#SociallyacceptableCHI – A CHI 2018 Workshop on Social Acceptability

Workshop Title: (Un)Acceptable!?! – Re-thinking the Social Acceptability of Emerging Technologies

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CHI'18 Workshop on (Un)Acceptable!?! – Re-thinking the Social Acceptability of Emerging Technologies, April 21, 2018, Montreal, QC, Canada.

Preface

Actual, or imagined disapproval from other people can have a major impact on how information technological innovations are received, which is often embraced by "social acceptance" or "social acceptability". With the increasing ubiquity of information and communication technologies potential issues with social acceptance become highly topical.

However, the field of HCI lacks comprehensive, up-to date, and actionable, articulations of social acceptability, as well as agreed-upon metrics to measure their effects. In this regard the #sociallyacceptableCHI workshop brought together academics and practitioners to discuss the current state of research on social acceptability in the context of modern human-computer interaction (HCI).

Held during CHI 2018, the workshop provided a platform for presenting and discussing open issues and challenges as well as novel ideas on how to design for social acceptability. It was characterized by a stimulating atmosphere, and attracted high quality contributions from all over the world. We are glad that we could compile an interdisciplinary program demonstrating that social acceptability will be an essential area of interest in HCI's future research agenda.

Finally, we would like to thank all participants, as well as the CHI workshop chairs; without their contributions this workshop would not have been possible – thank you sincerely.

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Workshop Proposal

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(Un)Acceptable!?! – Re-thinking the Social Acceptability of Emerging Technologies

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Abstract
A central viewpoint to understanding the human aspects of interactive systems is the concept of technology acceptance. Actual, or imagined disapproval from other people can have a major impact on how information technological innovations are received, but HCI lacks comprehensive, up-to date, and actionable, articulations of "social acceptability". The spread of information and communication technologies (ICT) into all aspects of our lives appears to have dramatically increased the range and scale of potential issues with social acceptance. This workshop brings together academics and practitioners to discuss what social acceptance and acceptability mean in the context of various emerging technologies and modern human-computer interaction. We aim to bring the concept of social acceptability in line with the current technology landscape, as well as to identify relevant research steps for making it more useful, actionable and researchable with well-operationalized metrics.

Author Keywords
Social Computing; Technology Acceptance; Emerging Technologies; Social Acceptability

ACM Classification Keywords
K.4.0 [Computers and Society]: General

Social acceptability issues may arise with emerging technologies in various contexts. Some examples are:

Virtual Reality (VR) has become available and mobile, but social concerns might make it difficult to use VR with others around.

Assistive devices need to balance the trade-off between being recognized as such to increase social acceptability and being unobtrusive to reduce stigmata.

Background

Emerging, "game-changing" technologies create new interaction paradigms, usage situations, contexts, and intentions, and allow us to tackle challenges that were previously considered unsolvable. On the other hand, novel technologies and applications such as head-mounted-displays for everyday assistance, deep neural networks for classification of all kinds of data, or self-driving vehicles for increased comfort and safety, might create new threats, raise new concerns and increase social tension between users and non-users. While some of these technologies and interactions have become more perceptible to others (e.g., head-worn devices, gesture and speech interfaces), other technologies might be very discreet (e.g., intelligent contact lenses) but cause discomfort and affect the social climate due to their (potential) presence or availability.

A user's experience of interacting with an interface not only comprises her actual personal (user) experience, but also compounded by other people's perceptions: whether a device is considered "cool" or "weird" might influence impression management (c.f., Goffman [9]), and thus affect her willingness to use it – even when unwatched. Despite being highly useful and usable, some devices might also reveal information the user does not want to reveal, which might result in privacy breaches or stigmata (e.g., when using assistive technologies, c.f. [20]) or displaying interactions to bystanders [8]. In public spaces, interactions with an interface may affect or even intrude the social sphere of others, cause discomfort and social tension. In light of these, we believe that social aspects of technology usage need to be re-thought as one of HCI's quality characteristics, as the spread of information and communication technologies into all aspects of our lives has opened up many new trap doors to social acceptance – or non-acceptance, respectively.

This workshop is intended to foster critical re-thinking of social aspects in the adoption of novel, interactive technologies, which is often embraced by "social acceptance" and "social acceptability". While these terms have been frequently used in the field of HCI, they have only been sparsely defined (e.g. by Montero et al. [16]), and there are no agreed-upon metrics to measure their effects (yet). However, we believe that in the context of emerging technologies and their dissemination into all facets of public and personal life there is a need to discuss how social acceptability issues shall be dealt with in HCI research: does an interaction or a technology have to be specifically designed for social acceptance, or will acceptance come naturally over time if the interface is accepted by 'everyone else'? Should tech companies hire "Social Acceptance Advocates"? What about engaging in technology-driven research resulting in products that might not become socially acceptable in a lifetime? We speculate that social acceptability might not be a simple, binary decision between "acceptable" and "unacceptable", but that decisions are also contextual, may be temporary, and influenced through media coverage or greater societal changes. For this reason, we believe it is high time to re-think and reconsider the notion of social acceptability in CHI in an interdisciplinary workshop with researchers and practitioners from academia and industry.

The main goals of this workshop are three-fold. First, we explore how "social acceptance" and "social acceptability" are understood, encountered, and used in the CHI community and beyond. Second, we will gather method suggestions for how the social acceptability of an interactive system can be measured and evaluated in a comprehensive way. Third, we discuss what types of social acceptability research (if any) would be the most useful for those trying to design/develop for social acceptability.

