Acceptance by Design: Towards an Acceptable Smart Glasses-based Information System based on the Example of Cycling Training

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Abstract. Smart glasses-based information systems have the potential to support cycling training and other tasks which require high attention, by the presentation of relevant information into the user's field of view to reduce (road) risks through less distraction and a hands free navigation. Nevertheless, when introduced in 2012 to the consumer market smart glasses faced acceptance problems. Therefore, acceptance is a crucial requirement in the system design. Making use of a Design Science Research approach, acceptability design requirements are derived and integrated into the design phase. This set of requirements for smart glasses-based information systems contributes to theory while specific design requirements and a design proposal for an accepted system contribute to the field.

Keywords: Smart Glasses, Acceptance, Design Requirements, Acceptability Requirements, System Engineering, Cycling, Training support.

1 Smart Glasses based Information Systems in Cycling

Smart glasses show high potential for the business market. The context sensitive information provision into the user's field of vision combined with hands free control enables a pervasive and appropriate information provision without media disruption and limited mobility [1]. Therefore, application scenarios in several sectors e.g. health, technical service, production or logistics have been identified and are current research topics to the field of IS [2]. Hence, producer of smart glasses focus with the functional design on business needs.

Nevertheless, the pervasive information provision has potential to improve processes in private use. A promising consumer use case for smart glasses is training support in cycling. The status quo in cycling training already contains a variety of devices for the digital information provision as navigation devices, heart rate monitors, speedometers and further performance data monitors. The devices are mounted on the handlebar consequently, cyclists have to look down to gather their information or control the devices. Thereby, those training support devices cause distraction from roads and traffic and such devices propose are a risk for accidents. To encounter these risks information provision and device control must be integrated into the cyclist's field of view. Smart

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glasses meet these requirements by displaying the information into the corner of the cyclist's field of view (the traffic is not overlaid with digital objects) and enable a hands free control [3].

Nevertheless, smart glasses are currently not widespread on the consumer market, as user are concerned about social consequences of the usage [4]. Thus, this innovative technology faced acceptance barriers when first introduced in 2012. Therefore, a user centric design is a necessity for the development of a marketable product in the sports market. Technology acceptance is a crucial factor for innovative technologies to cross the chasm into the mainstream market and is assumed as a more decisive factor than a products usability [5]. Against this background, our research is guided by the questions (RQ1) *What are user requirements for a smart glasses-based information system to support cycling training?*, (RQ2) *How to design an accepted system corresponding to these requirements?* and closely connected to that (RQ3) *Which factors influence the acceptance of the regarding system?*. Addressing the research questions three expert interviews and an online survey (participants n = 100) have been conducted. Thereby, this paper contributes to the knowledge base of DSR by including acceptance factors into the engineering of a smart glasses-based system. The design and description of an artifact is a theoretical contribution itself [6].

Approaching with DSR as research strategy the paper is structured as follows: In section 2 related work is reviewed to outline the problem class of Smart Glass acceptance, followed by the illustration of the research method in section 3. Afterwards we derive user requirements in section 4. The aligning design requirements are stated in section 5 which are discussed in section 6. To conclude the findings an outlook for further research is given in section 7.

