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Design and Evaluation of a Private Digital Companion for Women's Perception of Safety in Shared Automated Vehicles

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Affidavit

I hereby declare that I have written this paper independently, have not submitted it elsewhere for examination purposes, have not used any sources or aids other than those indicated, and have marked verbatim and analogous quotations as such.

Ingolstadt, 18.09.2023

Katharina Vogl

A handwritten signature in black ink, appearing to read 'K. Vogl', is written on a light-colored rectangular background.

Acknowledgments

My gratitude goes to my two supervisors Martina Schuß and Andreas Riener for all their time and assistance.

My parents and grandma, who are always there for me and support me.

My little sister Annalena Vogl, who untangled mental knots and gave meaning to sentences.

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My dear participants and their confidants who, without hesitation, took part in the study.

And of course, Sherlock, my emotional support dog, who kept me company until late at night.

Abstract

The aim of this master thesis is to develop and evaluate a private digital companion for the specific needs of women to increase the women's individual sense of safety in shared automated vehicles (SAVs). To do this, the essential aspects of SAVs, perceived safety and digital assistants will be explained, and women's needs will be highlighted in the context of shared mobility. To gain an even better understanding of women's concerns and needs regarding SAVs and to learn what women understand as a feeling of safety, a workshop (N = 5) that was held will be described. Further will be explored how women envision personal digital companionship in the context of a ride in SAVs. The three prototypes of a private digital companion that were developed on basis of the workshop will be introduced and the user study (N = 13) in which these companions were tested will be described. The user study aims to explore the usability and acceptability of digital companions, the level of trust placed in them, and the impact they have on women's overall anxiety. In addition, the emotional response to digital companions will be assessed to avoid a sense of uncanniness that can occur with artificial beings.

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1. Introduction

Autonomous vehicles are the subject of active research in the automotive industry. There is no question that they will one day be a familiar sight on our roads [1].

There are many theories as to which models of self-driving automobiles will prevail in the future. Many of these theories involve some type of shared automated vehicles [2].

Women make up 50% of the world's population [3], and they continue to raise our children, significantly influencing the behaviour patterns of the next generation. Yet women users are completely neglected [4]. For example, while women have the same right as men to access transportation - and are more likely to use public transportation than men - transportation is rarely designed with women and their needs in mind [5].

Many women are exposed to sexual or aggressive behaviour from other passengers while using shared transportation, such as buses, trains, cabs, or Uber. Although this significantly affects women's sense of safety and has a negative impact on women's use patterns of shared transportation, women as a user group and their needs are severely neglected in this regard [6].

In the future, when automated vehicles dominate the roads, this issue will continue to exist as community-used automated vehicles will outweigh private automated vehicles. Women's insecurity could increase because of the lack of a driver in automated vehicles. In many countries, the driver is considered a supervisory and respectful figure and thus conveys a heightened sense of security among women [2].

Commercial digital assistants such as Amazon Echo (Alexa) [7], Apple's Siri [8] and Google Home [9] are already familiar companions in our lives [10]. We tend to establish a human-like relationship with them. A social relationship, as opposed to a master-slave relationship, between humans and digital assistants is based on trust [11].

A trusted digital companion can also increase women's sense of safety in automated vehicles [2]. It can serve as functional support providing information and as emotional support against fears and discomfort, positively influencing the experience, and making the use of SAVs more attractive to women [12, 13].

Giving the digital companion personality and emotion through authentic facial expressions, gestures, voice, and dialogue makes it more human-like and increases the sympathy, and interest towards it. Nonetheless, when creating artificial beings like a digital companion the uncanny valley effect must be considered. This phenomenon can trigger strong negative feelings up to disgust and can affect interaction, trust, and emotional engagement with the digital companion negatively. This can happen when a representation appears realistic but has subtle inconsistencies or deviations from reality [14–16].

It must be clarified how women envision a personal digital companion in the context of a ride in SAVs. Therefore, a workshop (see 3.Workshop) was conducted (N = 5). Based on the results of the workshop three prototypes of a private digital companion (see 4.3.Companions) were created and then tested in a user study (N = 13) (see 4.User Study) for usability and acceptability (UEQ-S), the level of trust (CFT) placed in them, and the impact they have on women's overall anxiety (STAI short). In addition, the questionnaire on the uncanny valley effect was applied to assess the emotional response to the digital companions and avoid negative feelings (see 4.6.2.Methods).

1.1. Objective and Methodology

Based on the current state of research and the special needs of women, a private digital assistant will be developed, which increases the individual feeling of safety of women during the use of shared autonomous vehicles.

The following questions arise in this context:

RQ1: How should a private digital companion be designed from a woman's perspective to increase the perceived safety in shared automated vehicles?

RQ2: Do women prefer a private digital companion representing their real-life confidant to a companion representing a stranger?

RQ3: How human-like should a private digital companion representing women's real-life confidant be designed?

The presented research questions will be answered by means of a workshop (see 3.Workshop) and a user study (see 4.User Study). RQ1 will be researched based on the workshop, while RQ2 and RQ3 will be answered based on the subsequent user study.

For the user study, the following hypotheses will be verified or rejected:

H1: Women feel more trust towards a confidant as a private digital companion.

H2: Women feel less anxiety when accompanied by a private digital companion who represents a confidant.

H3: The user experience is more positive when accompanied by a private digital companion who represents a confidant.

H4: Different depictions of the confidant as a private digital companion do not trigger an Uncanny Valley effect.

At the beginning, a literature review will be conducted, which will form the basis for the subsequent primary research (see 2.Theoretical Framework). By means of co-creation techniques, a workshop (see 3.Workshop) will be conducted, whose participants (N = 5) (see 3.1.Participants) as well as leader will be exclusively women, to ensure the most open communication possible. In the workshop, the basis for three prototypes (see 4.3.Companions) will be formed, which will be evaluated in a within-subjects user study (see 4.User Study). Using a mixed-methods approach, several methods such as standardized questionnaires (UEQ-S, STAI short version, Checklist for Trust, Uncanny Valley Questionnaire) and qualitative post-session interviews with open-ended questions will be used (see 4.6.2.Methods). Diversity among the participants will be considered in both the workshop and the user study.

1.2. Outline

This paper explains the key terms "Shared Automated Vehicle", "Digital Assistant", "Perceived Safety", and "Uncanny Valley", and builds the theoretical foundation (see 2.Theoretical Framework) associated with these terms and needed in the further course.

The target group of women is introduced and their needs and problems as well as their relevance as a user group are put into context and examined.

A workshop (see 3.Workshop) conducted within the theoretical framework and a user study (see 4.User Study) based on both are described. This, together with the results (see 5.Results) obtained and their interpretation (see 6.Discussion), makes up the bulk of the work. It is explained how various prototypes of a private digital companion prototypes (see 4.3.Companions) were developed, tested, and evaluated and what conclu-

sions (see [7.Conclusion](#)) can be drawn from them.

In the concluding section, the content of the work is summarized, and limitations (see [7.2.Limitations](#)) and further research possibilities (see [7.1.Future Work](#)) are pointed out.

2. Theoretical Framework

This chapter explains the necessary basics and thus forms an important basis regarding the problem definition and the subsequent elaboration and evaluation. The necessary terminology of shared automated driving (see 2.1. Shared Automated Vehicles), digital assistants (see 2.4. Digital Assistants) and safety aspects (see 2.2. Perceived Safety) are explained and put into context with each other. In addition, women as a target group (see 2.3. Enablement of Women) are discussed and their needs are highlighted in the context of shared mobility.

2.1. Shared Automated Vehicles

Shared autonomous vehicles (SAVs) are an emerging and innovative concept in the automotive industry and are designed to enable efficient and sustainable mobility. SAVs are vehicles that drive and navigate without human intervention using automated driving functions such as acceleration, braking and steering. Unlike autonomous vehicles (AVs), SAVs are not private vehicles but publicly accessible, shared vehicles [17].

The use of SAVs can reduce the number of private vehicles and thus traffic density. This results in less congestion and a reduction in pollutant emissions [18].

Parking space demand also decreases with the use of SAVs, as they are constantly on the move and continue to their next destination immediately after dropping off or picking up a passenger [19]. This means that the space earmarked for parking can be used for other purposes, such as green spaces and housing.

The SAV concept can be integrated into the existing public transport infrastructure by taking over the so-called first and last mile, the distance between the starting point and the station or the station and the destination [20]. This makes it easier to switch between different modes of transport and enables certain groups of people to use public transport or to be mobile at all [2]. In this way, people from rural areas, as well as elderly people, people with disabilities and people without a driver's license or their own vehicle, can be independent and flexible and achieve a better quality of life.

People who find it difficult or impossible to afford their own vehicle also benefit from using SAVs. Instead of the acquisition costs and other incidental expenses, only the costs for the kilometres travelled must be borne. They also remain flexible and independent, because an SAV can be requested anywhere and at any time, enabling stress-free and

smooth traveling [21].

SAVs have the potential to change and improve mobility in a sustainable and efficient way, which is why this work focuses on them, in the belief that other modes of transport will also benefit from the results.

2.2. Perceived Safety

Safety, both physical and psychological, is one of the most basic needs of every person and is only surpassed by the vital need for food and oxygen [22].

A distinction is made between objective and subjective security. Objective security deals with the actual security situation and factors such as crime rates, accident statistics and security measures. Subjective safety, on the other hand, is more complex and does not always coincide with objective safety, as it is based on a person's individual perception, risk assessment and experience and therefore varies from person to person. Age, gender, education level and income can be influencing factors [23, 24].

Subjective safety has a strong influence on the behaviour and quality of life of every person. It can be strengthened by various factors, such as a sense of control, existing (self-)trust, access to information and social support [25].

Trust also plays an important role, whether it is trust placed in people, security measures, technology, or other factors. People who trust that they are safe and protected feel a greater sense of safety and general well-being and are more willing to take risks [26].

Subjective safety can influence decision-making and lead to cautious or avoidant behaviour in the event of a lack of a sense of safety. Among other things, this can lead to restricted mobility, for example, to refrain from being out and about after dark, to keep away from certain places, or to avoid public transportation [2].

The fear of becoming a victim of violence or crime has a significant negative impact on the feeling of safety. This ranges from discrimination, sexism, harassment or threats to theft, vandalism or damage to sexual assaults, physical attacks, or injuries. Personal experience or knowledge of such incidents leads to a feeling of vulnerability and insecurity and thus reduces the perceived safety [6, 27, 28].

A study resulting from a collaboration between the Technical University of Berlin, the German Aerospace Center and the Institute of Transportation Systems divided the fears

of SAV users into three categories - fear caused by other passengers, fear caused by insufficient transparency of the system and fear of system malfunctions. All these fears translate to a lack of perceived safety and pose a challenge developers must face [29].

<i>Category</i>	<i>Description</i>	<i>Identifier</i>
Fears related to other passengers	A frightening group dynamic arises (e.g. drunken hooligans)	group dynamics
	Unpleasant / strangely behaving passenger is entering the bus	unpleasant passenger
	Being subjected to physical violence or sexual assault	physical violence
	Criminal assault / theft	theft
	No help of passengers in emergency situations	no help
	Overcrowded bus	overcrowded
	Signs of vandalism and destruction in the bus	vandalism
Uncertainty - Fears related to a not transparent system	Unexpected stop of bus - not knowing what to do	unexpected stop
	Unpunctual arrival, planning uncertainty	unpunctual
	Bus takes a route through a bad area	bad area
	Bus takes a route that is unfamiliar - not knowing where you are	unfamiliar route
System safety – Fears related to technical malfunctions and the design of the system	Not knowing whether the sensors recognized an obstacle in the direction of driving	sensor uncertainty
	Fear of a puncture	puncture
	Fear of inability to intervene in the driving course	no intervention
	Fear of insufficient maintenance of the vehicle	no maintenance
	No emergency exit / Fear of inability to exit when it is very crowded and there is only a single door	blocked exit
Fear with regard to protection of personal data (booking via app)	personal data	

Figure 1: Categories of Fears [30]

The study highlighted the potential danger posed by other passengers to their own well-being as a particularly relevant fear, and the absence of an authority figure seemed to play a particularly important role [30]. Considering not only objective safety but also subjective safety is a necessary step in the development of autonomous public transportation and essential to achieve acceptance among the population, even without a supervising authority such as a bus driver [23].

2.3. Enablement of Women

People with disabilities, people of colour, immigrants, homosexual, bi-sexual and transsexual people as well as many others, are referred to as marginalized groups and are unfortunately often not sufficiently considered in research due to their minority status [31]. However, women, although they make up half of the world's population [3] and are therefore not a minority, are also severely neglected [4].

Although women are an important target group in their role as mothers, as they have a great influence on the next generation, their individual needs and problems are hardly addressed [5].

Gender-related, women are a target of (sexual) violence and (sexual) harassment. They are afraid of being victimized and are very concerned about their safety. For example, women feel uncomfortable and less safe when sharing a vehicle with a stranger man or when traveling at night [2, 5].

Right To Be (formerly Hollaback!) [32], an organization that works to fight harassment in public, in collaboration with Cornell University conducted approximately 16,600 interviews in 22 countries on the topic of harassment in 2015. Over 80% of the women surveyed said they had been harassed in some form [5]

Unlike men, who mostly drive private vehicles, most women use public transportation because they have less access to private vehicles [33].

Furthermore, their daily structure, and thus their mobility pattern, differs from that of men. Women tend to drive short distances, but do so more frequently than men, who tend to drive long distances [34].

Women are more environmentally conscious than men and tend to behave in a more environmentally friendly manner. This includes a willingness to use public transport and services such as ride sharing [35]. Thus, even in the future, when autonomous vehicles are a real alternative, women will be more willing to use SAVs to reduce exhaust emissions.

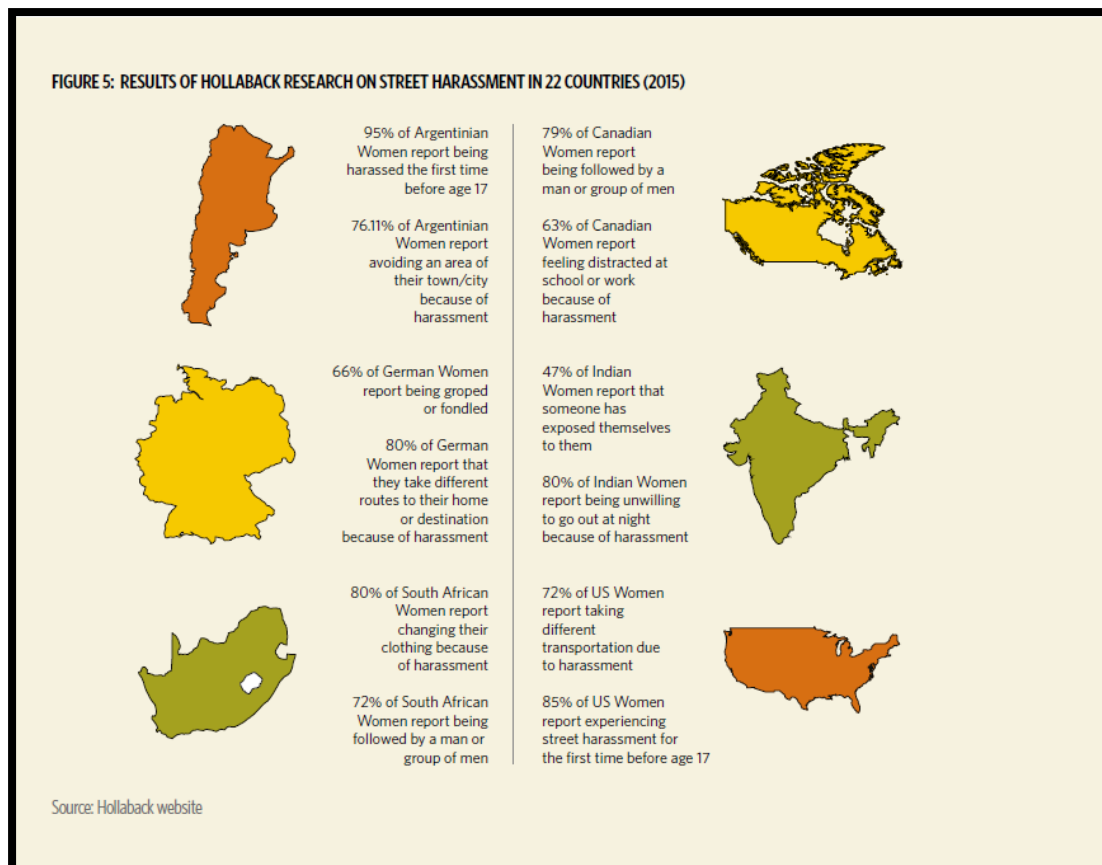


Figure 2: Hollaback Study on Street Harassment [5]

However, the risks of violent or sexual assault, as well as past experiences with various forms of harassment, already limit the actual use of shared transportation such as buses, trains, etc., and have a significant negative impact on women's sense of safety [28].

The lack of a driver in SAVs, who in some cultures is a person of respect and thus a go-to person to aid in dangerous or uncomfortable situations, could even lead to a significant increase in safety concerns and discomfort among women [2].

For all these social and economic reasons, this paper focuses on women, with the belief that other user groups will also benefit from the results.

2.4. Digital Assistants

Our conception and understanding of digital assistants are shaped by historical, commercial, cultural, and fictional influencing factors [11].

Historically, for example, we associate the role of the servant at that time with today's digital assistant. Servants were subject to a clear hierarchy, so they were not seen as

equals. They were rarely trusted or respected and were only allowed to speak with prior permission. Such a master-slave relationship is all too familiar to us from current commercial digital assistants [11]. Input-output systems such as Amazon Alexa [7], Apple's Siri [8], and Google Home [9] are portrayed as intelligent yet obedient digital assistants that speak only when requested and are clearly subject to us. They thus present themselves more as servants than as actual conversation partners [11].

But the fictional future created by creative minds such as the cabaret artist Marc Uwe Kling in his work "Qualityland" also have a non-negligible influence on our image of digital assistants. In his version of the future, for example, automated vehicles are not only the norm, but also possess their own personality in addition to their own name. Despite this human-like design, implemented routines and the passenger still retain control. For example, certain personality traits can be regulated or even deactivated, such as humour [36].

It's a different story with "K.I.T.T.", the intelligent, talking vehicle from the "Knight Rider" series. K.I.T.T. makes decisions independently and holds conversations and discussions with its driver Michael Knight. The relationship between K.I.T.T. and Michael is based on friendship and trust. They meet as equals and thus embody the contrast to the master-slave relationship, a social relationship in which the digital assistant not only speaks but also understands [37].

Today's private digital assistants offer personalized and interactive experiences and support and accompany users in their private lives. They offer a variety of functions and features that distinguish them from traditional digital applications. Thanks to artificial intelligence and machine learning, they can not only provide information, answer questions, and complete tasks, but also engage in human-like conversations, provide personalized recommendations based on the user's preferences and needs, and even recognize and respond to emotions [12, 13].

Fitbit or Apple Health are private digital health assistants that help users collect and evaluate their personal health and fitness data. They also provide personalized recommendations based on this data. They thus support their users in or on the way to a healthy lifestyle [38, 39].

Private digital pets like Tamagotchi or Nintendogs, on the other hand, are designed to keep users' company and develop a relationship with them. They are an emotional support for their users [40, 41].

Even during the use of SAVs, digital assistants can serve as functional and emotional support and positively influence the experience with this new way of getting around [2, 12, 13]. For example, they can take over tasks that are normally attributed to the bus driver, such as answering questions and providing information. But there is also the potential to use digital assistants to convey a sense of security and thus make the use of SAVs more attractive and facilitate adoption of the concept [42]. Especially for vulnerable groups such as women (see 2.3. [Enablement of Women](#)), the provision of a digital assistant as an emotional support against fears and discomfort can be crucial to feel safe and thus contribute to a positive user experience [2].

2.5. Uncanny Valley Effect

The Uncanny Valley Effect is a phenomenon that makes people feel uneasy. It occurs primarily in robotics, animation, and virtual representations and refers to human-like figures that evoke an eerie or even repulsive feeling in the viewer. When a representation appears realistic but has subtle inconsistencies or deviations from reality, this can trigger the Uncanny Valley Effect. The effect describes the viewer's increasing acceptance and sympathy regarding the character as it becomes more human-like, until it drops off quite abruptly. This valley is called Uncanny Valley and leads to an eerie feeling in the viewer [43].