Existing Work

In 1994 Nielsen named social acceptability as essential part of system acceptability [18]. Despite this, HCI research in the past decades mainly focused on creating and improving what Nielsen embraced as practical acceptability, including e.g., usability, and utility. Also, early observations, e.g., Hosokawa's Walkman Effect [10] were purely descriptive and did not aim to design for social acceptability. Technology acceptance research (e.g., Davis' Technology Acceptance Model, TAM [3]) has been extended to incorporate social factors (e.g., by Malhotra et al., in 1999, [15]), but research and resulting models were influenced through the technology positivism of that time; Potential non-acceptance of (interactive) technologies was not considered, however, has been taken up more recently in various areas of HCI:

- Social acceptability of "performing" interactions in front of others has been investigated for mobile, gestural and on-body interfaces [1, 16, 21, 23, 24], speech interfaces [7], and public displays [19].
- Social acceptability of technology usage has been inverstigated for various contexts and situations [13] or by particular user groups, e.g., for accessability [20, 25] or in medical use cases [4, 27].
- Ethical and social implications of particular classes of technologies, were looked at e.g., for wearables [11], smart glasses [5], drones [26, 14], lifelogging cameras [12] and CCTV [17], as well as discussed for ubiquitous computing in general [2].
- A further string of research e.g., by the University of Twente[1] (Netherlands), covers intelligent personal assistants and human-robot-interaction.

[1] Human Media Interaction and Socially Intelligent Computing, http://hmi.ewi.utwente.nl/Research, accessed 10.10.2017

Workshop Goals

We aim for a highly interdisciplinary workshop, bringing together designers, researchers, and practitioners from different domains of CHI to generate a shared understanding of "social acceptance" and "social acceptability" to discuss the implications of this for the CHI community. We aim to discuss which problems and challenges regarding social acceptance are being faced during research and design activities, along with solution strategies for mitigating risks of social non-acceptance of new HCI technologies and artifacts. We furthermore aim to initiate a discourse about which methods and metrics are suitable to comprehensively measure the social acceptability of an interactive system. We believe CHI2018 to be the ideal venue for this workshop as CHI invites an interdisciplinary dialogue between designers, researchers, and practitioners, and has had a long tradition in looking at social aspects of technology usage e.g., at what is "cool" [22] or "embarrassing" [6].

Workshop Questions

Questions to be discussed during the workshop include, for example:

- Which emerging technologies and their characteristics are particularly challenging with regard to social acceptability?
- How can we develop/design for social acceptability?
- What role does social acceptability play in the overall perception of system quality or user experience?
- Which factors affect the social acceptability? What role do new interaction techniques play?
- How would disappearing computers (c.f. Ubiquitous Computing visions) affect acceptance?
- What are the needs to design for social acceptability; or is it something that is naturally achieved over time once a market gets used to the technology?

- Where has research in the CHI community succeeded or failed in designing for social acceptability?
- How can aspects of social acceptance be measured in valid and useful ways?

Expected Outcome

The main objective of this workshop is to provide a definition and common ground of what "social acceptability" is for the CHI community. A related practical outcome is the collection of existing methods to evaluate "social acceptability", as well as the ideation of new methods, measures or perspectives that are missing in existing theories. We further expect the workshop to set the scene for discussing the relevance of "social acceptability" of emerging technologies for the CHI community (if any) and chart a future research agenda for its systematic study.

Participants and Expected Interest

Social acceptance is an element that becomes often apparent in user studies, whether it was purposefully studied or not. For this reason the workshop aims to include both, those that are studying, tackling and working on social acceptability, and those that stumble across social acceptability issues when testing prototypes or deploying their products in the wild. Hence, to better incorporate diverse participation in the workshop we have decided to offer two submission formats: 1. position papers - to be presented as a poster and, 2. full papers - to be included as an oral presentation. The call for participation will be distributed via mailing lists, social media and our institutes' websites.

We believe that the social acceptability of emerging technologies is of direct interest to all designers, researchers and practitioners who design, study or use (novel) interactive systems. The workshop has ties to various areas in HCI, including mobile, wearable and ubiquitous computing; interaction in public spaces; on-body interfaces; intelligent personal assistants and HRI; interactive and provocative design; and social software. It would also invite attendees having more general interests, such as information ethics; social computing or any psycho-social dynamics of HCI.

Organizers

The workshop will be organised by an interdisciplinary team of researchers from 5 different countries/universities.

Marion Koelle [main contact] is a research associate at the University of Oldenburg. Her background is in Augmented Reality, wearable computing and Computer Vision. She published research on factors influencing the social acceptance of smart glasses at MobileHCI and CHI. Recently, she has been with the BMBF project "ChaRiSma", that covered chances and risks of smart cameras in public spaces. She will soon submit her dissertation on designing body-worn cameras that intelligently adapt to social contexts.

Halley Profita recently completed her PhD in CS and Human-Centered Computing (HCC) at the University of Colorado Boulder (CU). Her research primarily focuses on e-textile and wearable technology development, accessibility, and the social acceptability of on-body device use. Prior to CU, Halley received her master's degree in Industrial Design from Georgia Tech where she spent much of her time infiltrating various CS labs to explore interactive technology projects of all shapes and sizes.

Thomas Olsson is an associate professor at University of Tampere, focusing on the experiential and social implications of information technology and research through design. His research interests include designing socially aware and acceptable information technology, enhancing social interaction with the help of emerging ICT, Big Social Data analytics, extended reality technologies, and steering digitalization towards desirable futures. He has organized several interdisciplinary workshops in the field of HCI.

Julie Williamson is a Lecturer of Human Computer Interaction at the University of Glasgow. Her research explores how tangible performative interactions can be embedded into public places, focusing on ways of attracting users, encouraging playful behaviour, and evaluating user experience without intervening during users' interactions.

Robb Mitchell is assistant professor, social interaction design at University of Southern Denmark. He is a graduate of Environmental Art at Glasgow School of Art and holder of a PhD entitled "Facilitating Shared Understandings of Risk". He has led hands-on workshops at TEI, DRS, Participatory Innovation, and Service Design conferences. In addition, he organised many creative gatherings for New Media Scotland, and had founding roles in several making oriented interdisciplinary collectives including The Electron Club, and The Chateau, Glasgow.

Shaun Kane is an assistant professor in the Department of Computer Science at the University of Colorado Boulder, where he directs the Superhuman Computing Lab. His research explores the design of mobile and wearable assistive technology, including how to empower end users to create and customise their own assistive devices.