2 Smart Glasses Adoption and Technology Acceptance

Smart glasses-based information systems have been successfully designed for industrial use cases utilizing design requirements and principles [7], [8]. Smart glasses can restructure processes and support information intensive tasks in an ergonomic way as they present context sensitive information directly into the user's field of view, and facilitate a hands free navigation [1]. The information retrieval in the field of view and hands free navigation is beneficial for cyclists, too as it has the potential to reduce distraction and thereby road risks. So far, user requirements and design principles for such a system are not found in literature. Evidence for the usefulness of Information display in the field of view instead of conventional dashboards can be found regarding automobiles. To reduce road risks head-up displays, which are displaying the relevant information in the windscreen are replacing conventional dashboards and infotainment displays in cars [3]. Thereby the driver can retrieve the required information in the field of view. The distraction of a car driver when looking down to the dashboard or infotainment screen is comparable to cyclists monitoring their training information on their handlebar in road traffic. Nevertheless, smart glasses have faced acceptance problems since their first introduction by Google in 2012 due to privacy concerns and reservations in communication with smart glasses wearers [4]. Consequently, smart glasses wearers have been insulted as “Glassholes”. Therefore, we conclude that there is a lack of social acceptance. Due to that matter, corresponding measures to ensure acceptance is a crucial factor for the system design. Technology acceptance itself is a well studied field in IS, with validated models to measure the user’s attitude such as the renowned Technology Acceptance Model (TAM) [9] and its derivatives like the Unified Theory of Acceptance and Use of Technology (UTAUT) introduced by Venkatesh et al. (2003). Nevertheless, common models do not take smart glasses specific characteristics such as the high integration of hardware and software into account. These characteristics make it on the one hand, hard to distinguish whether the user evaluate the comprehensive system, the hard- or software and on the other hand, are not addressed in current acceptance models. Therefore, the established models might lack a comprehensive understanding of the acceptance factors for such systems. Acceptance models focusing on pervasive computing in general take the ubiquity of a smart glasses-based system into account such as the UTAUT2 extension presented by Segura and Thiesse (2015). Nevertheless, joining the measurement of the acceptance, attitude specific design requirements are required to address acceptance barriers and improve the system. The knowledge base of IS [1] and the smart glasses manufacturer themselves [10] focus on functional design and do not provide design principles or at least requirements to improve the acceptability of smart glasses-based systems.

3 Research Strategy and Path of Knowledge

3.1 Making use of Design Science Research

To provide a problem-based approach of conceptualizing a smart glasses system in the cycling domain, the paradigm of Design Science Research (DSR) was chosen. We followed a DSR approach presented by Hevner (2004) to ensure rigor and relevance of the artefacts [11]. Thereby, we applied DSR by first collecting requirements from experts through interviews, as well as from survey respondents of an online questionnaire. To be certain that the designed system will be accepted among the potential users, we derivate specific acceptability requirements as we deploy an acceptance model for smart glasses among potential users in the requirement analysis. These requirements are then aggregated and consolidated to meta-requirements (MR) and finally a mock-up is conceptualized. To acquire rigorous outputs two evaluation activities are included in this approach. According to Sonnenberg and vom Brocke (2012) design specifications are evaluated through surveys to obtain validated design specifications, as well as the instantiation of an artifact with a prototype to proof the applicability of an artifact [12]. Following the argumentation of Thomas (2009) an executable model is a feasible prototype, as the implementation is a technical activity [13]. Therefore, the design requirements derived from the expert interviews are validated and completed through an online survey. Secondly, a prototype is conceptualized through a mock-up to evaluate the suitability, operationally and feasibility of the artifact before we carry out a technical instantiation. The course of action is integrated into the three cycle view of DSR [14] that is presented in figure 1.