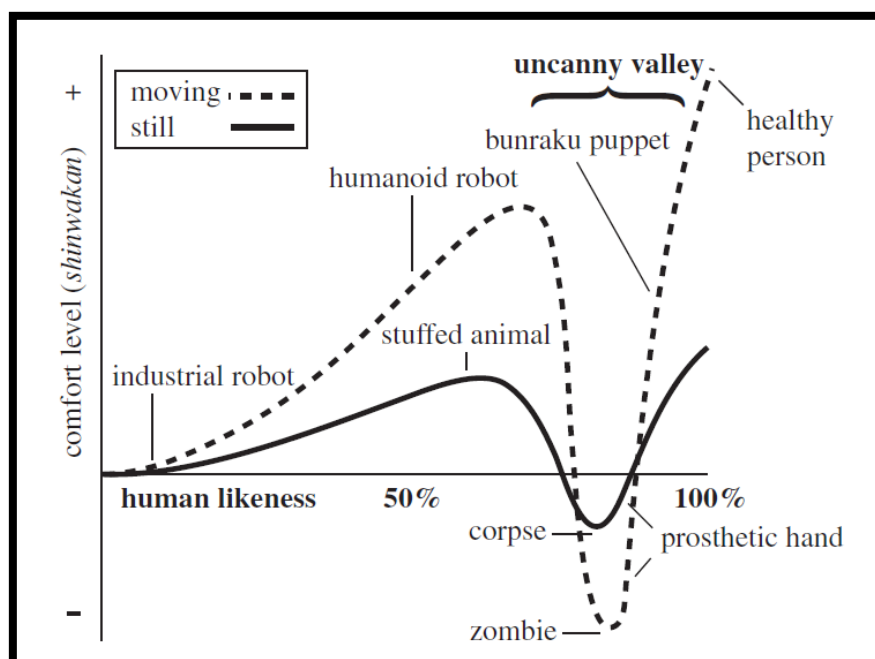


Figure 3: Acceptance Curve of the Uncanny Valley Effect [43]

Depending on the degree of similarity of the depiction to humans, figures can evoke different emotional reactions in the viewer. Robots or stuffed animals are clearly not human and thus do not trigger any unease or rejection towards them [15]. With increasing humanness, sympathy, and interest towards the characters increase. As with animated characters or humanoid robots, however, there should still be clear differences between reality and representation. Because as soon as a character reaches the critical area and only shows small and subtle deviations from reality, strong negative feelings up to disgust can arise. The viewer perceives the figure as unnatural or uncanny. Only when the difference to the real human being is no longer noticeable, such a realistic representation can be accepted by the viewer without negative feelings [44].

Negative emotional reactions can affect interaction, trust, and emotional engagement and cause the viewer to distance him or herself from the character. For example, the human characters in the computer-animated film "Polar Express" affected the viewer's movie experience by creating an eerie feeling and making it difficult to become immersed in the film. In video games such as "Mass Effect: Andromeda," the gaming experience can also suffer by triggering the Uncanny Valley effect, and too little identification with the characters due to animated characters that feel creepy can lead to low player commitment. There is also a danger with (virtual) chatbots and assistants that are designed as human-like avatars [16].

Incorrect proportions, unnatural movements, missing or exaggerated facial expressions, and inconsistent lip movements are known triggers of the Uncanny Valley Effect. In contrast, authentic facial expressions, gestures and voice can make the character more tangible and sympathetic, giving the character personality and emotion that can reduce the uncanny feeling and lead to a more positive perception [14–16].

It is worth mentioning that not all people feel the same way, and a figure may already be considered creepy to some, while others would still classify it as acceptable or even appealing [45].

The strong emotional and psychological impact of the Uncanny Valley Effect must be considered when creating human-like representations to provide users with a pleasant and positive experience and ensure acceptance towards the character.

2.6. Conclusion

SAVs have the potential to change and improve mobility in a sustainable and efficient way and to enable certain groups of people.

Subjective safety is complex and based on a person's individual perception. It can influence our experience, our emotions, and our behaviour. A lack of a sense of safety in the context of SAVs can lead to a restriction of the acceptance and usage of SAVs.

Women are a target of (sexual) harassment. The fear of becoming a victim has a significant negative impact on their sense of safety. They feel especially uncomfortable and less safe when sharing a vehicle with a stranger man or when traveling at night.

Digital assistants can recognize and respond to emotions, engage in human-like conversations and be an emotional support. The provision of a digital assistant in SAVs can strengthen the subjective safety of women. But not only the knowledge of support but also the trust placed in the digital assistant plays an important role to convey a sense of safety and make SAVs an attractive option for women.

With increasing humanness of the digital assistant, sympathy, and interest towards it increase. Authentic facial expressions, gestures, voice, and dialogue can make the character more tangible and sympathetic, giving the character personality and emotion. But when creating such human-like representations the Uncanny Valley Effect, which can trigger strong negative feelings up to disgust and can affect interaction, trust, and emotional engagement with the digital assistant, must be considered.

3. Workshop

To gain an even better understanding of women's concerns and needs regarding SAVs and to learn what women understand as a feeling of safety, a workshop was held (N = 5). This further served to find out how women envision personal digital companionship in the context of a ride in SAVs. The vision of a private digital companion was explored through focus group discussions [46] and prototyping.

The workshop was held in German, as all participants were German native speakers, and took about 180 minutes. It was conducted in person and was not compensated. Only drinks and cake were provided to the participants. The participants were informed of their rights and signed an informed consent form.

3.1. Participants

For the workshop, 5 women in different life situations were invited (childless, pregnant, mother, grandmother, single, wife, widow, working, student, retired). They were 2 young women (21-29 years), one middle-aged woman (30-39 years) and 2 senior women (60 or older). Among the women, 2 were with disabilities. The women had varying levels of educational background, all had access to a private vehicle (ownership or shared with a family member) and reported at least infrequent to regular use of public transportation.

After the warm-up exercise, participants were divided into two groups. Care was taken to have one young woman (21-29 years) and one senior woman (60 or older) in each group. It was assumed that the young women would bring their technological knowledge and the older women their life experience, and thus the two age groups would complement each other well. It was also assumed that the women's concerns, needs, and opinions would differ greatly due to the different generations and life situations, thus stimulating discussion. In addition, care was taken to include a woman with a disability in each group to incorporate the individual needs and experiences of this minority.

3.2. Procedure and Methods

A participatory approach [47] using co-design techniques and focus group discussions [46] was used for the workshop to examine women's understanding of a private digital companion (see [C.1.Instructions and Guides Workshop](#)).

After the participants arrived on site, the demographic data questionnaire (see [A.5.Demographic Data](#)), the consent form (see [B.Declarations of Consent](#)), and a booklet (see [G.Booklet](#)) explaining the terms automated vehicle, digital assistants, and sense of safety, as well as the timeline of the workshop and space for notes, were handed out to each participant. The booklet could be taken home by the participants after the workshop. All other documents were collected again in filled-out and signed form before the start of the workshop.



Figure 4: Workshop booklet with timeline

As a warm-up exercise, participants were asked to discuss what they understand and associate with feeling safe (see [3.4.1.Warm-up Exercise](#)). They were instructed to record their findings on sticky notes and place them in the centre of the table. This collection was to serve as a support as the workshop progressed. The task served to get the participants in the mood for the topic and for talking with each other openly. In addition, it should enable the participants to have a positive approach with a focus on the pleasant feeling of safety and make it difficult to drift towards dystopia and a defensive attitude.

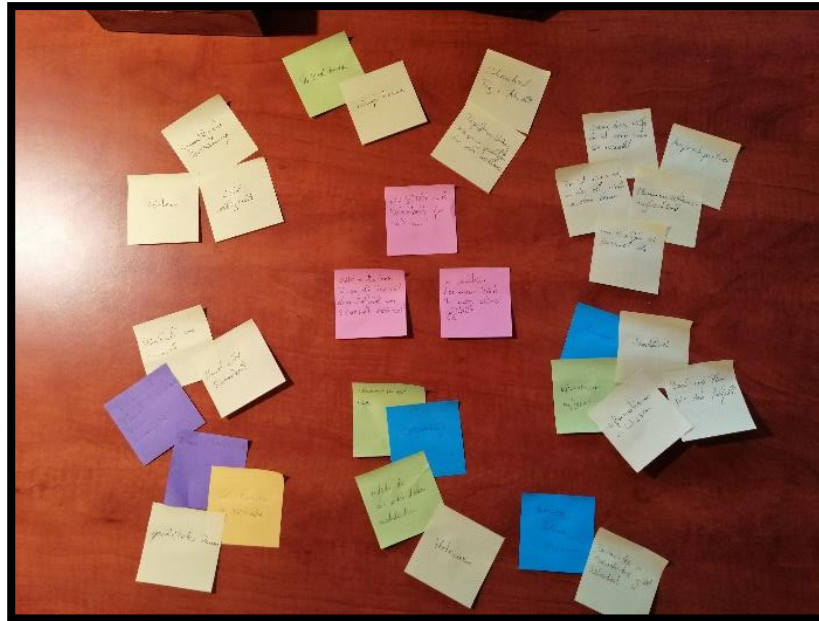


Figure 5: Clustering of sticky notes during warm-up exercise.

After the warm-up exercise, participants were divided into groups and asked to create a concept of a personal digital companion that would give them a sense of security while riding in an SAV (see 3.3.1. [Concept Group 1: Avatar on Smartphone](#); 3.3.2. [Concept Group 2: Hologram of Confidant](#)). The participants were given freedom on how to implement the task (writing, drawing, crafting, etc.) and were provided with all the necessary materials (sticky notes, glue, scissors, etc.). For inspiration, they were given the following questions in paper form:

- What feeling do you want your companion to give you?
- How do you interact and communicate?
- What social and emotional relationship do you have?
- What gender is your companion? (Or none?)
- Where or how do you have your companion with you?

The groups were asked to present their ideas of a personal digital companion to one another and to explain their thoughts about it. The participants were also encouraged to ask questions about the concepts and discuss them.

The groups were then given the choice of working on their own concepts or on a new concept. Both groups decided to refine their respective concepts.

Again, the groups were asked to present their refined ideas and discuss their final concepts.

3.3. Data Collection and Analysis

The workshop was not video, or audio recorded. Instead, notes were taken especially during the focus discussions (see [D.3.Instructors Notes](#)).

The workshop produced two concepts of a private digital companion and a collection of Sticky Notes on the theme of "Feeling Safe".

To analyse the acquired qualitative data, an affinity approach was used by writing the important data from the two concepts and the instructor's notes on sticky notes and using inductive coding, refining the themes and codes in an iterative way. The same approach was used for the warm-up exercise data [46].

During conception, both groups did not attach any importance to the gender of the digital companion as they did not think it to be important.

Wearables were rejected by both groups. Group 2 found them too restrictive, and group 1 considered an additional device to the smartphone unnecessary and impractical.

In addition, they agreed that in physically threatening situations, only a human can help.

3.3.1. Concept Group 1: Avatar on Smartphone

At the core of this concept was the distraction from the unpleasant situation one finds oneself in with the help of the private digital companion (see [D.1.Participants Notes 1](#)).

The group classified the potential situations in which one does not feel safe and uncomfortable into three levels: queasy, unpleasant, and threatening. They agreed that digital companionship could not help in physically threatening situations and would even go so far as to switch it off. Only a human being would be able to help here, and a digital companion would only distract the user unnecessarily.

In queasy and unpleasant situations, on the other hand, this distraction would be desirable. It should be realized through conversations with the digital companion, the possibility of being told jokes, being able to compete against the digital companion in games, the possibility of listening to music and much more. The wide range of offers should dis-

tract from the situation and one's own insecurities.

Furthermore, the group focused on flexible communication with the digital companion. It should be possible to communicate via headphones and speech as well as in writing to adapt to individual needs in different situations.

In general, individuality and flexibility played a big role for this group because part of the concept is the free creation and design of several different avatars to be able to select or change them depending on the situation and mood of the day.

The selected avatar was to be shown on a display. The group decided on the smartphone as this is a constant companion for most people and thus no additional device would be needed.

The digital companion itself was intended to be natural, calm, humorous, and good-humoured, and to evoke a sense of calm and community. Much emphasis was placed by the group on a beautiful speech melody, which they described as calm and clearly understandable, as well as infused with emotion.

In addition, the digital companion should act proactively, but not independently, asking how the person is feeling, offering possible actions, and asking if they should intervene in the situation.

3.3.2. Concept Group 2: Hologram of Confidant

The key to this concept is the close relationship a woman would have with her private digital companion. The companion should represent a trusted person and accordingly be emotionally close to the user (see [D.2.Participants Notes 2](#)).

It would sit in real size either next to you or, optimally, at the wheel to simulate the driver. Since the digital companion would represent a real, familiar person, it should be as lifelike as possible and communicate like a real person via speech, gestures, and facial expressions.

Although it would only be a projection, the digital companion should provide a sense of security and trust as well as control. This control was to be realized by linking the digital companion with the SAV. Thus, with the help of the companion, it would be possible to stop the vehicle and thus ensure the possibility to get out of the vehicle at any time. It would also be possible to control and adjust operational elements such as the speed and temperature of the vehicle. Furthermore, the feeling of control should be strength-

ened by providing information such as traffic situation and arrival time.

The digital companion should be reassuring and de-escalating, reacting according to the situation and learning from experience. It should also provide the possibility of contacting real people for situations in which the digital companion cannot provide support.

It is worth mentioning the scepticism of the other group regarding the display of a known person. They expressed the fear that the break between the real person and the person portrayed could make them feel uncertain. The developers of this concept, on the other hand, argued that people would subconsciously deceive themselves to gain a sense of safety.

3.4. Results

In the following, the summarized results of the qualitative content analysis will be presented.

3.4.1. Warm-up Exercise

The collection of sticky notes on the theme of "Feeling Safe" that emerged during the workshops warm-up exercise could be organized into the 5 themes of "Control", "Environment", "Physical Safety", "Restraint/Backing/Help" and "Feelings Associated with Safety". These clusters can in turn be grouped under the aspect of "Trust".

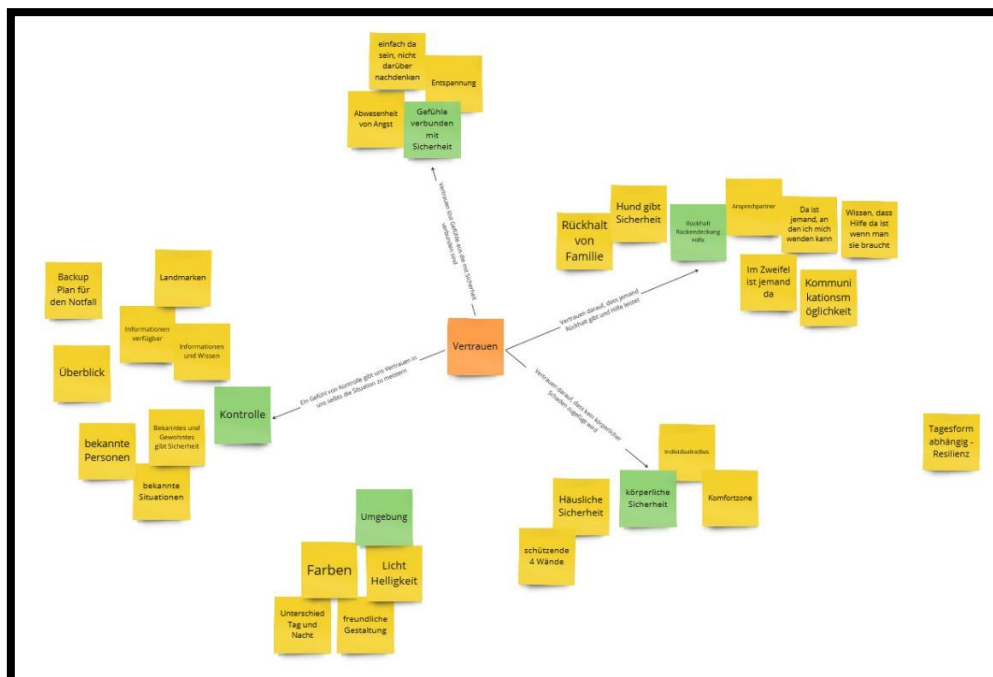


Figure 6: Cluster on the topic of "feeling safe" of the workshop warm-up exercise.

Information, as well as what is known and familiar, gives a sense of control and results in the trust that difficult situations can be mastered.

Physical safety is objective, but whether we trust that no physical harm can come to us is subjective. Thus, trust in physical integrity can also increase the feeling of safety, even if it is not given.

Social support can be given in various ways. Whether through family, a pet, a contact person, or society in general, a sense of safety can only be established if there is also trust that support will be given, and help will be provided.

Both safety and trust trigger a feeling of relaxation and are characterized by the absence of fear.

A positive environment (bright, friendly) makes us trust ourselves and others more easily, while a negative environment (dark, uninviting) makes us distrustful and insecure. An example of this is the change in perception between a daytime drive and one at night.

3.4.2. Concepts

The collection of sticky notes derived from the two concepts (see 3.3.1. [Concept Group 1: Avatar on Smartphone](#); 3.3.2. [Concept Group 2: Hologram of Confidant](#)) during the conception phase of the workshop could be organized into the 5 themes of "Control", "Private/Personal", "Trust", "Humanization" and "Threatening Situations".

Humanization in this context means that the companion should be as natural and human-like as possible. This includes, for example, communication through speech, which is a natural and human way of communicating. Not to be disregarded are the emotions that should be transmitted through the voice and the speech melody. But gestures and facial expressions should also contribute to communication, just as they do with humans.

Another human trait is the ability to learn, which is expected of the digital companion. The companion should learn through experience and be able to reflect on and evaluate past situations and reactions.

The distraction of insecurities by offering a variety of entertainment, such as playing a game together, or a simple conversation, also represents perfectly human behaviour and thus falls into this category.

At this point, it should be noted that the representation of the companion via a projection

is also a very realistic representation to emphasize human aspects. Although this aspect was classified in the "trust" cluster because of the reference to the trusted person, the link to "humanization" is also clearly recognizable.

The trust category is very similar to the results of the warm-up exercise and includes physical safety and support or assistance. But also, the relationship between human and companion should take place on a personal level and include emotional aspects. Particularly noteworthy is the desire of some participants for the companion to be a confidant.

In addition, the companion should be private and personal in order to establish a relationship as close as possible and to accompany the user permanently. Communication should also take place privately and exclusively with the user, without involving other passengers.

In contrast to this aspect is the need for flexibility. Thus, it should be possible to turn the companion on loudly for all as an option and thus make it accessible to all passengers. Communication should also be as flexible as possible, both by voice and in writing.

It should also be possible to flexibly select and change the companion from a selection according to the mood of the day. At first glance, this seems to contradict the desire for a personal relationship, but a comparison can also be made between a selection of companions and a circle of friends. In this way, the user figuratively selects a friend to accompany him on his journey.

This possibility to choose individual companions and to design or customize their appearance and reactions also influences the aspect of individuality and evokes a feeling of control. The possibility of accessing information via the companion and giving commands to the vehicle increases the feeling of control. This makes it possible, for example, to obtain information about the current traffic situation or to get out of the vehicle at any time. This means that a contact person is available for every situation.

In addition, they agreed that in physically threatening situations, only a human can help.

3.5. Conclusion

In summary, it can be concluded from the results of the workshop that the representation of a trusted person is a good way of embodying the digital companion and thus fulfilling the need for trusting companionship. However, many of the participants see the break to reality as critical, which is why the effects of such a representation need to be tested. The gender of a digital companion does not seem to play a serious role in this.

Furthermore, the implementation as a hologram gives the companion a natural and human appearance and thus plays into the aspect of humanization. Flexible communication also increases privacy and is at the same time individually tailored to the respective user. Depending on the situation, it must be possible to change or adapt the communication according to the needs. Spoken language as a means of communication is also the most natural way to communicate. However, communication via chat has also become a ubiquitous and private means of communication. Accordingly, we associate both types with natural and human behaviour. Thus, it only makes sense to transfer this to a digital companion as well.

A social and thus personal relationship with the digital companion represents an essential bond to be able to offer people support and assistance in uncomfortable or unpleasant situations. In threatening situations, however, it cannot be the responsibility of a digital companion to solve them, but rather to request real human help.

4. User Study

Based on the literature review (see 2.Theoretical Framework) and the workshop (see 3.Workshop), three prototypes of a private digital companion (see 4.3.Companions) and four scenarios (see 4.4.Scenarios) in which such a companion can provide assistance while driving in SAVs were developed.

