular (navigation / camera / phone)" is constructed from the often assigned initial codes "function navigation", "function camera", "function news", "function phone", "function google", "function e-mail" and "function watch". These applications are the most popular choices among the participants and are all used without hands but rather via voice and gesture control. Still, most of these applications are used to retrieve information rather then requiring the wearer to type a lot of input.

The last focused code "fragmented use of applications" has emerged through the remaining applications which have all been coded with a frequency under ten. The used initial codes are "function games", "function SMS", "function Google Now", "function video", "function language learning, "function star map", "office usage", "function field explorer", "function social network", "function calendar", "function fitness" and "function watch video". Hence, there is no clear pattern to be identified but rather a user dependent application usage which is compliant with the code "main usage try out", indicating that almost half of the participants did use the device to try out a variety of functions.

4.4.2.6 Smartphone Comparison

4.4.2.6.1 Initial Codes - Smartphone Comparison

The theme "smartphone comparison", is structured differently compared to the pilot study. It will discuss the topic in a lot more detail and not exclusively user-centric. The comparison made in this chapter refers solely to a comparison of the devices and their respective applications, since the participants behavior regarding the usage has already been discussed in the chapter "About the participants" on page 135. Furthermore the theme "market", which was not treated separately in the pilot study, will be discussed in the chapter "Market" on page 163.

The following table will give an overview of the initial codes that have emerged from the comparison between the Google Glass device and a smartphone.

Smartphone Comparison	Frequency absolute	Frequency normalized
application better than smartphone	81	100
smartphone very integrated into everyday life	29	35,8
Glass not prefered in any situation	13	16,1
application better on smartphone	10	12,4
used function more than on smartphone	9	11,1
similar daily routine	5	6,2
function more complicated on Glass	3	3,7
entertainment better than on smartphone	2	2,5
faster with smartphone	2	2,5

Table 22: Initial Codes - Smartphone Comparison

When examining the initial codes, "application better than smartphone" has been the most assigned by far. Although the applications were limited at the tested time, all of the participants stated that certain software is better or more useful on a smartglass. The most named applications in this context include the navigation, the camera, the watch, the augmented reality application "explore the stars" and the phone calls. A minority claimed that they were better entertained with the device. A frequency of 9 for the code "used

function more than on smartphone" indicates that the device has already replaced some of the smartphones functionality for some of the participants.

> *"Definitely Runtastic. Navigation. The phone makes more sense but the quality of the sound is worse. Voice Input. Things like the star-app. That is not possible on a smartphone. I already said lyrics. The games were fun, since it is something completely different. It is interactive, not just pressing [buttons]." (MM-17, paragraph 20)*[55]

This phenomenon happened despite the fact that the smartphone is a very integrated part in the life of most participants. When asked to describe a typical daily routine, a pattern emerged. The smartphone is present at almost any moment of the day and is used throughout the routine for most of the electronic communication as well as for many other applications such as an alarm clock, public transport information, music player just to name a few. Five of the participants would describe their daily routine as similar when comparing the Google Glass device to their smartphone. The following quote describes a typical day in the life of a male participant, which is used as an example for the pattern that emerged throughout the interviews of the main study.

> *"At first the alarm clock of my smartphone wakes me up in the morning. Before getting up I read the news on my smartphone. Then I get up and usually have to go somewhere and listen to music on it. If I don´t know where to go, I look it up on maps. Otherwise I check for the times of the bus. If I need a bike I book it over my smartphone. Actually it is used the whole day. If I am in the subway I play on my smartphone. Soon it is afternoon. When I am going home I listen to to music again. Hence it is actually used the whole time." (MM-07, paragraph 42)*[56]

55. „Definitiv Runtastic. Navigation. Telefon sinnvoller aber nicht besser weil die Soundqualität schlecht ist. Sprachsteuerung. So Sachen wie diese Star-App. Das geht ja auf dem Handy nicht. Lyrics hatte ich schon gesagt. Die Games fand ich auch lustig, weil es einfach mal was komplett anderes ist. Interaktiv, nicht nur rumtippen."

56. „Also zuerst mal weckt mich der Wecker vom Smartphone. Bevor ich aufstehe, lese ich die Nachrichten auf meinem Smartphone. Dann stehe ich auf, muss dann meistens irgendwo hinfahren und höre damit Musik. Wenn ich nicht weiss wo ich hinmuss schaue ich auf Maps nach. Ansonsten schaue ich wann der Bus fährt auf dem Handy. Wenn ich ein Fahrrad brauche buche ich mir das übers Handy. Also eigentlich ist es den ganzen Tag über in Gebrauch. Wenn ich dann in der U-Bahn bin, spiele ich ein Spiel auf dem Handy. Dann ist schon bald Nachmittag. Wenn ich Heim fahre höre ich wieder Musik. Also eigentlich ist es die ganze Zeit in Gebrauch."

The codes "application better on smartphone" and "faster with smartphone" indicate that more than one third of the participants prefer the applications on their smartphone compared to the equivalent on the Google Glass device. This strongly correlates with the code "function more complicated on Glass". Due to the apparent added complexity of use and the more refined applications on a smartphone, the device was not preferred in any situation by almost half of the participants.

4.4.2.6.2 Focused Codes - Smartphone Comparison

For the theme "Smartphone Comparison", a total of three focused codes have been created from the initial codes.

certain applications better on smartglass

more accustomed to smartphone / very integrated

replace some functionality

Figure 44: Focused Codes - Smartphone Comparison

The first focused code "certain applications better on smartglass" is constructed from the initial codes "application better than smartphone" and "entertainment better than on smartphone". As the code implicates, a variety of applications is preferred by the participants on the smartglass in comparison to their smartphone. Please refer to the chapter "Application Usage" on page 152 for a full comparison of applications used.

The second focused code "more accustomed to smartphone / very integrated" is constructed from a variety of initial codes. These include "smartphone very integrated into everyday life", "Glass not prefered in any situation", "application better on smartphone", "function more complicated on Glass" and "faster with smartphone". The focused code implies that the smartphone has become very integrated in most of the participants´ lives and therefore a new device such as a smartglass as used for this study is, in some cases, classified as unnecessary. With well developed applications, a smartphone is the standard for most of the participants against which all other devices are measured. This notion manifests itself in the complaint of some participants that the device is more complicated

to use and that the accessibility to most of the functions is faster and more intuitive than with the Google Glass device.

The last focused code "replace some functionality", is constructed from the two initial codes "used function more than on smartphone" and "similar daily routine". The first initial code implies that although the testing period was rather short, some applications were already used more than on the known smartphone and hence replaced certain basic functionalities of the latter. The second initial code refers to the fact that some participants did not feel any change of routine while using the device and would describe their experience as "similar to their smartphone", hence replacing all or some functionality of their existing device.

4.4.2.7 User Experience

4.4.2.7.1 Initial Codes - User Experience

The theme "user experience" emerged from the interview data and was not initially planned in this study. Due to the many statements of the participants about their experiences with the device and the resulting positive and negative critique, this topic hence had to be elaborated in more detail.

The following initial codes have hence been filtered into this separate theme and sorted, following the overall structure of this study, by frequency.

User Experience	Frequency absolute	Frequency normalized
disappointed by Glass	19	100
want to use more	17	89,5
learning curve	14	73,7
positive image after	8	42,1
good experience	7	36,8
initial euphoria	7	36,8
new experience	6	31,6
seen as toy	5	26,3
future of User Interface	2	10,5

demystified	2	10,5
fun to use Glass	2	10,5

Table 23: Initial Codes - User Experience

The most assigned code for this theme was "disappointed by Glass" with a total frequency of 19. As the code indicates, the participants initially had higher expectations regarding the device. In comparison, only eight participants would rate their image of the device as "positive" after their testing period. Two participants stated that the device has been demystified to them after the use. This is mainly related to the lack of applications which limits the overall usefulness of the device (see also "Application Usage" on page 152). The device was hence categorized as a toy by some participants, since the applications did not provide an actual, productive use for their everyday lives.

> *"A little bit of disenchantment, because it can not do as much as one would anticipate. It is only a technical toy." (MM-06, paragraph 54)*[57]

The second most assigned code for this theme was "want to use more", indicating that the participants were not able to use the device as much as they would have wanted to in many situations. Again, the missing applications are one of the main reasons for this phenomenon.

> *"There weren´t many applications, so when they increase I could implement Glass more in what I do every day." (MF-09, Absatz 6)*

When discussing the topic of user experience, seven participants stated that the initial euphoria was very high and that they had encountered a new experience. Two of the participants mentioned the feeling of fun while using the device. Still, almost half of the participants would rate the learning curve for a device which has no touchscreen as

57. „Ein kleines bisschen Ernüchterung, weil sie einfach noch nicht so viel kann, wie man eigentlich vermuten würde. Das es halt doch nur eine technische Spielerei ist."

"steep", since all of them are used to operate a smartphone, which through years of usage has become their standard for an intuitive user interface.

> *"It took a little time until I understood the principle of how it works. How I quit things, how I open things. That I have to talk to it in order for it to work good." (MF-30, paragraph 48)*[58]

Although only coded two times, the alteration of the human-computer-interaction needs to be mentioned in the context of the overall user experience. Since the device is controlled primarily via voice and gesture commands, the interaction between the user and the device increasingly shows patters of how humans would interact with one another rather than how humans interact with machines. This new way of interacting with technology might also be translated to other categories of devices such as phones, tablets, laptops and other kinds of robots.

> *"The most interesting thing is the motion-input via the head. The most obvious thing is the control of the games. [...] This was surprisingly positive for me, since a whole new world opens up. Right now of course, this is rather fragmented." (MM-31, paragraph 62)*[59]

The following chapter will summarize the initial codes for the theme "user experience" and will present the emerged focused codes.

4.4.2.7.2 Focused Codes - User Experience

For the theme "User Experience", a total of three focused codes has been created. The first focused code "use too marginal" has been constructed from the initial codes "disappointed by Glass", "want to use more" and "seen as toy". As the code implies the participants felt disappointment when using the device, mainly because of the few use cases for

58. „Es hat ein bisschen gedauert, bis ich das Prinzip verstanden habe wie es funktioniert. Wie ich Sachen beende, wie ich Sachen öffne. Das ich am besten mit ihr reden muss, bis sie gut läuft."

59. „Das Interessanteste ist die Bewegungssteuerung mit dem Kopf. Das wird im Moment bei den Spielen glaub ich am deutlichsten. [...] Das fand ich wirklich überraschend positiv, dass man da noch mal eine neue Welt auftut. Das ist im Moment natürlich noch eher fragmentarisch."

it. Through this notion the device got entitled as a toy and was not seen as a technical innovation with more serious usage.

The focused code "initial expectations / euphoria high" is constructed from the initial codes "initial euphoria", "good experience", "fun to use Glass" and "demystified". When the participants first tried the device the initial excitement for most of them was very high since the feeling of wearing a smartglass has been entirely new to all of the users. Although the overall experience has been rated as good by some of the participants, the device lost its momentum over the testing period and became just "another gadget".

use too marginal initial expectations / euphoria high interaction with device unfamiliar

Figure 45: Focused Codes - User Experience

The third focused code "interaction with device unfamiliar" consists of the initial codes "learning curve", "new experience" and "future of User Interface". Since most of the participants are used to a touchscreen on their smartphone, the user experience has been rated as new. This includes a steep learning curve since the interactions with the device has not been considered as intuitive by most of the participants. Still, some participants pointed out that, although the interaction is a new experience, it might be seen as an attempt to design the future of user interfaces.

Due to the comparatively low frequency of the initial code "positive image after", no separated focused code has been created nor has it been allocated to any other focused code listed here.

4.4.2.8 Market

4.4.2.8.1 Initial Codes - Market

This inquiry was held in order to evaluate how the innovation would eventually be accepted in a broader mainstream market and if there is a market at all for the category smartglasses. The topic was therefore treated with a lot more attention to detail than in

the pilot study and became a subject of its own rather than just be treated as an aspect of the smartphone comparison (see chapter "Smartphone Comparison" on page 120).

Market	Frequency absolute	Frequency normalized
would wear smartglass	24	100
recommend test before buy	17	70,8
will replace smartphone	17	70,8
would rather wear smartwatch	15	62,5
potential seen	13	54,2
would rather wear Glass than smartwatch	12	50
expansion for smartphone	10	41,7
recommend wait before buy	8	33,3
would not wear smartglass	8	33,3
no necessity for Glass	7	29,2
will not replace smartphone	6	25
will miss Glass	5	20,8
would not recommend buying Glass	4	16,7
would wear Glass and Smartwatch	3	12,5
would recommend Glass depending on usage	3	12,5
not ready for market	2	8,3
would recommend buying Glass depending on tech-savviness	2	8,3

Table 24: Initial Codes - Market

The most dominant code for this theme was "would wear smartglass" with a frequency of 24. The question that was asked did not refer to Google Glass specifically, but rather if the participant could imagine him oder herself wearing a similar device in the future. This implied a more refined version with less technical difficulties and a broader spectrum of applications. This outnumbered the code "would not wear smartglass" with a frequency of 8. More than half of the participants believe that devices like this will eventu-

ally replace their smartphones as they see the potential that this new category of devices offers. In comparison, six participants believe that the device will not replace their existing smartphone. One third of the asked people believe that it will be at least used as a complementary device and hence expand the functionality of their smartphone.

> *„Yes, but maybe a more refined version. First of all I would combine them with my regular glasses. Second, I would appreciate a bigger screen. Maybe some sort of typing input. If there would be a way to get the typing right on Glass that would be huge. Goodbye Smartphone, I get the Glass." (MF-09, Absatz 64)*

When comparing the smartglass to a smartwatch, half of the participants would prefer the latter, mostly because of the social acceptance of the device. The reason for this comparison was the novelty of both devices and the category in which they both belong: wearable computing. Although a comparison with the smartphone was necessary, a comparison with another wearable device or category seemed key in order to evaluate what the consumer would rather buy.

> *"As of right now yes, since it is a step back, more comfortable to use and easier to handle in public places than the glasses. But the moment there is a contact-lens, I would take the lens." (MM-25, paragraph 52)* [60]

Still, twelve people would rather wear a smartglass than a smartwatch. This has a variety of reasons. The most named are the practicability of the smartglass and the resulting variety of possible use cases, the comfort of wearing a pair of glasses in comparison to a watch and lastly for fashion reasons. Three participants would wear both depending on which device provides the most benefit for the given situation.

> *"I would wish for both. I can wear the smartwatch all day. It can probably give me a certain kind of benefit and certain kinds of functions." (MM-01, paragraph 52)*[61]

60. „Im Moment ja. Auf jeden Fall, weil es einfach noch einen Schritt zurück ist und noch angenehmer ist zu benutzen und auch einfach für Öffentlichkeit nicht so schwer ist, damit umzugehen wie eine Brille. Aber wenn es eine Kontaktlinse gibt, dann ist es eher die Linse."

61. „Ich glaube ich würde mir beides wünschen. Die Smartwatch kann ich den ganzen Tag am Arm behal-

When asked what the participants would recommend in regard to the device, the most dominant answer was "test before buy" with a total frequency of 17. Others would recommend to "wait before buy". Four participants would not recommend buying the device at all, while three suggest to buying Google Glass depending on the planned usage. With the device still being in the beta-stage of the development, two participants state that it is only useful to buy the device if the user is very technological savvy.

While five participants will miss the device after their testing period, a total of seven people did not see any necessity for a device like this. Two of the participants quote that the device is not ready for the mass market since it is still in an early development state and needs a variety of technical refinements.

4.4.2.8.2 Focused Codes - Market

For the theme "Market" a total of four focused codes have been created in order to further evaluate the chances of a device like a smartglass in a mass market.

would wear smartglass eventually
will eventually replace smartphone
smartwatch as intermediary step
smartglass not for everyone

Figure 46: Focused Codes - Market

The first focused code "would wear smartglass eventually" has been constructed from the initial codes "would wear smartglass", "potential seen", "recommend test before buy", "would rather wear Glass than smartwatch", "recommend wait before buy", "will miss Glass", "not ready for market" "would wear Glass and Smartwatch", "would recommend Glass depending on usage" and "would recommend buying Glass depending on tech-savviness". As the code implies most of the participants would wear a smartglass at some point. This of course depends on a lot of factors such as design, applications, social accep-

ten. Die kann mir garantiert einen gewissen Mehrwert und gewisse Funktionen bieten."

tance and alike. Still, the fact that almost half of the participants did see the potential of the technology implies an interest in a more refined version.

The second focused code "will eventually replace smartphone" has been composed from the initial codes "will replace smartphone" and "expansion for smartphone". The notion regarding a possible smartphone replacement has been observed throughout the interviews. More than half of the participants believe that a technology like this will indeed replace their existing smartphones, creating opportunities for new use cases. Of course this notion closely correlates with the notion that smartglasses are able to function autonomously without a smartphone as a processing unit. For the near future almost one third of the participants believe that a smartglass will be an extension of their smartphone rather than replacing it completely.

The last focused code "smartwatch as intermediary step" has been constructed from the initial code "would rather wear smartwatch". The code in this context implies that most participants would rather wear a smartwatch now, than a smartglass. This is mainly due to the weak social acceptance of such a device. Other reasons include that some of the participants oppose to the concept of wearing glasses in general and that the functionality at the tested time was very similar on both devices.

Another group of participants did lean towards never buying the device which is why the focused code "smartglass not for everyone" has been created from the following initial codes: "would not wear smartglass", "no necessity for Glass", "will not replace smartphone" and "would not recommend buying Glass".

4.4.2.9 Places

4.4.2.9.1 Initial Codes - Places

The theme "places" emerged from the pilot study interviews. The topic was not treated to its full extend in the latter and was hence further inquired about in the main study. The chapter is thus investigating the usefulness of the device in a certain surrounding or a certain location.

Places	Frequency absolute	Frequency normalized
useful on the go	31	100

no use at workplace	19	61,3
used at workplace	6	19,4
useful at home	3	9,7
not useful at specfic location	3	9,7

Table 25: Initial Codes - Technical Difficulties

The most applied code for this theme was "useful on the go" which can also be seen as the most dominant code. With a total frequency of 31, most of the participants agree that the main use of the device is not at home or indoors, but rather when traveling or commuting by foot, bike, public transportation or in a car. In contrary, only three participants felt that the device is useful at home.

> *"Actually always on the go. [...] I read a lot of e-mails. News. I have to summarize this with the expression "on the go". If I would have had my daily commute to work, I would have used it more often in the train. I would not have looked at the weather on my smartphone. I actually didn´t at some point." (MM-27, paragraph 26)*[62]

The other code that is dominant when discussing the topic of places is "no use at workplace". Most of the participants stated that the device has no additional value at their workplace due to the fact that they work with a computer and prefer to get the information through their PC. It is worth noting that none of the participants was working a manual labor, which might lead to different results since a desktop computer is not present at all times.

> *"Not at all. I my case work is work in front of a screen. I also do not have a smartphone there but a computer. At work not at all." (MM-15, paragraph 20)*[63]

62. „Eigentlich unterwegs immer. Also [...] E-Mails habe ich viel gelesen. Nachrichten. Das muss ich in dem Wort "unterwegs" zusammenfassen. Wenn ich jetzt meinen täglichen Arbeitsweg gehabt hätte, hätte ich es in der S-Bahn öfter genutzt. Wetter hätte ich morgens nicht mehr auf dem iPhone nachgesehen. Habe ich auch irgendwann nicht mehr."
63. „Gar nicht. Bei mir ist Arbeit Bildschirmarbeit und da habe ich auch kein Smartphone was ich brauche sondern einen Computer. Bei der Arbeit gar nicht."

A few participants did mention a peripheral use at their workplace, mostly for checking e-mails, SMS, the calendar or engaging in a phone conversation, which was mainly not for business reasons, but for private matters.