Susanne Boll is full professor for Media Informatics and Multimedia Systems at the University of Oldenburg (UOL). In 2012, she joined the board of OFFIS – Institute for Information Technology. Susanne Boll is a lead researcher in a number of international and national research projects in the field of intelligent user interfaces, and leads the Human-Machine Cooperation Competence Cluster, which drives the activities of the OFFIS research institute in this field. She has co-organized several international events, is member of several editorial boards, and has been a member of more than 100 Technical Program Committees.

Pre-Workshop Plans

Starting from December 2017 we will recruit a program committee to review and decide on successful submissions. Prior to CHI, participants will be asked to complete an (on-line) survey on their (personal) understanding of "social acceptance" and "social acceptability" as well as relevant measures and metrics, and their experience with (un)acceptable systems. Following a "snowballing" principle, the participants will be encouraged to recruit at least 8 additional participants each (no maximum). Results of the survey will be presented in the workshop's opening talk.

Workshop Structure

The workshop is planned as a 1-day workshop with a structure as follows (with coffee breaks 10:30 – 10:45 and 15:00 – 15:15, and lunch 12:15-13:30):

Introduction and Ice Breaker (9:00 – 9:45): Introductory presentation to outline the workshop motivation and goals, summing up the results of the pre-workshop survey, followed by an ice breaking activity.

Speed Dating (9:45 – 10:30): Following the "speed dating" procedure, participants will discuss their perspective on social acceptance in HCI, and related issues they might have encountered during their research activities.

Session 1 (10:45 – 11:30): Participants present results of their research in 7 minutes each.

Session 2 (11:30 – 12:15): Participant's presentations; identical format to session 1. Activities for the workshop's remainder will be discussed and agreed.

Posters (13:30 – 14:15): Poster presentations, sharing experiences with socially (un)acceptable interfaces.

Group Session 1 (14:15 – 15:00): Participants will divide in groups based on interest and experience. Each group will target at one particular interaction paradigm or interface and redesign it in an either more acceptable, or totally unacceptable way. This way discussing factors that influence the social acceptability of a system will be facilitated.

Group Session 2 (15:15 – 16:00): Participants will come together in different groups and discuss how social acceptability is or could be measured and evaluated. A list of existing methods and examples suggested by the participants will be prepared based on the pre-workshop on-line survey.

Discussions (16:00 – 16:45): Participants will be invited to present and discuss their findings. Key research questions, implications for the CHI community and future directions will be discussed and summed up in a poster.

Wrap-up and Closing Remarks (16:45 – 17:30): Workshop results and remaining open questions will be wrapped up, options for follow-up activities will be discussed.

Post-Workshop Plans

We will invite the participants to submit an extended version of their workshop papers to be included in a special edition journal. Outcomes of the method collection will be provided as overview on the workshop's website and in a joint survey publication. Where possible, questionnaires, metrics and tools will be made available open-source via github.

Call for Participation

What does social acceptance mean
with respect to modern HCI?
How to design for social acceptability and
how to evaluate it?
Where has research in the CHI community succeeded or
failed in designing for social acceptability?

The concepts of technology acceptance and social acceptability are central in the long development of human-centric understanding of interactive technology. However, considering the variety of modern ICT, the early definitions and theories related to the social and societal aspects of technology acceptance seem outdated and narrow. We invite academics and practitioners to discuss how social acceptance and acceptability are understood nowadays. In this workshop at CHI 2018, we will discuss how to re-conceptualize the relevant concepts and outline new research agendas for this unsung topic.

*** Important dates ***
Submission deadline: Jan 27th, 2018
Notifications: Feb 22nd, 2018
Workshop date: 21st or 22nd of April, 2018

We invite submissions of (1) position papers: 2 pages in SIGCHI Extended Abstracts format to be presented as posters, or (2) full papers: 4 pages in SIGCHI Extended Abstracts format to be presented as oral presentation.

Possible contributions include, but are not limited to:

Experiences, case studies, and lessons learned from designing (not) socially acceptable interactive systems.

Methodological contributions: conceptualizations, evaluation measures, design considerations, etc.

Design/system contributions: interactive systems that provide socially (more) acceptable qualities, provocative designs or breaching experiments.

User Studies about social aspects of technology acceptance.

The workshop participants will be selected based on the submissions' relevance to the workshop topic and their potential to engender insightful discussion at the workshop. For more information and submitting your contributions, please visit: https://www.socialacceptabilityworkshop.uol.de/

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Session 1

Social Acceptability in-the-wild

Re-thinking the Social Acceptability of Decision Support Systems for Career Choice

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Abstract

Choosing a career is one of the most important decisions in life and many people face difficulties during the career choice process. A large number of decision-aid tools can be found online, providing the user with all different types of information. However, people might have to deal with individual problems these systems cannot address and therefore prefer personal one-to-one counseling [6]. This paper aims at identifying problems the user could be confronted with and discusses the question how the research community could improve online-based career decision aids in order to gain a higher social acceptability for those systems. We found *trust issues*, *human characteristics*, *indecisiveness* and *individual needs* to be the most important sources for problems and reflect on them with regard to other research areas in HCI. However, further research is necessary to find out how these problems are interconnected and which of the proposed ideas are really suitable to improve the social acceptability of online-based decision-aid tools.

Author Keywords

Social acceptability; Decision Support Systems, DSS, In-person counseling, Career choice, Career decision-making

ACM Classification Keywords

K.4.m [Computers and Society]: Miscellaneous

Introduction

Choosing a career is one of the most important decisions in life and for most people it is a complex process that goes along with several learning experiences. A common way of dealing with this problem is consulting a personal career counseling service. Professional advisers can respond to the questions of the clients individually and help them define criteria for their career choice. The major problem of this approach is the large effort of one-to-one counseling. This is one of the reasons why a large number of online decision support systems (DSS) for career choice have been developed over the last decade. These tools can reach a wider audience and range from information portals to online self-assessments and knowledge tests. However, most of the systems only deliver general information and cannot respond to the personal needs of an individual user. This could be a reason for people to decide for a personal appointment rather than exclusively using a technical solution. In order to design systems with an improved social acceptability, we should take a closer look at the difficulties in career-decision making and take into account the unique factors of personal counseling.