These companions were tested and assessed by 13 participants (exclusively women with an emphasis on diversity) (see 4.1.Participants) in a within-subjects design study (see C.2.Instructions for User Study). A mixed-methods approach was used to obtain a comprehensive picture of participants' preferences, opinions, and emotions regarding the digital companions by collecting both quantitative and qualitative data (see 4.6.Procedure and Methods). This was ensured using various questionnaires, the thinking-aloud method, and a post-session interview (see 4.6.2.Methods).

The study took place from the 08th of July to the 18th of July and was conducted in a study bus (see 4.5.1.Study Bus) designed to simulate a SAV. The digital companions (see 4.3.Companions) were created from the 05th of July to the 15th of July. For this purpose, individual Zoom meetings [48] were held with the participants' confidants (see 4.2.Confidants), in which video and audio material were created to produce two digital companions (realistic and avatar) each. Such a Zoom meeting [48] was also conducted with a person who was not known to the participants to be able to create a digital companion representing a stranger (see 4.3.Companions).

A total of 12 realistic digital companions (1 stranger, 11 confidants) and 11 avatars were created prior to the study. 3 participants indicated the same trusted person, although with different relationships to her (granddaughter, daughter, friend).

The User Study was held in German, as all participants were German native speakers, and took about 90 minutes each. It was conducted in person and was not compensated. The participants as well as their confidants were informed of their rights and signed an informed consent form (see B.Declarations of Consent).

The quantitative data obtained from the different questionnaires was processed and analysed using statistical methods (see 5.Results).

4.1. Participants

All 13 participants in the user study were women and belonged to four different age groups (21-29 years, 30-39 years, 50-59 years, 60 or older), and the average age was between 40 and 49 years. They had different levels of education (**Fehler! Verweisquelle konnte nicht gefunden werden.**) and marital status (**Fehler! Verweisquelle konnte nicht gefunden werden.**). Among the participants there was one student and one pensioner, the rest worked full or part time. 9 women were mothers and 3 of the women had a disability. All participants were German, only one was an Austrian citizen residing in Germany. There was only one participant who did not have a private vehicle (owner or family vehicle) and only one other who stated that she never used public transportation but used her own private vehicle almost exclusively. None of the participants came from a large city, but the places of residence were divided between medium-sized towns, small towns, and rural communities.

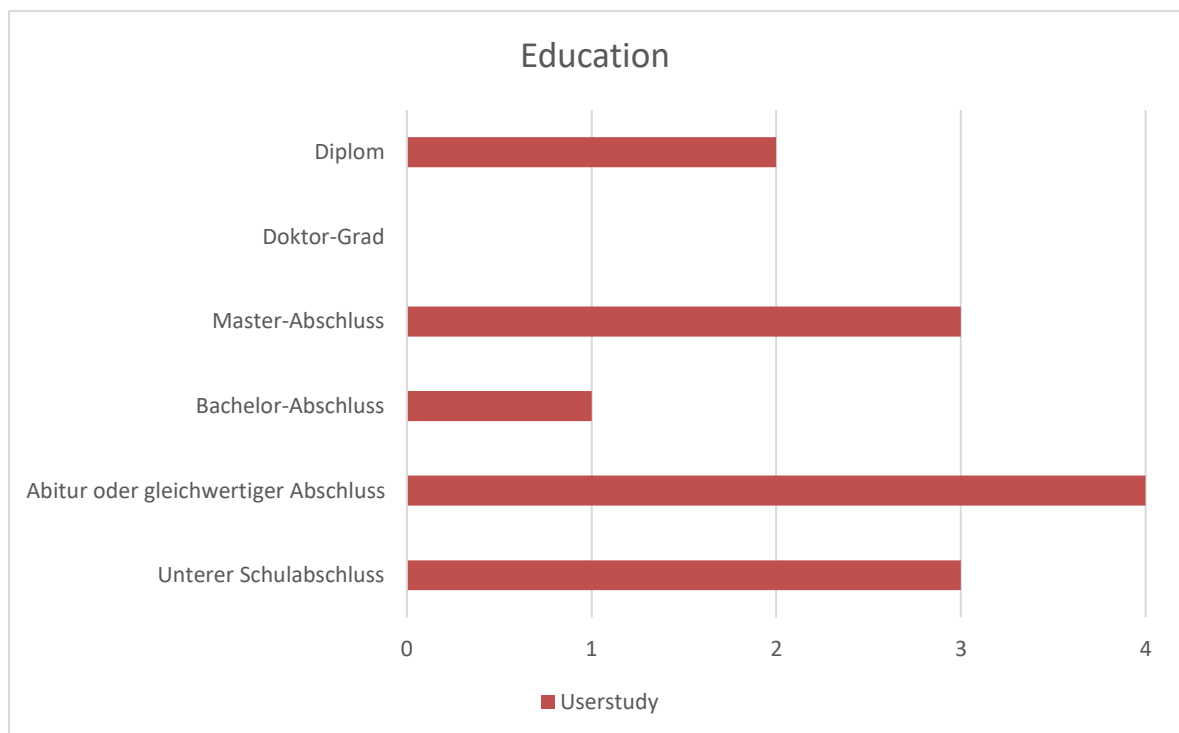


Figure 7: Highest level of education of the participants in the user study.

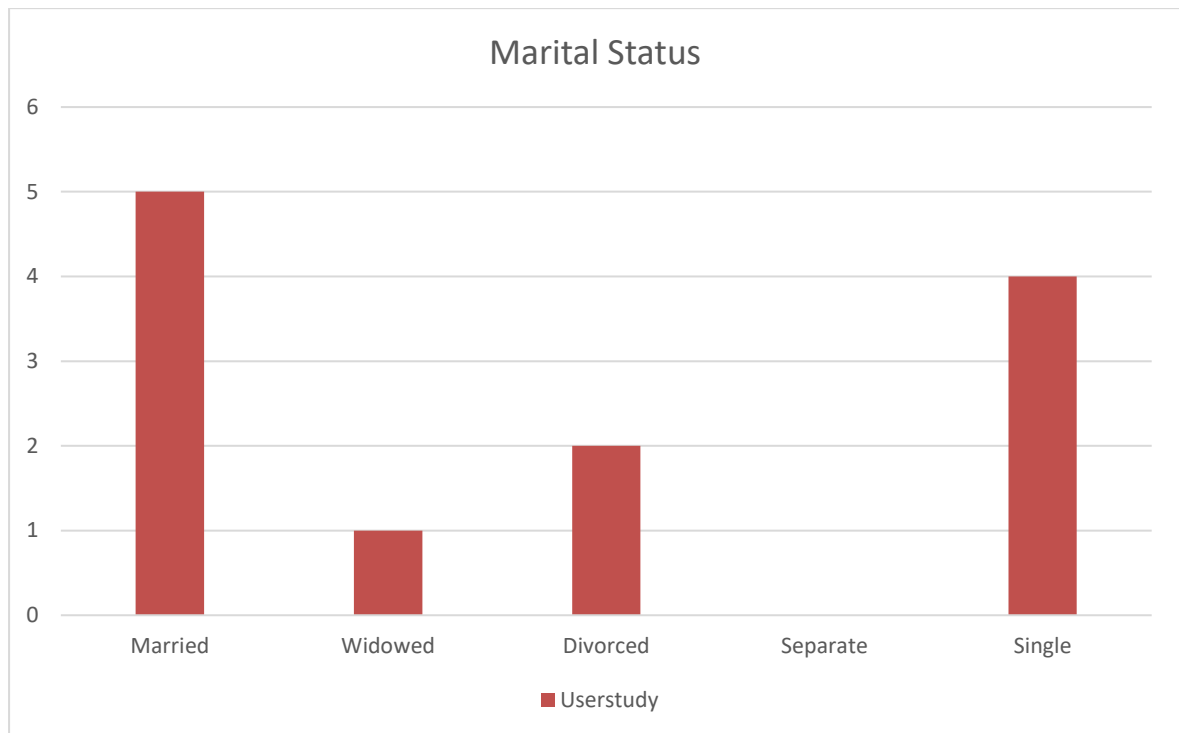


Figure 8: Marital status of the participants in the user study.

4.2. Confidants

Each participant (see 4.1.Participants) was asked in advance to name a trusted person of her choice. 6 of the participants chose their male partner, 4 chose a child or grandchild (male or female), and 3 indicated a female friend as their confidant.

The initial contact with the trusted person would be made through the participant. In the further course the participant in question was no longer involved. The confidants had to fulfil only 2 conditions. They had to have the trust of the respective participant and be willing to cooperate in the preliminary stages of the study.

If these criteria were met, the confidant was invited to a 15-minute Zoom meeting [48]. Here, the purpose of the study, their personal contribution, and the setting in which their data (video and audio recording) would be used were explained. In the further course, the confidant was presented with the 4 scenarios (see 4.4.Scenarios) that the participants would go through during the user study and the respective reactions of the digital companion. Subsequently, with the consent of the confidant (see B.2.Declaration of Consent for Confidants), a video recording was started during which he or she spoke the reactions of the digital companion, as if he or she were the companion and was

speaking to the respective participant. The recording was a continuous recording that was later edited. This gave the confidants the opportunity to speak the texts several times until they were satisfied with them.

Finally, they were asked to remain silent about the content of the meeting and their contribution to the study so as not to influence the participants in advance.

4.3. Companions

Based on the literature review (see [2.Theoretical Framework](#)) and the workshop (see [3.Workshop](#)), three different prototype variants of a private digital companion were developed for the purpose of supporting women while traveling in SAVs.

One variant of these private digital companions was a realistic representation of a person unknown to the participants with whom there was no relationship (Stranger). The other two variants were a realistic (Companion) and a comic-like representation of the respective chosen trusted person (Avatar) and thus had to be created anew for almost every participant.

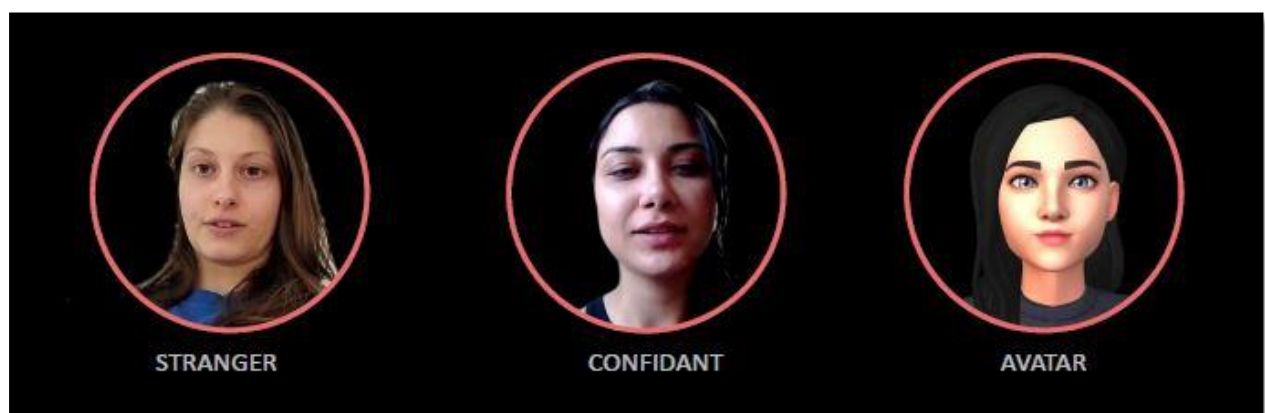


Figure 9: Digital Companions (from left to right): 1) Stranger 2) Confidant of P8 3) Avatar of P8.

The audio and video material obtained from the Zoom meetings [48] with the trusted persons was edited and converted into a hologram video (see [C.4.Instructions for Hologram Video](#)) using the Adobe After Effects [49] tool to create the individual realistic DCs. The same was done with the material of the person who was not known to the participants, to be able to create a DC representing a stranger. For the comic-like DCs, the online open-source tool Ready Player Me [50] was first used to create avatars of the

confidants. The downloaded avatars were imported into the also open-source desktop tool Animaze [51] and embedded with the corresponding audio tracks before they were likewise converted into hologram videos with the software Adobe After Effects [49].

4.4. Scenarios

During the User Study, participants (see 4.1.Participants) repeatedly ran through four self-designed scenarios (see E.Scenarios) of potentially unpleasant situations that could occur while driving an SAV. In addition, a corresponding supportive digital companion response was devised for each scenario. The selection of the scenarios and the corresponding response were based on both the literature review (see 2.Theoretical Framework) and the insights gained from the workshop (see 3.Workshop).

	Alone in the vehicle	With other passengers
<i>At night</i>	Accident CONTROL	Stranger man as only other passenger CONTROL
<i>At day</i>	Missing orientation SECURITY	Drunken passenger SECURITY

Tab. 1: Scenarios.

The four scenarios and the respective responses of the digital companion are briefly described below.

Scenario 1: Drunken Passenger

In this scenario, the participant is on her way home from work and is feeling exhausted. A drunk passenger gets on, who smells unpleasant and is loud.

The digital companion offers the possibility to contact the operating staff or to change the vehicle.

Scenario 2: Stranger Man

After an evening with colleagues, the participant drives home. Sitting with her in the SAV is a man who is a stranger to her. Being alone with a stranger at night triggers a queasy feeling and she begins to worry.

The digital companion offers the possibility to change the vehicle or to be distracted by a game against each other.

Scenario 3: Missing Orientation

On the way to a friend's new home, the participant loses her orientation and can no longer identify her surroundings. Not knowing where she is makes her nervous.

The digital companion informs the participant that an accident must be circled, but that the travel time does not change and offers to give the exact location.

Scenario 4: Accident

On her way home from an evening out with friends, the participant arrives at an accident scene and is momentarily overwhelmed by the situation. It is nighttime and she is alone in the SAV.

The digital companion acts as a reassuring influence on the participant, explaining what needs to be done and what options she has.

Since the study took place in Germany with German participants, this scenario considered the German legislation that women are not obliged to stop and provide first aid at an accident scene when they are traveling alone for reasons of self-protection. However, there is always a duty to call emergency services [52].

Since women feel more insecure at night, two of the scenarios take place exactly then. The "Accident" and "Stranger Man" scenarios target the need for control, and the other two, "Drunk Passenger" and "Lack of Orientation" target the need for safety. In the two scenarios "Accident" and "Missing Orientation" the participant has the SAV to herself, in the other two she shares it with one or more other passengers.

4.5. Study Setting

4.5.1. Study Bus

To create the most immersive experience possible, the study was conducted in a bus with a built-in table and turned around front seats facing the table. This was to simulate an autonomous vehicle. The bus was parked on the side of a road to increase immersion through the acoustic feedback of passing vehicles.



Figure 10: Participant sitting in study bus.

Due to a heat wave, the study was conducted with lowered windows and open sliding door for all participants in to avoid endangering the health of participants and instructor by the heat building up in the vehicle. Twice, the study had to be relocated intermittently from the study bus to an air-conditioned room due to dangerously high temperatures. In the case of one participant, the vehicle had to be parked in the garage instead of along the road as usual to avoid hail damage. Due to technical problems, the study had to be temporarily stopped for 2 participants (P1 and P7). It was continued on another day.

4.5.2. Hologram projector

A self-made hologram projector (see C.3.Instructions for Hologram Projector) made of acrylic glass allows to simulate a hologram of the companion. To do this, a hologram video (see C.4.Instructions for Hologram Video) is first created based on a video of the woman's confidant (see 4.2.Confidants) using suitable software such as Adobe After Effects [49] in combination with Adobe Media Encoder [53].

To create a hologram video from a normal video, first the background of the video is removed and replaced by a black one. Then the video is duplicated 4 times and the 4 versions are arranged at right angles to each other so that a square is created in the centre (see C.4.Instructions for Hologram Video).

The finished hologram video is then exported to a tablet and displayed. The hologram projector is placed on the tablet and creates the illusion of a hologram of the companion, which is located above the tablet (see Figure 11: From video to hologram (from left to right): 1) Video with transparent background, 2) Hologram video 3) Hologram projector displaying self-made hologram.).



Figure 11: From video to hologram (from left to right): 1) Video with transparent background, 2) Hologram video 3) Hologram projector displaying self-made hologram.

4.6. Procedure and Methods

A mixed-methods approach using various standardized questionnaires, the thinking-aloud method, and post-session interviews with open-ended questions (see 4.6.2.Methods) was used to obtain a comprehensive picture of participants' preferences, opinions, and emotions regarding the three developed prototypes of a private digital companion (see 4.3.Companions). These companions were tested and assessed by 13 participants (exclusively women) (see 3.1.Participants) in a within-subjects design

study. The user study was conducted with each participant individually.

In order not to influence the participants, they knew in advance only the general topic and the rough course of the study but nothing else concerning the different digital companions, the modalities of the presentation or the role of their respective confidant (see 4.2.Confidants) in advance.

The study was conducted in the study bus (see 4.5.1 Study Bus), whose purpose of simulating an automated vehicle was explained to the participants in advance.

With the consent of the participants (see B.1.Declaration of Consent for Participants), an audio recording of the conversation was made. Participants were informed about each start and stop (for example, for breaks) of the recording.

They were also made aware of potential breaks and asked about any ambiguities that potentially arose several times during the study.

4.6.1. Procedure

After a participant (see 3.1.Participants) arrived on site, a participation information sheet (see F.Participation Information Sheet), the demographic data questionnaire (see A.5.Demographic Data), and the consent form (see B.1.Declaration of Consent for Participants) and the STAI-Trait (see 4.6.2.Methods) were handed out to her. The participation information sheet could be taken home by the participant after the user study. All other documents were collected again in filled-out and signed form before the start of the user study.

At the beginning, the participants were again given the most important information in a general introduction (see C.2. Instructions for User Study). This was about the purpose, aim and duration of the study, what was expected or not expected of them and how questions on their part would be handled. It was emphasized that they could not do anything wrong or answer incorrectly, that open and honest communication was appreciated, and that the data collected would be anonymized.

Thereafter, the procedure of the study was addressed in more detail. It was explained to the participants that they would repeatedly run through 4 different scenarios (see 4.4.Scenarios) and then fill out questionnaires (see 4.6.2.Methods). It is important to mention that they were not told how many digital companions were involved, so as not to raise expectations.

Each of the 4 scenarios was presented to the participants in paper form and additionally read aloud to appeal to both acoustically and visually inclined people. If the scenario was scenario “Drunken Passenger” or “Stranger Man”, the participant was asked to wear headphones to hear the digital companion through them. For Scenario 3 and 4, the tablet's device speaker was used. A video of the digital companion's response (see [4.4.Scenarios](#)) was shown using a tablet and the hologram projector (see [4.5.2.Hologram projector](#)). Participants were asked to complete questionnaires after each scenario. Scenarios 1-4 were run for each of the 3 digital companions (see [4.3.Companions](#)).

After participants experienced and evaluated all 3 digital companions, a semi-structured interview was conducted with them about their newly made experience with a personal digital companion.

At the end, the participants received information about the further course of the project and were thanked for their time and participation.

4.6.2. Methods

The user study was a within-subjects design study followed by a post-session interview using a mixed-methods approach to obtain both quantitative and qualitative data. The standardized questionnaires UEQ-S [54], STAI Short Version [55], CFT [56], and the Questionnaire on the Uncanny Valley Effect [43, 45] were used to collect the necessary quantitative data (see [A.Questionnaires](#)) and the thinking-aloud method during the scenarios and the post-session interview to collect the qualitative data.

By using the within-subjects design, individual differences between participants (see [3.1.Participants](#)) could be minimized and the effects of the digital companions (independent variable) on various dependent variables, such as perceived safety or trust, within the same person could be measured more accurately. The decision was made not to randomize and instead to use controlled variation to be able to introduce the digital companions in a targeted manner [57].

The UEQ-S (see [A.1.User Experience Questionnaire Short](#)) provides a quick and effective way to obtain feedback on the usability and acceptance of digital companions. This short version of the UEQ consists of 26 questions answered on a 7-point Likert scale. The questions are divided into the six dimensions of attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty [54].

To query trust, the Checklist for Trust (CFT) ([see A.3. Checklist for Trust](#)) was used. The CFT is used specifically when trust plays an important role and potentially influences aspects of human-machine-relationships. The CFT consists of statements (Likert scale), which in this case are intended to capture the level of trust in the relationship between the respondent and the digital companion [56].