4.4.2.9.2 Focused Codes - Places

A total of two focused codes have been created and evaluated for the theme "places".

useful on the go not useful at workspace

Figure 47: Focused Codes - Places

The first focused code "useful on the go" has been constructed from the identical initial code "useful on the go". The respective counter-codes "not useful at specfic location" and "useful at home", both with a frequency of three, have been discarded in comparison to the since the frequency of the code "useful on the go" outmatches them. The code implies that the device´s main use is not in a domestic scenario, but in public spaces and during commutes.

The second focused code "not useful at workspace" is constructed from the initial codes "no use at workplace". Again, the frequency of 19 outmatches the frequency of six of its respective counter-code "used at workplace". As the code implies, the device is not yet suited for a serious use at the workplace and remains a gadget for personal matters.

4.4.2.10 Everyday Life Change

4.4.2.10.1 Initial Codes - Everyday Life Change

Since the key aspect in this study was to elaborate whether how smartglasses are embedded to the everyday life, the inquiry in the main study has been a lot more detailed compared to the pilot study. Instead of only applying the initial code "everyday life change", a variety of initial codes have been assigned to the interview results. The chapter is two-fold since there are two factors in this study that have been identified as changing everyday life. First, every aspect that is related to the change of application use and the

resulting shift of devices. Second, all aspects related to different social behaviors. This leads to the following matrix of initial codes for the theme "everyday life change".

Everyday Life Change	Frequency absolute	Frequency normalized
situational use	81	100
everyday life change	29	35,8
different behavior	23	28,4
made everyday life easier	15	18,5
suppose it can change everyday life	11	13,6
no everyday life change	10	12,4
no different behavior	6	7,4
try to integrate Glass into everyday life	2	2,5

Table 26: Initial Codes - Everyday Life Change

The most dominant code for this theme is "situational use" with a total frequency of 81. This initial code implies that the device is useful only in certain situations and not as integrated throughout the curse of an entire day as a smartphone. When examining the interviews, a variety of examples have been mentioned where the device is classified as "more useful" than a smartphone. This includes mostly hands-free applications such as navigation on a bicycle or when using augmented reality applications such as "explore the stars". Also, for many participants the camera functionality had a significant advantage over the traditional smartphone. Being able to take photos or videos without actively pointing a camera at the desired object or person does lead to more "natural" results. Of course other applications such as fitness software have also been used in this context. Being able to get real time information about the current run or bicycle ride on a heads-up display was often mentioned when discussing the use cases of such a device.

Hence, the device is not able to fully replace a smartphone but rather to extend its functionality and even be the preferred device in a variety of situations (compare "Smartphone Comparison" on page 120).

> *"I believe that different functions and different content will be distributed among different devices in a manner that I get the greatest possible benefit. There are certain things that will rather do with my smartphone in the future. Maybe there are certain things that I would rather do on a smartwatch and there are certain things which I would rather do on a smartglass. Hence I do not think that it can replace my smartphone, but surely expand it. (MM-01, paragraph 50)* [64]

The code "everyday life change" has been assigned with a frequency of 29, being the second most mentioned code. As disclosed previously, change is defined as something the user would not normally do with his or her smartphone. This also includes activities that the user performed more often in comparison to a smartphone. In this context a key aspect of the new technology is the "always on state" which implies a more ubiquitous connection to the Internet. Since the device is head worn, notifications such as phone calls, e-mails and SMS alerts are directly pushed to the users eye which makes it more difficult to ignore than on a smartphone. The constant connection between the user and the technology is one of the reasons applications such as the camera have often been mentioned in the context of everyday life change. Through the constant availability of the device, the inhibition threshold is much lower which led many participants to take more photos than they would have with their smartphone.

The following quotes will serve as examples of possible scenarios where the participants preferred the device over their smartphones and experienced a change through this technology.

> *"E.g I did not work out at the gym with my regular plan, but with the fitness app on Glass. That was rather fun." (MM-25, paragraph 6)*[65]

> *"I noticed that I would take a lot more pictures with the device [...], which I do not do as often with my smartphone." (MM-31, paragraph 46)*[66]

64. „Ich glaube es werden verschiedene Funktionen und Inhalte auf verschiede Geräte verteilt und zwar so, dass ich den grösstmöglichen Nutzen daraus ziehe. Es gibt Dinge die mache ich garantiert auch in Zukunft eher auf dem Smartphone. Es gibt vielleicht Dinge, die mache ich eher auf einer Smartwatch und es gibt Dinge die mache ich auf einer Smartglass. Also ersetzen glaube ich zum jetzigen Zeitpunkt nicht, aber garantiert erweitern."

65. „Ich habe auch z.B. im Fitnessstudio nicht meinen normalen Plan gemacht, sondern was von der Fitnessapp. Das war ganz lustig."

66. „Was ich gemerkt habe, ist, dass ich mit dem Gerät wesentlich mehr Bilder machen würde., [...] was ich

> *"What really provided a benefit was the navigation. That means I got off the subway, entered an address and navigated there. That was really good. I also tried this on a bicycle. That is pretty much the best experience." (MM-21, paragraph 4)* [67]

With a frequency of 15, the code "made everyday life easier" indicates that the life of almost half of the participants was not only changed but facilitated in certain situations. Some participants state that the smartphone is more complicated than Google Glass since it needs to be fetched out of the pocket, even for little interactions such as looking at the clock or checking SMS or e-mail. Through the new form factor which the device embodies, interactions with technology become more marginal. Through the constant presence of the device, getting information is becoming easier since the boundary between the user and the device is decreased. Hence, a variety of actions with the device is made simpler and adds to the existing notions that smartglasses can be useful in a variety of situations.

When discussing the topic of everyday life change, the code "different behavior" is an indicator of the social changes that happened in the lives of the participants apart from the used applications. With a total frequency of 23, most of the participants behaved differently while wearing the device in a variety of social scenarios. With a frequency of six, the code "no different behavior" indicated that six participants did not notice any changes regarding their behavior.

Some of the different behavioral patterns are described by the participants as distractions, mainly due to the above described "always-on state" of the device i.e. not reaching for the smartphone when trying to acquire a certain information. According to the interviews, other alterations have been noticed while communicating i.e. about the device (compare chapter "Communication" on page 140). Still, most of these alterations happened to the participants while being in public spaces, mainly in the presence of strangers. This includes feelings of an uncomfortable situation or the taking of photos, and hence acting on these situations accordingly.

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mit dem Smartphone nicht so oft mache."

67. „Was es mir wirklich gebracht hat war von der Navigation her, d.h. ich bin aus der U-Bahn ausgestiegen, habe eine Strasse eingegeben und bin eben da hin navigiert. Das war richtig klasse. Auch mit dem Fahrrad hab ich ausprobiert. Das war so ziemlich das Beste Erlebnis eigentlich."

> *"Yes. I wore them a few times in public. Actually I am a person who likes to look around and look at people. My view simply wanders. I noticed that I stopped doing that because people are looking at you and coupled with that is a very uncomfortable kind of eye contact because they awkwardly look away when you look back." (MM-12, paragraph 6)*[68]

The code "no everyday life change" with a frequency of ten, implies that some participants did not notice any active changes to their daily routine while wearing the device. Still, when asked if they could see possible ways in which the device might be able to change their lives, the code "suppose it can change everyday life" indicates that in deed they can see possible use cases where a smartglass is more useful than a smartphone.

The code "try to integrate Glass into everyday life", with a frequency of two, indicates that two participants did not see a need for the device but tried to integrate it into their daily routine just for the purpose of this study. The code has hence not been taken into account in the following chapter.

4.4.2.10.2 Focused Codes - Everyday Life Change

A total of four focused codes have been created to summarize the theme of "Everyday Life Change".

situational use

changes to everyday life

triggers unknown needs

different behavior in certain situations

Figure 48: Focused Codes - Everyday Life Change

68. „Ja. Ich hatte die ein paar mal in der Öffentlichkeit auf und ich bin eigentlich jemand, der sich sehr gerne umschaut und Leute anschaut. Einfach so den Blick schweifen lässt. Ich habe gemerkt, dass ich das aufgehört habe weil dich natürlich andere Leute anschauen damit und das immer zu so einem unangenehmen Blickkontakt kommt weil die Leute dann so betreten wegschauen, wenn du zurückschaust."

The first focused code "situational use" has been constructed from the equally named initial code. It implies that the device is useful in a variety of certain situations rather than throughout the whole day like a smartphone which is very embedded into the everyday life routine of the participants. Although the applications as well as the situations are the same, many participants used the device to replace their smartphone with the device since it seemed more practical to them. This included fitness applications, news applications, cooking applications and others where the device provided and advantage through the form factor.

The second focused code, "changes to everyday life", has been created from the initial code "everyday life change". In this context the initial code "no everyday life change" has been discarded due to the relatively low frequency when compared to its counterpart. As described in the previous chapter, changes of use did in deed happen to most of the participants in a variety of situations. This includes examples such as navigation on a bicycle and other hands-free applications that are made possible through the novel form factor.

Through this code, another focused code emerged: "Triggers unknown needs", which has been constructed from the initial codes "made everyday life easier" and "suppose it can change everyday life". The code implies that the device triggers yet unknown desires when using the new technology i.e. the taking of more photos than with a regular smartphone or a camera.

The last focused code, "different behavior in certain situations" has been constructed from the initial code "different behavior", which also has outnumbered its respective counterpart "no different behavior" in terms of frequency. The code mainly refers to a change that did not happen through the use of applications but in social situations. Most of the participants did behave differently while wearing the device. These alterations of behavior have been mentioned in the context of open public spaces as well as closed public spaces in which the participants did feels the need to behave differently due to the yet low social acceptance of the device.

4.4.3 Summary Focused Codes

This chapter will provide a brief tabular overview of the above elaborated themes as well as their respective focused codes. This overview provides a first impression of the interview findings which are yet to be sorted into proper grounded theory categories.

Outside Reactions	Places
– need for sensitization – positive curiosity	– useful on the go – not useful at workspace
Personal Restrictions	**Technical Restrictions**
– asked to take off device – want to take off device – familiar surrounding initially important – social etiquette important	– hardware / software not suited for all-day / prolonged use – technical refinement needed
Application Usage	**User Experience**
– missing applications – hands-free applications popular (navigation / camera / phone) – fragmented use of applications	– initial expectations / euphoria high – interaction with device unfamiliar – use too marginal
Communication	**Smartphone Comparison**
– device represents a distraction in normal conversation – people did not communicate differently – device topic of conversation	– certain applications better on smartglass – more accustomed to smartphone / very integrated – replace some functionality
Market	**Privacy**
– would wear smartglass eventually – will eventually replace smartphone – smartwatch as intermediary step – smartglass not for everyone	– additional endangerment of privacy (wearer and surroundings) – new laws / regulations / controls needed
Everyday Life Change	
– situational use – changes to everyday life	– triggers unknown needs – different behavior in certain situations

Table 27: Summary Focus Codes Main Study

In order to further proceed with the grounded theory methodology, the initial arrangement of the themes presented in this table have been discarded. The breaking up of this structure allowed for the creation of categories from the above mentioned focused codes. This was done by rearranging the codes into suitable categories which are used as the foundation of the presented theory in chapter "The Final Theory - The Situational Use of Smartglasses" on page 202.

This chapter concludes the presentation of the main study interview findings. The next chapter will examine the media diary findings in order to understand what implications they have in relation to the aforementioned main study findings.

4.4.4 Media Diary Findings

As mentioned in the chapter "Media Diary" on page 94, the participants of the main study had to fill out a media diary along with their testing of the Google Glass device. A variety of aspects could be taken out of this data and have been illustrated in the following chapters. These include the contexts of the well-being scale, the time of use and the the motives of usage. Furthermore, the application use as well as the utilization of the device in a specific location have been evaluated.

4.4.4.1 Wellbeing

One of the primary aspects in this study was to examine how the participants felt while wearing the device. Since the media diary features a wellbeing-scale, the level of comfort has been tracked through the week and ultimately evaluated. Please note that the social situation "work" as well as the attendees "colleagues" have been taken out of these diagrams since the participants did not wear the device at work enough in order to be representative.

Figure 49 shows the well-being in relation to the location the participants have encountered. The scale used for this inquiry ranged from 1-6, 1 being very comfortable and 6 being very uncomfortable. The option "0" was not available to the participants making "1" the choice for an optimum level of wellbeing. All of these results have been calculated by consolidating all diaries of every participant and consequently determining the average value. As the above diagram shows, the participants felt most comfortable with the device at home. The wellbeing scale never passes the value two and has a decreasing tendency.

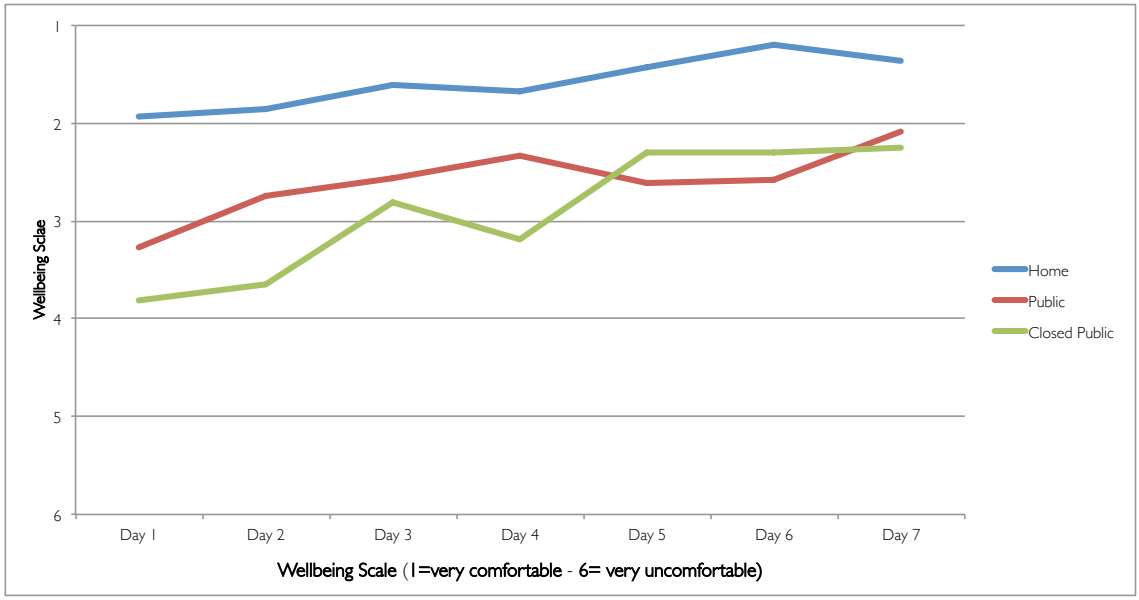

Figure 49: Wellbeing in relation to location

The most uncomfortable the participants felt was in closed public environments. These include metros or subways, restaurants, cafés, museums and so forth. The value starts at an average of 3.8 (*SD=1.6*) and ends with a 2.25 (*SD=1.28*). This indicates that the participants felt more comfortable with the device after spending some time with it, since the tendency is decreasing. The same can be observed for public places, which starts with an average value of 3.27 (*SD=1.34*) and ends with a 2.08 (*SD=1.12*). Throughout the week the participants have hence gotten used to the device and the reaction it provokes. It is believed that this tendency will continue to decrease over a larger amount of time.

Figure 50 shows the wellbeing in relation to the people which have been present during the wearing or the use of the device.

The used scale has been the same as in the anterior graph. This means that the participants generally felt the most comfortable when being alone or with their partners. When examining the average values for being alone with the device, starting with a 2.34 (*SD=1.5*) and ending with a 1.62 (*SD=1.06*), indicating an increased level of comfort. A similar result has been found in relation to the presence of the participants´ respective partners, starting with a 1.67 (*SD=1.05*) and ending with a 1.45 *(SD=0.96*).

The same observation can be made when the participants were in the company of friends or acquaintances. The starting average value was a 2.3 (*SD=1.61*), ending with a 1.7 (*SD=1.03*) hence also showing a decreasing tendency. The most uncomfortable the

participants felt while wearing the device was in the presence of strangers. Still, when examining the graph with a starting value of 3.27 (*SD=1.38*) and an ending value of 2.31 (*SD=1.09*) the tendency has been decreasing through the testing period, which indicated that the device becomes "normal" over time or in other words, that the participants got increasingly used to wearing the device.

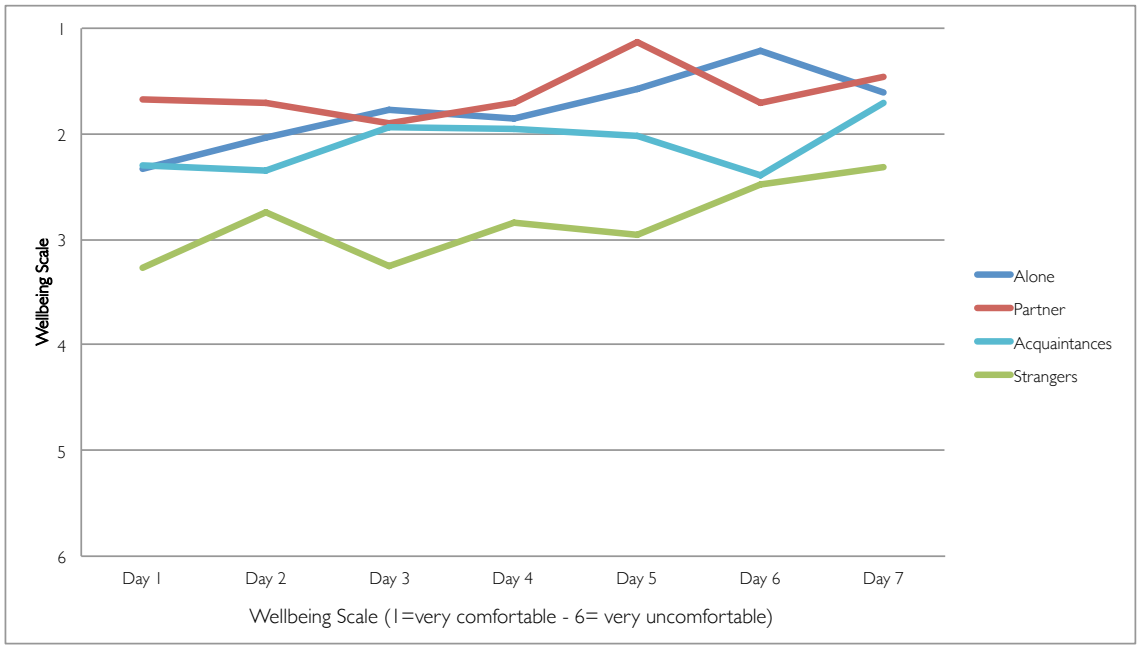

Figure 50: Well-Being in relation to attendees

All of the above tendencies are believed to decrease over a longer period of time, and hence increasing the level of overall comfort.

4.4.4.2 Duration and Time of Usage

This chapter will further examine how long the average application usage has been and how the usage has developed over time. Generally the duration of use in a single session is 1-2 minutes. This includes applications such as camera, clock, google and alike.

The second most applied duration is five minutes or more. These are applications like navigation, in some cases news, videos and often various applications in one session, which are considered to be used more than five minutes at a time.

The duration of 2-5 minutes has been assigned least, which means that applications such as the telephone, Google, games and news have been used longer at times.

The general finding is that the actual use of the device has been decreasing throughout the week. It is believed that the initial euphoria and the testing phase has initially been high and has decreased over time due to the lack of applications and the hence restrictive use cases the device provides.

The following diagram has been created by counting all the durations that the participants provided in their media diaries.