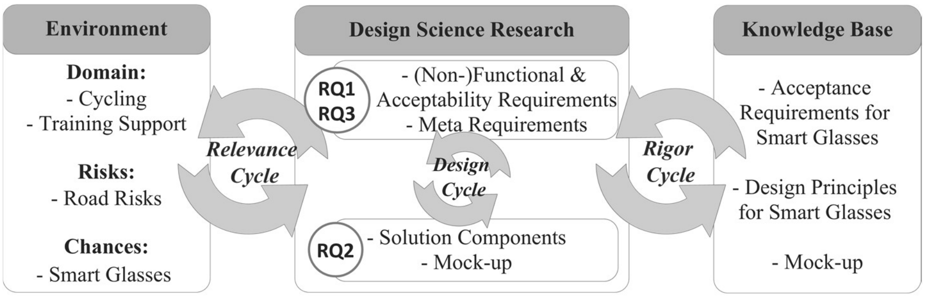

Figure 1. Design of an acceptable smart glasses-based information system

3.2 Deduction of Requirements through Expert Interviews

Following the approach of Myers and Newman (2007) we conducted three semi-structured interviews with experts in cycling training to structure the problem space and deduct relevant aspects for the online survey [15]. Therefore, we asked the experts about the areas problems in cycling training, benefits of smart glasses in cacling training, ergonomic design of smart glasses, required functionalities and market entry barriers. The experts were chosen according to the following attributes: (1) comprehensive domain knowledge in cycling training, (2) marketing knowledge or experiences with the market launch of products and (3) IS specific knowledge. The interviewees are experienced cyclists (6 to 14 years), with two of them having racing experience. Interviewee A is a junior brand manager and participates in cycling races for 8 years. Interviewee B is an information scientist with experience in software development and a cyclist for 6 years. Interviewee C is a business student with 14-year experience in race cycling and a certified trainer for cycling as well as a cycling race team leader. The interviews aim to structure the problem space and derive a set of requirements for smart glasses-based systems as a cycling training support according to research question RQ1. Afterwards we transferred the findings into survey questions in two different ways: (i) either as contingency questions to validate measures, e.g. price acceptance, and (ii) as open-ended questions to validate and complement the experts statements. The exploration of the problem space through expert interviews and thereon the design of the online survey is exemplarily illustrated in table 1 followed by a further description of the resulting online survey (section 3.3).

Table 1. Derivation of survey questions from expert interviews

Research Question	Analysis Dimension	Interview Question	Survey Question	Question Type
RQ1	Functional Design	Which functions are demanded?	Which of the following functions do you require?	Contingency Question

3.3 Extension of Requirements through an Online Survey

The online questionnaire consists of two parts, (a) the validation and complementation of the functional and non-functional requirements that we identified in the expert interviews and (b) the structured questionnaire from an established acceptance model. The questions that we derived from the interview's insights are stated in table 1 (c.f. section 3.2.). Therefore, the questionnaire contains open-ended, contingency and closed-ended questions. Open-ended questions were deployed to validate and extend requirements or information needs. To collect data about price acceptance, the duration of cycling training or validate specific requirements we used contingency questions. We applied closed-ended questions for the second part of the questionnaire referring to the user acceptance, which are responded through a 6-point Likert rating scale with endpoint labeling. To avoid a bias of the respondents and facilitate a statistical evaluation, the gradations between (1) strongly disagree to (6) strongly agree are labeled with numbers. Responses to open questions are qualitative analyzed and aggregated to response classes [16].

Introductory a demonstration video of the use case is shown, followed by demographic questions and about the status quo of digital training support. Then, experience with monitoring devices, resulting road risks and required training data is focused. Afterwards the (non-) functional requirements derived from the interviews are reviewed. Aiming at a high acceptability of our solution components, the questionnaire is supplemented with an acceptance questionnaire to provide insights on RQ3. Therefore, our approach followed the UTAUT 2 adoption of Segura and Thiesse (2015) by adapting their questionnaire to the context of smart glasses-based information systems in cycling. Therefore, the acceptance of such an ubiquitous system is measured with conventional acceptance measures as stated in UTAUT2 [17] and extended by three pervasiveness-related variables: Ubiquity, Unobtrusiveness and Context Awareness [18]. The question sets are merged in an anonymous online questionnaire. The sample has been acquired in relevant social media groups and in race cycle teams making use of the snowball effect. The majority of the respondents are male (96 %) amateur cyclists (82 %), are either between 25 and 39 years old (39 %) or 40 and 59 years old (38 %) and have more than 6 years of cycling experience. The share of male participants is higher compared to the statistical distribution of cyclists in Germany, 73 % of them are male and 23 % female [19], which could distort the findings as it is not an average sample. A vast majority (96 %) is using digital devices to monitor their training. Most of the participants (89 %) are familiar with smart glasses even though they did not test them so far. Overall, 100 participants conducted the full questionnaire.

4 Form and Function of a Smart Glasses-based System for Cycling

4.1 Derivation of User Requirements

Functional Requirements. According to Niemöller et al. (2017), requirements for smart glasses-based information systems are differentiable into functional (F) and non-functional (NF) requirements. The functional design requirements define system functions and components, which are identified in the expert interviews and the online survey (c.f. table 2). According to the interviewees, the smart glasses are a beneficial and innovative human-computer-interface with the opportunity to integrate necessary information into the cyclist's field of view. Therefore, the experts specified 26 functional requirements regarding features for the general design of smart glasses (F1 – 14) as well as training and context-specific requirements (F15 – 30). In the online survey, the participants confirmed 13 of the experts' functional requirements and added four further requirements.