Difficulties in Career Decision Making

Many people are indecisive or have problems to choose the right career. Amir et al. state that "difficulties in career decision making are among the most prevalent vocational problems" [1]. In the literature, a number of theories regarding career indecision can be found and different types of career decision-making difficulties are discussed. Gati et al. provide a "Difficulties Taxnonomy" [5], defining three main problems that can occur during the career decision process: lack of readiness, e.g. missing motivation, indecisiveness, dysfunctional beliefs; lack of information (about the process, about self, about occupations); and inconsistent information, e.g. unreliable information or internal or external conflicts. Kelly et al. [12] conducted further research on this taxonomy and identified affective experiences during the decision-making process, such as choice anxiety, and disagreements and conflicts with others as main groups of career indecision next to information deficit and identity diffusion. Germeijs et. al. [7], who examine career indecision from the position of (normative) decision theory, identify three major groups for problems in career related decision-making: lack of information, valuation problems and uncertainty about the expected outcomes.

In general, we can roughly distinguish two categories of possible problems: (1) lack of information and (2) psychological difficulties, like for example motivational problems or anxiety. Our theory is that existing technical systems are well-designed to support the user in obtaining information, but we assume that they cannot keep up with personal counseling when it comes to individual problems. As a consequence, we think that if we do not re-think our way of designing those systems, online-tools will not be able to reach the same social acceptability as personal counseling.

Technical Solutions to Support Career Choice

Computer-assisted career guidance (CACG) systems have been implemented since the 1960s [10]. SIGI (PLUS) and DISCOVER were two of the first CACG systems that were widely used in universities and colleges in the US. A lot of research has been conducted on these early systems and evaluation is showing an overall positive effect on the career decision process [2, 17] and the attitude of students towards such programs [3, 9, 21].

Of course, technology has evolved a lot since the 1960s. Today, the internet can be used in various regards for career assessment and planning: It addresses self-assessment, but also informational purposes, for example for finding the right occupation [18]. Internet-based career planning systems have several advantages in comparison to traditional computer-based programs, like helping to "overcome geographical, psychological, physical, and financial obstacles" [11]. Using the internet in career planning also means that technical career choice solutions get more interactive and offer a better user experience, which enhances the overall attractiveness of such systems [19]. However, modern systems, mostly provided by private companies, have also received some criticism regarding ethical and professional concerns from the research community [2, 17]. Guidance provided by internet-based systems is "rarely supervised, controlled or monitored by a professional career counselor" [1]. The tools often "vary considerably in quality and level of sophistication" [17] and do not pay enough attention to individual differences. The result may be that people who are already facing personal problems regarding their career decision get even more discouraged.

To sum up, state-of-the-art systems still seem to have problems coping with psychological difficulties as mentioned in the previous section and therefore do not seem to be able to reach an equal social acceptability as in-person counseling.

Designing for Social Acceptability

In order to reach a high social acceptability for online-based DSS for career choice, we should concentrate on the factors why people might prefer in-person counseling to using a web-based solution. In the following, we will shortly discuss the reasons of which we think that they are worthy of consideration.

Trust issues

The users might have trust issues and would rather rely on the experience of a human professional than on a technical system. This is a well-known problem in HCI [4], which is addressed in various research fields. There has also been some work done in the area of decision support systems [16], but findings are very general and we have to find specific solutions for career counseling.

We think that in this case, trust could be improved by having a main brand (also a well-known university) behind a DSS, by having reports form peers who have undergone the same process, and by a high coincidence between personal judgements and recommendations at least in parts of the test. This of course needs to be investigated in detail.

Human characteristics

One major advantage of personal counseling is obviously the contact with a human professional who can sympathize with the client. Especially graduates, who have to deal with major life decisions, might want to talk to an experienced advisor, who can empathize with them.

It is probably not the right solution to try to mimic human personality, although this has been tried in commercial products. The path for success might rather be a system giving the impression to adapt to the individual situation of the user. This idea can be derived from the early experiences with the ELIZA system [20]. Having in mind our possibilities nowadays, we could think about creating the illusion of a system which shows that it has information about the user but clearly presents itself as objective and neutral, maybe even more than a human would do.

Indecisiveness

Because of the variety of provided systems, users might be overwhelmed by the large amount of information and therefore not be able to (1) chose a DSS that fits their needs and (2) finally make a career decision.

Similar to the trust issues, (1) could possibly be resolved by having a main brand and a clear advertising strategy. The purpose of a system should clearly be communicated to the users. To find a solution for (2), we should think about trying to design more (inter-)active systems, rather than only providing information passively. We think that research on DSS for career choice can highly benefit from the interactive and dynamic possibilities of modern web-based technologies.

Individual needs

There are a number of different theories on career decision making [14, 13]. All of them have in common that career choice is a complex progress, depending on multiple internal and external factors. This means that everyone facing a career decision has individual needs in counseling. Personal advisers are experienced to adapt to those needs. When designing technical solutions for career choice, we should have a closer look at current research in personalization and try to learn from different application areas like for example e-commerce [8] or learning [15]. We can probably improve traditional personalization methods by modern machine learning techniques and maybe by resorting to models of human behaviour like personality traits.

Discussion

In order to design user-oriented decision support systems for career choice, we should adapt approaches from research areas in HCI that are already dealing with the topics presented above. However, a lot of work needs to be done to find out how the named problems are interconnected and which of the proposed ideas are really suitable to improve online-based decision-aid tools. How can we develop trustworthy, personalized decision-aid tools that engage users in interacting with them? Is it possible to eliminate all concerns about the use of online-based systems so that they become a viable alternative to in-person counseling? Is it desirable that a technical system brings the same qualities as a human counselor such as empathy and experience or can we even take advantage of the neutral and objective characteristics of a technical system? Trying to answer these questions will take us one step further to increasing the social acceptability of technical solutions for career choice.