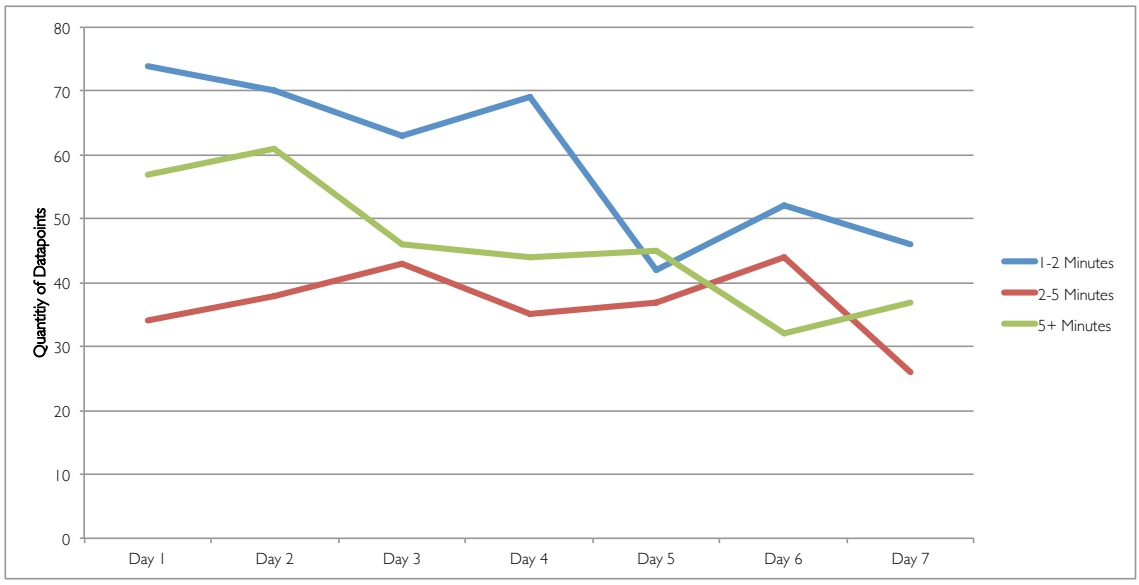

Figure 51: Duration of usage

When considering the time of day, many participants did unconsciously forget to provide it while filling out the media diary. The rest of the data has been evaluated to the result that no clear pattern could be identified. There has been no routine among the participants since not all of them worked "9-to-5" office jobs. Many of them were students or freelance workers, and others who work regular office hours still did not provide whether they work part time or on weekends. Hence it can not be concluded that a certain application is used most or more at a certain time of day.

Still, the time of day variable did provide a valuable insight - it does not matter. The application usage has been very cluttered even within certain times of day which means that a clustering of application usage with the time of day as an indicator was no seen as useful for this study.

4.4.4.3 Motives of Usage

The aim of this chapter is to examine the motives of usage and the change they undergo in the tested period. The initial motives of mobile have been taken from Karnowski and Jandura (2011). They name five possible motives to use a smartphone, namely: Status, the care for social contacts, entertainment, reachability and research information. Throughout this study, and mainly due to the novelty of the device, a sixth motive has been added: Test. This refers to the times the participants installed applications and tried out the respective functionality.

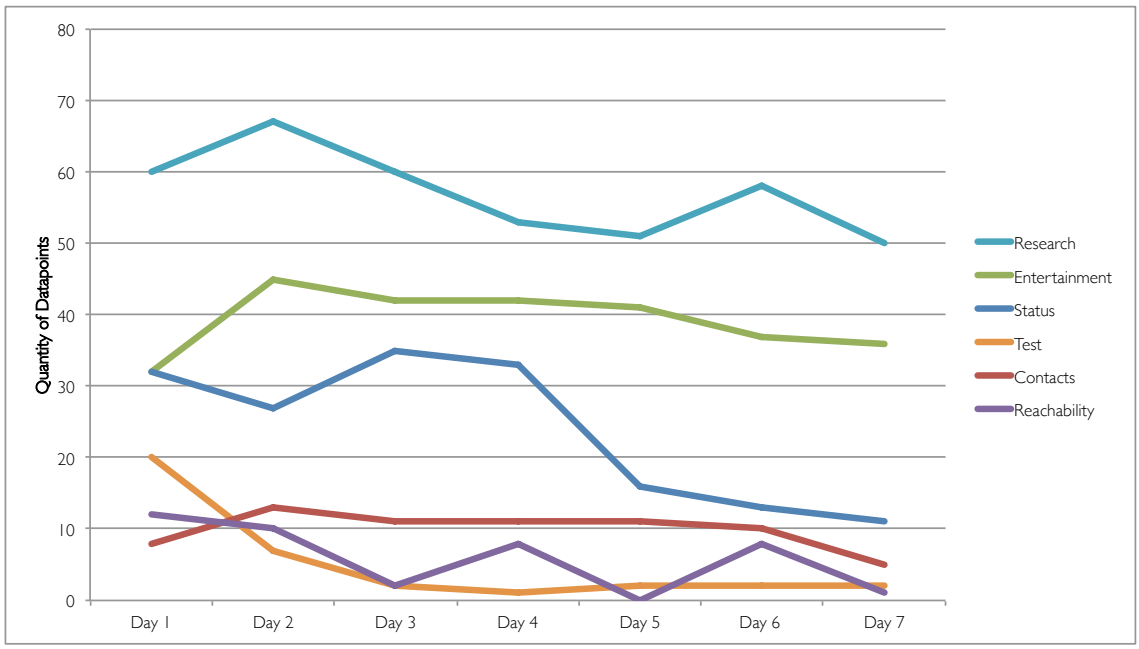

Figure 52: Motives of Use

The motive "test" has been high initially and steadily decreasing throughout the tested time. Of course, a new device with new applications is tested in the initial phase and over time is used only for use cases that are meaningful to the participants.

The motives "contacts" and "reachability" only have a secondary use as their curve remained mostly constant throughout the week. Applications like phone, SMS and e-mail are only options to communicate and have not been popular among the participants. This is due to the participants´ use of alternative messaging systems like "Whatsapp", "Threema" or "Telegram" and the general problem with the dictation option only being available in the English language. The remaining motive, "status" has been constantly decreasing

while using the device. It is believed that at some point the novelty of the device is not given anymore and the participants did not feel the need of showing off the device to their friends and family.

Mostly the device has been used for research and entertainment purposes. This means that applications like navigation, camera, games, Google and so forth have been used most.

4.4.4.4 Application Usage

The aim of this chapter is to evaluate what applications have generally been used most and how the use of them has changed during the testing period. For the creation of the following graph the frequencies have been counted regardless of any circumstantial factors such as location, well-being, attendees and so forth.

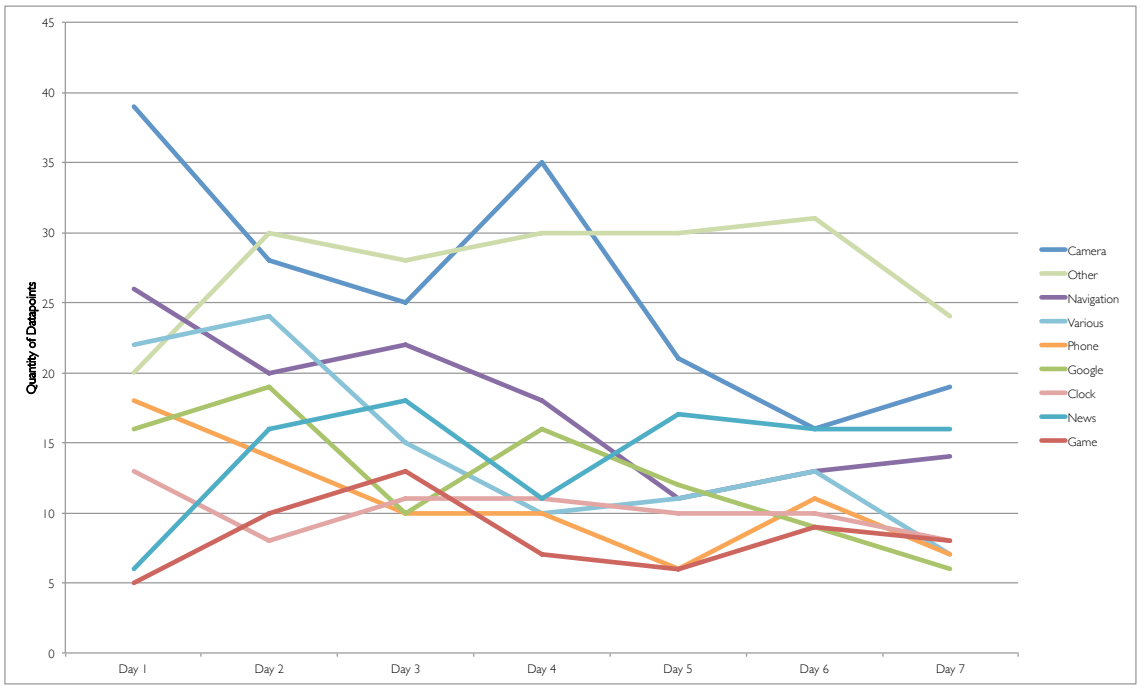

Figure 53: Application Usage

The most used application throughout the testing week has been the camera since it did not require any internet connection and has been easy to use. Still, the use has been decreasing throughout the week.

The category "other" has been created in order to avoid confusion in the graphic illustration. The applications included in this category are: all fitness applications, all social network applications, calendar, compass, recipe application, e-mail, Evernote, field trip, google now, language learning, music, product scanner, shazam, SMS, start chart, stopwatch, timer, translator, word lense and Youtube. Since these applications did not belong to the most used, they have been summarized and designed as a single line. All of these applications together have been used more than the camera throughout the week and show how the usage is going down towards the end of the week.

When examining the rest of the here described applications, namely the phone, google, clock, games and various applications at a time, a pattern emerges. The participants used the device and hence the respective applications less towards the end of the week. Therefore an initial euphoria with a lot of testing involved, can be concluded. This does not happen for three applications: camera, navigation and news. Although the use has decreased, it can be observed that at the end of the week, it reaches a point where the use becomes more stable and are believed to be used more during a longer period of time.

4.4.4.5 Application Usage per Location

This chapter aims to examine where the device has been used most, and what applications have been used most in the respective locations. The first chart will illustrate where the device has been used most in general without listing the applications that have been used in the particular locations.

As seen in figure 54 the device has mostly been used at home, closely followed by public spaces. At home, the participants installed and tried many applications and, as the interview results show, felt comfortable due to a familiar surrounding (compare "Outside Reactions" on page 137). Although most of the participants did not feel comfortable with the device in public spaces, the device offers its main use when commuting (compare "Places" on page 167). Still, the level of comfort has been too low in order to be used regularly in closed public spaces.

The place "friend´s home", also with a comparatively low frequency of visit, is not related to the state of well-being but rather to the overall amount of visits during their testing period, which compared to being alone in public or at home, is not as high.

Since the device offers no real value at the workplace, except for private matters, the device has not been used as often at work (compare "Places" on page 167).

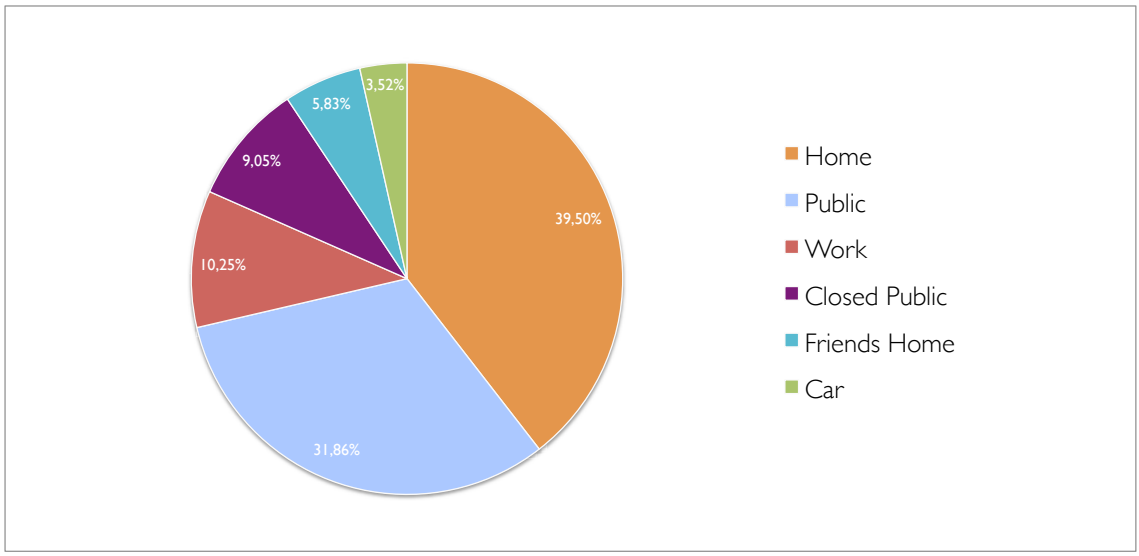

Figure 54: Device Usage per Location

The device has least been used in a car. Two limitations apply in in this situation. The first being that not every participant owns a car, or did use it in the testing period. The other being that, due to an unclear legal situation, some participants did not know whether they could use the device while operating a vehicle.

As figure 55 illustrates, each location has been examined individually in terms of application usage in order to explore the divergencies and patterns between the different places the device has been used at. The following charts will examine what applications have been used most at which location. Please note that the actual analysis of these charts will follow later in the chapter "Discussion and Analysis of Findings" on page 189 in order to substantiate the interview findings and their respective focused codes.

These results can also be compared to the initial codes of Application Usage found in the chapter "Application Usage" on page 152 as well as the chapter "Places" on page 167, which correspond with the findings presented here.

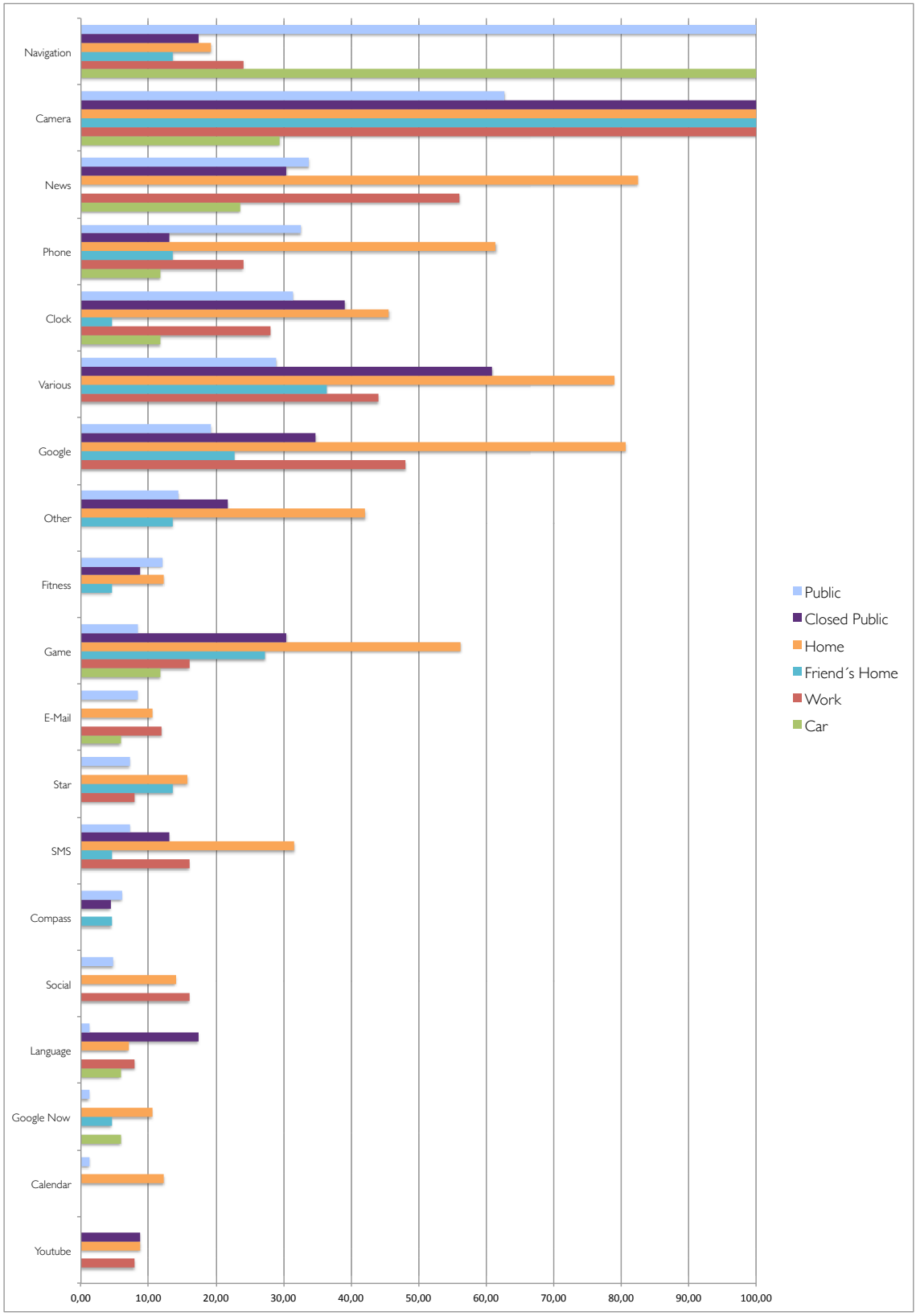

Figure 55: Application Use per Location (normalized)

The category "other" found in the above chart has been composed of the ensuing applications: recipe application, Evernote, field trip, music, product scanner, shazam, stopwatch, timer, translator and word lens.

As the above chart illustrates, the application usage varies depending on the location the device is used at. While the navigation as well as the camera has been most used in public places and the car, applications like the news, google as well as the camera have been used more at home.

When at a friend´s home, the participants did prefer applications like the camera and the games. In closed public locations, the preferred applications include the camera, the clock and google. At work, the most used features were the camera, the news, google and the clock. Although the camera is not a work tool for most office jobs, it is believed that in this context the camera was used to show the device to co-workers and let them try the device on their own.

While the use of applications is fragmented and differs depending on the location, the most used applications as seen in the chapter "Application Usage" on page 152 remain the same.

The next chapter will summarize all the constructed focused codes in order to be rearranged, compared and analyzed in the following chapters, together with the results of the media diaries with the ultimate result of creating a grounded theory.

4.4.5 Final GT Categories

The here proposed categories have been constructed through the careful analysis and re-clustering of the main study focused codes (see chapter "Summary Focused Codes" on page 174), which are supported through the media diary findings. This serves the purpose of organizing the focused codes into the here presented grounded theory categories.

Category	Related focused codes
Privacy	– additional endangerment of privacy (wearer and surroundings) – new laws / regulations / controls needed – asked to take off device

Sensitization	– need for sensitization – initial expectations / euphoria high – device topic of conversation – positive curiosity – familiar surrounding initially important – interaction with device unfamiliar – would wear smartglass eventually – smartwatch as intermediary step
Social Etiquette	– social etiquette important – asked to take off device – device represents a distraction in normal conversation – people did not communicate differently
Location	– useful on the go – fragmented use of applications – certain applications better on smartglass – hands-free applications popular (navigation / camera / phone)
Restricted Use	– want to take off device – hardware / software not suited for all-day / prolonged use – technical refinement needed – not useful at workspace – more accustomed to smartphone / very integrated – smartglass not for everyone – missing applications

Situational Use	– situational use – replace some functionality – certain applications better on smartglass – changes to everyday life – triggers unknown needs – different behavior in certain situations – use too marginal – will eventually replace smartphone

Table 28: Categories with focused codes

The next chapter will summarize all the the presented findings, including the pilot and main study as well as the media diary, and provide an overview of the results.