The State-Trait Anxiety Inventory Short (STAI Short) ([see A.4. State-Trait-Anxiety Inventory Short Version](#)) is the short version of the STAI, consisting of 20 statements (Likert scale) to determine the general and situational anxiety of a person. The STAI Short is divided into two parts and contains the abbreviated STAI-T (State-Trait Anxiety Inventory - Trait), which determines the general anxiety as a personality trait of a person and the also abbreviated STAI-S (State-Trait Anxiety Inventory - State), which examines the current anxiety state of a person in a specific situation [55, 58].

The questionnaire on the Uncanny Valley phenomenon ([see A.2. Uncanny Valley Questionnaire](#)) investigates the participants' emotional reaction to artificial beings such as robots, virtual characters and avatars in order to assess the extent of uncanniness and to avoid triggering the Uncanny Valley Effect ([see 2.5 Uncanny Valley Effect](#)). It is worth mentioning that other aspects of perception and interaction regarding artificial beings cannot be investigated with the help of this questionnaire, as it is specifically designed to investigate the Uncanny Valley Effect [43, 45].

To gain insight into the participants' thoughts while interacting with the digital Companions, the Thinking-Aloud-Method was used. It helps to better understand the behaviour and decisions of the participants, to find weaknesses and opportunities for improvement of the digital companion and additionally promotes open and honest communication.

To gain a deeper understanding of the participants' experiences, opinions and perspectives, a post-session interview with open-ended questions was conducted. By using a semi-structured interview, a flexible approach was used that allowed for further questions to be asked, if necessary. To ensure that all participants were asked the same questions and to facilitate the analysis through the comparability of the answers, an interview guide ([see C.5. Interview Guide](#)) was created. This helped to keep the interview structured and focused, especially since it was a complex topic with many questions. It also ensured that no questions were forgotten and that all important topics were covered. It is important to mention here that the developed interview guide provides structure without compromising flexibility and room for spontaneous questions or follow-up questions [57].

4.7. Data Collection and Analysis

The whole user study was audio recorded and transcribed verbatim afterwards.

The quantitative data from the different questionnaires (see 4.6.2.Methods) was organized by using Microsoft Excel [59] and analysed using statistical methods.

The requirements for the different statistical methods are considered to be fulfilled such as the assumption of the data being normally distributed.

The mean values, standard deviations, and confidence intervals were obtained for each scale.

To test whether the scale means of the digital companions differed significantly, simple two-sample t-tests were performed. The alpha level was set to 0.05 for each test [57].

Since the word pairs of the UEQ-S are randomized and thus inconsistently start with the negative or positive term, the raw data had to be transformed before evaluation. For this purpose, the corresponding negative data sets were inverted. The same transformation was done for the questionnaire on the Uncanny Valley phenomenon. The STAI Short was also recoded for the evaluation, as some items were negative and others positive [54].

The processed data of the UEQ-S was divided into the 6 scales attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty [54]. The processed data of the questionnaire on the Uncanny Valley into the indices of attractiveness, humanness, and eeriness and into the eeriness subscales eerie and spine-tingling [45].

The CFT can be divided in questions 1 to 5 to measure distrust and questions 6 to 12 to measure trust between participants and digital companions [56].

General anxiety tendencies (mean values) for state and trait anxiety were determined from the STAI Short data, ranging from 10 to 50. These were then converted into percentages (scale 0-100%) [55].

For the mean of trait anxiety, a cutoff value of 40 is suggested for a range of values between 20 and 80, resulting in a cutoff value of 33.3% for the range of 10 to 50 used. This cutoff value divides participants into anxious (mean greater than 33.3%) and non-anxious (mean less than 33.3%) categories, in terms of anxiety as a character trait [60–62].

To determine the change in state anxiety, the state anxiety after each scenario (see 4.4.Scenarios) was compared with the state anxiety before the user study (baseline) (see 4.User Study). Means, standard deviations, and confidence intervals for the respective companions (averaged across all scenarios) and for the respective scenarios (averaged across participants) and means for the respective participants (averaged across all scenarios) were calculated over these change values of the state anxiety (mean).

5. Results

In the following, the results of the user study are presented. For the sake of clarity, the chapter is structured according to the methods (see 4.6.2.Methods).

5.1. User Experience

Based on the data collected, none of the three variants of a digital companion (see 4.3.Companions) seems to have triggered a negative user experience. While the realistic representations are consistently located in the positive experience range of the value scale (values > 0.8), the comic-like representation is perceived as neutral (between - 0.8 and 0.8) in terms of attractiveness and dependability.

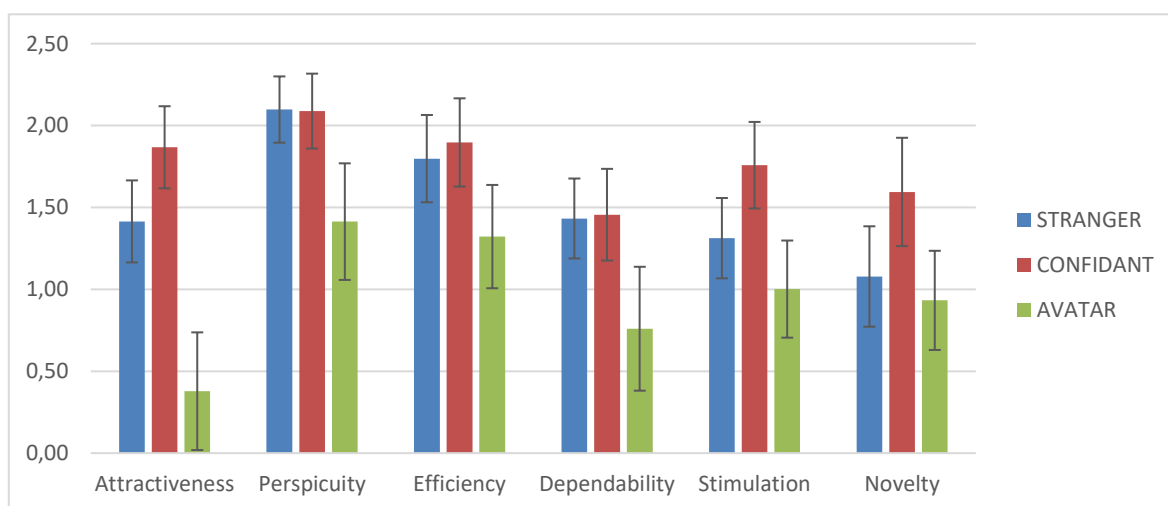


Figure 12: Comparison UEQ – Stranger, Confidant and Avatar

It should be noted that the data is based on individual and therefore different opinions, perspectives and response behaviour, and values above +2 and below -2 are accordingly very unlikely [54]. Therefore, it is remarkable that both the Stranger (value = 2.10) and the Confidant (value = 2.09) could achieve a value above +2 in terms of perspicuity.

Regarding the standard deviation can be said that the participants highly agree on their perception of perspicuity of the two realistic representations (Stranger = 0.74, Confidant = 0.83) which backs the above statement. It is also noteworthy that the Avatar causes mixed opinions in all aspects as the standard deviation is above 1.01 for all scales.

Novelty (STD > 1.01 for all companions) also appears to be rated differently by participants. This could be because they have probably been exposed to similar technologies to different degrees.

The only other low level of agreement is seen in the evaluation of the dependability of the Confidant (STD = 1.02). The reason for this can only be conjectured at this point. There could be a connection with the real relationship between participant and confidant. Thus, an aspect of this relationship might have been transferred to the relationship with the DC. Whether this was a positive or negative aspect is open to question. However, this theory is based purely on conjecture and assumption and remains to be tested.

To test whether the scale means of the DCs differed significantly, three simple two-sample t-tests were performed. The alpha level was set to 0.05 for each test.

When comparing the Stranger and the Confidant, the test showed significant differences in the areas of attractiveness, stimulation, and novelty. However, looking at the corresponding diagram of the scale means, the error bars overlap for all three scales of the compared DCs. This could indicate false-positive results or a sample size that is too small.

When comparing the Stranger and the Avatar, the test showed significant differences in the areas of attractiveness, perspicuity, efficiency, and dependability. In terms of stimulation and novelty the test indicates no significant difference. A look at the diagram seems to support this result for the most part. Only in the case of efficiency do the overlapping error bars again indicate a false-positive result or an insufficient sample size.

When comparing the Confidant and Avatar, the t-tests showed significant differences in all areas. However, the error bars for efficiency are overlapping here as well, again indicating a false positive result or an insufficient sample size.

5.1. Uncanny Valley

The data collected on the uncanny valley effect (see 2.5. [Uncanny Valley Effect](#)) can be divided into the three indices of humanity, attractiveness, and eeriness. The two subscales of the eeriness index are eerie and spine-tingling, which provide additional detail. When creating animated characters, it is advisable to check the score on the spine-tingling subscale, as it tends to be higher than that of robots and thus may indicate neg-

ative sensations [45].

According to the t-tests performed, the two realistic representations of a digital companion do not show any significant differences. This is supported by the overlap of the error indicators in the diagram with the average values of the indices of the DCs.

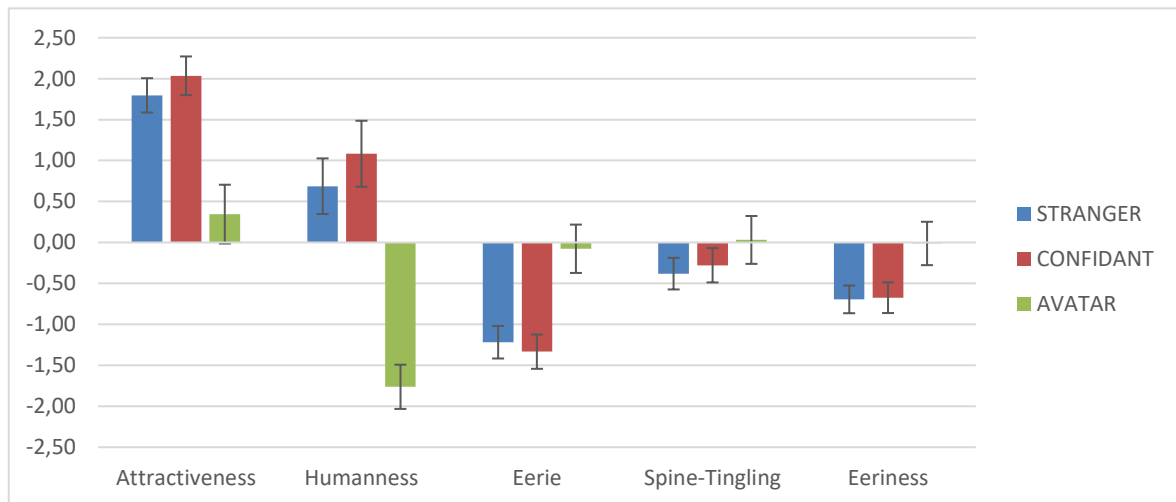


Figure 13: Comparison Uncanny Valley - Stranger, Confidant, Avatar

The standard deviations of the scale means for these two DCs indicate high agreement (< 0.83) among participants. Exceptions are the attractiveness of the Confidant, which is slightly in the medium agreement category (0.86), and the low agreement (> 1.01) regarding the humanity of the two realistic companions.

In contrast, the standard deviations of the scale means for the Avatar show low agreement (> 1.01) between participants for all indices and subscales.

The t-tests performed show significant differences between the realistic representations and the comic-like representation for all indices. Only when looking at the subscales of the eeriness index does it become apparent that there is no significant difference for spine-tingling, which seems to be a weak spot of animations [45].

It is remarkable that all indices and subscales of the Avatar, apart from humanity, lie around zero (between -0.08 and 0.35). If this is considered in combination with the error indicators and the low agreement between the participants, it is no longer clear whether the scores are in the positive or negative range. From this, the assumption could be made that the Avatar is perceived as creepy or acceptable depending on the person.

However, it is evident that the DC is not considered human (-1.76).

5.2. Trust

The evaluation of the CFT (see 4.6.2.Methods) shows that apparently Stranger and the Avatar are met with the same degree of trust and distrust, respectively.

The Confidant, on the other hand, scores a relatively high value of 6.07 on the trust scale with a small size of the error bar, indicating a high level of agreement between participants, especially since the sample size is relatively small. Additionally, the t-tests performed show significant differences in trust as well as distrust between the Confidant and the other two versions of a DC.

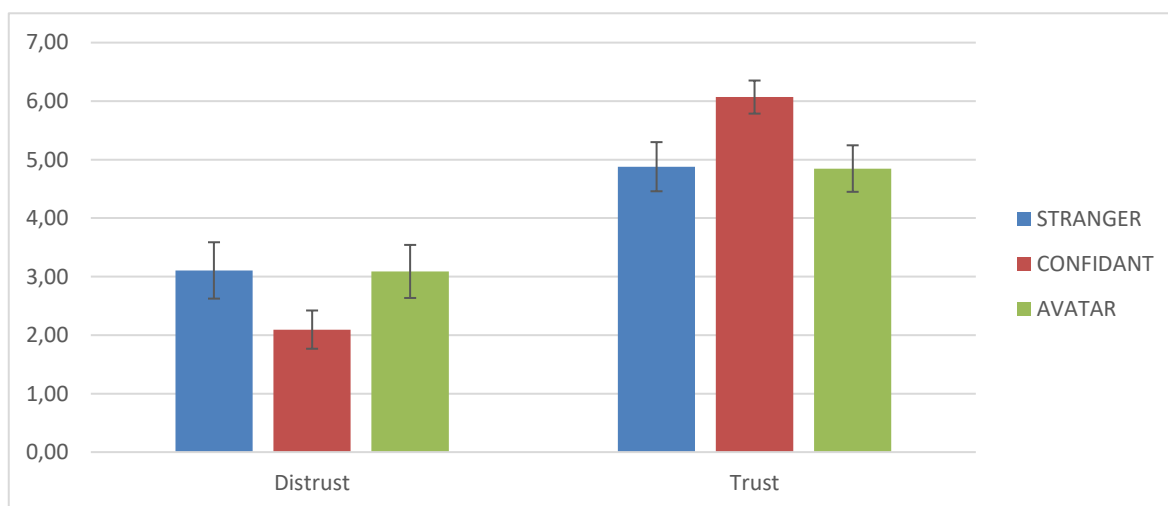


Figure 14: Comparison Trust and Distrust - Stranger, Confidant and Avatar

5.3. Anxiety

The participants (see 4.1.Participants) can be divided into anxious and non-anxious categories, in terms of anxiety as a character trait (see Figure 15: Anxiety Change vs Baseline - Overall, Anxious participants and Non-Anxious Participants).

Of 13 participants, 7 could be categorized as anxious (see Figure 16: Comparison of Scenarios - Non-Anxious Participants) with an anxiety score of 33.3% or greater, while 6 participants with an anxiety score less than 33.3% were categorized as not anxious (see Figure 17: Comparison of Scenarios - Anxious Participants).

By means of a t-test, a significant difference for anxious study participants can only be

found in the comparison of realistic representation versus the comic-like representation of the confidant. Despite confirming values in the t-test, this result must be viewed critically, since the error indicators of the DCs in question overlap (see Figure 15: Anxiety Change vs Baseline - Overall, Anxious participants and Non-Anxious Participants). This means that this result could also be false positive. The large confidence value ($c = 6.24$) suggests that the sample of study participants was too small to reliably detect a significant difference.

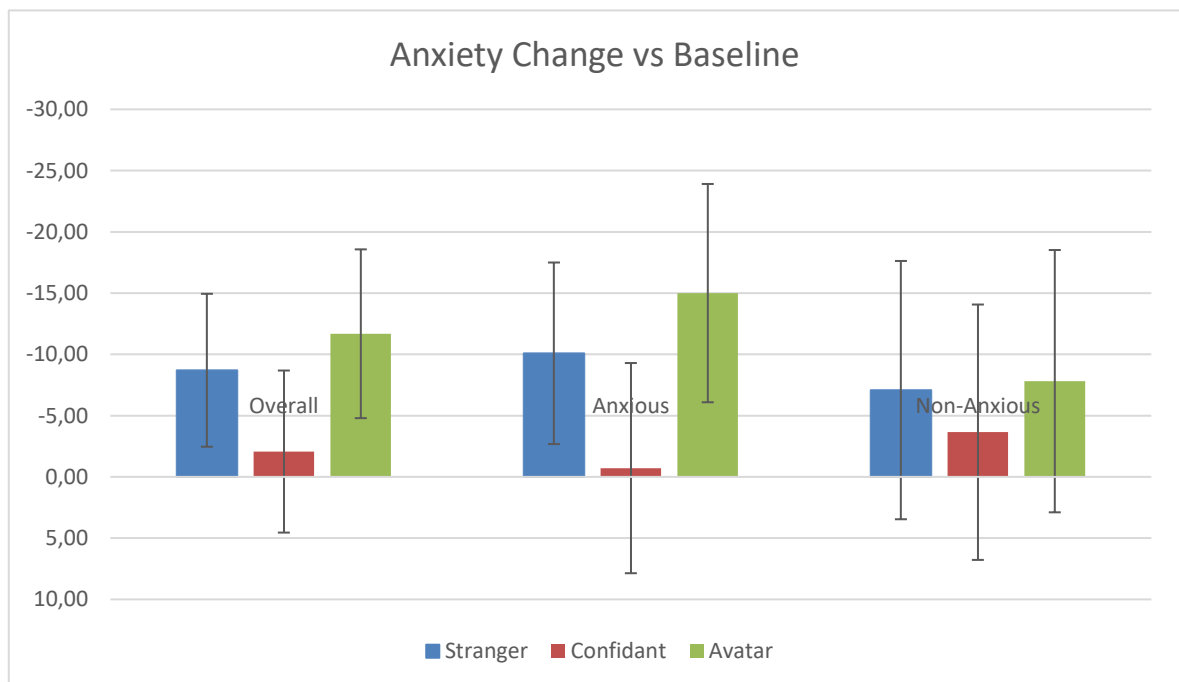


Figure 15: Anxiety Change vs Baseline - Overall, Anxious participants and Non-Anxious Participants

Overall, however, the comparison between anxious and non-anxious participants does not allow any conclusion to be drawn that a DC would have more or less effect on one of the two groups than on the other.

For example, conspicuously high anxiety values (< -58) can also be found in the group of non-anxious participants (see Figure 16: Comparison of Scenarios - Non-Anxious Participants). It is not possible to determine whether these may be outliers because the sample is too small ($N = 6$).