Conclusion

Making a career decision is a complex task, many people are struggling with. Currently, there are two ways of getting assistance for this problem: in-person counseling and online-based decision aid tools. While the latter are a cost-effective way of providing information to a large number of users, they cannot react to individual problems and therefore have not reached the same level of social acceptability as one-to-one counseling. In this paper, we identified *trust issues*, *human characteristics*, *indecisiveness* and *individual needs* as possible reasons for this and gave first ideas how we could improve design for social acceptability in the future. However, research in this area is still in its infancy and the mentioned factors need to be investigated in detail to draw precise conclusions.

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Perspectives to Social Acceptability Issues in Professional Social Matching Systems

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Abstract
Professional Social Matching (PSM) is an understudied area in human-computer interaction, referring to computer-supported networking, partnering, and grouping of people in professional contexts. We are working on a new type of PSM that aims to encourage new encounters in work life, particularly between seemingly different and yet complementary individuals. Utilizing big social data in designing matchmaking mechanisms allows the creation of extensive profiles of individuals, which helps computationally identifying suitable social matches across individuals and organizations. Although novel PSM services have the potential to revolutionize the way people find more suitable collaborators and business partners, they also come with major risks regarding social acceptance and ethics. This paper provides an overview of relevant acceptance challenges, as well as considerations for the service design and UI design of PSM systems.

Author Keywords
Social Acceptability, Professional Social Matching, Big Social Data, People Recommender Systems

ACM Classification Keywords
K.4.3 [Organizational Impacts]: Computer-supported collaborative work; H.5.3 [Group and Organization Interfaces]: Collaborative computing

Background and Motivation

For decades, supporting and encouraging collaboration between people has been an essential design goal in information and communication technology, particularly in the field of computer-supported cooperative work [3]. Recently, this has led to research and design of people recommender systems [9] and social matching [8] applications that unite users with relevant others. The majority of designed systems focus on dating application scenarios (e.g., Tinder) or opportune interactions with strangers (e.g., Happn), while only a few focuses on professional matchmaking (e.g., Shapr, Grip, and Brella).

Such systems utilize similarity-maximizing analytical approaches, following two social network evolution mechanisms. The first one, so-called homophily [5], relates to the tendency of meeting and collaborating with like-minded people [7]. The second refers to triadic closure hypothesis – new connections are most likely to form between actors already having strong bilateral ties (e.g., friends-of-friends). These mechanisms have been found detrimental in a professional context [7] decreasing innovativeness. According to Pentland et al. [6], the effects of fruitful collaboration tend to result from new enriching, complementary viewpoints of actors with diverse backgrounds, rather than similar.

We envision new computational solutions to PSM that can provide more informed (data-driven) and unexpected suggestions of collaborator candidates. For example, a system might provide the user with recommendations of people who share an interest or professional goal but who are from different disciplines or social circles or have complementary knowledge. We question the traditional mindset (i.e., homophily, triadic closure) of interpersonal interactions in professional life and explore how information technology could play a more meaningful role in such sensitive topic as professional interpersonal relationships. However, such non-traditional approaches bring risks of acceptance: gaining social insights from such systems will require more than just delivering efficient matchmaking mechanisms and usable interfaces. The following provides key perspectives and directions for making such systems also socially acceptable.

Perspectives to Acceptability Challenges

This section outlines acceptability challenges in relation to five key perspectives that are also illustrated in Figure 1.

(1) The *internal* perspective refers to the user's perceptions of the other people's acceptance of their behavior and choices. For example, an expected design challenge relates to the user's willingness to hand over some of their agency to a computational system in choosing with whom to collaborate. One might question if others find it acceptable that collaboration decisions are made based on a seemingly small-minded algorithm's recommendation.

(2) The *interpersonal* perspective relates to the dynamics and norms in interpersonal interaction and social encounters. It remains an open question how to trigger and facilitate encounters between seemingly different people in a way that does not feel awkward, privacy intrusive or untrustworthy for anyone involved in the situation. For example, it is crucial to get holistic overview situations in which two matched strangers would initiate conversation and understand how to support the follow-up interactions with ICT. Another vital concern relates to the context of interactions – whether it should take place face-to-face or mediated by chat applications or similar.

(3) The *organizational* perspective is about the acceptance of such technology within a company or other organization. For example, a company's interests might include prevent-

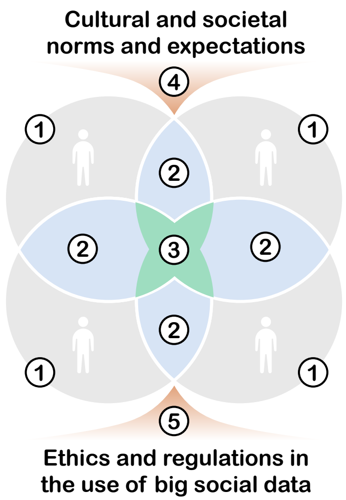

Figure 1: The diagram of five acceptance perspectives: 1 – Internal; 2 – Interpersonal; 3 – Organizational; 4 – Cultural; 5 – Ethics and regulations.

ing or controlling which of the individual workers can be matched with other people inside or outside the organization and for what purposes. Also, the information that is available about individuals' interests and skills can be business sensitive.

(4) The *cultural* perspective relates to implicit, unwritten societal and cultural norms and expectations. For example, how can a society welcome the idea that algorithms would increasingly meddle with the social fabric and networks of people, especially given the recent debate on how much the algorithms of the Internet giants affect users' information ecologies and media landscapes. This demands an understanding of how such systems can avoid creating confrontations between overly dissimilar people, particularly in unstable societies.

(5) The *ethics and regulations* perspective relate to written rules, such as law and ethical regulations, particularly about the use of big social data for PSM. At one end of the spectrum, social supercollider, "a facility that combines multiple streams of data, creating richer and more realistic portraits of individual behavior and identity, while retaining the benefits of massive scale," [11] would enable the implementation of robust social matching services. At the same time, from ethics viewpoint, building a collection of such social data is unthinkable, as governance and regulations on gathering and using it continue to be developed.