4.5 Chapter Summary and Conclusions

First, the pilot study findings have been clustered into different themes in order to gain an overview of the contents of the interviews. A total of eight different themes have been proposed. These include the reality perception, the outside reactions, the communication, the privacy, the personal and technical restrictions, the application usage, a smartphone comparison and lastly, the everyday life change. Through the evaluation of the initial and focused codes in the pilot study, the data has been analyzed and further examined for possible patterns of use. Furthermore, throughout the presentation of findings of the pilot study, the proposed memos have been elaborated and presented, which serve the purpose of further refine the questions for the main study.

Through the conduction of a focus group interview, new insights could be gained, since new aspects have been discussed which have been left out in the one-on-one interviews of the pilot study. Both, the pilot study as well as the focus group discussion served the purpose of refining the questions for the main study.

The findings of the main study have consequently been presented. Since the initial theme "reality perception" has not produced any promising results, it has been left out in the main study. However, three initial themes, namely "User Experience", "Market" and "Places", have been added since more interviews have been held and the gathered data was more comprehensive. Similar to the pilot study the findings have been presented with the respective initial and focused codes.

In the next step, the findings of the quantitative media diaries have been presented, which has been added in order to add a triangulation of methods which helps to generate more data. This diary has been tested by one participant in order to further refine it for the actual implementation in the main study. Again, clustered into themes which include the wellbeing, the duration and time of usage, the motives of usage, the application usage and the application usage per location. These findings have later been used to further verify the data gathered from the qualitative interviews.

Lastly, the grounded theory categories have been proposed, based on the focused codes of the main study, which are supported through the results of the media diaries. These categories will be analyzed in the next chapter and have formed the foundation of the final grounded theory.

5. Discussion and Analysis of Findings

The following chapter will analyze the findings presented in the previous chapters. As mentioned above, a total of six grounded theory categories have been created from the focused codes, which are: Privacy, Location, Social Etiquette, Sensitization, Restricted Use and Situational Use. The categories "Situational Use" as well as "Restricted Use" are defined as the core categories since all other proposed categories are connected to them. Furthermore, it creates the foundation for the final theory of this study. The chapter will continue to analyze the here presented categories in detail and discuss how they are related to to situational as well as the restricted use use of smartglasses.

Furthermore, the chapter will look into the parallels and divergencies from the academic literature which has been examined in the chapter "Theoretical Context and Key Concepts" on page 7.

5.1 Analysis of grounded theory categories

5.1.1 Category 1 - Privacy

5.1.1.1 Privacy of wearers and surroundings additionally endangered

Privacy has been a concern to all of the participants. This does not necessarily mean that privacy is of equal importance to every one of them. Still, a lot of issues have been raised for two reasons.

The first reason, from a user perspective, refers to the fact that the wearer has to accept a license agreement from Google which allows the company to track the users location constantly (compare chapter "Privacy" on page 143). This alone was reason enough for some participants not to wear a device from this particular manufacturer. Some argued that smartglasses seem like a practical and useful device, but if wearing it implies to sign a contract that binding, they would rather relinquish the device and buy it from another company. Also, the creation of an account for the social network "Google Plus", which was necessary to activate the device was another, personal burden that some of the participants had to overcome when initially setting up the device. Furthermore, the participants had concerns about their data like personal photos or videos being taken. Since all of this personal footage is uploaded automatically to the Google Plus network, some of the participants refused to use the device for the purpose of taking pictures and videos.

The second reason, from a surroundings perspective, which has been mentioned in the context of privacy, is the head worn camera (see chapter "Wearable Computing Privacy" on page 49). Since the camera does not point at the participants themselves, but at their immediate surroundings, they often got asked to take off the device, after getting asked if the device is capable of taking photos. Also, the participants themselves claimed that it was very easy to take pictures of strangers and their surroundings unnoticed and hence saw a potential danger for themselves if other people wore the device.

5.1.2 Category 2 - Sensitization

5.1.2.1 The user struggles with unfamiliarity

This aspect of the discussion is two-fold. One perspective to the mentioned unfamiliarity is the handling of the device itself, while the other facet refers to the initial importance of a familiar surrounding while using the smartglass.

The initial euphoria when first getting the device was comparatively high due to its novelty and its innovative character. After a certain time with the device this euphoria declined due to the unfamiliar handling of the device. Many participants encountered problems with the user interface and were hence disappointed as well as frustrated quickly. Since all of them are used to handle a smartphone or a tablet with a touchscreen, the user interface which is mainly controlled via voice and gesture commands, seemed rather confusing to many of them. Hence a new sensitization has to take place, since the interaction with technical devices will change over time. Through new methods of interplay with technical innovations, the communication with robots will become more like humans interact: through voice and gestures. The same notion has also been suggested by Campbell et al. (2014). At the tested time, most of the participants had difficulties with this new kind of exchanging information with a machine.

The other aspect of unfamiliarity is of social nature. For most of the participants a familiar surrounding was initially important when wearing the device. Due to the low social acceptance of the device, a safe environment was needed in order to familiarize themselves with the device and the reactions it triggers. Hence, the participants wanted to try out the device in a familiar surrounding which can either be location-related i.e. at home and or at a friend´s home, and / or attendee-related i.e. with friends, partner or family. In the appropriation phase of the domestication framework, Silverstone et al. (1992) suggest

that the rules for a new technology are first defined in the household and later in a society at large.

As seen in the the chapter "Wellbeing" on page 176, the level of indisposition decreases over time, making the device more normal to the wearer. Rogers (2003) suggests that it depends on the type of innovation, but that at some point in the implementation phase it will become "normal" or taken-for-granted. This can also be seen as the reason for why most of the participants would wear such a device eventually. Of course, other aspects such as a variety of technical refinements as well as a broader social acceptance are also seen as possible aspects of a future buying decision.

5.1.2.2 Smartglasses are not socially accepted

One of the main concerns for the participants has been the constant staring of strangers in public spaces. Since the device attracts a lot of attention due to the unusual form factor, the participants often got a feeling of discomfort while the device was worn.

It is believed that the missing sensitization of the broader masses regarding the device is responsible for the sometimes irritated reactions. Still, the overwhelming reaction from strangers has been very positive which has manifested itself through many curious questions i.e. "What is that?", "What can it do?", "May I try them?" and so forth. This portend to an increased interest towards the technology, but also shows that most of the people did not know the device, which sometimes let to people asking the wearer to take off the device.

When with friends or family the participants noticed that the topic of conversation changed at some point to the device. It needed to be explained, to be tried and overall, to be discussed. Through the constant attention the device attracts, some of the participants got annoyed, and wanted to take it off, since they wanted to have a "normal" conversation, which does not include talking about the smartglass.

For both, the reactions from strangers and the reactions from the close social surroundings, some participants stated that it would be better at this point in time to wear a smartwatch, since it is less obtrusive and is less apparent to others. Still, this is seen as an intermediary step, since a smartglass potentially provides more use cases through the augmented reality applications. Through the low sensitization of the technology, some of the

participants felt that the use of a device which stands out less would add to the overall level of comfort.

This notion adds to the general concept of a restricted or situational use, which in this context is mainly created through the low social acceptance and the need for sensitization, which led many of the participants to take off the device in certain situations.

5.1.3 Category 3 - Social Etiquette

5.1.3.1 Social etiquette is important

Throughout the interviews, a pattern emerged. To many of the participants, a certain politeness is important. Google itself released an etiquette guide (Google Inc., 2013b) which tells their users how to behave when wearing the device. This "handbook of manners" includes nine rules, which the wearer how to comport themselves while being in a social situation. The following excerpt is taken from this manual in order to illustrate how Google wants their users to behave.

> *"Respect others' privacy and if they have questions about Glass don't get snappy. Be polite and explain what Glass does and remember, a quick demo can go a long way. In places where cell phone cameras aren't allowed, the same rules will apply to Glass. If you're asked to turn your phone off, turn Glass off as well." (Google Inc., 2013b)*

Even without reading this guide, many of the participants respected the rules dictated by common sense. Lenart et al. (2010) argue that a restructuring of the social etiquette regarding smartphones has already happened when examining a younger demographic group (see chapter "Smartphones in Society" on page 55). Behaviors have changed (for better or worse) in social contexts when using a smartphone. Campbell et al. (2014) assert that through devices like smartglasses these rules might get altered again. This includes taking the device off when it seemed impolite or inappropriate when being in a conversation or when others asked them to take off the device due to privacy concerns. Others asked for permission when wanting to use the device at a specific location like a department store or a cinema.

This again adds to the overall notion that the use of the device is restricted by many factors. In this case, the society which is not entirely sensitized in regard to the device. Similar to the legal regulations discussed in the chapter "Restricted through legal bound-

aries" on page 198, it is believed that other societal rules for such devices will emerge over time, when it is clear what they are and aren´t capable of and how to best make use of them.

5.1.3.2 Communication does not change

When examining the social etiquette regarding this new technology, it is inevitable to discuss the potential change of communication. When first designing the interview questions, the assumption was that the face-to-face conversation gets altered since a new piece of technology is essentially in the way.

This assumption could not be confirmed. Although the participants stated that the topic of conversation often drifted to the device itself, as already discussed in the chapter "Smartglasses are not socially accepted" on page 191, the communication itself did not undergo any noticeable change. This was stated by the participants for both themselves as the "wearer" as well as for the surroundings which in this case are seen as the "conversation partner". Again, in certain instances the wearer was asked to take off the device, since privacy concerns were raised by the conversation counterpart, which is not seen as a "talking or communicating differently" but rather as an interruption of the face-to-face communication itself.

5.1.3.3 Smartglasses represent a distraction in a normal conversation

An initial assumption was that the smartglass could help in regular face-to-face conversations compared to a smartphone. The device has the potential to be less obtrusive than a smartphone due to the head mounted display. Hence, instead of looking at the phone every time a push notification is displayed, the wearer of a smartglass could simply dismiss these notifications by taking a quick glance at it and then deciding whether it has to be dealt with right away or if it can be put off for later. This would allow the wearer to be more engaged in the conversation he or she is having since a phone has to be actively taken out of the pocket in order to see a notification. Lenart et al. (2010) assert that younger people have already adopted the division of attention into their daily lives and through the use of a smartphone a portal is created which gives social peers the opportunity to appear and disappear virtually at any given time. In the case of smartglasses this kind of behavior might increase due to constant presence of the device.

However, this has not been the case for the participants. Most of them saw the device as a distraction, mostly because it is worn all the time. Hence, the technology creates a boundary between the two or more conversation partners. Through the unavailable option to not wear the device in order to be useful, the technology is constantly intruding the conversation, even if not engaged. Of course, with the form factors getting smaller and essentially approach regular glasses, this might be an issue which could go away in future or other version of devices like these hence enabling the wearers to be less distracted in a conversation than with a smartphone.

5.1.4 Category 4 - Location

5.1.4.1 The main use of smartglasses is in transit

When examining the interview results, a pattern emerged. Although the participants did use the device at home in order to install applications and familiarize themselves with the device, the main use has been when communing from one place to another. This mainly manifested itself when asking the question about a typical day with the device. Although some participants stated that there has been no routine while wearing the device, they still believe that the main use is when being in public.

When comparing the smartphone to the smartglass, it has become clear that the smartphone is a very domesticated device (Vincent, 2013), which has many use cases inside and outside of the home. The smartglass however is a device which the participants would start using when leaving the house i.e. the participants would get woken up, check e-mail, text messages and the weather while still at home with their smartphone, and would then switch to the smartglass in order to use the navigation (on a bicycle, in a car or while using public transit), use it as a headset for hands-free phone calls, as a clock or to check the news while commuting (see chapter Media Diary Findings - "Application Usage per Location" on page 182). Theoretically, "places with sense" could be developed and constructed through the prolonged use of devices devices like these ("Mobile Societies" on page 52). Through the hands-free form factor of the device, the notion of convenience did prevail in the overall evaluation of the interviews.

Hence, in certain situations, mainly in transit, the device was used more than the smartphone since the form factor did not necessarily allow new uses, but rather made the old uses more practical. This again adds to the notion of a situational, restricted use of smartglasses, which at the tested time could not be seen as a domesticated device, but

rather a device which has been used outside and on the go. In this context, the domestication framework of Lie and Sørensen (1996) might be more appropriate than the approach of Silverstone et al. (1992), since the focus is shifted from the household to other situations of use such as outside of the house.

Still, some technical restrictions may apply i.e. bad cellular or network connection, which will be reviewed in the chapter "Restricted through technical boundaries" on page 197.

5.1.4.2 The paradox of a dominant use in public

Still, a paradox arises when claiming that the main use is in public spaces: the low social acceptance of smartglasses.

As already discussed in the chapter "Smartglasses are not socially accepted" on page 191, the device provoked a variety of uncomfortable situations in public spaces. This is mainly due to to novelty of the device and the unusual form factor. The paradox arises from the fact that is was difficult for many participants to wear the device in public due to the missing social sensitization and the fact, that the main use of the device is in public spaces. Hence it seemed rather difficult to balance these two opposites.

Of course, this does not apply to all participants and is still a very subjective matter. Still, the general notion of this paradox again adds to the notion that the device is used rather situational due to the social anxiety that could be found for most participants. It is believed that this will be solved by different designs of future versions of this or other, similar devices, since most of the participants stated that they would feel more comfortable wearing such a device if the form factor would be less obtrusive.

5.1.4.3 The application usage of smartglasses is fragmented

Although it has been established that the main use of smartglasses is in public places, the overall use of the device has still been very fragmented. As presented in the chapter "Application Usage" on page 152, the main functions of the device (navigation, camera, news), have mainly been used in public spaces as seen in the chapter "Application Usage per Location" on page 182. Still, a variety of other applications have also been used at a range of different locations, which, depending on the user, have been diverging, similar to smartphones.

The way smartphones are used by the participants, although exhibiting a pattern, also varies through the use of many different applications, suited to the needs of each user (Vincent, 2013). Still, when smartphones first became a mass phenomenon, they did not provide as many applications and, hence tried to undertake uses of already existing technology like a phone, a camera, a music player and alike. Over time, new uses developed which made the use of smartphones a lot more comprehensive.

Although the smartglasses did not provide as many applications as a modern day smartphone, the pattern is the same (compare "The influence of technology on society" on page 51). The smartglass incorporates the "old uses" of a smartphone such as camera, navigation, phone, text messages and alike and at the same time, develops new uses through augmented reality applications, voice and gesture controls. Of course, these applications can also be found on a smartphone, but, according to participants, make more sense on a device that is head-worn.

Although the device has mainly been used for certain applications as well as in certain locations or social situations, the participants did use a variety of other applications, which are suited to their current needs.

5.1.5 Second Core Category - Restricted Use

5.1.5.1 Restricted through personal boundaries

The chapter about restricted use has three parts. First, the personal boundaries which restricted the user will be discussed. The second part of this chapter will examine the technical restrictions the users encountered, and the third part is concerned with the legal limitations. This structure is derived from the Social Shaping of Technology (Wajcman, 2004; Williams & Edge, 1996) perspective since a new technology has to be understood as something that is neither exclusively social nor technical. Thus, in order to gain a holistic view one must examine all aspects.

The first personal restriction arises from the fact, that the user is very used to his or her current mobile device, the smartphone. The device is a very integral, domesticated part of the users´ everyday life which is problematic to replace by a new technical innovation. Even more if this innovation does not perform most of the tasks as good as the device they are currently using. Through a lot of societal as well as technical restrictions (see the following chapter), the Google Glass device has not become as integral as initially expected.

The users hence wanted to take off the device in a variety of situations triggered by the feeling of shame and social inappropriateness. This happened mainly in social situations with other attendees i.e. in a restaurant or at a friends home, where it seemed impolite to keep using the head worn device. Consequently the desire to take off the device and be part of a conversation rather then distracting from it, became so strong that many participants decided to put the device away.

Furthermore, it has been stated that a smartglass is not for everyone. The device has been worn by a variety of participants which at the end of their testing period stated that they would rather wear a smartwatch or keep using their smartphone and did not see any benefit from using a device like this. As seen in the uses and gratifications approach on page 46, a variety of different motives can be identified when examining the use of mobile media. If the user does not believe that the device is beneficial, then the usage will decrease respectively. Besides from the missing added benefit, they stated that a device that intrusive is still not socially accepted enough which restricts the wearing of it most of the time. Thus adding to the notion that the use of device is rather situational and circumstantial since it needs to be taken off in certain social scenarios.

5.1.5.2 Restricted through technical boundaries

The second part of this chapter will examine the technical restrictions the participants encountered while wearing the device.

One of the most stated issues were the missing applications, which the participants expected while testing the device. Since all of the participants are used to having a vast choice of personalization on their smartphone, the applications available on the device are not sufficient to satisfy this need. When comparing the available applications by numbers, ("Number of apps available in leading app stores as of July 2015", Statista, 2015) it becomes clear that both app stores (Apple and Google) with well over 1.5 million different applications are no comparison to the barely over 100 applications available for Google Glass. Hence the device can not be individualized as much, and can only be used in situations, where an application has already been designed. Akrich (1992) argues that the use of technological artifacts is thus limited by design. The proposed "script" approach asserts that the actions which can be performed with a new technology are already embedded in the latter, thus leaving the user no choice but to behave accordingly.

Aside from the software, the hardware is also not suited for a prolonged use throughout the day. Problems arose with the very poor battery life, which did not last a full day. In comparison, a smartphone battery usually lasts an entire day and is meant to be charged over night. However, many participants stated that they always had the charging cable present in order to refill the battery once it was empty. Another issue that presented itself while using the hardware, was the development of heat when using certain applications such as the watching and taking of videos for more than five minutes. Through the head worn nature of the device this problem was classified from "unpleasant" to "unwearable" by most of the participants, which makes it only usable for certain applications. Hence in many aspects, a technical refinement is needed in order to create a solid ground for future development. This does not only apply to the technical problems but also to the design of the device which for many of the participants has been too obtrusive.

As a last point one might add that the device has not been useful at the workplace for most of the participants. This is classified here as a technical restriction since the device did not offer any applications that would have been useful in this scenario. Again, the notion of a situational use becomes more distinct.

5.1.5.3 Restricted through legal boundaries

To many participants the laws and regulations when using or wearing the device have not been clear. Hence a variety of questions arose during the testing period: "May I drive a car / bike with the device?", "May I go to the cinema wearing the device?", "Are there situations in which it is forbidden to take photos?" and alike. At the time of the study, the legal situation has not been clear enough to answer any of these questions properly.

These concerns have been disturbing to many of the participants, since the restrictions of use from a legal point of view have not been defined clearly enough. John McKinlay, a partner at the law firm "DLA Piper", states the following:

> *"Overall, the benefits of embedding and wearing technology are so numerous that their rise is unstoppable but it is an area with many legal challenges, and it seems clear that further official guidelines and legislation will be necessary to ensure that the implications of their use are controlled and safe for everyone." (McKinlay, 2014)*

He hence argues that a new set of regulations of controls are needed in order to ensure not only a safe way of working and handling the devices to come, but also that privacy as well as legal issues can be addressed by the people affected by the technology can be handled in an uncomplicated manner. A variety of examples further illustrate the unclear set of regulations. In the USA a woman has been fined with a ticket due to the use of Google Glass while operating a vehicle. This accusation later got dismissed in court (Graham, 2014). Another case arose when a bar in Seattle / USA forbid the wearing of Google Glass on the premisses (Hickey, 2013). The device was also especially forbidden in certain cinemas (Child, 2014). Generally the device is not allowed in any closed environment which have rules against photo or video recording. This includes casinos, government buildings, gym locker rooms, doctor´s offices and alike (Petronzio, 2013).