Table 2. Functional requirements

#	Functional Requirement	Expert Interviews	Online Survey
F1	Price	X	X
F2	Customizable presentation of information	X	
F3	Battery run-time	X	X
F4	Display readability	X	X
F5	Connection to social media (e.g. Strava)	X	
F6	Smart Notifications	X	X
F7	Breaking resistance	X	
F8	Weather resistance	X	X
F9	External information processing	X	
F10	No heat generation	X	
F11	Alternative device controls (voice, buttons, gesture)	X	
F12	Weight of the device		X
F13	Size of the device		X
F14	Individual information objects		X
F15	Navigation	X	X
F16	Timekeeping	X	X
F17	Wattage monitoring	X	X
F18	Heart rate monitor	X	X
F19	Pedal frequency monitoring	X	
F20	Distance monitoring	X	X
F21	Speedometer	X	X
F22	No overlay of information into real world objects	X	
F23	No camera	X	
F24	Look-through display	X	

#	Functional Requirement	Expert Interviews	Online Survey
F25	Clip-on solution	X	X
F26	Display illumination dimmable	X	
F27	Distance measurement between cyclists	X	X
F28	Connectivity to telemetric devices	X	
F29	Alternative interfaces (ANT+, Bluetooth, WiFi)	X	X
F30	Changeable spectacle lenses (solar lenses, prescription lenses)		X

Non-Functional Requirements. The experts further stated non-functional requirements that describe quality attributes for a smart glasses-based information system in cycling, which are not addressing specific technical functionalities, (c.f. table 3). Pursuing with non-functional requirements in the online survey, five of the expert's requirements have been confirmed. Although, half of the participants (44 %) do not agree that their current monitoring devices, such as speedometers and are a distraction, almost a third (30 %) experienced incidents or crashes caused by a distraction due to monitoring devices. Situation descriptions given can be aggregated to (i) configuration of a device and (ii) limited field of view as the cyclist looked down to the handlebar to retrieve information. Consequently, smart glasses should not limit the (NF2) field of view of the cyclists and allow an (NF8) simple control.

Table 3. Non-Functional requirements

#	Non-Functional Requirement	Expert Interviews	Online Survey
NF1	Reduced distraction	X	X
NF2	Unrestricted field of view	X	X
NF3	Simple design of information objects	X	
NF4	Ergonomic fit	X	
NF5	Compliance with traffic regulations	X	
NF6	Unobtrusive design	X	X
NF7	Simple handling	X	X
NF8	Simple device control	X	X

Acceptability Requirements. Taking user acceptance as a crucial success factor for the launch of a smart glasses-based system in end-user business, acceptability requirements (AR) are differentiated as a further category of system requirements. We analyzed the acceptance model deployed in the online survey with a structured equation model to identify significant influence factors on the user acceptance and thereby deduce areas of development. Therefore, we further examined the significant influencing factors, shown in figure 2. *Ubiquit*y (UBI) as the continuous provision with relevant information, *Unobtrusiveness* (UNO) addressing the hardware as well as a discrete interaction with the device and *Context Awareness* (CAW) to provide contextual information in dynamic manner have an indirect influence on the acceptance of a smart glasses-based information system for cycling. Further, the factors *Performance Expectancy* (PE), *Social Influence* (SI) and *Hedonic Motivation* (HM) have a significant influence on *Behavioral Intention* (BI) and thereby on user acceptance.

These factors are further investigated in connection with the free text fields and the (non-) functional requirements resulting in the deduction of 10 acceptability requirements (c.f. table 4). Therefore, we deployed a qualitative content analysis [16] to aggregate the statements into requirements. Two of the resulting requirements, (AR6) Price and (AR5) Unobtrusive design, are stated by the participants already as non-functional requirements and have been additionally verified through the acceptance model. Overall 74 % of the cyclists rate a smart glasses-based support in cycling training as beneficial. The respondents specified three reasons to reject such a system. First they are (AR1) satisfied with the current devices, secondly (AR2) they are apprehensive of road risks caused by the distraction of and thirdly, participants assume smart glasses would be (AR3) uncomfortable to wear.