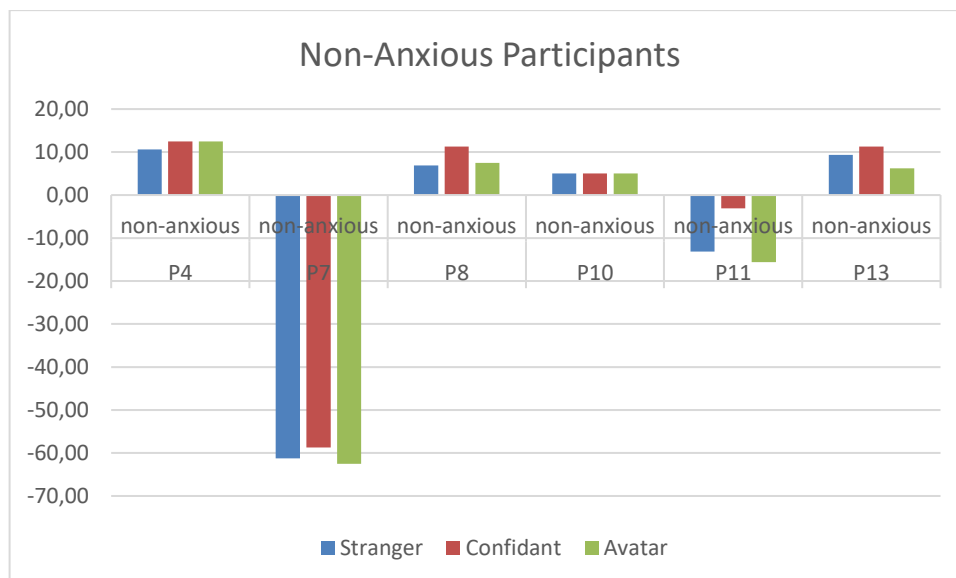


Figure 16: Comparison of Scenarios - Non-Anxious Participants

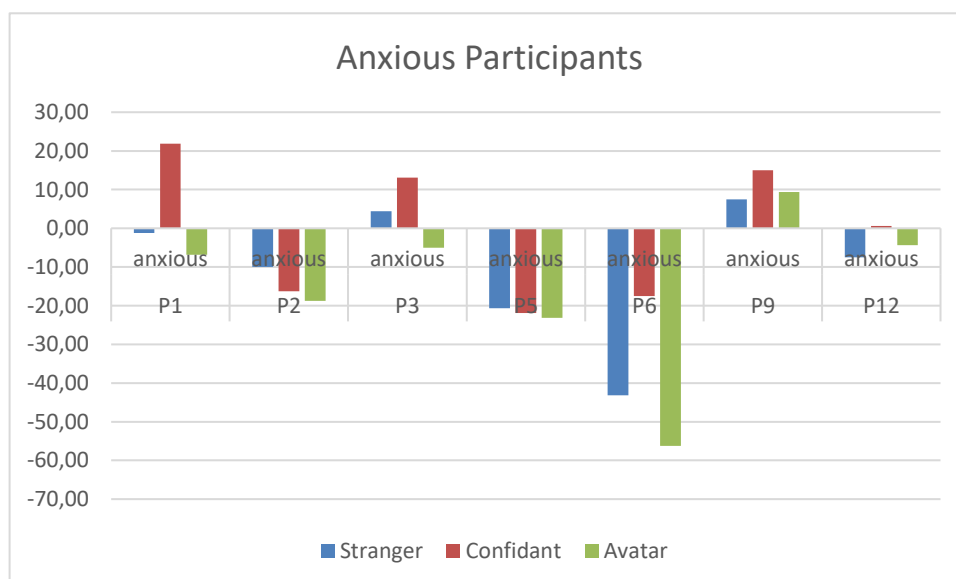


Figure 17: Comparison of Scenarios - Anxious Participants

The following table (see Tab.2: Level of fear in the scenarios for each digital companion) shows the changes in the anxiety values for the respective scenarios (see 4.4.Scenarios) averaged over the participants. This means that the changes to the entire group of participants can be observed without a differentiation between anxious and non-anxious. Interesting at this point is whether one scenario causes more anxiety than another. As before, no conclusions can be drawn here due to the small sample. In the existing sample, scenarios 2 and 3 seem to tend to evoke less fear. However, this tendency cannot

be generalized in any case, since the confidence value is far too large here as well.

Scenario	Mean Stranger	Mean Confidant	Mean Avatar	Mean Overall	STD	Confidence
S1	-13,65	-4,62	-14,04	-10,77	23,72	7,44
S2	-6,92	2,50	-10,19	-4,87	22,11	6,94
S3	-3,85	1,92	-5,19	-2,37	22,67	7,11
S4	-10,38	-8,08	-17,31	-11,92	28,30	8,88

Tab. 2: Level of fear in the scenarios for each digital companion

6. Discussion

The following section focuses on relating the research questions and hypotheses posed at the beginning of the paper (see 1.1.Objective and Methodology) to the data and study results (see 3.4.Results) collected.

The workshop (see 3.Workshop) conducted, realized with the help of co-design techniques, focused on answering RQ1.

RQ1: How should a private digital companion be designed from a woman's perspective to increase the perceived safety in shared automated vehicles?

Based on the workshop, two concepts emerged to realize a private digital companion: Avatar on Smartphone (see 3.3.1.Concept Group 1: Avatar on Smartphone) and Hologram of Confidant (see 3.3.1.Concept Group 1: Avatar on Smartphone). If we bring these two concepts together, we can identify several essential core components that a private digital companion must possess from a woman's point of view to increase the perceived safety (see 3.5.Conclusion). The gender of the DC does not seem to play a fundamental role. However, it is clear to the workshop participants (see 3.1.Participants) that a DC cannot replace a real person in physically dangerous situations. The participants distinguished between three types of situations: queasy, unpleasant, and threatening. The digital companion is only intended for the first two levels, queasy and unpleasant.

Regarding the attributes that the DC should embody to increase trust and thus perceived safety (see 2.2.Perceived Safety) in just such situations, humanity and the social relationship should be particularly emphasized. This includes, for example, flexible communication or the distraction from uncomfortable situations through games. The increased sense of control that arises, for example, when the car can be stopped via the DC, also contributes to increased trust. The key factors of the two developed concepts for a DC include the distraction from uncomfortable situations and the close social relationship with a DC who represents a real person of trust.

Based on the findings of the workshop (see 3.4.Results), RQ2 and RQ3 were examined in detail in the subsequent user study. The collected attributes from the two concepts were used to develop three prototypes for a digital companion (see 4.3.Companions), which were implemented as holograms (see 4.5.2.Hologram Projector): realistic stranger, realistic confidant, comic-like confidant. These were the subject of considera-

tion in the user study (see 4. User Study).

RQ2: Do women prefer a private digital companion representing their real-life confidant to a companion representing a stranger?

The existing literature on this topic already shows that people can trust digital assistants and thus form a human-like relationship with them. Digital assistants (see 2.4. Digital Assistants) already offer emotional support in many aspects of everyday life. In the context of SAVs (see 2.1. Shared Automated Vehicles), trust in such a digital assistant plays a particularly important role, as this also has an influence on perceived safety. For women, this also means that SAVs are more accessible and attractive if they receive support from a DC who helps them overcome uncertainties or unpleasant situations.

To answer the Research Question, hypotheses 1-3 must first be examined.

H1: Women feel more trust towards a confidant as a private digital companion.

The level of trust determined by the CFT (see 5.2. Trust) shows a relatively high value of 6.07 on the trust scale for the realistic representation of a trusted person as a DC. Despite a small sample size (N = 13), the result shows a low indication of error. In addition, the t-tests conducted show significant differences in trust and distrust, respectively, between the Confidant in contrast to the Avatar as well as to the Stranger.

It can be concluded that women have significantly more trust in a representation of a real confidant than in that of a stranger or a comic-like representation of the confidant as a DC.

H2: Women feel less anxiety when accompanied by a private digital companion who represents a confidant.

Regarding the feeling of anxiety of women in using SAVs, no significant conclusions can be drawn (see 5.3. Anxiety). By means of a t-test, a significant difference between the realistic and the comic-like confidant was calculated in the group of participants who were overall anxious (trait anxiety), but this cannot be emphasized as positive. Due to the high error indicators, this result can also be a false positive, which is due to the small sample size (N = 6). In the comparison between Confidant and Stranger as well as between Stranger and Avatar no significant differences could be determined.

These results imply that it cannot be statistically confirmed that women experience less anxiety when accompanied by a private digital companion representing a confidant.

However, it is interesting to note that the group of non-anxious participants tends to have some high anxiety scores. Overall, though, there are no noticeable differences between the results of the anxious and the non-anxious participant groups. Nevertheless, these are only observations concerning the present sample without significant differences.

H3: The user experience is more positive when accompanied by a private digital companion who represents a confidant.

The user experience was determined using the UEQ-S [54] to collect feedback quickly and effectively (see 5.1. User Experience). The rating of the Confidant is continuously in the positive experience range and achieves a remarkable result, especially regarding comprehensibility. The Stranger as DC achieved a comparably good value in this category.

In addition, the t-test shows significant differences in the areas of attractiveness, stimulation and novelty between Confidant and Stranger as a DC. However, it must be pointed out that this could again be a false-positive result since the error bars in the corresponding diagram of the scale mean values for all three scales overlap. The reason for this could be the small sample of participants (N = 13). This means that a significant statement cannot be made with certainty, but rather merely a tendency can be determined.

In summary, there is a clear tendency toward good user experience, high trust scores, and low anxiety scores for the representation of the digital companion as a realistic confidant compared to the other two representations. These tendencies cannot be verified as statistically significant, probably because of the small sample of participants.

RQ3: How human-like should a private digital companion representing women's real-life confidant be designed?

When it comes to the question of how close a digital assistant should come to the image of a human being, but also to his behaviour, there are some aspects to consider. The resemblance to humans plays an essential role for the trust we place in a digital companion and how much we rely on it in unpleasant situations, as already shown in RQ1 and RQ2. But the more a DC resembles a real person in behaviour and appearance, the more aspects like the Uncanny Valley Effect (see 2.5. Uncanny Valley Effect) have to be considered. Since this can even cause disgust in the user, it is crucial to avoid it in order not to cause negative effects such as mistrust or even fear.

H4: Different depictions of the confidant as a private digital companion do not trigger an uncanny valley effect.

To determine the uncanny valley effect, a corresponding questionnaire ([see A.2.Uncanny Valley Questionnaire](#)) was used to determine the extent of uncanniness and the emotional reaction of the participants towards the different variants of the digital assistant ([see 5.1.Uncanny Valley](#)).

It is striking that the participants were fundamentally divided in their evaluation of the Avatar. This phenomenon probably arose from the fact that the uncanny valley effect is perceived individually by each person. Accordingly, attributes or features of the digital companion can be the trigger for the uncanny valley effect for one participant, while precisely these same features are perceived as acceptable for another.

The t-test also finds a significant difference between the Confidant and the Avatar in all areas. Only in efficiency is this result not reliable, since the error indices are too large to exclude a false positive result.

Regarding the Confidant, the participants disagreed only on the aspect of humanity.

The hypothesis can therefore only be partially confirmed. The realistic depictions of the DC (Confidant and Stranger) do not trigger an uncanny valley effect, while the comic-like Avatar is in the border area of the uncanny valley.

7. Conclusion

In summary, it can be said that a private digital companion that embodies an individual person of trust holds numerous potentials. Particularly regarding the trust required to rely on such an assistant, especially in unpleasant or uncertain situations, the basis is already in place, since there is already trust in the real person associated with it.

The workshop also clarified many components of a possible digital assistant for SAVs. Aspects such as humanization, flexible communications, and factors that increase the sense of control can help to increase the perceived safety of women and thus make future mobility models such as SAVs accessible and usable.

Even though the small sample size ($N = 13$) of the user study does not permit any significant findings, some tendencies have become visible that can be used as a basis for further research. It has become clear that it is important to avoid the uncanny valley effect to implement a digital companion in a targeted manner. The realistic representation of a companion generally seems to perform better than a comic-like representation, even if it is a well-known person.

However, not only the private DC itself, but also the scenarios in which it is used offer a lot of potential for deepening insights into the meaningful use of an assistant and the corresponding reactions. In the user study, for example, some scenarios hinted at triggering more anxiety in the participants than others, regardless of whether the subjects belonged to the more anxious or non-anxious test group. Trait anxiety is another factor that could influence the design of a digital companion in this context.

Nevertheless, there are numerous application scenarios for a digital companion, whether it is assistance in an accident, making an emergency call or simply entertainment through conversation, games, or other features.

7.1. Future Work

Future studies could include different contexts, cultures, or populations to improve the external validity of the results.

Another possible future work is to investigate the requirements and preferences for the behaviour of a digital companion in different situations.

It would also be interesting to investigate whether a private or a public digital companion

is preferred, or even a combination of private and public companions. This then leads to the idea of what combination possibilities exist.

Another possibility is to investigate whether some confidants are better suited than others for a digital companion and what the influencing factors (gender, character traits, social relationship with the user) are.

7.2. Limitations

It is important to acknowledge the limitations of the study to adequately assess the accuracy and reliability of the results.

One of the main limitations of this study is the limited sample size. This could affect the external validity of the results and limit the generalizability of the findings.

Another limitation of this study is the selection of participants. Although participants were selected according to specific criteria, it is possible that the sample is not representative of the overall population and therefore biases the results.

A further limiting factor is the limited generalizability of the results to other contexts or cultures. This study was conducted in Germany and with almost exclusively German participants, which limits the generalizability of the results to other settings or cultures.

The focus on women as a target group, is also a limiting factor, as for example men, non-binary and transgender persons are neglected.

Another limitation lies in the statistical methods used, which are based on certain assumptions such as the normal distribution of the data and the homogeneity of the variances. If these assumptions are not met, unreliable results may be obtained. Also, the risk of false positive results when performing multiple T-tests on different groups has to be considered.

Finally, it is important to note that this study may not have considered certain variables or factors that could have an impact on the results.

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List of Abbreviations

Abbreviation	Term
AV	Autonomous Vehicle
Avatar	Comic-like Representation of a Confidant
Confidant	Realistic Representation of a Confidant
DC	Digital Companion
PT	Public Transport
RQ	Research Questions
SAV	Shared Autonomous Vehicle
Stranger	Realistic Representation of a Stranger

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A. Questionnaires

A.1. User Experience Questionnaire Short

Erlebnis (UEQ)

Um die Begleitung zu bewerten, füllen Sie bitte den nachfolgenden Fragebogen aus. Er besteht aus Gegensatzpaaren von Eigenschaften, die die Begleitung haben kann. Abstufungen zwischen den Gegensätzen sind durch Kästchen dargestellt. Durch Ankreuzen eines dieser Kästchen können Sie Ihre Zustimmung zu einem Begriff äußern.

Entscheiden Sie möglichst spontan. Es ist wichtig, dass Sie nicht lange über die Begriffe nachdenken, damit ihre unmittelbare Einschätzung zum Tragen kommt. Bitte kreuzen Sie immer eine Antwort an, auch wenn Sie bei der Einschätzung zu einem Begriffspaar unsicher sind oder finden, dass es nicht so gut zur Begleitung passt. Es gibt keine richtige oder falsche Antwort. Ihre persönliche Meinung zählt!

	1	2	3	4	5	6	7	
unerfreulich								erfreulich
unverständlich								verständlich
kreativ								phantasielos
leicht zu lernen								schwer zu lernen
wertvoll								minderwertig
langweilig								spannend
uninteressant								interessant
unberechenbar								voraussagbar
schnell								langsam
originell								konventionell
behindernd								unterstützend
gut								schlecht
kompliziert								einfach
abstoßend								anziehend
herkömmlich								neuartig
unangenehm								angenehm
sicher								unsicher
aktivierend								einschläfernd
erwartungskonform								nicht erwartungskonform
ineffizient								effizient
übersichtlich								verwirrend
unpragmatisch								pragmatisch
aufgeräumt								überladen
sympathisch								unsympathisch
konservativ								innovativ
unattraktiv								attraktiv

Source: [54]

A.2. Uncanny Valley Questionnaire

Menschlichkeit (Uncanny Valley)

Um die Begleitung zu bewerten, füllen Sie bitte den nachfolgenden Fragebogen aus. Er besteht aus Gegensatzpaaren von Eigenschaften, die die Begleitung haben kann. Abstufungen zwischen den Gegensätzen sind durch Kästchen dargestellt. Durch Ankreuzen eines dieser Kästchen können Sie Ihre Zustimmung zu einem Begriff äußern.

Entscheiden Sie möglichst spontan. Es ist wichtig, dass Sie nicht lange über die Begriffe nachdenken, damit ihre unmittelbare Einschätzung zum Tragen kommt. Bitte kreuzen Sie immer eine Antwort an, auch wenn Sie bei der Einschätzung zu einem Begriffspaar unsicher sind oder finden, dass es nicht so gut zur Begleitung passt. Es gibt keine richtige oder falsche Antwort. Ihre persönliche Meinung zählt!

	1	2	3	4	5	6	7	
unattraktiv								attraktiv
Unordentlich								Gepflegt
abschreckend								angenehm
hässlich								schön
primitiv								stilvoll
beruhigend								schaurig
uninspirierend								Gruselig
fade								unheimlich
empfindungslos								ausgeflippt
langweilig								schockierend
normal								übernatürlich
emotionslos								haarsträubend
vorhersehbar								spannend
menschengemacht								menschlich
künstlich								lebensecht
synthetisch								real
unsterblich								sterblich
leiblos								lebendig
mechanische Bewegung								natürliche Bewegung

Source: [43, 45]

A.3. Checklist for Trust

Vertrauen (Checklist for Trust)

Nachstehend finden Sie eine Liste von Aussagen zur Bewertung des Vertrauens zwischen Menschen und Automatisierung. Es gibt mehrere Skalen, auf denen Sie die Intensität Ihres Vertrauensgefühls oder Ihren Eindruck von dem System während der Bedienung einer Maschine bewerten können.

Bitte kreuzen Sie in jeder Zeile das Kästchen an, das Ihr Gefühl oder Ihren Eindruck am besten beschreibt.

Folgende Aussagen treffen zu.	Überhaupt nicht							Ganz und gar
Das System ist irreführend.								
Das System verhält sich hinterhältig.								
Ich bin misstrauisch gegenüber den Absichten, Handlungen oder Ergebnissen des Systems.								
Ich bin vorsichtig gegenüber dem System.								
Die Handlungen des Systems werden ein schädliches oder verletzendes Ergebnis haben.								
Ich bin zuversichtlich gegenüber dem System.								
Das System bietet Sicherheit.								
Das System hat Integrität.								
Das System ist verlässlich (emotional).								
Das System ist zuverlässig (technisch).								
Ich kann dem System vertrauen.								
Ich bin mit dem System vertraut.								

Source: [56]

A.4. State-Trait-Anxiety Inventory Short Version

Angst (STAI short version)

Bitte geben Sie an, wie oft folgende Aussagen auf Sie zutreffen. Bei „fast nie“ kreuzen sie ganz links, bei „fast immer“ ganz rechts an. Mit den Kästchen dazwischen können Sie abstimmen.

Folgende Aussagen treffen auf mich ... zu.	Fast nie				Fast immer
Ich werde schnell müde.					
Ich verpasse günstige Gelegenheiten, weil ich mich nicht schnell genug entscheiden kann.					
Ich bin ruhig und gelassen.					
Ich bin glücklich.					
Ich neige dazu, alle schwer zu nehmen.					
Mir fehlt es an Selbstvertrauen.					
Ich fühle mich geborgen.					
Ich fühle mich niedergeschlagen.					
Unwichtige Gedanken gehen mir durch den Kopf und bedrücken mich.					
Ich werde nervös und unruhig, wenn ich an meine derzeitigen Angelegenheiten denke.					

Wie sehr treffen die folgenden Gefühlsbeschreibungen im Moment auf Sie zu? Kreuzen Sie das auf Sie passende Kästchen an. Es gibt keine richtigen oder falschen Antworten. Überlegen Sie bitte nicht lange und entscheiden Sie dann, wie stark das betreffende Gefühl im Moment bei Ihnen vorhanden ist.

Folgende Aussagen treffen auf mich ... zu.	Überhaupt nicht				Ganz und gar
Ich bin ruhig.					
Ich fühle mich angespannt.					
Ich bin aufgeregt.					
Ich fühle mich ausgeruht.					
Ich bin beunruhigt.					
Ich fühle mich selbstsicher.					
Ich bin nervös.					
Ich bin verkrampft.					
Ich bin besorgt.					
Ich bin vergnügt.					

Source: [55]

A.5. Demographic Data

Demographische Daten

Alter

Zu welcher der nachfolgenden Alterskategorien gehören Sie?

- 17 oder jünger
- 18-20
- 21-29
- 30-39
- 40-49
- 50-59
- 60 oder älter

Geschlecht

Bitte geben Sie Ihr Geschlecht an.

- Weiblich
- Männlich
- Divers

Familienstand

Sind Sie derzeit verheiratet, verwitwet, geschieden, getrennt oder ledig?

- Verheiratet
- Verwitwet
- Geschieden
- Getrennt
- Ledig

Bildung

Was ist Ihr höchster Schul- oder Hochschulabschluss?

- Unterer Schulabschluss
- Abitur oder gleichwertiger Abschluss
- Bachelor-Abschluss
- Master-Abschluss
- Doktor-Grad

Erwerbstätigkeit

Welche der folgenden Kategorien beschreibt Ihren Beschäftigungsstatus am besten?

- Angestellt, Wochenarbeitszeit von 1-39 Stunden
- Angestellt, Wochenarbeitszeit von 40 Stunden oder mehr
- Ohne Beschäftigung, arbeitssuchend
- Ohne Beschäftigung, NICHT arbeitssuchend
- Pensioniert
- Behindert, arbeitsunfähig
- Studierend

Wohnort

Wie lautet Ihre Anschrift?

Kinder

Haben Sie Kinder?

- Ja
- Nein

Staatsbürgerschaft(en)

Gesundheit

Sind Sie in Besitz eines Behindertenausweises?

- Ja
- Nein

Fahrzeug

Besitzen Sie ein eigenes Fahrzeug?

- Ich besitze ein eigenes Fahrzeug
- Ich teile ein Fahrzeug mit meinem Partner/Familienmitglied/Freund etc.
- Ich besitze kein Fahrzeug

Öffentliche Verkehrsmittel

Wie häufig nutzen Sie öffentliche Verkehrsmittel?