The privacy issues described in the previous chapter as well as the unclear legal situation, add to the overall notion that the use of such a device is still very restricted by a variety of aspects. However, from a legal point of view the participants did not encounter any problems except for some minor occurrences where they were asked to take off the device e.g. in a department store.

5.1.6 Core Category - Situational Use

5.1.6.1 Partial changes to everyday life

When examining the changes made to everyday life, a phenomenon occurred. The device has been triggering unknown needs in some of the participants. This manifested itself when the participants i.e. took more photos than they would with their smartphone or read the news more often. Hence, the form factor allows the user to access certain information more quickly or be able to take a picture or a video of a certain situation easier than with a common smartphone. Therefore, through the constant presence of the device, certain needs get triggered and can be acted upon almost instantly without the hesitance whether to pull out the smartphone or not. Rogers (2003) argues that in the knowledge phase of the innovation-decision process, needs are created which impact the buying decision. However, in this scenario the needs are created and partly reinforced although the device is already obtained.

Also, when discussing different patterns of behavior, other changes occurred, mainly in public places. Since many of the participants did not know how to behave in public places while wearing the device, they acted differently when in a social situation. This includes

looking away more often, being distracted, hiding from perceived stares and so forth. The participants felt that these devices are not socially accepted and that they need to behave differently in order not to be extruded or to be embarrassed.

Generally, aside from the triggered needs and different behavioral patterns, many changes to the everyday lives of the participants occurred. These are different from case to case but include alterations like using fitness applications, taking digital notes, taking pictures and most of all using the navigation. All these applications, aside from the basic functions such as telephone, e-mails, SMS and so forth, have been used more or mostly on the device. Through a greater overall embeddedness (Campbell et al., 2014) the device was preferred over the smartphone for convenience in many cases.

5.1.6.2 A possible smartphone replacement

The device did replace the basic smartphone functionality for most of the users. Basic functionality in this context is defined as telephone, SMS, navigation and camera. Still, there are many applications which are important to the users that could not be replaced. Hence the replacement took place only for certain applications in specific situations. McQuail (2010) argues that a new technology first undertakes the uses of an old technology. Over time however, new uses develop (see chapter "The influence of technology on society" on page 51). At the time of this study, a few new uses could be identified i.e. the augmented reality application "star explorer". It is believed that when the device is more advanced technically, more people will use the device and thus more applications will be developed making it more convenient to integrate the device into the daily life of users and create new uses, that are not possible on a modern day smartphone. Furthermore, devices like Google Glass have the potential to become truly domesticated over time by integrating them into households and replacing the smartphone.

When asked if the participants think that the device could replace their existing smartphone, more than half answered that it definitely will in the future. Also, the majority of participants would wear such a device, if it undergoes a technical refinement and the design changes accordingly.

5.1.6.3 The use has to be defined as situational

Concluding, connecting to all other chapters and categories, stands the situational use of this wearable device.

The results suggest that the device cannot be integrated fully into the daily life as initially expected. Still, there are situations in which the participants preferred the device over their smartphone. This might be to replace the basic functionality of their mobile phone, or applications in which the hands free form factor did provide an actual benefit at a certain location such as navigation on a bicycle (see chapter Media Diary Findings - "Application Usage per Location" on page 182). Also, for augmented reality application such as the star explorer where the user can look into the sky and enhance the stars with additional information, depending on the star they are looking at.

However, many applications are still missing and there are yet gaps to fill in order to truly replace such an integrated and domesticated device like the smartphone. Also, other aspects such as the privacy protection, the low social acceptance and sensitization, the social etiquette, the main use in public places as well as the technical and personal boundaries contribute to the notion that the device is not ready to be used all day in any given situation. Rather the user has to see if there is a useful application in the situation he is in, and then verify if all the above aspects allow him to use the device for the task he is planing to fulfill (see also "Situational Media Use" on page 43).

The situational use is hence defined as the core category to which all other proposed categories connect. The following chapter will illustrate the final grounded theory and how the proposed categories connect to each other, as well as how all of them are related to the core categories - restricted and situational use.

5.2 The Final Theory - The Situational Use of Smartglasses

5.2.1 The Model

The here presented model is the outcome of the above proposed final Grounded Theory categories as well as the evaluation of the media diary findings. It shows how and to what extend the categories are connected. The category "User Bound Factors" has been added from the extensive review of the literature, and intents to cover all aspects that have not been discussed in the interviews, but still influence the situational use of smartglasses. The model is shown in the following as an illustration in oder to understand said links.

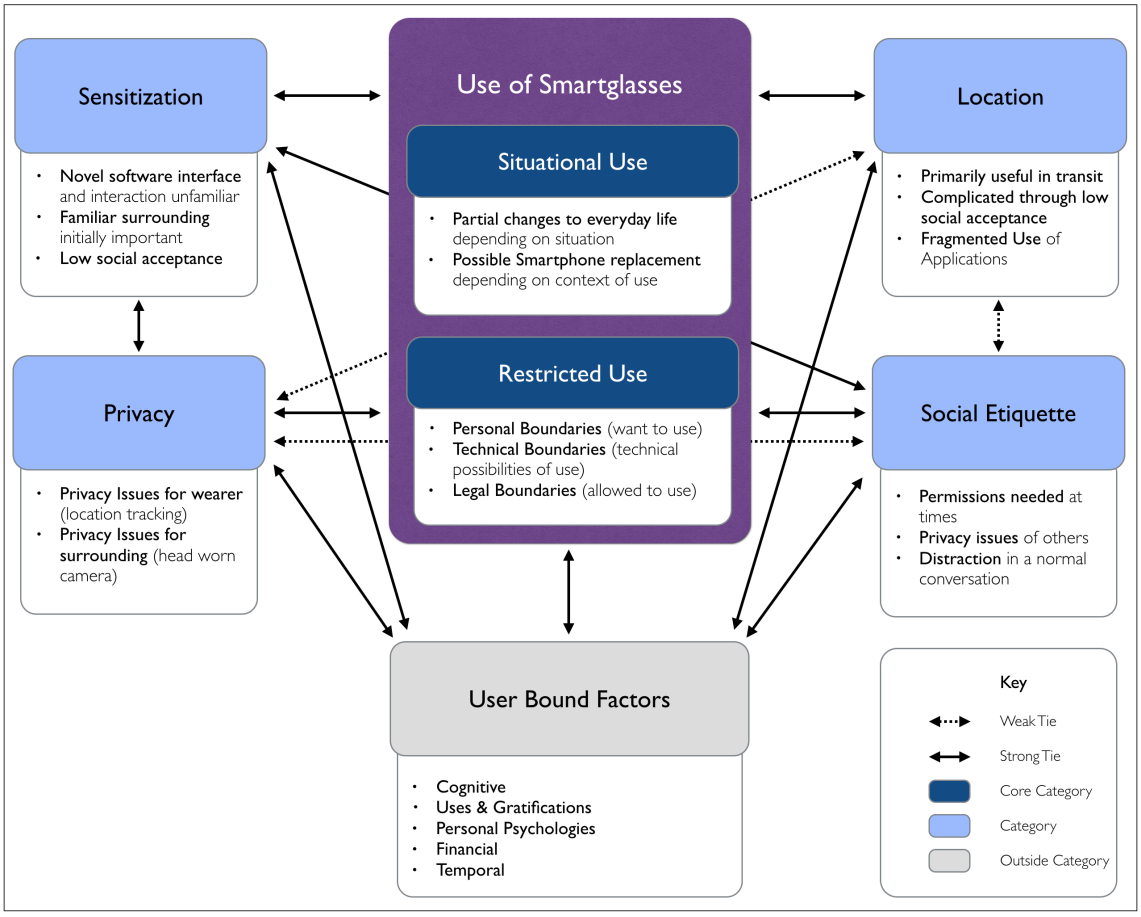

Figure 56: Situational Use of Smartglasses

In the following chapter the connections between the categories will be explained in further detail and elaborate how the categories are connected among each other.

5.2.2 The relation of the categories to the core categories

The proposed first core category "Situational Use" is related to all other categories. It is especially connected to the second core category "Restricted Use" since the device could only be used if the wearer (1) feels comfortable wearing the device in a given social situation, (2) if the technical boundaries did not prevent the use and (3) if no legal prohibitions applied. This means that the restrictions have a major influence over the use of the device. Only if all three aspects were not limiting the user in his or her intended use, the device could fulfill the wearer´s needs, if existing.

The category "Social Etiquette" related to the situational use could also be seen as a kind of a restriction, but has been listed as a separate entity since the participants felt that it is a key factor in the use of the device. The key difference between a personal restriction and a restriction through social etiquette is the reason for non-use. In the first scenario the wearer would feel uncomfortable and take off the device, while in the second scenario the social surrounding would point out that it might be not be adequate to wear the device and hence not use it, which in both cases led the wearer to take off the device. Hence, the social situation in which the wearer encounters him- or herself is a key factor of the use or non-use and thus related to the situational use as well as the restricted use.

The category "Sensitization" has been proposed here in order to capture the participants initial struggles with the device. In this study it could still be identified as a major influencer on the situation the wearer was in. Through the low social acceptance of the device, the users often seemed unsure whether to use or not use the device, mostly in public places. Hence, if the situation gets too uncomfortable the wearer felt obligated to take off the device. It has also often been mentioned that a familiar surrounding is important in order to familiarize themselves with the device. This hence adds to the notion that initially the user needs to be in a comfortable environment in order to explore the functionality and grasp an initial understanding. Furthermore a familiar situation has to be created in order to initially interact the device and get used to the novel software interface and the operation of the latter. While the category "Social Etiquette" is believed to maintain its validity, the category "Sensitization" is believed to fade over a prolonged period of time, since the interaction with the device, as well as the social acceptance will most likely become more natural or "normal" if the devices are more widespread throughout society.

The category "Privacy" relates to the situational use for two reasons. The first that could be identified is the additional privacy endangerment which led some of the participants to carefully consider the use of the device in certain situations, mainly due to the constant location tracking of the wearer. Hence the protection of their own privacy was one concern. The second reason to take off the device at times was the privacy of others due to the constant presence of a head worn camera. Both aspects add to the notion of a situational as well as a restricted use.

The category "Location" has been defined in order to understand the comparison of a wearable device like Google Glass and a modern day smartphone. While the smartphone is very domesticated and overall integrated into the user´s daily life, a smartglass is not. Through the main use in public places and in transit situations, the smartglass´ dominant use scenario is, although not exclusively limited to, "on-the-go". This again adds to the notion that the use is situational as well as restricted regarding the location and not yet as domesticated as a smartphone.

The category "User Bound Factors", which has been added from the literature review, is believed to be connected to the "Situational Use", since all properties of this category are influencing the "when and how" of the use. These include aspects like financial, cognitive and temporal dimensions. Furthermore the uses and gratifications as well as the personal psychologies are believed to guide the use of smartglasses since it determines when and in what situation the device is useful to the wearer.

In the next step, the relations of the other categories to the second core category "Restricted Use" will be examined. The notion of a restricted use is closely related to the situational use since it is also linked to all other categories.

The category "Social Etiquette" is related to the restricted use since it is an outside, social restriction which in certain situations led the wearer to take off the device due to the social pressure of a single person or a social group. The category "Sensitization" is also seen as a restriction in this context since the low social acceptance of the device and the constant fear of the surrounding of being recorded by the wearer restricts the use of the device. The category "Privacy" directly adds to the notion of a restricted use due to the increased fear of a privacy invasion for the wearer and the respective social surroundings. Lastly, the category "Location" defines a use that is location bound (mainly in transit), rather than ubiquitous, hence vastly limiting the use of a device like this.

Lastly, the "User Bound Factors" are believed to be connected to the "Restricted Use" since not all restrictions have been covered by the interview results. Hence, new properties like financial, temporal and cognitive add to the notion of a restricted use and hence complete the here proposed model.

5.2.3 The relation of the categories among each other

The category "Sensitization" is further connected to the category "Privacy" as well as to the category "Social Etiquette". Both connections refer to the new rules that have to be created in order for society to accept these kind of devices. These do not refer to legal regulations, but rather to societal norms which regulate the protection of privacy, as well as the social etiquette. Hence, the categories intertwine since the social norms as well as the norms for the privacy protection might change, once the devices are more socially accepted and are less intrusive.

The category "Privacy" shows weaker ties to the categories "Social Etiquette" and "Location". It can be argued that the social etiquette might be influenced by privacy concerns. Still, the level of dependence is not entirely clear. Essentially it depends on the social environment which is involved and how these kinds of concerns are addressed. Again, a new set of regulations regarding this connection might be useful. The use of the smartglass in transit could hence also be seen as an additional endangerment of privacy, depending on how it is used. This is why no generalizations can be made at this point.

Another weak tie could be identified between the categories "Social Etiquette" and "Location". This mainly refers to the social norms in public when using the device and how strangers feel about the presence of a smartglass. Again it is believed that new societal rules will apply in public spaces if these kind of devices become more common.

The "User Bound Factors" are believed to be linked to all other proposed categories. First, to the the category "Sensitization" since properties like the personal psychologies and cognitive restrictions influence the attitude towards the unfamiliarity with the device and the acting on the latter. These same attributes together with the accessibly of media have an influence over the category "Privacy", due to the individuals perception of the latter. The category "Location" is further limited by temporal as well as accessibility aspects, which influence the use of the device in different surroundings, together with the aforementioned properties. Lastly the "User Bound Factors" are connected to the category

"Social Etiquette" since the cognitive aspects as well as personal psychologies are believed to be responsible for an altered behavior in certain social situations.

This concludes all connections in the proposed model. Please note that no connection between the categories "Sensitization" and "Location" could be found. It is believed that both categories relate more to the first and second core category, more than they relate to each other.

In the following chapter the parallels and divergencies from the academic literature regarding the here presented findings will be discussed and elaborated.

5.3 Parallels and Divergences from the Academic Literature

In the first chapter, the empirical findings of this study will be put in context of the theoretical framework of the adoption and use of mobile communication technologies as seen on page 33. Please note that only one term out of the definitions, "Cyborgs" as seen on page 19, will be taken into account, as i.e. the history of wearable computing does not promise to be a purposeful comparison. The second chapter will compare the findings to the embedding of technology into society as found in the theoretical framework on page 51.

At the time of this dissertation there has been almost no previous research regarding smartglasses, except for a variety of medical publications which are mostly concerned with the embedding of the device into the very specific context of hospitals and the use of the device to cure certain types of illnesses (Muensterer et al., 2014; Glauser, 2013; Feng et al., 2014; Albrecht et al., 2014).

Since the research question of this dissertation tries to answer how the device is useful to a consumer in everyday life and what restrictions are encountered, the most applicable theories from media and technology research have been examined and will be compared to the findings in the following.

5.3.1 Adoption and Use of Mobile Communication Technologies

5.3.1.1 The Innovation-Decision-Process

In the Innovation-Decision-Process, the knowledge phase is of interest for one particular reason: the creation of needs. Although this phase is mainly concerned with the user learning about a particular innovation and what benefit it provides, in the case of this study the creation of needs is given more importance, since, as mentioned above, the de-

vice was provided and not purchased by the participants. While smartglasses provide a certain benefit in certain situations, the findings suggest that during the testing period the participants felt needs that did not exist before. These include the taking of more photos, the use of "Google Now", which can display nearby locations, and alike (see chapter "Everyday Life Change" on page 169). Hence new needs have been generated and other needs got intensified through the use of this novel form factor, which is constantly present in the field of view of the wearer in comparison to a smartphone.

In the persuasion phase the user tries to evaluate the usefulness of an innovation. However, this process usually happens before actually purchasing an innovation which was not considered in this study.

Similar to the persuasion phase, the decision phase is concerned which actions that lead a consumer to adopt or reject an innovation and hence purchasing it. Since the device was given to the participants of this study it has not been of importance in here. Still, in this same phase the decision to fully use the innovation is made. Although the initial euphoria indicated a full integration, the decreasing use (see chapter "Application Usage" on page 181) over the testing period suggests that most of the participants tend to reject the innovation due to the missing benefit (see chapter "Everyday Life Change" on page 169), the low social acceptance (see chapter "Outside Reactions" on page 137) as well as the personal and technical difficulties (see chapter "Restrictions" on page 146) that have been encountered.

The implementation phase is central to this study since on of the main objectives was to determine how smartglasses are embedded into everyday life. Generally the findings suggest that only partial changes to everyday life occurred, since the device did not provide the sufficient amount of applications which the participants are accustomed to from their smartphones (see chapter "Application Usage" on page 152). Furthermore, this phase an innovation ideally becomes normal. As the findings of the media diary suggest, the wellbeing of the participants was increasing in relation to the location as well as to the present surroundings during the testing period, indicating that the device did become more normal over time (see chapter "Wellbeing" on page 176).

The confirmation phase could not be examined properly in this study since the tested time was too short. However, the findings suggest that the use of the device has been decreasing which might be an indicator for the consequential rejection of the innovation (see chapter "Application Usage" on page 181). This might be due to the missing benefit

the device provides as well as through mixed messages that conflict with the user´s information about the innovation (Rogers, 2003).

5.3.1.2 Unified Theory of Acceptance and Use of Technology

When looking at the unified theory of acceptance of technology (see chapter "Unified Theory of Acceptance and Use of Technology" on page 37), a variety of elements influence the usage behavior. In the case of smartglasses, it is believed that all of these aspects are of importance. Except for the self-explanatory elements such as gender, age and experience, the other elements will be examined in the following and explained in their relation to smartglasses.

- **Voluntariness of Use**: High degree of voluntariness. The users were not forced to use the technology. However, they have been forced to agree to the terms and conditions, which may have included aspects that the participants would not have agreed to when not participating in a study.
- **Effort Expectancy**: Hard to learn. Unknown user interface through voice and gesture controls made it hard for the user to fully understand the device and the functionality it provided.
- **Performance Expectancy**: High degree of expectations through initial euphoria. Initial expectations towards the performance were not met. Smartglasses could only partly facilitate everyday life.
- **Social Influence**: High degree of social influence by close social surroundings as well as society at large.
- **Facilitating Conditions**: Almost non existent. Very small technical eco-system, did not facilitate the choice of adopting the innovation and alter more parts of everyday life.

When comparing the above model to the proposed model in study as seen in the chapter "The Final Theory - The Situational Use of Smartglasses" on page 202, differences can be identified. This is due to the fact that both models have different purposes. The above mentioned model tries to identify the use behavior of technology, while the model proposed in this study tries to identify the factors which influence the use of wearable

smartglasses. Still, the unified theory of acceptance and use of technology can be applied to the use of smartglasses, and helped gain a deeper insight into the topic since the elements of this model did not entirely overlap with the here proposed model.

5.3.1.3 Domestication Theory

Since one of the main goals of this dissertation is to examine the change of the everyday life through smartglasses, the connection to domestication theory is inevitable to review (see "Domestication Theory" on page 39).

In this chapter the four "non-discrete" elements of domestication will be reviewed and compared to the findings of this study. Before analyzing these elements, it seems reasonable to argue that smartglasses have not become domesticated in the tested period. Through the rather short testing period of seven days and the personal and technical problems that arose, it does not seem adequate to compare these kind of devices to other ICTs, such as smartphones, which are a very integral and domesticated part of the users lives (Vincent, 2013). Still, since the objective of this chapter is to see how the domestication framework is related to smartglasses, a further insight will be given into the four elements which constitute the latter.

Appropriation

Since the device was given to participants (see chapter "Data collection" on page 91), it is difficult to assign a central role to the acquisition of the technology in this study. However, it might be useful to examine the rules and the negotiations by which the device has been integrated to a household. The findings indicate that some participants had difficulties since the cohabitant of the household felt uncomfortable after some time which lead the wearer to take off the device (see chapter "Personal Restrictions" on page 146). This also implies a certain set of restrictions that not only apply to public spaces, but to the household as well, although they are less ambiguous.