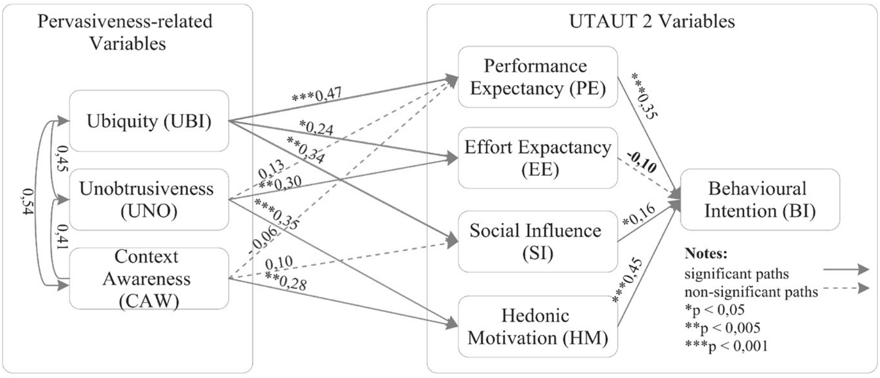

Figure 2. Structural equation model to analyze acceptance questionnaire

The survey participants require (AR4) ubiquitous information provision during the training with an (AR7) automatic adaption to the environment in terms of illumination or highlighting sufficient measures. Thereby the system has to be a (AR8) support for the achievement of training goals. Further, the acceptance of the potential users is influenced by the (AR6) price of the product (average price = 264 €), the (AR9) approval of the users social environment and the (AR10) enjoyment experienced during usage. Regarding the acceptance barriers known in literature, we have found no evidence regarding privacy concerns, but implications that the social acceptance is crucial. These findings are supported by (non-) functional requirements as AR2, AR3, AR5, AR6 and AR7 can be mapped to the previously identified requirement set. Regarding the initial motivation to reduce distraction by implementing a smart glasses-based system (AR2) is major requirement for the whole system design.

Table 4. Acceptability requirements

#	*Acceptability Requirement*	*#*	*Acceptability Requirement*
AR1	Degree of innovation	AR2	Distraction
AR3	Physical influence	AR4	Ubiquity of relevant information
AR5	Unobtrusive design	AR6	Price
AR7	Automatic adaption to environment	AR8	Support for goal achievement
AR9	Approval of social environment	AR10	Enjoyment

4.2 Derivation of Meta Requirements

The structured design requirements (functional, non-functional and acceptability requirements) are aggregated to meta-requirements that are the design goals for the conceptual artifact in the form of a first instantiation (c.f. section 4) [6]. The overall 16 meta requirements and the corresponding design requirements are stated in table 6. Strong meta requirements, which meet functional, non-functional as well as acceptance requirements are (MR3) safety and compliance of the information system, the system's (MR8) ergonomics and (MR12) unobtrusiveness. Meeting at least two types of design requirements, (MR2) usability, (MR4) a minimalistic information display, (MR9) the price, (MR11) ubiquity and (MR13) context awareness are identified.

Table 5. Aggregation to meta requirements

#	*Meta Requirement*	*Corresponding Requirements*		
		Functional	*Non-Functional*	*Acceptance*
MR1	Interfaces	F5, F28, F6, F29		
MR2	Usability	F11	NF7, NF8	
MR3	Safety & Compliance	F24, F27	NF1, NF2, NF5	
MR4	Minimalistic information display	F22, F23	NF3	
MR5	Robustness	F7, F8		
MR6	Display of telemetric data: (distance, wattage, pedal frequency, etc.)	F15, F16, F17, F18, F19, F20, F21		
MR7	Customization	F2, F25, F30, F14		
MR8	Ergonomics	F10, F9, F12, F13	NF4	AR3
MR9	Price	F1		AR6
MR10	Battery run-time	F3		
MR11	Ubiquity		NF1	AR2, AR4
MR12	Unobtrusiveness	F13	NF6	AR3, AR5
MR13	Context awareness	F26, F4		AR7
MR14	Social influence			AR9
MR15	Hedonic motivation			AR1, AR10