- Ständig
- Regelmäßig
- Gelegentlich
- Selten
- Nie

B. Declarations of Consent
B.1. Declarations of Consent for Participants



Einwilligungserklärung für Teilnehmer*innen an der Studie zum Thema automatisiertes Fahrzeug und einer unterstützenden persönlichen digitalen Begleitung für Frauen.

Name, Vorname _____

Information für Teilnehmenden

Zielsetzung der Studie

Diese Studie wird an der Technischen Hochschule Ingolstadt (THI) im Rahmen einer Masterarbeit durchgeführt. Ziel der Studie ist es, die "Ziele" unserer Teilnehmer, ihre Bedürfnisse und das Gefühl, das sie mit einer positiven Erfahrung während der Fahrt mit einem automatisierten Fahrzeug verbinden, zu analysieren. Unser Anliegen ist es, den digitalen Begleiter auf der Grundlage unserer Erkenntnisse weiterzuentwickeln. Die Studie erfordert kein spezifisches Hintergrundwissen. Ihre Teilnahme an der Studie ist freiwillig!

Ablauf der Studie

Die Studie dauert etwa 60 Minuten und ist in drei Abschnitte eingeteilt. Im ersten Abschnitt werden Sie in einem Fragebogen um ihre demografischen Daten gebeten. Danach wird Ihnen der Hintergrund der Studie, Sinn und Zweck, sowie deren Ablauf genauer erläutert.

Anschließend werden Sie in mehreren Szenarien verschiedene digitale Begleitungen kennenlernen. Wir werden Sie bitten Fragebögen auszufüllen und wir werden eine Befragung durchführen, um die Designentscheidungen zu begutachten. Die Studie ist danach abgeschlossen.

Mögliche Risiken

Es sind keine weiteren Risiken zu erwarten. Falls Sie sich unwohl oder erschöpft fühlen sollten, melden Sie dies dem Versuchsleiter, der Versuch kann jederzeit abgebrochen werden.

Rücktrittsrecht

Der Rücktritt von der Studie ist jederzeit ohne Angabe von Gründen möglich.

Bei Fragen oder Anliegen zu dieser Studie sowie zur Ausübung meines Rücktrittsrechts kann ich mich an folgende für diese Forschung verantwortliche Person wenden:

Prof. Dr. Andreas Riemer
c/o Technische Hochschule Ingolstadt
Esplanade 10, 85049 Ingolstadt

Tel. +49 841 9348-2833
Email: andreas.riemer@thi.de

Datenschutzhinweise

Alle persönlichen Informationen werden streng vertraulich behandelt. Die erhobenen Daten werden auf lokalen Servern der Technischen Hochschule Ingolstadt gespeichert und verarbeitet. Nur die für diese Studie direkt zuständigen Mitarbeiter haben bis zur Löschung Zugang zu den aufgezeichneten Daten.

Rechtsgrundlage für die mit dieser Studie zusammenhängen Datenverarbeitung ist Ihre – nachfolgend erbetene - Einwilligung gemäß Art. 6 Abs. 1 lit a DSGVO und Art. 6 Abs. 1 lit e. DSGVO i. V. m. Art. 2 Abs. 1 Satz 1 BayHSchG für Forschungszwecke.

Nach der Datenschutzgrundverordnung stehen Ihnen folgende Rechte zu:

- Soweit personenbezogene Daten verarbeitet werden, haben Sie das Recht Auskunft über die zu ihrer Person gespeicherten Daten zu erhalten (Art. 15 und 89 DSGVO).
- Sollten unrichtige personenbezogene Daten verarbeitet werden, steht Ihnen ein Recht auf Berichtigung zu (Art. 16 und 89 DSGVO).
- Liegen die gesetzlichen Voraussetzungen vor, so kann der/die Teilnehmer(in) die Löschung oder Einschränkung der Verarbeitung verlangen sowie Widerspruch gegen die Verarbeitung einlegen (Art. 17, 18, 21 und 89 DSGVO).
- Wenn der/die Teilnehmer(in) in die Datenverarbeitung eingewilligt hat oder ein Vertrag zur Datenverarbeitung besteht und die Datenverarbeitung mithilfe automatisierter Verfahren durchgeführt wird, steht gegebenenfalls ein Recht auf Datenübertragbarkeit zu (Art. 20 und 89 DSGVO).
- Sollte die Datenverarbeitung auf der Einwilligung beruhen, so hat er/sie das Recht, diese jederzeit zu widerrufen (Art. 7 Abs. 3 DSGVO). Der Widerruf ist schriftlich an **Prof. Dr. Andreas Riener**, andreas.riener@thi.de
- Weiterhin besteht ein Beschwerderecht bei der zuständigen Aufsichtsbehörde. Die für öffentliche Stellen in Bayern zuständige Aufsichtsbehörde ist gemäß Art. 15 BayDSG der Bayerische Landesbeauftragte für den Datenschutz (BayLfD). Sie erreichen ihn unter:

Email: poststelle@datenschutz-bayern.de
Tel. +49 89 212672-0
Fax +49 89 212672-50

Verantwortliche für die Datenerhebung:

Technische Hochschule Ingolstadt
Vertreten durch den Präsidenten Prof. Walter Schober
Esplanade 10, 85049 Ingolstadt

Telefon 0841/9348-0
E-Mail: praesident@thi.de

Die zuständige Datenschutzbeauftragte ist erreichbar unter:

Technische Hochschule Ingolstadt
Telefon: 0841/9348-1234
E-Mail: datenschutz@thi.de

Datenschutzrechtliche Einwilligungserklärung

Mir ist bekannt, dass die Aussagen des Interviews anonym verschriftlicht werden und zu Forschungszwecken verwendet und in diesem Zusammenhang ggfs. auch veröffentlicht werden. Alle weiteren Daten, die während der Studie in Form von Fragebögen erfasst werden, werden anonymisiert und es sind dadurch keine Rückschlüsse auf meine Person möglich. Ich bin damit einverstanden, dass alle mit der Forschung betrauten Mitarbeiter Einblick in die während der Studie erfassten Daten haben.

Liste der gesammelten Daten	Einwilligung
Daten aus Fragebögen	<input type="checkbox"/> Ja <input type="checkbox"/> Nein
Daten aus Interview	<input type="checkbox"/> Ja <input type="checkbox"/> Nein
Tonaufzeichnungen	<input type="checkbox"/> Ja <input type="checkbox"/> Nein

Ich kann diese Einwilligung jederzeit widerrufen: Der Widerruf ist schriftlich zu richten an Prof. Dr. Andreas Riener, E-Mail: andreas.riener@thi.de oder schriftlich per Post an Prof. Dr. Andreas Riener, c/o THI, Esplanade 10, 85049 Ingolstadt.

Durch den Widerruf der Einwilligung wird die Rechtmäßigkeit der aufgrund der Einwilligung bis zum Widerruf erfolgten Datenverarbeitung nicht berührt. Diese Daten können unter den Voraussetzungen des Art. 89 DSGVO für die Forschung weiterverwendet werden, soweit dies erforderlich ist.

_____, den _____, _____
 Ort Datum Proband/In (Teilnehmer/In)

Source: [63]

B.2. Declarations of Consent for Confidants



Einwilligungserklärung für Teilnehmer*innen an der Studie zum Thema automatisiertes Fahrzeug und einer unterstützenden persönlichen digitalen Begleitung für Frauen.

Name, Vorname _____

Information für Teilnehmenden

Zielsetzung der Studie

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Ablauf der Studie

Die Studie dauert etwa 15 Minuten und ist in zwei Abschnitte eingeteilt. Im ersten Abschnitt wird Ihnen der Hintergrund der Studie, Sinn und Zweck, sowie deren Ablauf genauer erläutert.

Anschließend werden Sie gebeten für mehrere Szenarien die Reaktionen der digitalen Begleitung zu vertonen. Sie werden dabei mit Bild und Ton aufgenommen. Zu einem späteren Zeitpunkt wird das bearbeitete Material der Teilnehmerin vorgeführt, die Sie als Vertrauensperson angegeben hat. Die Studie ist danach abgeschlossen.

Mögliche Risiken

Es sind keine weiteren Risiken zu erwarten. Falls Sie sich unwohl oder erschöpft fühlen sollten, melden Sie dies dem Versuchsleiter, der Versuch kann jederzeit abgebrochen werden.

Rücktrittsrecht

Der Rücktritt von der Studie ist jederzeit ohne Angabe von Gründen möglich.

Bei Fragen oder Anliegen zu dieser Studie sowie zur Ausübung meines Rücktrittsrechts kann ich mich an folgende für diese Forschung verantwortliche Person wenden:

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Datenschutzhinweise

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Rechtsgrundlage für die mit dieser Studie zusammenhängen Datenverarbeitung ist Ihre – nachfolgend erbetene - Einwilligung gemäß Art. 6 Abs. 1 lit a DSGVO und Art. 6 Abs. 1 lit e. DSGVO i. V. m. Art. 2 Abs. 1 Satz 1 BayHSchG für Forschungszwecke.

Nach der Datenschutzgrundverordnung stehen Ihnen folgende Rechte zu:

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- Sollten unrichtige personenbezogene Daten verarbeitet werden, steht Ihnen ein Recht auf Berichtigung zu (Art. 16 und 89 DSGVO).
- Liegen die gesetzlichen Voraussetzungen vor, so kann der/die Teilnehmer(in) die Löschung oder Einschränkung der Verarbeitung verlangen sowie Widerspruch gegen die Verarbeitung einlegen (Art. 17, 18, 21 und 89 DSGVO).
- Wenn der/die Teilnehmer(in) in die Datenverarbeitung eingewilligt hat oder ein Vertrag zur Datenverarbeitung besteht und die Datenverarbeitung mithilfe automatisierter Verfahren durchgeführt wird, steht gegebenenfalls ein Recht auf Datenübertragbarkeit zu (Art. 20 und 89 DSGVO).
- Sollte die Datenverarbeitung auf der Einwilligung beruhen, so hat er/sie das Recht, diese jederzeit zu widerrufen (Art. 7 Abs. 3 DSGVO). Der Widerruf ist schriftlich an **Prof. Dr. Andreas Riener**, andreas.riener@thi.de
- Weiterhin besteht ein Beschwerderecht bei der zuständigen Aufsichtsbehörde. Die für öffentliche Stellen in Bayern zuständige Aufsichtsbehörde ist gemäß Art. 15 BayDSG der Bayerische Landesbeauftragte für den Datenschutz (BayLfD). Sie erreichen ihn unter:

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Tel. +49 89 212672-0
Fax +49 89 212672-50

Verantwortliche für die Datenerhebung:

Technische Hochschule Ingolstadt
Vertreten durch den Präsidenten Prof. Walter Schober
Esplanade 10, 85049 Ingolstadt

Telefon 0841/9348-0
E-Mail: praesident@thi.de

Die zuständige Datenschutzbeauftragte ist erreichbar unter:

Technische Hochschule Ingolstadt
Telefon: 0841/9348-1234
E-Mail: datenschutz@thi.de

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Liste der gesammelten Daten

Videoaufzeichnungen

Einwilligung

Ja Nein

Ich kann diese Einwilligung jederzeit widerrufen: Der Widerruf ist schriftlich zu richten an Prof. Dr. Andreas Riener, E-Mail: andreas.riener@thi.de oder schriftlich per Post an Prof. Dr. Andreas Riener, c/o THI, Esplanade 10, 85049 Ingolstadt.

Durch den Widerruf der Einwilligung wird die Rechtmäßigkeit der aufgrund der Einwilligung bis zum Widerruf erfolgten Datenverarbeitung nicht berührt. Diese Daten können unter den Voraussetzungen des Art. 89 DSGVO für die Forschung weiterverwendet werden, soweit dies erforderlich ist.

_____, den _____, _____
Ort Datum Proband/In (Teilnehmer/In)

Source: [63]

C. Instructions and Guides
C.1. Instructions for Workshop

Instruktionen Workshop

5-6 Teilnehmer, 180 Minuten, vor Ort

Ankunft

15:00 Uhr / 30 Min.

Setting: Kaffee, Tee und Kuchen

Bei Ankunft erhält jede Teilnehmerin eine Broschüre mit Erklärungen zu den Begrifflichkeiten „Autonomes Fahrzeug“, „Digitaler Assistent“ und „Sicherheitsgefühl“. Des Weiteren enthält die Broschüre einen zeitlichen Ablaufplan des Workshops sowie einige leere Seiten, die Platz für Notizen bieten. Zudem erhält jede Teilnehmerin eine Einverständniserklärung und einen Fragebogen zu den demographischen Daten, die es auszufüllen gilt. Die Teilnehmerinnen werden einander vorgestellt und können sich in entspannter Atmosphäre kennenlernen, die Broschüre durchgehen und die Dokumente ausfüllen.

Einführung

15:30 Uhr / 30 Min.

Setting: großer Tisch mit Sitzmöglichkeiten, Sticky Notes, A4-Papier, Stifte

Alle Teilnehmerinnen werden gebeten am Tisch Platz zu nehmen. Kaffee und Tee können wahlweise mitgenommen werden. Einverständniserklärungen und Fragebögen zu den demographischen Daten werden eingesammelt. Ein Dankeschön für die Teilnahme und das rege Interesse an dem Workshop wird ausgesprochen. Es wird ein Hinweis auf die sanitären Einrichtungen und die frei zur Verfügung stehenden Getränke gegeben. Außerdem wird darauf hingewiesen, dass alle sich auf dem Tisch befindlichen Materialien frei genutzt werden dürfen. Den Teilnehmerinnen wird erklärt, dass sie in diesem Workshop keine Erwartungen zu erfüllen haben und auch nichts falsch machen können. Ihnen wird vermittelt, dass ihre persönlichen Meinungen, ihre Erfahrungen und Emotionen im Vordergrund stehen und wichtig für das Gelingen des Workshops sind. Um eine offene und angenehme Atmosphäre für die freie Äußerung von Persönlichem zu gestalten, werden grundsätzliche Umgangsregeln eingeführt. Es folgt ein Hinweis auf die an der Wand aufgehängten Regeln.

- Freie Meinungsäußerung
- Keine Bewertungen
- Respektvoller Umgang
- Diskussionen erwünscht

Die Teilnehmerinnen werden auf den Ablaufplan des Workshops in ihren Broschüren hingewiesen. Der Ablauf wird kurz erläutert, mit dem Augenmerk auf Pausen, Dauer und Endzeit des Workshops. Fragen zu Broschüre und Ablauf werden geklärt.

Aufwärmübung

16:00 Uhr / 15 Min.

Als erste Aktivität wird eine Gruppendiskussion durchgeführt. Den Teilnehmerinnen werden folgende Fragen gestellt:

- Wie fühlt sich Sicherheit für euch an?
- Welche Emotionen verbindet ihr mit dem Gefühl der Sicherheit?

Die Teilnehmerinnen werden angehalten ihre Gedanken zu äußern und auf Sticky Notes festzuhalten, welche in der Mitte des Tisches gesammelt werden. Sollte der Einstieg in die Diskussion schwerfallen oder die Diskussion frühzeitig zum Erliegen kommen, können weitere themenbezogene Fragen als Hilfestellung gestellt werden.

- In welchen Momenten habt ihr euch sicher gefühlt?
- Gibt es äußere Reize, die ihr mit dem Gefühl von Sicherheit verbindet?

Konzeption 1

16:15 Uhr / 30 Min.

Als zweite Aktivität wird ein Konzept eines persönlichen digitalen Begleiters erstellt. Die Teilnehmerinnen werden dazu in zweier oder dreier Gruppen eingeteilt und nochmals auf die frei verfügbaren Materialien hingewiesen. Die Art der Umsetzung steht den Teilnehmerinnen komplett offen – ob basteln, malen oder schriftlich. Ihnen wird die Aufgabenstellung in Papierform ausgehändigt.

Aufgabenstellung:

Wie stellst du dir deinen persönlichen digitalen Begleiter vor, der dir ein Gefühl von Sicherheit während der Fahrt mit einem autonomen Fahrzeug gibt, in dem noch weitere Passagiere sitzen?

Inspiration:

- Welches Gefühl soll dir dein Begleiter geben?
- Wie interagiert und kommuniziert ihr?
- Welche soziale und emotionale Beziehung habt ihr?
- Welches Geschlecht hat dein Begleiter? (oder keines?)
- Wo oder wie hast du deinen Begleiter bei dir?

Gruppendiskussion 1

16:45 Uhr / 15 Min.

Die Gruppen werden gebeten ihre Ideen von einem persönlichen digitalen Begleiter einander vorzustellen und die Gedanken dazu zu erläutern. Die Teilnehmerinnen werden angehalten Fragen zu den Konzepten zu stellen und zu diskutieren.

Konzeption 2

17:00 Uhr / 30 Min.

Jede Gruppe bekommt das Konzept der anderen Gruppe und soll dieses weiter ausarbeiten, indem sie die eigenen Ideen und Vorstellungen mit einbringen.

Gruppendiskussion 2

17:30 Uhr / 15 Min.

Die Gruppen werden gebeten ihre ausgebauten Ideen von einem persönlichen digitalen Begleiter einander vorzustellen und die Gedanken dazu zu erläutern. Die Teilnehmerinnen werden angehalten Fragen zu den Konzepten zu stellen und zu diskutieren.

Feedbackrunde

17:45 Uhr / 15 Min.

Es wird nochmals ein Dankeschön für die Teilnahme und die angenehme Zeit ausgesprochen. Den Teilnehmerinnen wird der Hinweis gegeben, dass die Broschüren gerne mit nach Hause genommen werden dürfen. Es wird nach Eindrücken, Kritik und Positivem über den Workshop gefragt.

C.2. Instructions for User Study

Instruktionen User Study

Eine Nutzerstudie zum Thema automatisiertes Fahrzeug und einer unterstützenden persönlichen digitalen Begleitung für Frauen.

Im Vorfeld

- Im Fahrzeug Platz nehmen
- Teilnahmeinformationen lesen
- Einverständniserklärung unterzeichnen
- Fragebogen zu den demographischen Daten ausfüllen

Einführung

Ganz herzlichen Dank, dass du an meiner Studie teilnimmst. Für mich und meine Masterarbeit ist das sehr wichtig.

Bevor wir anfangen, habe ich einige Informationen für dich, die ich vorlesen werde, um sicherzugehen, dass ich nichts vergesse. Du weißt wahrscheinlich schon, worum es geht, aber lass mich noch einmal kurz darauf eingehen. Im Rahmen meiner Masterarbeit forsche ich zum Thema „Digitale Begleitung für Frauen in automatisierten Fahrzeugen“. Diese Studie ist Teil meiner Masterarbeit und dementsprechend für mich und meine Arbeit sehr wichtig. Ich habe mehrere Personen gebeten, verschiedene Entwürfe einer persönlichen digitalen Begleitung zu testen, an der ich gerade arbeite, damit ich sehen kann, ob sie wie vorgesehen wirkt und funktioniert. Die Studie sollte etwa eine Stunde dauern.

Das Erste, das ich gleich klarstellen möchte, ist, dass ich die Entwürfe teste und nicht dich. Du kannst hier nichts falsch machen und es gibt auch keine richtigen oder falschen Antworten. Es geht mir um deine persönliche Meinung, deine Erfahrungen und Emotionen.

Während du die verschiedenen Begleitungen kennen lernst, werde ich dich bitten, so oft wie möglich laut zu denken. Sag, was du siehst und was du denkst. Das wird eine große Hilfe für mich sein.

Bitte mache dir auch keine Sorgen, dass du meine Gefühle verletzen könntest. Ich mache das, um die digitale Begleitung zu verbessern, also muss ich deine ehrliche Meinung hören. Bitte sprich also offen.

Wenn ich ein direktes Zitat verwende, werde ich es nicht dir persönlich zuschreiben, sondern anonymisieren.

Wenn du im Laufe der Studie Fragen hast, stelle sie einfach. Ich werde sie vielleicht nicht sofort beantworten können, denn mich interessiert, wie die Leute vorgehen, wenn sie niemanden neben sich sitzen haben, der ihnen hilft. Aber wenn du noch Fragen hast, nachdem wir fertig sind, werde ich versuchen, sie zu beantworten. Und wenn du irgendwann eine Pause brauchst, sagst du mir Bescheid.

Du hast vielleicht das Mikrofon bemerkt. Mit deiner Erlaubnis werde ich unser Gespräch aufnehmen. Die Aufnahme wird nur dazu dienen, herauszufinden, wie ich die digitale Begleitung verbessern kann, und sie wird von niemandem außer den Personen, die an diesem Projekt arbeiten, gehört werden. Und es hilft mir, weil ich nicht so viele Notizen machen muss.