Furthermore, in order to control the device, a familiar surrounding was initially important to most of the participants, which, as Haddon (2006) asserts, is part of the negotiation that takes place when the user tries to control and define the place of a new technology in everyday life.

Objectification

The first aspect of the objectification phase is the temporality. Although no clear statement about the time of day regarding the usage can be made, it still can be concluded that the use of the device in general has mostly been between one and two minutes (see chapter "Duration and Time of Usage" on page 178). When incorporating the second element of objectification, the spacial dimension, it becomes clear in which locations the device´s application have been used. As the findings suggest the navigation as well as the camera application have been used in public spaces while, at home, the camera, news and google have been the most prevalent ones ("Application Usage" on page 181).

Furthermore, it has been suggested that the social rules for new technologies, especially for mobile devices, are different depending on the location (Ling, 1997; Haddon, 2006). As the findings of this study suggest, smartglasses question the traditional social etiquette ("Personal Restrictions" on page 146) and challenge the existing legal framework, which coincides with the theory of Wood (1994), who asserts that new devices might get prohibited in certain places.

Incorporation

Through the duration of usage, it becomes clear that the use has been decreasing over the testing period (see diary "Duration and Time of Usage" on page 178). Since only partial changes happened to everyday life (see "Everyday Life Change" on page 169) the device did not become incorporated into the dialy practices of the users. Due to the lack of applications and the resulting lack of functionality many of the participants consequently rejected the device.

Conversion

In this phase of the domestication process an innovation is ideally seen as an artifact that is taken for granted (Haddon, 2006). The results demonstrate that, although the device did become more accepted and thus more "normal" over time (see chapter "Wellbeing" on page 176), it has not been converted into an object that is used without questioning its presence due to the restrictions that arose (see chapter "Restrictions" on page 146).

Concluding it can be argued that in comparison to a smartphone, these kind of devices are still far away from being domesticated. However, since the testing period was fairly short, a deeper integration into the daily life might have occurred. Still, as the findings of this study suggest, the use of the device has been decreasing (see chapter "Duration and Time of Usage" on page 178), which is rather an indicator for rejection than adoption.

5.3.1.4 Situational Media Use

In a first step the model of Karnowski and Jandura (2011), based on the initial idea of Zhang and Zhang (Zhang et al., 2010; Zhang & Zhang, 2012), which tries to define the key factors for situational mobile use (compare "Situational Media Use" on page 43) will be compared with the situational model of use for wearable smartglasses as proposed in this study (compare "The Final Theory - The Situational Use of Smartglasses" on page 202). The following table will show a comparison of the two models and list their differences in detail.

One of the main divergencies between the models is the legal aspect. The scenario for already existing technologies like phones, is a mostly cleared legal framework which applies to all members of a society. Still, for phones this has not been clear for a long time. Kay Nehm, the president of the "German Traffic Court Day (DGT)" states that: "When the legislator first released a law regarding the use of mobile phones in a car, these mobile phones could do a lot less. The usage as well as the functionality have changed fundamentally ever since" ("Straßenverkehr: Handy weg vom Steuer!", Spiegel Online, 2015)[69]. Through the increasing number of smartphones, a variety of legal questions arose regarding the use of these devices in a car. Of course, this example is just one of many legal situations which is questionable (see chapter "Restricted through legal boundaries" on page 198). Hence, with new technologies, new legal restrictions or legislations will be added over time. Thus, when discussing possible restrictions for the use of mobile, or in this case, wearable computers it is necessary to further elaborate what legal restrictions may apply.

69. Translated by Timothy Kessler (2015). Original Citation: "Als der Gesetzgeber das Handyverbot nach StVO erlassen hat, konnten Mobiltelefone deutlich weniger als heute. Bedienung und Funktionen haben sich seither grundlegend verändert."

Situational Media Use	Situational Use of Smartglasses
Restrictions	
Financial	Financial
Technical	Technical Boundaries
Temporal	Temporal
Cognitive	Personal Boundaries / Cognitive
-	Legal Boundaries
Location Bound Factors	
Location	Location
Media Accessibility	Technical Boundaries Legal Boundaries Location
Social Surrounding	Social Etiquette / Privacy / Sensitization
User Bound Factors	
Personal Psychologies (uses and gratifications)	Personal Restrictions Uses and Gratifications
-	Privacy
-	Social Etiquette

Table 29: Comparison of Models

Furthermore the personal psychologies or, as seen in the paper of Zhang and Zhang (2012), uses and gratifications (see "Uses and Gratifications Approach" on page 46) have been listed separately as a key factor of situational media use. If the device is not perceived as beneficial, the needs of the wearer can consequently not be satisfied. Uses and gratifications may be fulfilled by smartglasses in certain situations. However, these situations and the resulting gratifications that may be fulfilled are restricted through the factors that determine the situation itself (see chapters "The Concept of Situation" on page 43 and "The Final Theory - The Situational Use of Smartglasses" on page 202).

Another User Bound Factor has been identified in this study: the perceived endangerment of privacy. It is here seen as a user bound factor since, as elaborated in the chapter

"About the participants" on page 135, is highly subjective. The way every individual approaches his or her privacy differs vastly. In this context it is thus not seen as a restriction but as a user bound factor which influences the the situational use of the device.

The location bound factors that are named in their model are: the location itself, media accessibility and the social surrounding. The question of the physical environment in regard to smartglasses is not an easy one to answer. Although smartphones have been initially designed to be a mobile device, they have become increasingly domesticated and adopted for the use at home, sometimes even replacing the stationary computer as such (Vincent, 2013). In this study, the location has also been identified as an important factor of use. However, it has been revealed that the main use is in transit, which differs significantly from a modern day smartphone, which has a lot more domesticated uses.

The media accessibility in this context is compiled of technical, legal and spacial restrictions. The access to media seems to be given while wearing the device, but can still be prevented due to technical restrictions e.g. if the internet connection is failing. Furthermore, legal restrictions may apply which might limit the access to media on the device. Hence, in the context of smartglasses no further distinction is made between the restrictions that apply and the accessibility of media.

The factor social surrounding has been named as a factor of situational media use. However, for smartglasses it seems adequate to understand more about said surrounding since other concerns arise when using a novel device like this. The surrounding first needs to be sensitized in order to understand what kind of device they are confronted with. In the world of mobile phones this seems to be given (Vincent, 2013). Furthermore, in many cases the social surrounding had privacy concerns which made the device unusable at times. This also requires a certain amount of effort on the wearers side since it needed to be explained that the device i.e. is not recording at all times.

Lastly, the social etiquette, which also can be applied to smartphones, is listed as an influencer. Still, due to the constant presence of the device a new social etiquette might apply since a smartphone can easily be put away. If a smartglass however is not worn, it instantly looses all of its capabilities. Hence the wearer needs to be much more aware of his or her social surroundings as it plays a much greater role than in the use of a smartphone.

5.3.1.5 Privacy

In the definition of privacy, four spheres could be identified (see chapter "Privacy" on page 47). Since bodily as well as territorial privacy do not apply for the use of smartglasses, this chapter will focus on the privacy of communication and the privacy of information.

As the study shows, both of these aspects of privacy are additionally endangered through the wearing of a Google Glass (see chapter "Privacy" on page 143). Google in its terms of services states that personal information like photographs will be uploaded automatically. Furthermore the location of the device, and consequently the wearer, is being tracked at all times. Hence, the wearing of the device itself is an additional endangerment. Still, there is another aspect to the discussion about privacy - the privacy of others. Although not mentioned as one of the four spheres of privacy, Gavinson (1980) asserts that the privacy of an individual can be additionally endangered through the action of a third person, which in the case of smartglasses is seen as an additional risk, depending on the behavior of the wearer. Through the ability to take photos and videos unnoticed by others, the privacy of strangers as well as the social surroundings might be additionally endangered. The combination of recording others without their consent and the immediate uploading of this data into the Internet are hereby seen as a difficult subject, which needs to be controlled either by the wearer itself, a governing entity, a third party or an organization of some kind.

The second part of this chapter will continue to examine possible endangerments of privacy through wearable computers (see chapter "Wearable Computing Privacy" on page 49) and evaluate them based on the findings of this study.

New options for surveillance for organizations and governing entities through the recording and tracking of personal information have been found for all participants, due to the agreement with Google. As mentioned above, through the use of additional sensory input (in the case of smartglasses the tracking of the eye (see chapter Google Glass - "Technical Specifications" on page 22), in the case of fitness trackers and smartwatches sensors like blood pressure and hearth rate (see chapter "Smartwatches" on page 18)), the wearer automatically becomes more transparent and leaves him or herself open to new methods of surveillance. This often happens without the the explicit consent of user, or at least, through the missing transparency of said consent. Hence third party apps like

i.e. fitness applications may use that data and create an additional risk - a notion that could also be confirmed in this study.

New methods of authentication like the analysis and the resulting creation of movement profiles may be a risk in the near future, but could not be confirmed in this study. However, combination of data from a variety of sources is believed to be additionally endangering to privacy. Every new sensor is subject to the creation of new risks for the users privacy. When combining said data and collectively analyzing it, an ever more transparent, holistic image of the wearer is generated, which, depending who has access to this information, could be seen as an additional risk. The notion of "context collapse", by which the barriers of private and public spheres are additionally diminished could neither be denied or confirmed in this study.

Concluding it can be asserted that smartglasses, or wearable computing devices are creating and additional risk to the privacy of the wearer and the surroundings, which needs to be controlled by some sort of entity. Hence, a call for new laws and legations is obligatory in order to be able to use these kind of devices with the respective consent of the user. Still, as seen in chapter "About the participants" on page 135, privacy and its importance to the individuals is a highly subjective matter which makes it more difficult to grasp and, consequently, to protect.

5.3.1.6 Cyborgs

When examining the relation between users and technologies, the term cyborg has to be taken into account. As seen in the chapter "Cyborgs" on page 19, there are various definitions of the term. Following the definition of Zimmerli (2000), every human being who is surrounded by technology is already a cyborg. This hence also applies to smartglasses. When following the definition of Spreen (1998) as well as the definition of Haraway (1991), where the human body needs to be merged with a piece of technology creating a 'cybernetic organism', a smartglass and its wearer do not make up for a cyborg. However, there might be a middle ground, where the definition of a cyborg is sustained by the wearing of technology. It is neither one extreme nor the other, but something in between. Though the constant wearing of a computer, the human and the machine might be able to be defined as a cyborg, since a fusion, one way or the other, does indeed happen in the case of smartglasses.

5.3.2 The Embedding of Technology into Society

5.3.2.1 The Influence of Technology on Society

When examining the model proposed by McQuail (2010), the interactive sequence of technological change, found on page 51, the embedding of smartglasses into a society can be explained.

Through new ideas, new technologies, in this particular case smartglasses, have emerged in the context of society. The devices are still in development which is why it is tried to apply old uses known from the smartphone. These include functions like the phone, camera, navigation and so forth. However, through the new form factor the old uses change and become more convenient to apply in certain situations. This could be observed when the participants used the device to workout or to navigate hands-free, using an additional sensory input. Hence, this medium becomes, in the perhaps truest meaning of the phrase, an extension of man (McLuhan, 1964).

Although these kind of devices do not offer as many functions through the lack of applications (see chapter "Application Usage" on page 152), it could already be observed that new uses are starting to develop. This notion manifests itself when the participants used applications like the star explorer, which overlaid additional information onto planetary objects. It is believed that over time, with the respective development of the hard- and software, true augmented reality (see definition on page 10) will implement new uses.

Furthermore, although the device is missing many applications, communication institutions are already trying to adapt to this new technology. Newspaper like the New York Times, fashion magazines such as ELLE and broadcasting stations such as CNN all have developed applications for the device. Still, through the low social acceptance and the various technical problems, the process described by McQuail (2010) stops here, since it can be argued that no new cultural forms and meanings emerged yet. Hence the model would be fully applicable to the development of smartglasses, but a critical mass of users needs to be reached in order to be taken for granted (Ling, 2012) and thus, for new meanings to emerge.

5.3.2.2 Mobile Societies

First this chapter will revise the concept of communicative and local mobility (see chapter "Communicative Mobility" on page 53) as proposed by Hepp (2008), and compare it to the findings of this study. Since smartglasses are seen as a mobile device, which

can be used for interpersonal communication, it is included in the category of "getting mobile of communication devices", which is a subcategory of the communicative mobility in this model. The "mobility focus of stationary media" can also be applied here since the device help people to stay connected over a long distance through communication methods such as e-mail and SMS. Since the approach focuses on how these category are intertwined, it might be worth pointing out that the device is not able to function without stationary media, since i.e. a smartphone or a desktop computer has to be used in order to fulfill the setup applications (see chapter Google Glass - "General" on page 20). Furthermore the smartphone needs to be carried along side the device in order for it have a working internet connection or to be used as a processing unit. This means that in everyday life, and through the highly situational use (see chapter "Everyday Life Change" on page 169), each device is used to fulfill a specific kind of purpose or to solve a different kind of problem. This notion has also been asserted by Hepp (2008), since the communicative mobility approach focuses on the interrelation of different kinds of media, each of them proving different solutions for different kind of problems or conflicts. In this case, a smartphone could be used for typing, while a smartglasses could be used for navigating, depending on the situation the wearer is in, hence working as a unit of different devices to provide the greatest benefit for the user.

The aspect of "situative local mobility", which in this model is described as a subcategory of the local mobility, is related to all physical movement. As the results of this study demonstrate, devices like smartglasses are more useful in transit situations than in a domestic environment (see chapter "Places" on page 167). However, a paradox arises due to the low social acceptance of these devices, which is seen as a restriction. Thus it might be adequate to determine aspects which delimit the model of communicative mobility, or define scales since not all aspects of the approach will have to same influence in a real life implementation. The "biographical local mobility" which refers to the moving to another city for example might only happen a few times in the life of a person and is yet not notably different from the "situative local mobility" in terms of scale. Please note that the "biographical mobility" has not been further examined in this study, since no participants moved to another city in the tested period.

The second aspect that will be discussed is the relation of smartglasses to the notion of location based services (see chapter "Location Based Services" on page 54). Since the device did not possess the ability to enhance places through the display of virtual objects

and information via true augmented reality, the notion of Günzel (2013), in which places behave nearly mirror-imaged, could only partly be confirmed. Through the application "star explorer", it was partly possible to replicate this aspect, since the stellar constellations could be seen through the device and hence augmented with additional information. This technology also makes use of location based services since the exactly point of view needs to be determined by the application. However, through applications such as "Google Now" and "Field Explorer" the device makes use of existing tags in order to display geo-sensitive information, thus transforming spaces into "places with sense". In the context of smartglasses this can be seen as a partial change of everyday life, since applications like these are believed to be more convenient and therefore used more through the novel form factor (see chapter "Everyday Life Change" on page 169). Hence, location based services are in integral part of wearable devices, which, through the missing AR applications, have not reached their full potential just yet.

Campbell et al. (2014) argue that devices like Google Glass have the potential to further interlink the on- and offline world. While this might be true for future devices of this kind, the findings in this study indicate that this is not yet a reality. Since the device does not offer true augmented reality, or at least does not have the sufficient amount of applications yet, this notion could not be confirmed.

However, a division of attention did take place. While Lenart et al. (2010) state that younger demographic groups are increasingly accustomed to divide their mental capacities, the findings in this study suggest that the device represents a distraction in a normal conversation. Although this is often considered as rude by older demographic groups (Lenart et al., 2010), it is inevitable to consider the establishment of new social rules which are created through the increasing embeddedness of new technologies into the everyday life (Campbell et al., 2014). The notion of new social norms could be confirmed in the findings. Although it might not be adequate to speak of one layered social presence, the results of thus study suggest that the social etiquette as well as the resulting social interactions have been altered. This includes the permissions of others to use or not use the device as well as privacy concerns of others which at times led the participants to take off the device.

The second notion that will be discussed in this chapter is the novel user interface and how it alters the way people interact with technology. While Mann (2001) suggests that the wearable device and its wearer form a unified network which is mutually responsive

(see Wearable Computing - "Definition in the context of Humanistic Intelligence Theory" on page 14), Campbell et al. (2014) assert that the voice and gesture commands by which the device is operated, are an indicator for a new form of human-computer interaction. The findings support the notion that, through the unfamiliar software interface the interaction between the user and the device becomes increasingly more "human-like". Through speaking with and gesturing to the device, the participants (un-)consciously acted like a human being was present. This of course is supported by the overall handling of the device and the way commands are executed i.e. "OK Glass, take a picture" (see chapter Google Glass - "General" on page 20). Hence, the medium supports the theory of Reeves and Nass (1996, p. 5) who assert that the way in which humans interact with new media is something natural and social. Höflich (2003a) states that interactions with machines are, imagined or not, reciprocal, which further supports the notion of interaction between a human being and a machine.

However, the device and the wearer did not become a unified network in which the device could be seen as a "second brain" as suggested in the Humanistic-Intelligence approach by Mann (2001). This is mainly supported through the technical and personal issues the participants encountered with Google Glass, which did not permit a deeper integration into the everyday life (see "Restrictions" on page 146).

5.3.2.3 Social Shaping of Technology

In the context of smartglasses a social shaping perspective (see chapter "The Social Shaping of Technology" on page 59) is assumed since it is both a social as well as a technical product. This notion is mainly confirmed through the high level of social influence on the wearer as well as through the apparent need for technical innovations. As the results of this study suggest, smartglasses have yet to undergo a long way of being a finished product (see chapter "Technical Restrictions" on page 150). In the process, they also need to gain the social acceptance in order to function in a society (see chapter "Smartglasses are not socially accepted" on page 191). Hence, the notion of a device like this being socially shaped is seen as a necessity which is hard not to acknowledge. On the other hand, the notion of technological determinism is declined since, in the case of smartglasses, the technology does not influence society form "the outside", but is rather weaved into it and actively being shaped by it (see chapter "Technological Determinism" on page 61). When looking at the illustration on page 60, it becomes clear that a prediction of an innovation

trajectory is almost impossible. Still, over time these kind of devices will be formed by the choices of a society, negotiating its place and function.

From a social construction perspective (see chapter "Social Construction of Technology" on page 61), the findings of this study indicate that smartglasses are a "failure" since they have not been fully adopted by a social group. The term "interpretative flexibility" in this context is still in process. Until now, no prevalent use or meaning has been established, since the use of the applications has been very fragmented. Still, some applications have been used more than others. These include camera, navigation and google, which might be an indicator for the future development of these kind of devices (see chapter "Application Usage" on page 152). In this study, cultural factors have been left out. MacKenzie and Wajcmann (1999) assert that hence in other cultures and other social groups the results could differ from the findings presented here. This could be an interesting inquiry for future research on the subject.

5.3.2.4 Co-Construction of Users and Technology

In the following, the concept of "configuring" and the concept of "script" will be discussed. Both approaches are concerned with the manner in which the designer imprints a vision into a product which then is executed by the user (see chapter "Co-Construction of Users and Technology" on page 62). While this notion is mostly true, users still matter in the process of design. Through the massive collection of data by mobile phones and wearable computers, the design process has become much more interactive. Furthermore, users are able to give feedback which can later be incorporated into the product. For the example of Google Glass, a whole user forum was created in order to discuss further implementations to the device (Google Inc., 2013d). This, among other factors, led Google to eventually discontinue the production of the device in order to refine it. In an open letter to its users the company states that:

> *"Glass was in its infancy, and you took those very first steps and taught us how to walk. Well, we still have some work to do, but now we're ready to put on our big kid shoes and learn how to run." (Google Inc., 2015)*

Hence, through the continuous feedback process, the device is getting improved upon and made ready for mass production. In this context it seems useful to examine the theo-

ry of Oudshoorn and Pinch (2005), who assert that new technologies need to be accepted and implemented by society in order to be seen as functional. As the findings of the study suggest, the low social acceptance has led the smartglasses not to be seen as functional, (see chapter "Smartglasses are not socially accepted" on page 191) which consequently confirms the thesis at hand.