#	*Meta Requirement*	*Corresponding Requirements*		
		Functional	*Non-Functional*	*Acceptance*
MR16	Performance Expectancy			AR8

5 Design of a Smart Glasses-based System for Cycling

To translate the meta-requirements into action solution components are developed as stated in table 6. As the meta requirements and solution components are defined on a general level, a transmission to other use cases than cycling is feasible.

Table 6. Solution components meeting meta requirements

#	*Solution component*	*Specification*	*Meta Requirements*
D1	Interoperability	Interfaces to connect with telemetry instruments and social (i.e. STRAVA) and smart notifications.	MR1, MR6
D2	Robustness	Weather and impact resistance.	MR5
D3	Ergonomically design	External battery and information processing to avoid heat generation. Balanced weight.	MR8, MR10
D4	Minimalistic design	Small and light Hardware as a clip-on solution or with changeable spectacle lenses. Simple and customizable information display. External information processing.	MR4, MR12
D5	Usability	Multiple device controls and simple handling.	MR2
D6	Acceptance	Integration of social platforms, Gamification applications and customizable surfaces for enjoyment. Price range 264 - 400 €.	MR9, MR11, MR12, MR13, MR14, MR15, MR16
D7	Display	Highly readable color display. Look-through display at the corner of the field of view. Context aware display illumination.	MR3, MR12
D8	Monitoring information	Sufficient information for the training is easy accessible. The scope, amount and type of information objects is customizable.	MR6, MR7, MR16

The user retrieves training relevant information from a minimalistic dashboard. Further information objects or smart notifications are accessible additional tabs, like the displayed navigation map. The training data collected during usage can be shared directly on social media platforms or an online training monitoring studio to keep track of training goals. The system is easy to use, especially to control via voice command.

Relating to the hardware, processor and battery are located in a separate module within a weather and impact resistant case. The look-through display is a clip-on solution which can be used with convenient sports goggles and assures an ergonomic positioning in the corner of the user's field of view. Considering the current smart glasses models available on the market, e.g. Vuzix M300, Recon Jet or Google Glass 2, none meets the derived hardware requirements stated above (c.f. F3, F7, F8, F10, F25). Therefore, the development of a new device is required to correspond to the requirements and ensure the acceptance of the system.

6 Conclusion and Outlook

To conclude our findings, smart glasses-based systems still suffer acceptance problems. Even though, they bear the potential to reduce road risks the state of the art of current hardware and its functionalities as well as wearing comfort are barriers for the acceptance. Deploying a DSR approach, we stated the user's design requirements and transformed them into meta-requirements for smart glasses-based systems (RQ1). Afterwards we addressed the actual design and development of smart glasses-based systems, as we derived corresponding solution components (RQ2) to design a smart glasses-based information system to support cycling training. To assure user acceptance for the system specific acceptance requirements have been identified and integrated into the system design (RQ3). The major fields of improvement address the connectivity of the smart glasses such as connections to existing training periphery and a social media integration, as well as hardware adjustments such as a clip-on solution to use the system with any sports goggles and an external battery to reduce weight. Further evaluations are required at this point to establish design principles to consider the acceptance from the beginning. The findings are transferable to other sport disciplines like MTB, Triathlon, Running, Skiing and on a more abstract level to industry, e.g. logistics or technical customer service. Further research is required to evaluate and complement these findings in service and industry sector. The postulated product specifications for a smart glasses-based information contributes to the field as a mandatory prerequisite for the design of an according system. Furthermore, user acceptance is a crucial factor in design of smart glasses-based systems in technical customer service [1]. As evaluated through the mock-up prototyping the acceptance requirements contribute to theory as they integrate user acceptance successful into early stages of the design cycle. To determine and influence relevant acceptance factors for smart glasses-based systems further investigation is required. Additionally, further iteration cycles are necessary to improve the design and acceptability of the introduced system and thereby, to derive design principles. Hence, the influence of additional acceptance factors, for example privacy should be taken into consideration [20]. Furthermore, the implementation of the outlined system and further evaluation is necessary to examine the user experience and evolve an ergonomic and beneficial design. Additional research is required to discuss the implications on a more general level.