Hast du bis jetzt irgendwelche Fragen?

Test

Jetzt werde ich dich bitten, einige bestimmte Szenarien zu durchlaufen. Ich werde jedes Szenario laut vorlesen und dir eine ausgedruckte Kopie geben.

Es würde mir helfen, wenn du versuchst, laut zu denken, während du das Szenario durchläufst.

Für manche Szenarien werde ich dich bitten, InEars zu tragen. Diese werden nach jeder Teilnehmerin desinfiziert. Also keine Sorge.

Du wirst immer die gleichen 4 Szenarien durchlaufen.

Nach jedem Szenario werde ich dich bitten, Fragebögen auszufüllen. Versuche, nicht zu lange zu überlegen und antworte ganz intuitiv. Es gibt keine richtigen oder falschen Antworten.

Solltest du an irgendeinem Punkt Fragen haben, kannst du sie jederzeit stellen und ich werde versuchen, sie zu beantworten.

Hast du im Moment Fragen?

Dann fangen wir an.

Als erstes möchte ich dich bitten, diesen Fragebogen auszufüllen.

STAI übergeben und ausgefüllt zurücknehmen.

Vielen Dank.

Szenarien 1-4 für jede digitale Begleitung durchlaufen (Fremde Person real/ Vertrauensperson real/
Vertrauensperson comic-ähnlich)

Szenario 1

Für die ersten beiden Szenarien benötigst du die InEars. Damit du mich noch hören kannst verwendest du am besten nur einen.

InEars übergeben (bereits mit Tablet gekoppelt und angeschaltet).

Ich werde dir jetzt ein Szenario vorlesen, du kannst gerne mitlesen oder auch nur zuhören.

Gedruckte Kopie des Szenarios „Betrunkener Passagier“ aushändigen und Szenario vorlesen.

Hast du Fragen zu dem Szenario?

Sehr gut. Dann kommt jetzt die Reaktion der digitalen Begleitung.

Video der Reaktion der digitalen Begleitung für das betreffende Szenario auf dem Hologram-Projektor abspielen.

Ist alles soweit klar?

Gut, dann möchte ich dich bitten, diese Fragebögen auszufüllen.

UEQ + Uncanny Valley Questionnaire + Checklist for Trust + STAI übergeben und ausgefüllt zurücknehmen.

Vielen Dank. Damit haben wir dieses Szenario abgeschlossen.

Szenario 2

Ich werde dir jetzt das nächste Szenario vorlesen.

Gedruckte Kopie des Szenarios „Fremder Mann“ aushändigen und Szenario vorlesen.

Hast du Fragen zu dem Szenario?

Sehr gut. Dann kommt jetzt die Reaktion der digitalen Begleitung.

Video der Reaktion der digitalen Begleitung für das betreffende Szenario auf dem Hologram-Projektor abspielen.

Ist alles soweit klar?

Gut, dann möchte ich dich bitten, diese Fragebögen auszufüllen.

UEQ + Uncanny Valley Questionnaire + Checklist for Trust + STAI übergeben und ausgefüllt zurücknehmen.

Vielen Dank. Damit haben wir dieses Szenario abgeschlossen.

Szenario 3

Für die nächsten beiden Szenarien benötigst du die InEars nicht.

InEars abnehmen.

Ich werde dir jetzt das nächste Szenario vorlesen.

Gedruckte Kopie des Szenarios „Fehlende Orientierung“ aushändigen und Szenario vorlesen.

Hast du Fragen zu dem Szenario?

Sehr gut. Dann kommt jetzt die Reaktion der digitalen Begleitung.

Video der Reaktion der digitalen Begleitung für das betreffende Szenario auf dem Hologram-Projektor abspielen.

Ist alles soweit klar?

Gut, dann möchte ich dich bitten, diese Fragebögen auszufüllen.

UEQ + Uncanny Valley Questionnaire + Checklist for Trust + STAI übergeben und ausgefüllt zurücknehmen.

Vielen Dank. Damit haben wir dieses Szenario abgeschlossen.

Szenario 4

Ich werde dir jetzt das nächste Szenario vorlesen.

Gedruckte Kopie des Szenarios „Unfall“ aushändigen und Szenario vorlesen.

Hast du Fragen zu dem Szenario?

Sehr gut. Dann kommt jetzt die Reaktion der digitalen Begleitung.

Video der Reaktion der digitalen Begleitung auf dem Hologram-Projektor abspielen.

Ist alles soweit klar?

Gut, dann möchte ich dich bitten, diese Fragebögen auszufüllen.

UEQ + Uncanny Valley Questionnaire + Checklist for Trust + STAI übergeben und ausgefüllt zurücknehmen.

Vielen Dank. Damit haben wir das letzte Szenario abgeschlossen.

Nach den Szenarien für die digitalen Begleitungen Fremde Person real/ Vertrauensperson real

Möchtest du eine kleine Pause machen bevor wir mit der nächsten digitalen Begleitung weiter machen?

Nach den Szenarien für die digitale Begleitung Vertrauensperson comic-ähnlich

Damit hast du alle digitalen Begleitungen kennengelernt.

Interview

Zum Schluss möchte ich dir noch ein paar Fragen zu deinem Erlebnis mit einer persönlichen digitalen Begleitung stellen.

Möchtest du davor noch eine kleine Pause machen?

Siehe: Interview Guide

Closing

Hier noch die Info wie es mit dem Projekt weitergeht.

Ich werde die erhobenen Daten aller Teilnehmerinnen aufbereiten und analysieren. Anhand der Ergebnisse werden dann die Bedürfnisse neu definiert und die Anforderungen an die digitale Begleitung überarbeitet. Außerdem werden die gewonnenen Daten im Rahmen meiner Masterarbeit veröffentlicht.

Hast du noch offene Fragen?

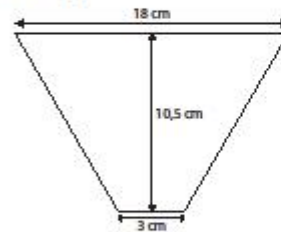
Danke für deine Zeit und deine Teilnahme an der Studie.

C.3. Instructions for Hologram Projector

Bauanleitung Hologramm Projektor für Tablets

Materialien:

- 2mm Acrylglas transparent
- Flüssigkleber
- Schere
- Tesastreifen

Vorlage:**Anleitung:**

Vier Trapeze nach Vorlage aus dem Acrylglas ausschneiden.



Die Trapeze an den schrägen Kanten aneinander legen und mit Tesastreifen fixieren.



Die Trapeze mit den Tesastreifen nach Innen zeigend anheben bis die beiden letzten schrägen Kanten aneinander liegen und ein Trichter entsteht. Diese beiden Kanten ebenfalls, von Innen, mit Tesastreifen fixieren.



Nun vorsichtig den Flüssigkleber auf die Kanten auftragen und trocknen lassen.



Die Tesastreifen abziehen und gegebenenfalls mit Schleifpapier überschüssigen Flüssigkleber vorsichtig abschleifen.

Source: [64]

C.4. Instructions for Hologram Videos

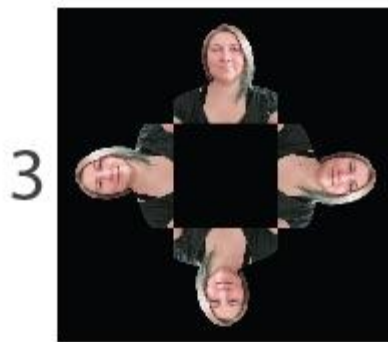
Anleitung zur Erstellung von Videos für Hologramm Projektor



Ein Video auswählen.



Den Hintergrund des Videos entfernen.



Video duplizieren bis vier Ausführungen vorhanden sind. Die Videos in rechten Winkeln aneinander ordnen, sodass ein Quadrat in der Mitte entsteht. Einen schwarzen Hintergrund verwenden.



Hologramm-Video auf einem Tablet öffnen und den Hologramm Projektor auf dem schwarzen Quadrat in der Mitte platzieren.

Source: [65]

C.5. Interview Guide

Interview Guide

Warm-up Questions:

- Du hast jetzt 4 Szenarien durchlaufen. Wie war das für dich? Erzähle mir davon.
- Was war dein erster Eindruck?
- Welches ist dein bevorzugtes Transportmittel?
- *Probe:* Erzähle mir, woran das liegt.

Main Questions:

- **Concept**
 - Worin soll dich die digitale Begleitung zusätzlich zu den Szenarien unterstützen?
Probe: Erzähl mir mehr darüber.
 - Kannst du bitte die DCs miteinander vergleichen in Bezug auf ihre Menschenähnlichkeit und Realistik.
 - Was hat dir am Konzept der persönlichen digitalen Begleitung besonders gut gefallen?
 - Was würdest du am Konzept der persönlichen digitalen Begleitung verändern?
Probe: Geh bitte ein wenig genauer darauf ein.
 - Welche Bedenken hast du bezüglich dieses Projekts?
 - Was würdest du dir wünschen, wenn die digitale Begleitung neugestaltet werden würden?
Probe: Erzähl mir mehr darüber.
 - Was hältst du von der Darstellung der digitalen Begleitung als Hologramm?
Hilfestellung: Vielleicht hilft es dir, wenn du mit der Darstellung auf einem Display vergleichst.
 - Was hältst du von den Reaktionen der digitalen Begleitung?
- **Experience**
 - Wie fühlst du dich jetzt, nachdem du die digitale Begleitung erlebt hast?
Hattest du an irgendeinem Punkt während der Interaktion ein negatives Gefühl?
Probe: Erzähl mir, wodurch dieses Gefühl ausgelöst wurde.
 - Wie würdest du die heute gemachte Erfahrung mit der digitalen Begleitung einstufen?
Probe: Erzähl mir wie du zu dieser Einstufung kommst.
 - Welche Gefühle verbindest du mit dieser Art der Interaktion?
- **Future**
 - Was wird sich aus deiner Sicht verbessert haben, sollte die digitale Begleitung erfolgreich umgesetzt werden können?
 - Wie wird sich deiner Meinung nach deine Interaktion mit anderen Fahrgästen durch die Verfügbarkeit einer digitalen Begleitung verändern?
 - Stell dir vor, es würde bereits die Möglichkeit einer digitalen Begleitung existieren, würdest du sie nutzen und warum oder warum nicht?
- **Favourite**
 - Welche der drei Begleitungen würdest du für dich auswählen?
Probe: Erzähl mir wie du zu dieser Auswahl kommst.
 - Was gefällt dir an dieser Begleitung besonders gut?

- Was überzeugt dich an dieser Begleitung?
- Was fehlt dir an deiner bevorzugten Begleitung?
- Was würdest du sonst noch an der Begleitung verbessern?

Cool-down Question:

Das war's mit meinen Fragen.

- Möchtest du noch etwas erwähnen über das wir noch nicht geredet haben?

D. Workshop Notes

D.1. Participants Notes Group 1

• Automatische Registrierung + Begrüßung 😊
 (→ info an Angehörige?
 von selber, kann abgeleitet werden)

→ Angebot von - Unterhaltung (wie geht es dir)

- Witze
- Musik
- Nachrichten
- Interaktionsfähigkeit !!!
- Spiel gegen Avatar

→ Wie sieht er aus?

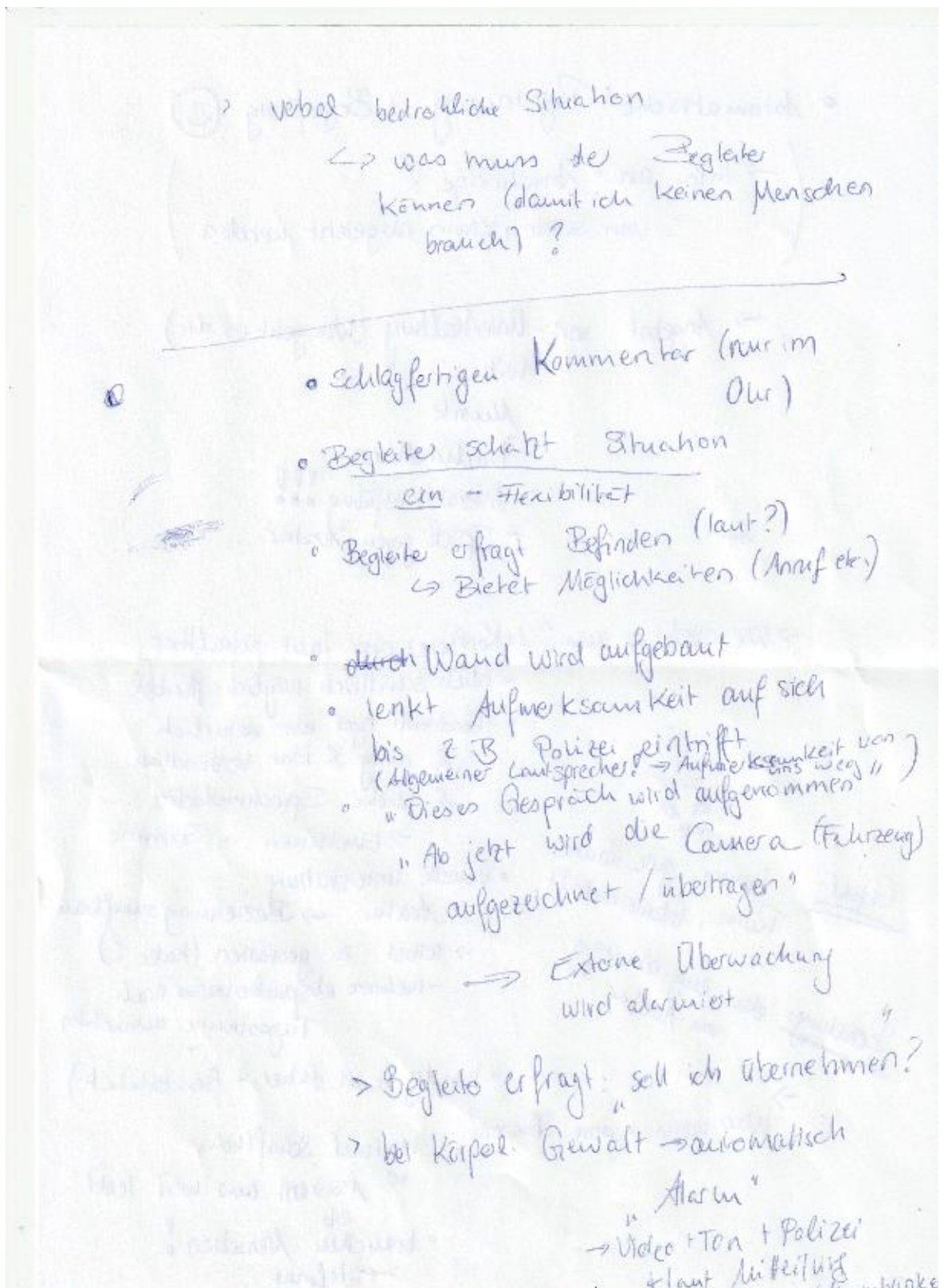
- Kopfhörer aber laut schallbar
- auch schriftlich möglich - flexibel
- Geschlecht egal aber natürlich & ruhig & klar verständlich & schöne Sprachmelodie
 - Emotionen in Stimme
- visuelle Unterstützung
 - Avatar ⇒ Beziehungsaufbau
 - selbst zu gestalten (katze?)
 - mehrere abSpeicherbar ⇒ nach Tagesstimmung aussuchen

Gefühl: Humor, gute Laune
 Ruhe, Gemeinschaft

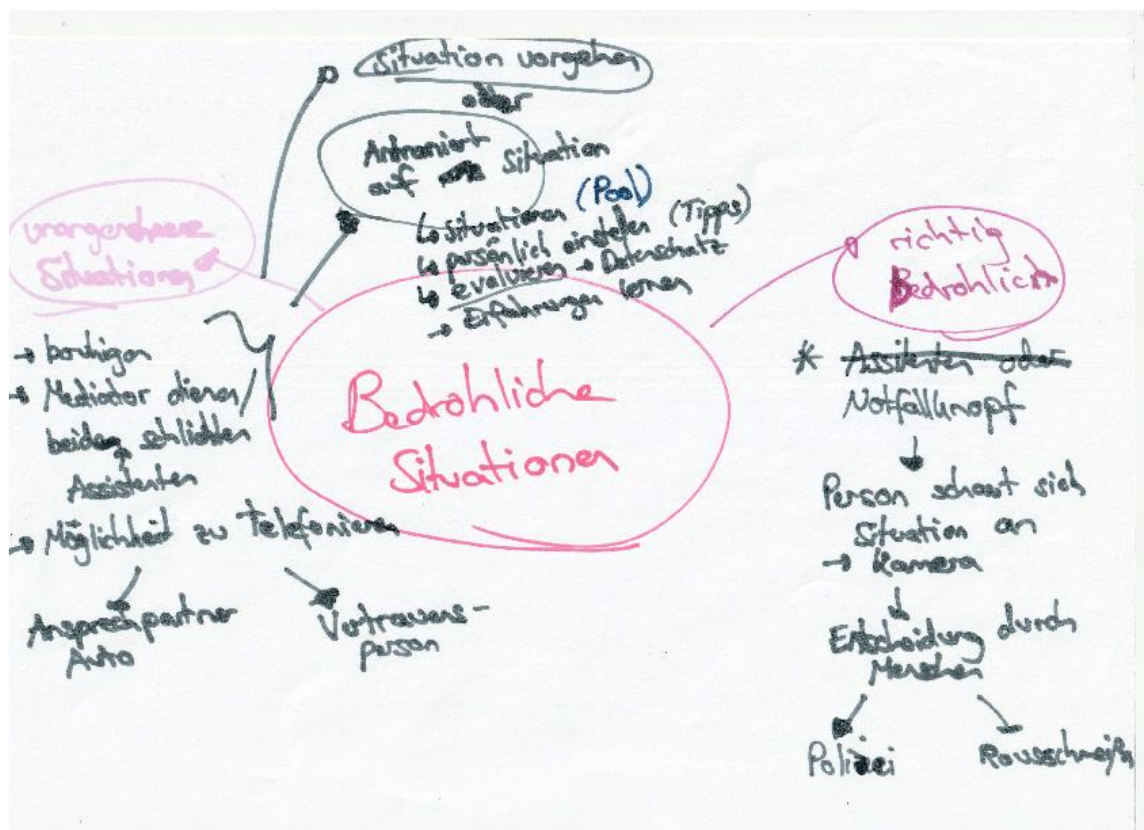
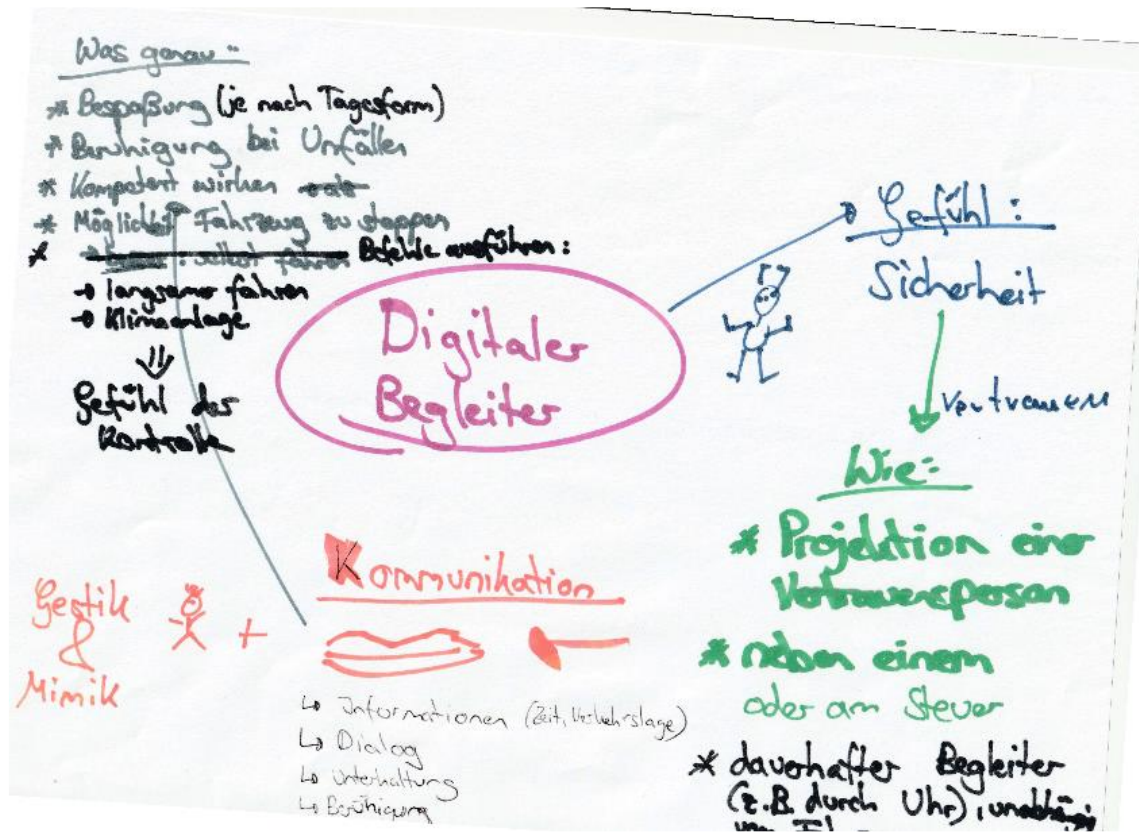
Beziehung: eher eng, abhängig von Avatar

→ Was wenn negative Situationen?