Design Considerations

Here we present some key considerations for the design in the envisioned novel PSM systems.

User Interface and Information Visualization
The ability of a system to effectively present recommendations is dependent on the user interface solutions and interaction techniques. In comparison with existing services, new types of PSM systems aim not only to trigger interpersonal interaction but also facilitate the follow-up activities needed to turn recommendations into action. Therefore, the next generation of PSM should move beyond traditional list-based approach while presenting potential collaborators. It has been found that the ability of the system to justify the recommended results create the perception of transparency and efficiency [4, 10]. These could be achieved through comprehensive information visualizations regarding both the similarities and complementary qualities between two individuals. In this regard, we are in line with Terveen and McDonald [8] who argued that "Social networks are useful tools for social matching." For instance, it might be substantial to bring potential weak ties [1, 2] to the front rather than the people that one already knows. Furthermore, it would be useful to visually indicate the inferred relevance level of a match or communicate the expected contexts in which particular matches are considered valuable.

Perceived Relevance of Recommendations
Perceived relevance refers to the degree of how recommendations in a matching system meet expectations of the user regarding internal drivers for collaboration and contextual factors. This affects the user's attitude towards intervention of technology to the process of social matching. While in dating applications like Tinder users are driven by a relatively clear need to find a romantic company, professional matching is characterized by diverse needs of partnering, collaboration, and networking. For instance, mentorship for vocational growth, knowledge and idea sharing, community building, and co-producing new information that could serve both individuals and organizations. These objectives lead to diverse requirements for identifying potential collaborators. Therefore, PSM is characterized by several dimensions of relevant matches. We propose the following criteria and viewpoints to consider the relevance of a recommendation:

(i) *similarity* in terms of goals and intentions (e.g., business goals, research aims); (ii) *complementarity* in terms of skills, knowledge, and social capital; (iii) *compatibility* in terms of group cohesion and interpersonal "chemistry"; (iv) *approachability/logistics* – how a person or organization is accessible for interaction in terms of physical proximity as well as social and organizational distance.

Persuasiveness for Behavioral Effects

Recommender systems often face challenges in converting the recommendations to user behavior. Notably, in the context of big social data based PSM systems, the decision-making about whether to interact with a match or not should be facilitated because the opportunities for one user can rapidly become numerous. Supporting the selection of the best match at different times as well as motivating the user to follow-up interactions are essential design targets to allow social acceptance of a system. A data-driven approach to the design of people recommender systems could, for example, result in intelligent assistance for a user with making a connection between the represented content and their own needs, interests, or background. A system might help with hints regarding inferences of how a given recommendation would be relevant to the target user thus supporting decision making. At the same time, this content can provide the users with tickets to talk to initiate discussion. Additionally, after a recommendation has been given, notifications about the recommended person's recent activities, career changes, and updates on topics of interests might help the target user proactively encourage following up on the new connection.

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Session 2

Socially (un)acceptable Applications and Interfaces

Talk-To-Me: Designing Speech Input for Public Spaces

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Abstract

The challenges of deploying interactive technology in public spaces are well known by academia and industry. Even though much effort has been put in designing public interactions that rely on gestures, typing and tangible buttons, speech recognition is not often the choice. This may not be a surprise, considering how uncomfortable passersby might feel to be seen talking to a machine, and the frustration felt when their input is not correctly recognized. Despite this resistance, speech input can be highly desirable as a way to collect open-ended answers. Therefore, a physical prototype was designed to investigate how speech recognition could be used to foster indirect communication between people in the same public space. However, during pilot studies, concerns about social acceptability raised interesting points for further discussions.

Author Keywords

Public devices; speech recognition; technology acceptance; in-the-wild studies.

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Figure 1: Talk-To-Me physical prototype: telephone and tablet

Introduction

Ideally, speech is a natural and straightforward way of providing input to computers. Such hands-free control does not require previous practice, and in principle, can be faster and more expressive than typing. It is also a safer modality when users need to use their hands to perform other tasks, like driving [2] or surgeries [7].

Even though it has advantages, speech recognition is not simple, as it has to deal with ambiguities, semantics, the variability of speakers, pronunciation and intonation [8]. In addition, voice recording in public spaces can be tricky, because the presence of an audience can discourage passersby to interact for fear of being judged [9]. Also, different contexts lead to different norms of what is socially acceptable [1]. Therefore, adequate design decisions need to be considered before choosing when and where to use speech recognition.

Given such challenges, a prototype was created to investigate what might be required for speech to be accepted in public spaces. When the input modality is made of spoken words, it is expected that users will be more self-conscious than when they discreetly type their answers. Also, their motivation to interact might be related to what they can gain with it. This paper describes and discusses some of the insights we got from pilot studies.

Related Work

Back in 2004, it was argued that speech input in public spaces was uncommon because this feature was not present in home computers and users could potentially develop unrealistic expectations of the capabilities of the device[4]. However, speech input has seen an increased acceptability of voice-control on mobile phones and home assistants in the last years [5].

When it comes to speech input for public spaces, the OK-net was one of the first instances. It was a public kiosk that allowed speech input for a more natural way to perform queries [11]. However, these queries had to be performed using a quite limited set of commands which the machine was programmed to recognize, constraining its utility. Furthermore, whenever the commands were not recognized, the interaction took more time than typing, contradicting the expectations of a more natural and straightforward input.

Additionally, conveying the speech modality can be tricky in public. In another study with intelligent kiosks, passersby felt apprehensive of touching the display, and they did not understand they were supposed to speak with it [6]. The lack of physical affordances such as a close-talk headset probably did not help with conveying that speech was the input modality. The microphone also picked up background noise, which made it difficult for the voice to be accurately recorded.

A more recent development was VoiceYourView, designed for recording and displaying open feedbacks about a public library [12]. A telephone was used as a microphone, and technology at that moment already allowed real-time transcription of the voice input, which opened space for more elaborated replies rather than just commands. This turned out to be a quite successful idea, especially because library visitors were keen to leave their opinions. However, its acceptability was questioned by the users, who still felt uneasy to speak to a machine. Interviewees said they were not comfortable with being observed by others, some elderly felt intimidated by the technology, whilst some adults thought the device looked like a toy.