5.3.2.5 Actor-Network-Theory

Since the traditional ANT (see chapter "Actor-Network-Theory" on page 64) proposes that people and things can act as a unified network (Latour, 1987), e.g. a university which consists of people as well as the objects it contains, the approach is not suited for the topic of smartglasses. However, the approach has been widened in order to understand so called "subject networks" which explicitly examine the attachment between people and, mostly, technological artifacts. In the broadest sense, this applies to smartglasses since the device is worn at all times. It has been designed in order to create such a network. Still, the designers´ vision does not necessarily apply to the participants in this study. Similar to Humanistic-Intelligence Theory proposed by Mann (2001), this study could not prove a real bond between the wearer and Google Glass. Due to the lack of social acceptance, the missing applications and the large number of restrictions that apply (see chapters "Restrictions" on page 146 and "Application Usage" on page 152), it is unlikely that the devices will be able to form a subject network in the near future. However, if these problems get solved and the social acceptance increases, it is very possible for the wearable computer and the user to form such a network.

5.3.2.6 Mediatization

The concept of mediatization seeks to examine how technological artifacts are embedded into everyday life and what alterations happen to communication (Hepp & Krotz, 2007). Since the focus of this study lies on the change of everyday life triggered through the use of smartglasses, the following will elaborate how the theoretical framework and the findings overlap by examining what changes to everyday life as well as to communication have been encountered. When examining the alteration to communication, almost no changes could be identified when compared to more integrated and domesticated forms of media, such as smartphones. However, the device did represent an additional distraction in a face-to-face communication, which is the only alteration in regard to com-

munication that could be conceived by the participants in the case of smartglasses (see chapter "Communication" on page 140).

Regarding everyday life, a variety of changes could be identified (see chapter "Everyday Life Change" on page 169), which are highly dependent on the situation the participants did encounter themselves in. Still, these changes found in the results of this study have been too marginal in order to be seen as a true implementation of mediatization.

Furthermore, Krotz and Hepp (2012) argue that through the use of augmented reality the perception of reality, and consequently everyday life, can be changed. It might be useful to add, that this, including diminished reality, can also be referred to as a mediated reality, which, as the name suggests, mediates the entire experience of how an environment is perceived (Mann, 2013). Although this might be certain for true augmented or mediated reality devices, Google Glass did not provide the sufficient amount of AR applications and did hence not change the perception of reality, a notion that got discarded in the pilot study (see chapter "Reality Perception" on page 101). Thus, this statement can neither be confirmed nor denied. Still, with the increasing research and development of AR technologies, it is believed that the notion of a meditated environment will have an increased effect on culture and society.

5.4 Chapter Summary and Conclusions

First, the chapter has examined and evaluated all proposed categories as well as their respective properties and dimensions. To summarize, the categories are: privacy, sensitization, social etiquette, location, restricted use and situational use. Through the triangulation of methods, the categories have been established on the foundation of the main study findings as well as the media diary findings.

Furthermore, the final model has has been proposed which is based on the two categories, restricted use and situational use, and all other categories which are related to the latter, as well as among each each other. These relations have been addressed in the subsequent chapters.

Lastly, the parallels and divergencies form the academic literature found in the theoretical framework in comparison to the here proposed model have been established. Concluding one might say that many theories are in fact applicable to the use of smartglasses, while some models do not provide the sufficient amount of detail, in order to be applied to the situational use of smartglasses. However, they maintain their validity for other forms of (mobile) media.

This concludes the analysis and discussion of this study. The next chapter will provide the final remarks, that complete the argument made in this dissertation.

6. Conclusions

The last chapter of this study will examine the contributions to the field of societal smartglass research, its limitations, elaborate how the proposed research objectives have been met, evaluate how the study maintains methodological validity through the revision of the grounded theory criteria, provide a conclusion for the entire study and propose topics that could be of interest for future research.

6.1 Contributions and Significance

This study has embarked on a journey to investigate the implications that smartglasses have for the everyday life of the individual as well as how these kind of devices are embedded into a society at large. Through the rise of wearable technology and especially the introduction of smartglasses into a society, this study aimed to explore the dynamics of the relation between the novel technology and the user as well as society. This has not yet been done before, neither quantitatively nor qualitatively.

The central theoretical contribution of this study to the field of mobile research has hence been the generation of a substantive theory, which is grounded in the gathered data. These include the conducted interviews, the held focus group discussion as well as the media diaries. The findings reflect the individuals´ perception of their experience with the Google Glass device. Based on the data, categories have been developed, which identified the most important anchor points of the data. Through the analysis of the categories as well as through the incorporation of the media diary findings, a (grounded) theory has been developed which identifies the factors which influence the use of smartglasses and hence, make it situational. This applies to the user as well as to society, due to the examination of categories such as the "Social Etiquette", the "Sensitization" and "Privacy".

Moreover, this model has later been compared to the existing academic literature in order to find parallels or divergences. This has been proven to be a very valuable exercise since many existing parts of the theoretical framework could be applied to the use of smartglasses. Others had shown clear divergencies from the here proposed model and had hence been criticized due to the lack of certain criteria.

It is believed that this study has hence proven to be of theoretical significance for future inquires. This is due to the triangulation of methods which has been applied here, since more data has been collected, thus delivering a more holistic view of the everyday

life of the participants. Furthermore, the findings of this study have been created in a time, where these kind of devices were not a fully released consumer product, which means that the research done here is ahead of the market, which makes this first inquiry all the more valuable. When these kind of devices finally are ready for a market release, other researchers will hopefully look into other issues that arise through smartglasses and have this initial study as a point of comparison, which was not existent at the time this research has been conducted.

This study, through its qualitative methodology with the quantitative element of the media diary, aimed to provide a first insight into the field of wearable smartglass research on an empirical level. By focusing on the individuals´ perceptions and opinions, unique uses and insights could be gained, which would not have been possible through a solely quantitative study.

6.2 Limitations

For this study, the following four limitations have been identified and evaluated in order to see what future research might improve over this study.

The first limitation that needs to be remarked is the small number of participants in this study. Although 41 participants are a relatively large number for a qualitative study, the results can still not be generalized for a larger population. Although a triangulation of methods through the quantitative media diary did take place, this study does not claim to be of statistical validity and can therefore not be seen as representative for an entire culture. The grounded theory methodology itself has a variety of limitations which have been examined in chapter "Limitations of Grounded Theory / Qualitative Methods" on page 81.

The second limitation is of geographical nature. Since the entire study did take place in Germany, mostly in the city of Munich, the study does not claim to be valid across various societies and cultures, since it is believed that the same approach might generate different results in other countries. Hence, the focus in this dissertation has been on the use of smartglasses in Germany and its culture. Hence aspects like the social etiquette, the perception of privacy and the sensitization may vary. However, other findings such as the technical difficulties are believed to be generalizable. Still, it might be of interest for future research to review the proposed substantive theory here and incorporate it into a formal theory, which then might be classified as generalizable (see chapter "Substantive and formal theory" on page 78).

Thirdly, one limitation has been of financial as well as temporal nature. Since the devices have not been for sale officially, none of the participants had their own device. This means that all the devices had to be paid by the researcher. Only three Google Glass devices could be obtained, which were given to the participants for the limited time period of one week, which might not have been enough time. This problem would not have presented itself i.e. with a more widespread technology such as smartphones. It is believed that if a study were conducted where the participants were using their own devices, (1) the time of the study could have been shortened since no "lending" of the devices would have to take place but the participants could just be interviewed, and (2) the results might differ since the participants would not have needed time to familiarize themselves with the device and hence would be able to discuss more about their long-term experience as well as long- term observations regarding everyday life changes through smartglasses.

The fourth limitation is related to the selected sample of the study, since all of the participants did work at an office or have been students. This means that no types of manual laborers have been taken into account. This could potentially lead to other results since an individual who is working in front of a computer might not have that much use for a second screen, as somebody who works a manual labor i.e. as a painter or a carpenter.

Also, the quantitative element of this this study, the media diaries is bound to some limitations. Generally there is a risk of low participation as well as the problem of forgetting to fill the diaries out at the needed point in time. Furthermore there is low control on the researchers side which might disturb the results of the overall study. Hence if the diaries are not filled out at the exact moment it is intended, the results could be inaccurate since the participants might not recall all events (Kuniavsky, 2012).

Lastly, it is worth noting that the researcher has been fairly new to the grounded theory methodology, since it was his first study of qualitative nature. Through the large amount of time as well as resources spent on the appropriation of the methodology and the learning of how to properly analyze the data, one might argue that this has also been a limitation. However, throughout this dissertation, the author embarked on a very small scale grounded theory project with only four participants, which helped to exercise the entire process from start to finish, hence facilitating the work done in this study through simple implementation of the methodology. Moreover, the interpretative role of the author might lead to distorted results, since the data might be interpreted differently by other researchers.

The following chapter will revise and evaluate the criteria for a grounded theory study and hence address the methodological validity of this study.

6.3 Evaluating the Grounded Theory Criteria

As seen in chapter "Criteria for GT studies" on page 79, a variety of criteria have been proposed by Charmaz (2014) in order to evaluate the validity of a grounded theory study. These criteria are the foundation of this chapter and are being compared with the outcome of this study in order to further verify the methodological approach.

1. Credibility

Central to the credibility of grounded theory studies is the connection between the gathered data and the theoretical framework. Through the thorough analysis of the latter combined with the empirical findings, it is believed that a strong argument has been made in order to support the here proposed categories as well as the final model - the situational use of smartglasses. With a total of 41 qualitative interviews, one group discussion as well as the quantitative media diary findings, the data is well saturated, as no new codes could be found (see chapter "Sample" on page 90). Though the combination of all the aforementioned data as well as the theoretical framework which has been used to support the categories, links between both could be established, which are the foundation of the compelling argument made in chapter "Discussion and Analysis of Findings" on page 189.

2. Originality

One of the main questions of originality in ground theory studies is whether the developed categories provide novel insights into the field of research. Since, the topic of smartglasses has been relatively uncharted at the time of this dissertation, one might argue that the research made here provides a unique insight into this particular area. The analysis furthermore takes those insights and creates new concepts such as the new social etiquette, the novel way of interacting with technology, a new challenge to privacy and the call for a new understanding of how smartglasses need to be embedded into society and culture.

Through the prosed theoretical model, it is claimed that this study and its respective results can be seen of theoretical significance. Through the comparison between the find-

ings and the existing academic literature, current models are being challenged and extended though the proposal of new aspects which need to be incorporated e.g. the situational use of mobile devices (see chapter "Parallels and Divergences from the Academic Literature" on page 206).

3. Resonance

The central objective to the resonance of grounded theory studies is whether the categories illustrate all aspects of the tested experience with smartglasses. Through the extensive interviews as well as the answers about the participants lives with their mobile phone, deeper insights into the use of mobile devices as well as their everyday lives surrounded by technology could be gained. With Google being the company which develops Glass, attitudes towards the institution in regard to privacy, mobile phones as well as other technologies such as smartwatches could be identified and analyzed.

4. Usefulness

The usefulness of this study is asserted through the validity it has for the people and their everyday life. Through the theoretical as well as practical work and interpretations that have been made here, a strong connection between the real and theoretical world could be established. This concerns the use of applications as well as the device itself, the new social etiquette, the relation to places where these kind of devices can be used as well as the new perception of privacy introduced by smartglasses. Through the mostly qualitative methodology, this study aims to illustrate how the individual is addressed in the process of embedding a new technology into society. These insights are certainly contributing to the body of mobile research, since no study of this kind in relation to smartglasses has been conducted before.

However, it is hoped that this study will only be the beginning of a long lasting process which is the study of smartglasses. The section "Future Research" on page 237 will provide a list of possible topics and areas where these devices may be implemented and hence, need to be researched outside the everyday life but rather in specific settings with even more specific applications.

6.4 Evaluating the Research Goals

In the following, the research goals which have been proposed in chapter "Research Goals" on page 3 will be revised and evaluated in order to see how the study met all of its initial objectives.

Objective 1: Analyze the influencing factors when using smartglasses

Since this objective is central to the entire study, it has been addressed in many parts of this dissertation. It has been a major part of the pilot study (see chapters "Pilot Study Findings" on page 101) and main study (see chapter "Main Study Findings" on page 134) as well as in the media diary (see chapter "Media Diary Findings" on page 176). Furthermore the proposed categories (see chapter "Final GT Categories" on page 185) as well as the model (see chapter "The Final Theory - The Situational Use of Smartglasses" on page 202) in this study is giving an overview of all factors that influence the use of smartglasses. These factors have later been analyzed and compared to the theoretical framework in the discussion of this dissertation (see chapter "Parallels and Divergences from the Academic Literature" on page 206).

Objective 2: Provide a theoretical framework in relation to technology

The theoretical framework of this dissertation has been structured into three subchapters. The first part, "Introduction and Definitions" on page 7, addressed the context of wearable computing as well as mediated reality, among others. The second part, "Adoption and Use of Mobile Communication Technologies" on page 33, has given an insight into the theories in the context of the technology and the user. The third and last part, "The Embedding of Technology into Society" on page 51, was concerned with the technology and the society, addressing the most relevant theories of the field. All three parts in conjunction are believed to have provided a comprehensive background which could later be compared to findings of the empirical study.

Objective 3: Identify how smartglasses relate to different locations / attendees

This issue has been addressed in a variety of instances. Firstly, in the main study findings in the chapters "Outside Reactions" on page 137 as well as "Places" on page 167. Later, in the media diary findings, as seen in chapter "Media Diary Findings" on page 176.

Lastly, as a grounded theory category as seen in the chapters "Category 2 - Sensitization" on page 190, "Category 3 - Social Etiquette" on page 192 and "Category 4 - Location" on page 194.

Objective 4: Elaborate how privacy is affected when using smartglasses

This objective was first examined in the theoretical framework (see chapter "Privacy" on page 47). It has then been identified as an initial theme in the pilot study (see chapter "Privacy" on page 110) and later got further presented in the main study (see chapter "Privacy" on page 143). Through its importance for the topic at hand, it has become a grounded theory category as seen in the chapter "Category 1 - Privacy" on page 189.

Objective 5: Identify differences between smartglasses and smartphones

This objective has been addressed in the pilot as well as the main study (see chapters "Smartphone Comparison" on page 120 and "Smartphone Comparison" on page 157). Furthermore it has been part of the final theory in the core category by incorporating the property "possible smartphone replacement" (see chapter "The Final Theory - The Situational Use of Smartglasses" on page 202).

Objective 6: Propose a grounded theory model regarding the use of smartglasses in everyday life

This objective has been met in the chapter "The Final Theory - The Situational Use of Smartglasses" on page 202. A comprehensive model has been proposed and evaluated in regard to the relevant academic literature (see chapter "Parallels and Divergences from the Academic Literature" on page 206). Furthermore, its limitations have been explored in the chapter "Limitations" on page 225.

The following chapter will elaborate the final conclusions and leanings of this study, and evaluate them.

6.5 Conclusion and Learnings

6.5.1 Usage diverging from Smartphone

The first conclusion discussed is the diverging use from a traditional smartphone. Although both devices offer a similar functionality, the varying form factor is responsible for the use of different applications. As shown in figure 57, the most used applications on a smartphone are text messaging, voice / video calls, Internet and Email. In this context the category "Internet" is related to all browsing activities such as looking up a certain information or gathering specific data.

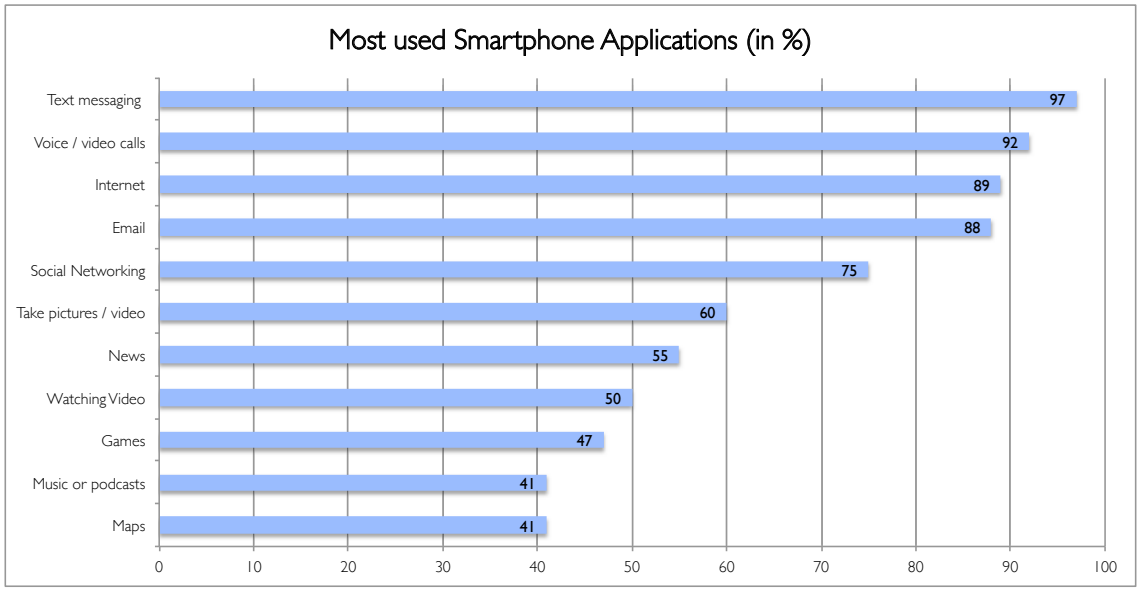

Figure 57: Most used Smartphone Applications (PEW Research, 2015)

However, for the Google Glass device the most used applications have been navigation, phone, take picture / video, news and Google. In this context, "Google" and "Internet" are here seen as a similar functions due to the inherent gathering of information. Hence, it can be argued that hands-free applications are more popular on Google Glass because they can be used in more situations i.e. navigation on a bicycle - a functionality that a smartphone could only offer through special accessories.

Sadly at the time of this dissertation, many applications which have been crucial to the daily life of the participants i.e. "WhatsApp" have been missing, which might cause distortion in the here presented results. Furthermore, augmented reality applications have been

nearly non-existent, except for a few functions such as the star explorer or word lens. Since no real new uses have been developed for the device, it has only been possible to compare the application use by form factor and the benefit this may bring. It is believed that future (AR) applications as well as other devices will drastically alter the way technology is used and the environment is perceived.

The second part that will be discussed here is the usage of both devices in different locations. As seen in figure 58, smartphones are often used at home, in a car or in public transit and at work.