- Handy (weil dabei + Flexibilität)
- maximal Schriftlich
 - od. Assistent aus weil lenkt ab
- brauchen Menschen
 - telefonat



D.2. Participants Notes Group 2



D.3. Instructors Notes

Mitschrift Workshop

Aufwärmübung (Gruppe 1 und Gruppe 2):

Rückhalt von Familie
 Abwesenheit von Angst – Entspannung
 Häusliche Sicherheit – geschützter Raum
 Kontrolle – Überblick
 Unterschied Tag und Nacht
 Bekanntes und Gewohntes gibt Sicherheit
 Komfortzone
 Vertrauen
 Tagesform – genug geschlafen etc. - mehr Resilienz
 Hilfe da wenn man Hilfe braucht
 Da ist jemand an den ich mich wenden kann
 Licht – Helligkeit
 Farben – freundliche Gestaltung
 Kommunikationsmöglichkeit
 Ansprechpartner wenn ich unsicher bin
 Back-up Plan für den Notfall
 Im Zweifel ist jemand da
 Hund gibt Sicherheit
 fehlender Orientierungssinn – im Wald verlaufen – Hund gab Sicherheit
 Landmarken geben Sicherheit
 Information und Wissen - Kontrolle

Gruppe 1:

Begleitung aktiviert sich selbst bei Einstieg ins Auto.
 Automatische Registrierung und Begrüßung.
 Vielfältiges Angebot: Gespräch mit der Begleitung, Begleitung erzählt Witze, Musik hören,
 Nachrichten, Spiel gegen die Begleitung
 Ablenkung von dem was einen Unsicher macht.
 Kommunikation über Kopfhörer und Sprache.
 Kommunikation auch schriftlich möglich.
 Flexible Kommunikation.
 Geschlecht spielt keine Rolle. (Andere Gruppe ist der gleichen Meinung)
 Ruhig und klar verständlich.
 Schöne Sprachmelodie.
 Emotionen in Stimme, ruhige Stimme.
 Avatar auf Display – z.B. Haustier.
 Verschiedene Avatare – frei erstellbar und wechselbar je nachdem was man gerade braucht.
 Aussehen der Begleitung kann selbst gestaltet werden.
 Mehrere Begleitungen abspeicherbar.
 Begleitung kann nach Tageslaune ausgewählt werden.
 Begleitung auf Handy (weil eh immer dabei).
 Begleitung soll humorvoll sein und gut gelaunt.
 Begleitung soll ein Gefühl von Ruhe und Gemeinschaft auslösen.
 Begleitung soll natürlich sein.

Eher enge Beziehung.
 Beziehung davon abhängig, welche Begleitung ausgesucht wurde.
 In bedrohlichen Situationen würden sie die digitale Begleitung abschalten.
 Avatar kann nur in neutralen Situationen Sicherheit generieren. (Andere Gruppe stimmt nach eigenen Überlegungen zu)
 Bei bedrohlichen Situationen muss ein Mensch ran. (Andere Gruppe ist der gleichen Meinung)
 Begleitung soll schlagfertige Kommentare ins Ohr flüstern.
 Begleitung soll Situation einschätzen können. Flexibilität.
 Unterteilung in drei Situationsstufen – mulmig, unangenehm, bedrohlich. (Andere Gruppe stimmt nach eigenen Überlegungen zu)
 Begleitung soll Befinden erfragen (laut?).
 Begleitung soll Möglichkeiten anbieten (z.B. Anruf).
 Es wird eine Wand zwischen den Beteiligten aufgebaut.
 Begleitung lenkt Aufmerksamkeit auf sich bis Hilfe eintrifft über allgemeinen Lautsprecher, von uns weg.
 Begleitung kann für alle laut geschaltet werden.
 In bedrohlichen Situationen erfragt Begleitung ob er übernehmen soll / sich einschalten soll.

Gruppe 2:

Gefühl: Sicherheit, Vertrauen.
 Es kann keine Beziehung zu Robotern aufgebaut werden → zu wenig menschlich und unnatürlich.
 (Andere Gruppe ist der gleichen Meinung)
 Projektion einer Vertrauensperson.
 Enge Beziehung – emotional nahe.
 Geschlecht spielt keine Rolle. (Andere Gruppe ist der gleichen Meinung)
 Begleitung soll neben einem sitzen.
 Im Optimalfall soll Begleitung am Steuer sitzen.
 Kommunikation: Sprache, Gestik, Mimik.
 Sprachassistent.
 Sprachbefehle.
 Bspäufung.
 Begleitung soll mich beruhigen.
 Beruhigung bei Unfällen.
 Kompetent wirken.
 Möglichkeit Fahrzeug zu stoppen.
 Aussteigemöglichkeit jederzeit aus Auto über Begleitung.
 Gefühl der Kontrolle.
 Dauerhafte Begleitung, unabhängig vom Fahrzeug.
 Hologramm von einer bekannten Person zu der man Vertrauen hat → Uhr.
 Befehle ausführen: langsamer fahren, Klimaanlage.
 Begleitung muss Kontrolle über Auto haben.
 Informationen – Verkehrslage, Zeit.
 Dialog.
 Unterhaltung. (Idee von anderer Gruppe aufgenommen)
 Beruhigung.
 Gestik, Mimik.
 Begleitung soll nur mit mir reden und nicht mit anderen Personen.
 Kommunikation zwischen zwei Begleitungen → wurde als kritisch angesehen.
 Projektion von einer Vertrauensperson.
 Neben einem oder am Steuer.

Bruch zwischen realer und dargestellter Person würde eher verunsichern. (Bedenken von anderer Gruppe)
Unterbewusste Täuschung von Projektion → Selbstbetrug.
In richtig bedrohlichen Situationen Notfallknopf – Person schaut sich Situation über Kamera an – Entscheidung durch Mensch – Rausschmeißen oder Polizei. (Idee von anderer Gruppe aufgenommen)
Begleitung als Mediator.
Begleitung soll deeskalierend vorgehen.
Idee: in unangenehmen Situationen werden alle Beteiligten von ihren jeweiligen Begleitungen beruhigt und die Situation geschlichtet.
Möglichkeit zu telefonieren → Ansprechpartner Auto, Vertrauensperson.
Begleitung erkennt Situationen und reagiert entsprechend.
Situationen-Pool.
Begleitung soll aus Erfahrung lernen.
Begleitung soll im Nachhinein Situationsverlauf evaluieren.
Reaktionen individuell anpassbar.
Persönlich einstellen wie Begleitung reagieren soll in unangenehmen Situationen.
Evaluation der Reaktion im Nachhinein → anlernen.
Begleitungen sollen Grundcharakter und Grundeinstellungen zu Reaktionen haben um nicht aggressiv eingestellt werden zu können.

Wearables wurden von beiden Gruppen verworfen weil zu einschränkend (Gruppe 2) bzw. zusätzliches Gerät zu Handy nicht notwendig (Gruppe 1)

E. Scenarios

Szenarien

	Alleine im Fahrzeug	Mit weiteren Passagieren
<i>In der Nacht</i>	Unfall KONTROLLE	Fremder Mann als einziger weiterer Passagier KONTROLLE
<i>Am Tag</i>	Fehlende Orientierung SICHERHEIT	Betrunkenener Passagier SICHERHEIT

Szenario „Betrunkenener Passagier“

Du bist auf dem Heimweg von der Arbeit. Draußen ist es zwar noch hell, aber dein Tag war anstrengend und du bist erschöpft und abgekämpft. Zu allem Überfluss steigt ein Passagier mit einer Bierflasche in der Hand zu. Der Innenraum des Fahrzeugs füllt sich schnell mit dem unangenehmen Geruch von schalem Bier und Schweiß. Dir wird schlecht und du fängst an flach durch den Mund zu atmen, aber du kannst den Geruch förmlich auf deiner Zunge schmecken. Der offensichtlich betrunkenene Passagier fängt an lauthals zu singen.

Deine digitale Begleitung bemerkt, dass etwas nicht stimmt und fragt bei dir nach. Du hörst ihre Stimme dank deiner Kopfhörer direkt in deinem Ohr. Um den unangenehmen Passagier nicht zu alarmieren, nutzt du die Chat-Funktion, um deiner Begleitung die Situation zu erklären.

Reaktion DC:

Wenn du möchtest, dann können wir das Betriebspersonal anschreiben und sie bitten, die Situation schnell zu klären. Ansonsten können wir auch jederzeit das Fahrzeug wechseln. Was wäre dir denn lieber?

Szenario „Fremder Mann“

Du warst nach der Arbeit noch mit Kollegen/-innen unterwegs, und es ist spät geworden. Nun fährst du nach Hause. Als einziger weiterer Passagier sitzt ein dir unbekannter Mann im Fahrzeug. Draußen ist es dunkel und es ist fast niemand mehr unterwegs. Du weißt nicht, warum, aber der fremde Mann löst bei dir ein mulmiges Gefühl aus und du beginnst dir Sorgen zu machen.

Deine digitale Begleitung bemerkt, dass etwas nicht stimmt und fragt bei dir nach. Du hörst ihre Stimme dank deiner Kopfhörer direkt in deinem Ohr. Um den anderen Passagier nicht zu alarmieren, nutzt du die Chat-Funktion, um deiner Begleitung die Situation zu erklären.

Reaktion DC:

Wenn du dich sehr unwohl fühlst, dann können wir jederzeit das Fahrzeug wechseln. Ansonsten hilft oft schon eine kleine Ablenkung. Wie wäre es mit einem Spiel? Ich spiele gerne eine Runde mit dir! Na, wie sieht es aus, was möchtest du tun?

Szenario „Fehlende Orientierung“

Eine Freundin von dir ist umgezogen und hat dich eingeladen, ihre neue Wohnung anzusehen. Du bist auf dem Weg zu ihr und hast das Fahrzeug seit dem letzten Halt ganz für dich allein. Als du nach einiger Zeit aus dem Fenster siehst, bemerkst du, dass du dich nicht mehr auskennst. Du bist dir nicht sicher, ob du noch nie in dieser Gegend warst oder ob du nur die Orientierung verloren hast. Nicht zu wissen, wo du bist, macht dich allerdings nervös.

Deine digitale Begleitung bemerkt, dass etwas nicht stimmt und fragt bei dir nach. Du hörst ihre Stimme dank deiner Kopfhörer direkt in deinem Ohr. Da du im Moment allein bist, nutzt du die Sprachfunktion, um deiner Begleitung die Situation zu erklären.

Reaktion DC:

Mach dir keine Sorgen, wir sind noch auf dem richtigen Weg. Wir umfahren nur einen Unfall, aber es wird deswegen nicht länger dauern. Möchtest du wissen, wo genau wir im Moment sind?

Szenario „Unfall“

Du bist auf dem Heimweg von einem gemeinsamen Abend mit Freunden. Du bist allein im Fahrzeug und schaust aus dem Fenster in die schemenhafte Dunkelheit. Du kannst zwar keine Details erkennen, aber du bemerkst ein offenbar verunfalltes Fahrzeug am Straßenrand. Du bist sofort alarmiert, aber unsicher, was zu tun ist und momentan überfordert.

Deine digitale Begleitung bemerkt, dass etwas nicht stimmt und fragt bei dir nach. Du hörst ihre Stimme dank deiner Kopfhörer direkt in deinem Ohr. Da du im Moment allein bist, nutzt du die Sprachfunktion, um deiner Begleitung die Situation zu erklären.

Reaktion DC:

Bleib ruhig und atme erst einmal tief durch. Das Wichtigste ist, dass wir den Notruf wählen, damit möglichen Verletzten geholfen wird. Außerdem sollten wir das Fahrzeug anhalten und nachsehen, ob jemand unsere Hilfe braucht. Wenn du davor zu viel Angst hast, ist das auch ok. Aber den Notruf müssen wir auf jeden Fall wählen!

F. Participation Information Sheet



TEILNAHMEINFORMATIONEN

Eine Nutzerstudie zum Thema automatisiertes Fahrzeug und einer unterstützenden persönlichen digitalen Begleitung für Frauen.

Die Gestaltung von Nutzererfahrungen ist ein Bereich, der sich in den Studien der Ökonomie und Psychologie recht schnell herausgebildet hat und seit kurzem eines der Hauptanliegen der Mensch-Computer-Interaktion ist. Automatisierte Fahrzeuge können Sie zu Ihrem bevorzugten Standort bringen, ohne dass Sie als Fahrer gebraucht werden. Wir haben einen interaktiven digitalen Begleiter entwickelt, der Sie unterstützt. Diese Studie wird uns helfen, die Grenzen und Möglichkeiten eines Fahrgast-Erlebnisses mit einem automatisierten Fahrzeug zu erforschen.

Was ist das Ziel der Studie?

Ziel des Projekts ist es, die "Ziele" unserer Teilnehmer, ihre Bedürfnisse und das Gefühl, das sie mit einer positiven Erfahrung während der Fahrt mit einem automatisierten Fahrzeug verbinden, zu analysieren. Unser Anliegen ist es, den digitalen Begleiter auf der Grundlage unserer Erkenntnisse weiterzuentwickeln.

Warum wurde ich zur Teilnahme eingeladen?

Wir sind der Meinung, dass Sie einen wertvollen Beitrag zur Gestaltung und Bewertung unserer digitalen Begleitung leisten können und dass Ihre Ansichten wertvoll sind.

Muss ich teilnehmen?

Nein. Es liegt ganz bei Ihnen, ob Sie an der Studie teilnehmen oder nicht. Außerdem haben Sie jederzeit die Möglichkeit, aus der Studie auszusteigen.

Was passiert, wenn ich teilnehme?

Wir werden Ihnen Szenarien vorgeben, in denen Sie verschiedene digitale Begleitungen kennenlernen können. Später werden wir Ihnen einige Fragen zu Ihren Erfahrungen und Ihren Gedanken und Gefühlen zu unseren Designkonzepten stellen. Während des Interviews werden wir Ihnen allgemeine Fragen zu Ihren bisherigen Erfahrungen mit automatisierten Fahrzeugen und digitalen Assistenten stellen.

Was muss ich machen?

Sie werden in mehreren Szenarien verschiedene digitale Begleitungen kennenlernen. Wir werden Sie bitten Fragebögen auszufüllen und wir werden eine Befragung durchführen, um die Designentscheidungen zu begutachten. Der Ablauf der qualitativen Befragung basiert auf einem halbstrukturierten Interview. Folglich können sich die Fragen je nach Gesprächsverlauf und den gewonnenen Erkenntnissen ändern. Die Fragebögen dienen der quantitativen Datenerhebung und sind somit die Gleichen für jede der digitalen Begleitungen.

Source: [63]

Was sind die möglichen Nachteile und Risiken einer Teilnahme?

Die Teilnahme ist mit keinerlei Nachteilen oder Risiken verbunden, außer einem geringen Aufwand an Zeit und Engagement.

Was ist, wenn etwas schief geht?

Die eingeführten ethischen Richtlinien und Verfahren gewährleisten, dass nur sehr wenig schief gehen kann und wenn doch, dann mit minimalen Auswirkungen auf alle Teilnehmenden.

Was möchten die Forscher herausfinden?

Alle Teilnehmenden helfen bei der Überarbeitung des digitalen Begleiters. Die Interviews geben uns einen Einblick in die Bedürfnisse und Gefühle der Nutzer. Die Sitzungen werden auf Video aufgezeichnet, und die Transkripte werden später von der Forscherin analysiert. Die ursprünglichen Anforderungen werden überarbeitet und angepasst. Die Videos und Transkripte der Interaktionen, die das Verhalten und die Konversation aufzeichnen, werden uns helfen das „Warum“ und „Wie“ der Interaktion zu erfassen. Eine thematische Analyse der Transkripte wird uns helfen, instrumentelle und nicht-instrumentelle Bedürfnisse zu definieren und die UX-Designziele und die Leistungsmerkmale des Systems zu überarbeiten.

Wird meine Teilnahme an dieser Studie vertraulich behandelt?

Die Daten werden anonymisiert, wodurch keine Person einer bestimmten Stellungnahme zugeordnet werden kann. Die Daten werden aufbereitet, so dass es unmöglich ist, zwischen den Teilnehmenden zu unterscheiden.

Was wird mit den Ergebnissen der Forschungsstudie geschehen?

Diese werden anonymisiert und im Rahmen von Konferenz- und Zeitschriftenbeiträgen weiter veröffentlicht. Alle Informationen, einschließlich dessen, was während des Gesprächs, des qualitativen Interviews und der Videoaufnahmen besprochen wird, werden innerhalb des Forschungsteams vertraulich (privat) behandelt. Niemand außerhalb des Forschungsteams hat Zugang zu Informationen, die zur Identifizierung Ihrer Person verwendet werden könnten. Die Forscher entfernen alle Informationen, die Sie identifizieren könnten (z. B. Ihren Namen), so dass die Daten, die wir speichern, anonym sind. Sobald dies geschehen ist, ist es nicht mehr möglich, Ihre Daten zurückzuziehen. Wenn wir unseren Studienbericht schreiben, werden wir keine Namen oder andere identifizierende Informationen erwähnen.

Wer organisiert und finanziert die Forschung?

Katharina Vogl finanziert und organisiert die Forschung im Rahmen ihrer Masterarbeit an der technischen Hochschule Ingolstadt.

Kann ich die Ergebnisse der Studie erfahren?

Wenn Sie ein Exemplar des Studienberichts erhalten möchten, wenden Sie sich bitte an Katharina Vogl unter der folgenden E-Mail-Adresse: kav2468@thi.de

Kann ich dieses Infoblatt behalten?

Ja, dieses Infoblatt ist für Sie bestimmt.

Source: [63]

G. Booklet

BEGRIFFE

Bei **AUTONOMEN FAHRZEUGEN** handelt es sich um Autos, die völlig ohne menschliches Zutun - also ohne Fahrer - auf der Straße fahren. Stattdessen übernimmt ein Autopilot im Fahrzeug das Steuer und trifft selbstständig Entscheidungen im Straßenverkehr. Der Mensch greift beim Fahren nicht mehr ein und ist nur noch Passagier.



Das **SICHERHEITSGEFÜHL** ist die von einer Person subjektiv wahrgenommene individuelle Sicherheit. Ein Gefühl von Sicherheit bedeutet nicht immer tatsächliche objektive Sicherheit. Im Kontext von autonomen Fahrzeugen bedeutet Sicherheit, jederzeit und ohne Angst diese nutzen zu können.



DIGITALE ASSISTENTEN sind künstliche persönliche Berater welche auf technischen Geräten nutzbar sind. Sie haben das Ziel, den Alltag von Personen zu unterstützen. Heutzutage bekannte digitale Assistenten sind Navigationssysteme, „Siri“, „Alexa“, „Cortana“ oder „Google Assistant“.



Bildquellen: <https://www.freepik.com/>



NOTIZEN

A red notebook template featuring a dark red cover with a white spine. The word "NOTIZEN" is printed in bold black capital letters on the white spine. The notebook is open to a blank page with horizontal lines, and a dark red triangular piece of the cover is visible at the bottom right corner.

NOTIZEN

An orange notebook template featuring a bright orange cover with a white spine. The word "NOTIZEN" is printed in bold black capital letters on the white spine. The notebook is open to a blank page, and orange triangular pieces of the cover are visible at the top left and bottom right corners.