Figure 2: Talk-To-Me interface for recording answers

Prototype

Building on previous work, a physical prototype was designed: Talk-To-Me. Its purpose was to allow a group of people at the same public space to ask and answer questions that they created themselves, as a way to get them to know each other through time. The idea was that those who created a question would feel curious to see what others had answered afterwards, and it would also be an entertaining gadget to have at an office space or event, for example.

A bright orange telephone was used as a microphone to record the answers, and it was attached to a tablet (see Figure 1). The tablet was running a web app that used the Chrome Speech API to transcribe the recorded answers in real-time and the text was displayed on the screen of the tablet (see Figure 2). As users reply to questions, their answers are stored and displayed on the tablet, so that other users can see what people have said so far. Given its goal to be placed in public spaces, the physical design and the choice for a striking telephone was meant to be attractive and to easily convey interactiveness.

Pilot studies

An initial set of eight questions was created by the research team, targeted at the other researchers in the building. They were short questions (between 39 and 74 characters) about their plans for the holidays, their research interests and opinions about the office space. Usability tests were then conducted in the lab: five think-aloud studies were followed by short semi-structured interviews.

Some acceptability concerns already started to appear. One participant said: *"I think it is recording even when I am not answering, it feels weird"*. Another one believed that their voice was being recorded and could be later on be used against them. This indicated a latent issue with privacy and the fear of the device being used for other purposes not disclosed. In addition, there were times when the speech recognition was not working properly, which left participants feeling quite frustrated. This was pointed out as a big drawback: *"The algorithm that detects speech does not work well, I think I would give up really quickly because of that"*.

Furthermore, there were issues with finding a good context for deployment. At first, the prototype was placed at two office spaces for an hour each (kitchen and entrance hall). The same set of questions of the usability tests was used. Even though people noticed the device, they were not approaching it. Short interviews showed that they did not want to be overheard by their colleagues. They also did not want to be seen performing an action that contradicts their expected role at work. When placed for an hour at a coffee shop at the university, with questions about the holiday season, no one was seen approaching the device as well.

In another pilot, the device was placed in a small event for urban planners. The research team pre-loaded three short questions, about the theme of the talk and people's expectations. During one hour, four users were observed interacting with the prototype and they recorded answers and questions spontaneously. All of them answered the first question which was "What do you expect to get from the event?". They said *"networking"*, *"learn more about the topic"*, *"meet people in health and city space"* and *"Seymour diamond design"* (probably a recognition error). Two of them created new questions, which were: "What effects does your city have on your mental health?" and "What is your background and training?".

Whenever a user answered a question, the system displayed it immediately, next to the other answers, but there was no information about how the recorded data was going to be used. During the semi-structured interviews, one participant explained that it was normal to use speech to give commands to the phone and to a home assistant device. However, the experience of doing that in public was slightly less comfortable for this user, especially when the room is quiet and people are overhearing everything.

Discussions

The current trend of voice-control on mobile phones and home assistants is probably changing the perception people have about speech input interfaces. However, applying this modality to public spaces might not be straightforward. The findings presented here are preliminary but they already point to some potential sources of unacceptability.

First, it could be that the purpose of the device was not appealing enough to make people stop their current activities and fully engage with it. A project like VoiceYourView was successful in getting users to submit feedback about a space they frequently go [12]. Further tests are required to understand to what extent the purpose of the installation can hinder engagement. Could it be that people are not interested in answering and asking questions between each other?

When the device was deployed in a space where people knew each other, users were concerned about being overheard and judged. At the coffee shop, people avoided approaching it. On the other hand, in an event full of strangers, they were more open to it. They also easily captured the purpose of the prototype, as they created questions that were relevant to the other attendees. Whilst the role of context has been studied for public installations [1], how to predict which contexts will be more conducive for people to speak up?

When it comes to the technical issues, they can lead to a significant drop in engagement. In a home environment, users might need to repeat a command several times, but if they really want to get the machine to perform an action, they will do it anyway [5]. However, in a public installation, passersby might not be bothered to speak multiple times, especially if they are busy with their own activities [3]. How can we keep users engaged even during the occasional system faults?

Moreover, the prototype functioned like a *recording machine*, as it did not speak back to the user. It could be that making the interaction more similar to a dialogue would have increased its acceptability. The interaction with voice-controlled home assistants resembles more a conversation [5] as well as in some virtual guides [10]. Could it be that conversational style leads to a more natural interaction? Would that help to decrease the feeling of being *spied*?

Some considerations to help mitigating acceptance issues include adding a more playful task to spark the users' interest. Allowing multiple people to play at the same time could make the situation appear less frightening. In occasions such as informal gatherings, events, group meetings, a more playful behaviour is allowed and expected, which can make users feel more at ease.

Finally, even though speech might not be as discreet as other modalities, it should not be simply avoided. The cases presented indicate that people might feel embarrassed and concerned with speaking in front of others. However, through the discussions of these questions, and future iterations on the prototype, we can better understand where, when and how speech input should be used.

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The Future Role of Visual Feedback for Unobtrusive E-Textile Interfaces

Figure 1: We discuss how the promising research field of smart E-Textiles and emerging visual mobile displays can work together to achieve powerful and unobtrusive E-Textile controls.

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Abstract

Emerging mobile interfaces are characterized by an increasing need for socially acceptable interaction supporting unobtrusive input. Simultaneously, they require rich visual feedback for many dynamic and complex mobile tasks. With this paper, we want to identify and discuss design options and parameters for body-centric and personal mobile interaction techniques that aim to be well-suited for both: social acceptability and rich functionality. Wearable E-Textiles are a promising research field for unobtrusive mobile computing since they allow novel, subtle and personal input controls. Therefore, we investigate, how they can be combined with high-quality Augmented Reality (AR) glasses to seamlessly provide visually augmented controls. For this, we question the role of visual feedback for unobtrusive mobile interfaces by classifying and discussing task- and context-depending visual feedback along the dimensions of the feedback type, position, time and visibility. Based on the sweet spots that we identified in our design classification, we conclude with two augmented E-Textile prototypes for future discussions.