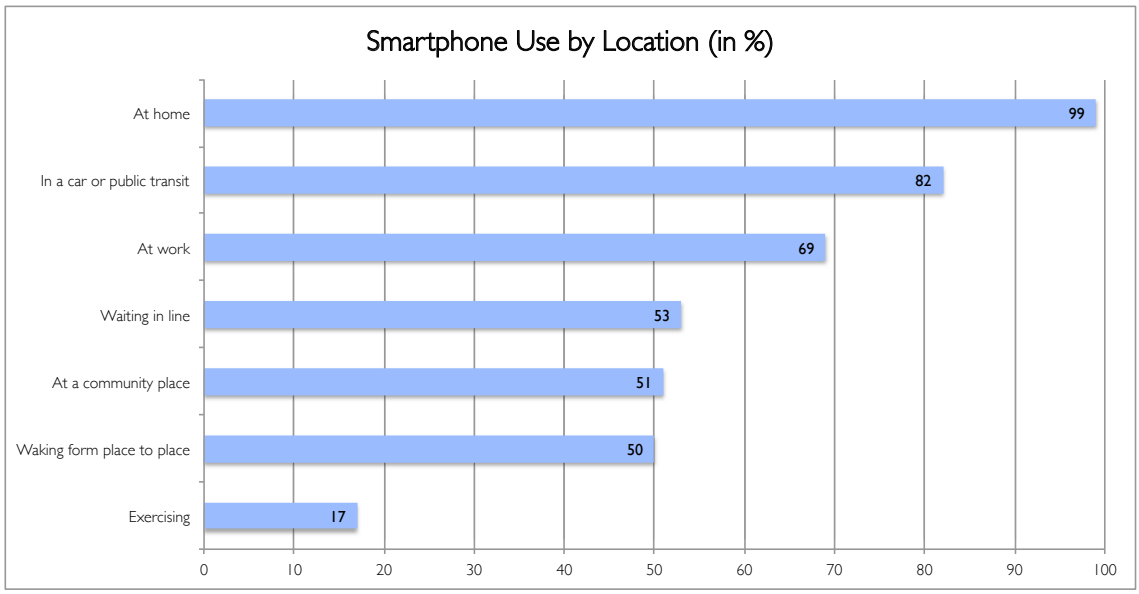

Figure 58: Smartphone Use by Location (PEW Research, 2015)

Although the quantitative media diaries point to the exact same results for smartglasses, it is worth pointing out that the qualitative interviews clearly state that the home has mostly been used to try and install the different applications, and the actual use has mostly been in public or in transit situations. Hence it can be argued that the uses of both devices fulfill different purposes in different places and situations.

Concluding, it is believed that in the near future a variety of different devices will work in a complementary manner, depending which technology provides the most benefit for the current situation of the user. Hence, e.g. for the typing of text messages a smartphone might be more adequate while for a hands-free navigation the appropriate choice is most likely a smartglass or a smartwatch.

6.5.2 The individual and collective privacy is additionally endangered

As mentioned a variety of times in this study, the risk of endangering the informational privacy of the individual as well as society at large is increasing through the introduction of new technology. This does not only apply to the wearing of smartglasses, but also to other technological artifacts.

Through the additional sensory input of smartwatches, new data can be gathered and potentially used for other, non-intended purposes i.e. by marketing or insurance companies in order to target different products at the wearer or to check their health. Generally, the more data is collected by different devices, the more the informational privacy is potentially endangered. Though the use of location based services, it is possible to track the every move of the user of a mobile phone. Furthermore, mobile payment technologies may provide a detailed view of the users purchases. The main danger is hence the combination of all the gathered data since, new methods of surveillance are possibly a risk for the user, due to the fact that it is very hard to control, who uses this data for what purposes (see chapter "Privacy" on page 47).

What sets the case of smartglasses aside from most other wearables is the head worn camera. Mann (2012) would argue that these cameras are a counter-form of surveillance, in his words, "sousveillance".

> *"Digital eye glasses like Google's Project Glass [...] will transform society because they introduce a two-sided surveillance and sousveillance. Not only will authorities and shops be watching us and recording our comings and goings (surveillance as we know it today), but we will also be watching and recording them (sousveillance) through small wearable computers like Digital Eye Glass." (Mann, 2012)*

While this might be true in a future scenario, the participants of this study still saw the constant wearing of a camera as a potential risk for others. Through the ability to take pictures and videos relatively unnoticed combined with the ability to upload these pictures to the Internet, the privacy of others got additionally endangered without the recorded persons´ consent. Thus, both the wearer´s as well as the privacy of his or her surrounding are additionally endangered. It might be sensible to establish new laws and regulations which do not prohibit the use of smartglasses in general, but rather in certain situations to grant a reasonable implementation into society. Furthermore, from a technical point of

view, the surrounding will have to be informed somehow that it is being recorded. This could be implemented i.e. by a blinking light on the devices every time the device takes a photo or a video.

Still, the importance of privacy protection has been highly subjective to each participant. While some of them have been very selective as to what data to share, others did not perceive the sharing of i.e. their location as something negative, since they "have nothing to hide".

Concluding, it is worth mentioning that none of the reviewed theoretical models on mobile communication devices incorporate neither privacy nor legal restrictions, although these kind of problems already do exist with modern day smartphones. Hence, a part of the findings that are proposed here in the context of wearable computing, namely the influence of privacy and legal restrictions, are believed to be in fact "backwards-transferable" and thus applicable to smartphones as well. This could lead to the revision of already existing models i.e. the MPA Model, the Situational Media Use and alike.

6.5.3 The Use of Smartglasses is highly situational and restricted

As seen in the proposed model and its respective categories the chapter "The Final Theory - The Situational Use of Smartglasses" on page 202, the use of the device is very restricted through a variety of factors, which makes the use of such devices highly situational. Concluding, these factors, including their dimensions are:

- **Personal Restrictions** (social acceptance)
- **Technical Problems** (device gets hot / low battery lifetime)
- **Legal Framework unclear** (no clear laws and regulations)
- **Privacy Issues of the wearer** (location tracking)
- **Privacy Risks for the surrounding** (head worn camera)
- **Permission to wear the device needed at times** (privacy issues or others / at department stores etc.)
- **Distraction in a normal conversation**
- **Primarily useful in transit** (hands-free navigation / notifications)
- **Fragmented use of applications**

- **Novel software interface and interaction unfamiliar** (voice and gesture input)
- **Familiar surrounding initially important**
- **Low social acceptance through public staring**
- **Only partial changes to everyday life**
- **Possible Smartphone replacement**
- **Cognitive**
- **Needs & Gratifications**
- **Personal Psychologies**
- **Financial**
- **Temporal**

These factors are the main findings and hence the central conclusion in this study. Since these aspects have already been addressed in detail in the chapter "Analysis of grounded theory categories" on page 189, they will not be elaborated here again. However, the *law of wearable success* as proposed by Patel (2015) will be reviewed and put in context of these findings.

> *"In order to be successful, any given piece of wearable technology has to be useful the entire time it's on your body. Prescription glasses sit on your face, but improve your vision all the time, so they're successful. [...] Google Glass sits on your face, but mostly does nothing, so it's a failure. It's a simple formula." (Patel, 2015)*

Generally, this is found to be true for smartglasses, since the Google Glass device has been helpful to the participants only in a variety of different situations and not at all times - instances where the smartphone could not fulfill a specific task and the smartglass has been proven to be more beneficial. As suggested by Patel (2015), if a wearable computer does not provide a clear advantage at all times, it is hence classified as a failure. When following the definition of Oudshoorn and Pinch (2005), a device is only defined as functional when a social group has adopted it. It is believed that this will not happen for current models of smartglasses since the use is too marginal.

Still, as mentioned above, each device (smartphone, smartglass, smartwatch) has a different purpose which can be helpful in different instances. Concluding, it can be argued that the less a device is integrated into daily life and the less functionality it provides, the more situational and thus restricted its use.

6.5.4 New ways of interacting with technology emerging

As mentioned in the chapter Google Glass - "General" on page 20, devices like Google Glass are mainly controlled via voice and gesture commands. Although, these features also exist in traditional smartphones, only 45% of the users actually engage in the habit of speech recognition (Cooney & Wheelock, 2015). However, it is forecasted that up to 82% of mobile users will operate their devices via voice commands by 2020, while haptic devices as well as their resulting usage will decrease over time (Cooney & Wheelock, 2015).

In the case of this study, it can be concluded that the user still struggles with the unfamiliar manner of interacting with this kind of technology (see chapter "The user struggles with unfamiliarity" on page 190). Although, this might be true for todays devices, Campbell et al. (2014) suggest that this novel method of interaction will cause a further embeddedness of mobile devices, since voice and gesture commands are much more integrated into the operating systems, than found in smartphones. Thus, smartglasses and other wearable devices might be the main influencers of future voice and gesture interactions with technology. However, this alteration of interaction will not happen if society does not accept this kind of interaction, since many participants in this study did feel uncomfortable when talking to the device in public places. This has mainly happened through privacy concerns, since the users did not want to enter i.e. a private message or a search term in front of acquaintances or strangers.

In a concluding thought, Berger and Luckmann (1967) assert that language is the most relevant tool for the construction of reality. Through the reciprocal relationship of the user and a smartglass, reality is co-created through the user and a machine, altering the way different spheres of reality are constituted, which creates new forms of meaning as well as reality.

6.5.5 Academic Literature on Smartglasses is marginal

This last chapter is less of a conclusion, but more of a learning throughout the study of smartglasses. During this dissertation it has become clear that the existing academic literature regarding smartglasses and their integration into daily life is nearly non-existent. The theoretical framework that has been proposed here has been constituted of a wide range of media and social theories which have later been used in order to compare and analyze the findings of this study.

Still, as more of these devices will enter the consumer market, more research will be needed in order to cover a variety of aspects like the change of privacy regulations, different cultural integrations, the changing human computer interaction and alike. This research is crucial to understand how these devices are embedded into the daily life and into societies in general. With this last chapter of the conclusion, a call for future societal smartglass research is made.

The next and final chapter of this dissertation will hopefully inspire some of the future research that can be approached. Ideally different methodologies will be applied in order to gain a holistic view of the field and to further see how not only the masses adopt smartglasses, but the individual as well.

6.6 Future Research

It is safe to argue that the possibilities for future research are vast due to the relatively novel character of the field of societal smartglass research.

The first aspect which could be of use to the area of study, is the generation of a formal theory. Since this dissertation has proposed a substantive theory (see chapter "The Final Theory - The Situational Use of Smartglasses" on page 202), other research or substantive theories could be combined with the one created in this study and built a more generalizable, formal theory. This could be achieved i.e. by examining the way smartglasses are integrated into other cultures and what implications this may have.

The second aspect is building on the first: the expansion of this research to other countries and cultures. By implementing similar studies across various countries or continents, a more holistic view of the use of smartglasses could be gained. Through the application to a larger scale, and the implementation of a quantitative methodology i.e. by providing questionnaires rather than conducting interviews, other insights might be generated

and evaluated in order to understand the social, cultural as well as the individual implications even further.

Since this study was limited by temporal and financial aspects, it could be interesting to investigate how the outcomes of this study would have differed, if these devices had been owned by the participants. Since it could be assumed that the devices have been used over a longer period of time and are hence more integrated into the daily life of the individual, it might be of interest to conduct another study, which makes use of this kind of advantage over the approach that has been applied here.

In this context it also seems adequate to further research the changing human computer interaction at a larger scale. With the voice recognition getting more refined on a daily basis, a need for research that is concerned with the future of computer interfaces is generated. Also, what implications this has on the social etiquette, as it might become more normal to talk to a computer in the future than it is today. Although efforts have been made to create use scenarios for voice recognition, it seems to be a marginal field of application. However, this could change, since an interaction by voice seems like a more natural way to interact with technology than typing.

Another aspect which will be of interest in future research is the interplay between the increasing number of mobile and worn computers such as smartphones, smartwatches, smartglasses and other sorts of wearable tracking devices i.e. for fitness purposes. Through the linkage of all data gathered by these kind of devices, new possibilities of the quantification of the self are created. Through the future research proposed here it could be of interest to examine what happens when all of this data is connected and how it affects the life of an individual.

One aspect which will very likely be part of future research is embedding of smartglasses into different kind of business and how they can aid and support them. This could be for instance in medial research, which is one of the fields which are already concerned with smartglasses (Muensterer et al., 2014; Glauser, 2013; Feng et al., 2014; Albrecht et al., 2014). Furthermore, an expansion of the research could include all sorts of manual labor, where future augmented reality applications could help to perform maintenance on cars, planes and other machines. Another field that could be of interest here is crime fighting. The New York Police Department has been known to beta-test the Google Glass device for face recognition and the recoding of videos during the search for evidence (Sparkes, 2014). It might be useful to investigate other areas where this kind of technology could be

of assistance, keeping track of the potential privacy issues that arise for the workers and, in the case of crime fighting and alike, for the ordinary citizen.

Although the aspect of privacy has been addressed in this study, it might be reasonable to further investigate this subject. Through the growing number of devices and the increasing number of sensors put on the body by wearable computers it seems adequate to research what implications this has for privacy and how governmental institutions as well as corporations plan to address these issues. Since at the time of this dissertation no clear legal boundaries have been established for the use of smartglasses, it is hence necessary to review future laws and regulations in order to prove their validity for the individual as well as for an entire society. Instead of prohibiting these kind of devices in certain places, it seems more reasonable to find a way to embed them into a society, where the use is controlled and regulated. Future research could hence address these kind of issues.

In the context of privacy and embeddedness it might be beneficial to examine the future social etiquette that could be implemented through the use of smartglasses. Through the constant presence of these kind of devices, it seems inevitable that new social rules will be created in order to embed these kind of devices into daily life. If smartglasses reach a critical mass of adoption, and are hence seen as functional in a society, the need for sensitization might also be decreasing, since people are more used to this kind of technology and are more familiar with the functionality. Hence, both aspects are believed to change over time and therefore need further inquiry.

The last aspect that might be interesting for future research, is the transferability of the findings of this study to other, future devices. Depending on the functionality that other smartglasses may bring, other uses might be found and adopted. However, it seems adequate to investigate if the here proposed model can be transferred to similar devices and still maintain its validity. It is believed that, though the fast changing pace of the field as well as the industry, some parts of this model will be discarded in the future i.e. the social etiquette. Still, other parts will maintain their usefulness for future inquiries, since this study is seen as one of the starting points for future societal smartglass research.

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8. Appendix

8.1 Unused Initial Codes

8.1.1 Pilot Study

The following initial codes have not been used in this study, since they have only been assigned one time.

Category / Unused Codes	Frequency absolute
Outside Reactions	
initiate to deal with glass	1
Communication	
communication will get better with glass	1
Privacy	
privacy endangered through smartphone	1
nothing to hide	1
Personal Restrictions	
need to hide glass	1
felt like a worse person	1
no added value	1
fear of robbery	1
strange feeling while wearing glass	1
Technical Restrictions	
viewing restriction	1
Applications Used	
worn for activities	1
used for weather	1
used for cooking	1
used for video	1

Smartphone	
will not replace smartphone	1
Unclustered	
viewing restriction	1
useful on the go	1
will miss status	1
glasses fashion item	1
need to hide glass	1
fear of robbery	1
felt like a worse person	1
no added value	1
strange feeling while wearing glass	1
positive and negative experience	1
do not trust first impression	1
always something new	1
less lonley with Glass	1
benefit bigger than uncomfortable	1
not good for prolonged use	1
search for killer feature	1
feel sensitized after	1
dangerous situation	1
barrier to get out smartphone is bigger	1
breaks smartphone barriers	1
cultural difference	1
photo / video more personal	1
feel ok in public place	1
got other people into Glass	1
will miss comfort	1
does not like attention	1

used to show off	1
better to explain Glass before	1
expected Glass to be more intuitive	1
reading on Glass difficult	1
better to speak than touchpad	1
would like to try more	1
expect longer battery life	1

Table 30: Unused Initial Codes Pilot Study

8.1.2 Focus Group Codes

Unused Focus Group Codes	Frequency absolute
smartwatch understatement compared to glass	1
constant smartphone comparison	1
potential seen	1

Table 31: Unused Initial Codes Focus Group Discussion

8.1.3 Main Study Codes

Category / Unused Codes	Frequency absolute
Outside Reactions	**Frequency**
does not want to put others in uncomfortable situation	1
embarrassing for social surrounding	1
try in know environment first	1
social sourrounding not interested	1
not used to Glass	1
enjoy wear Glass in known environment	1
social sourrounding from negative to positive	1
strange to be only one wearing Glass	1

Communication	
would not use in normal conversation	1
less distracting than smartphone	1
Privacy	
sousveillance	1
feel transparent	1
new laws needed	1
privacy settings not good enough	1
important to control privacy settings	1
good privacy setting	1
Personal Restrictions	
wearing restricted through open hair	1
Technical Restrictions	
English language recognition problem	1
no technical difficulties	1
Application Usage	
function compass	1
function music	1
function notes	1
function "Shazaam"	1
function cooking	1
function "music box"	1
function hangouts	1
function song learning	1
did not like games	1
function word lens	1
will miss watching videos	1
will miss input method	1
will miss speech recognition	1

will miss calendar	1
will miss phone	1
will miss games	1
will miss field explorer	1
Smartphone Comparison	
used to smartphone	1
can still be aware of environment	1
Market	
design ugly	1
design important	1
uncomfortable to wear	1
computer preferred	1
would buy Glass	1
would not buy Glass	1
first watch then Glass	1
need for improvement	1
contact lens preferred	1
no need for Glass	1
Places	
at home only for installing apps	1
Everyday Life Change	
old use undertaken	1

Table 32: Unused Initial Codes Main Study

8.2 Media Diary

Name: __________________ / **Day:** ___________________

Time	**Used Function**	**Duration**	**Social Situation / Place**	**Attendants**	**Motive**
Well-Being Scale ☐☐☐☐☐☐ 1 2 3 4 5 6	☐ Camera ☐ Watch ☐ News ☐ Phone ☐ Google ☐ Navigation ☐ SMS ☐ Other:	☐ 1-2 Min. ☐ 2-5 Min. ☐ 5 + Min.	☐ At Home ☐ Workplace ☐ Public ☐ Friends house ☐ Restaurant ☐ Other: ______________	☐ Alone ☐ Acquaintances ☐ Strangers ☐ Colleague ☐ Partner ☐ Other: ______________	☐ Status ☐ Contacts ☐ Entertainment ☐ Reachability ☐ Research ☐ Other: ______________
Time	**Used Function**	**Duration**	**Social Situation / Place**	**Attendants**	**Motive**
Well-Being Scale ☐☐☐☐☐☐ 1 2 3 4 5 6	☐ Camera ☐ Watch ☐ News ☐ Phone ☐ Google ☐ Navigation ☐ SMS ☐ Other:	☐ 1-2 Min. ☐ 2-5 Min. ☐ 5 + Min.	☐ At Home ☐ Workplace ☐ Public ☐ Friends house ☐ Restaurant ☐ Other: ______________	☐ Alone ☐ Acquaintances ☐ Strangers ☐ Colleague ☐ Partner ☐ Other: ______________	☐ Status ☐ Contacts ☐ Entertainment ☐ Reachability ☐ Research ☐ Other: ______________
Time	**Used Function**	**Duration**	**Social Situation / Place**	**Attendants**	**Motive**
Well-Being Scale ☐☐☐☐☐☐ 1 2 3 4 5 6	☐ Camera ☐ Watch ☐ News ☐ Phone ☐ Google ☐ Navigation ☐ SMS ☐ Other:	☐ 1-2 Min. ☐ 2-5 Min. ☐ 5 + Min.	☐ At Home ☐ Workplace ☐ Public ☐ Friends house ☐ Restaurant ☐ Other: ______________	☐ Alone ☐ Acquaintances ☐ Strangers ☐ Colleague ☐ Partner ☐ Other: ______________	☐ Status ☐ Contacts ☐ Entertainment ☐ Reachability ☐ Research ☐ Other: ______________
Time	**Used Function**	**Duration**	**Social Situation / Place**	**Attendants**	**Motive**
Well-Being Scale ☐☐☐☐☐☐ 1 2 3 4 5 6	☐ Camera ☐ Watch ☐ News ☐ Phone ☐ Google ☐ Navigation ☐ SMS ☐ Other:	☐ 1-2 Min. ☐ 2-5 Min. ☐ 5 + Min.	☐ At Home ☐ Workplace ☐ Public ☐ Friends house ☐ Restaurant ☐ Other: ______________	☐ Alone ☐ Acquaintances ☐ Strangers ☐ Colleague ☐ Partner ☐ Other: ______________	☐ Status ☐ Contacts ☐ Entertainment ☐ Reachability ☐ Research ☐ Other: ______________