7 References

1. Niemöller, C., Metzger, D., Thomas, O.: Design and Evaluation of a Smart-Glasses-based

Service Support System. In: 13. International Conference on Wirtschaftsinformatik. pp. 106–120 (2017).

2. Elder, S., Vakaloudis, A.: Towards uniformity for smart glasses devices: An assessment of function as the driver for standardisation. In: 2015 IEEE International Symposium on Technology and Society (ISTAS). pp. 1–7. IEEE (2015).
3. Heymann, M., Degani, A.: Classification and organization of information. In: Design of Multimodal Mobile Interfaces. pp. 195–217 (2016).
4. Koelle, M., Kranz, M., Andreas, M.: Don ’ t look at me that way ! – Understanding User Attitudes Towards Data Glasses Usage. MobileHCI’15. pp. 362–372 (2015).
5. Kim, K.J., Shin, D.-H.: An acceptance model for smart watches: Implications for the adoption of future wearable technology. Internet Res. 25, 527–541 (2015).
6. Gregor, S., Hevner, A.R.: Positioning and Presenting Design Science Types of Knowledge in Design Science Research. MIS Q. 37, 337–355 (2013).
7. Caudell, T.P., Mizell, D.W.: Augmented reality: an application of heads-up display technology to manual manufacturing processes. In: Proceedings of the 25th HICSS, 1992. pp. 659–669 vol.2 (1992).
8. Metzger, D., Niemöller, C., Berkemeier, L., Brenning, L., Thomas, O.: Vom Techniker zum Modellierer - Konzeption und Entwicklung eines Smart Glasses. In: Smart Service Engineering. pp. 193–213 (2016).
9. Davis: A technology acceptance model. (1985).
10. Google: Design for Glass, https://developers.google.com/glass/design/.
11. Hevner, A.R., March, S.T., Park, J., Ram, S.: Design Science in Information Systems Research. MIS Q. 28, 75–105 (2004).
12. Sonnenberg, C., vom Brocke, J.: Evaluations in the Science of the Artificial – Reconsidering the Build-Evaluate Pattern in Design Science Research. In: DESRIST 2012, LNCS 7286. pp. 381–397 (2012).
13. Thomas, O.: Fuzzy Process Engineering. (2009).
14. Hevner, A.R.: A Three Cycle View of Design Science Research. Scand. J. Inf. Syst. 19, 87–92 (2007).
15. Myers, M.D., Newman, M.: The qualitative interview in IS research: Examining the craft. Inf. Organ. 17, 2–26 (2007).
16. Mayring, P.: Qualitative content analysis: theoretical foundation, basic procedures and software solution. , Klagenfurt (2014).
17. Venkatesh, V., Thong, J., Xu, X.: Consumer Acceptance and Use of Information Technology: Extending the UnifiedTheory of Acceptance and Use of Technology. Mis. 36, 1–22 (2012).
18. Segura, S., Thiesse, F.: Extending UTAUT2 to Explore Pervasive Information Systems. In: ECIS 2015. p. Paper 154 (2015).
19. Statista: Rennrad-Fahrer in Deutschland nach Geschlecht 2017 | Statistik, https://de.statista.com/statistik/daten/studie/272375/umfrage/rennrad-fahrer-in-deutschland-nach-geschlecht/.
20. Berkemeier, L., McGuire, M.-R., Steinmann, S., Niemöller, C., Thomas, O.: Datenschutzrechtliche Anforderungen an Smart Glasses-basierende Informationssysteme in der Logistik. In: Informatik 2017. pp. 1037–1048. Lecture Notes in Informatics (LNI), Chemnitz (2017).