Author Keywords

mobile interaction; wearable; social acceptability; AR glasses; E-Textile; augmented controls; smart fabric

ACM Classification Keywords

H.5.2 [Information interfaces and presentation]: User Interfaces: Input Devices and Strategies, Interaction Styles;

Introduction

The success of mobile computing interfaces depends decisively on the personal added value, user experience and social acceptability that future wearable system will provide. While the fast-paced technological progress and ongoing miniaturization of wearable devices develop rapidly, the need to rethink the social acceptability and the functional scope of such emerging wearable technologies is an increasingly important issue (cf. [7]). Even though promising approaches have been proposed, such as garment-integrated E-Textiles interfaces and high-quality AR glasses, the everyday usage and social compatibility, however, remain challenging. E-Textile controls often lack direct visual feedback and are thereby mostly used for simple control tasks in an eyes-free manner. While AR glasses provide promising visual capabilities, they are in many cases disturbing in social context. For instance, hand gestures floating in mid-air or voice input make it often physically demanding and weird-looking to select or adjust values in AR.

With this work, we want to discuss the future role of visual feedback for unobtrusive E-Textile interfaces by combining the promising subtle characteristics of body-worn E-Textiles input with rich visual enhancements to support more dynamic garment-integrated interfaces and thereby improve social acceptability. Therefore, we want to utilize the visual capabilities of emerging AR glasses, such as the Microsoft HoloLens[1], to seamlessly enhance interactive fabrics with task-specific visual overlays that allow to control widgets in a more socially acceptable, dynamic and personal way.

Related Work

There has been much progress in the cutting-edge research field of body-worn wearable technologies and emerging E-Textiles interfaces (see [9] for a critical review). In the following, we want to briefly summarize current research with special regard to the input and output capabilities of current E-Textile approaches.

E-Textile Sensors: Researchers investigate E-Textile sensors concerning their *degrees of freedom* (e.g., pressure, location, and direction), different *form factors & types* (e.g., zipper, interface-like widgets, cords or accessories)[2], technology *acceptance* [1] and *body locations* [11] aiming to provide unobtrusive and rich mobile controls. However, these input approaches are promising, most of them lack direct visual feedback and are thereby mostly used for basic mobile tasks with predefined interaction mappings or for fast micro-interactions in an eyes-free manner.

Direct Visual Feedback for E-Textiles: While there is an enormous amount of work regarding E-Textile sensors for novel wearable input, there has been only little research on how E-Textiles can be visually enhanced for direct interaction interfaces. Choi et el. [2] introduced highly flexible clothing-shaped wearable displays by using fabric-based organic light-emitting devices, while Hashimoto et al. [5] utilize diffusive optical fiber to directly display strip-type illumination on a fibre fabric. In addition, de Vos et al. use a dispenser printer [4] and screen-printing methods [3] to apply electroluminescent displays on textiles for smart fabric applications, such as a completely printed watch display.

Visual Feedback – Design Criteria

Since the aim of our work is to investigate visual feedback to improve E-Textile controls and its social acceptance, we question the role of visual feedback for unobtrusive interfaces and classify visual feedback along the dimensions of *type*, *position*, *time*, and *visibility* (see Figure 2, A-D).

[1] Microsoft HoloLens. See https://www.microsoft.com/hololens

[2] Example sensor designs can be found, for instance, at the Kobakant wearable technology documentation: http://www.kobakant.at/DIY/

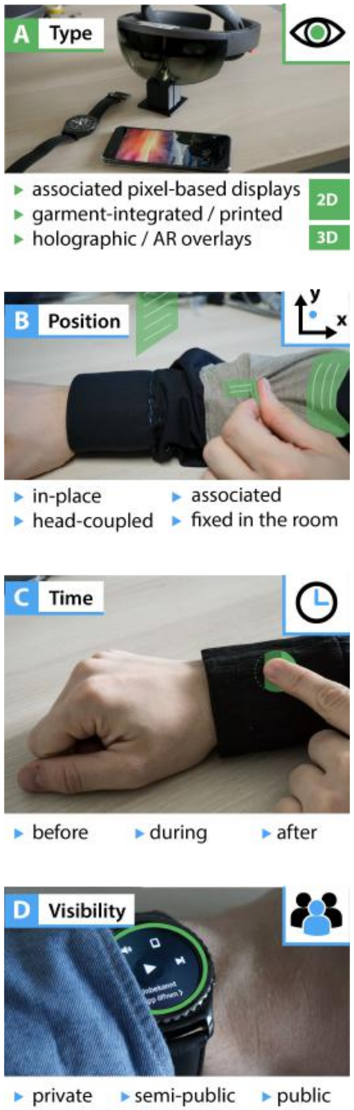

Figure 2: Possible visual feedback dimensions to enhance and design novel and rich E-Textile interfaces with regard to social acceptability.

◀ ***How can we provide visual feedback?*** *(A, Type)*
Associated pixel displays, such as smartwatches, can be used to visually support E-Textiles like smart sleeves. However, *garment-integrated* [2] or *printed displays* [4, 3] provide lower resolutions, they can enable dynamic visual feedback at same position of the E-Textile sensor. In addition, emerging AR glasses provide new opportunities to ubiquitously display AR overlays to visually enhance E-Textiles.

◀ ***Where can we place visual feedback?*** *(B, Position)*
In-place feedback combines the input and output modalities at same physical position enabling direct interaction. *Associated* visualizations are more loosely coupled and can be shown beside or above an E-Textile input or body part. *Head-coupled* feedback allows to view information fixed to the users perspective, while visualizations that are *fixed in the room* are suitable for interactions that will take a while.

◀ ***When can we provide visual feedback?*** *(C, Time)*
Depending on the current context or interaction tasks, the provision of visual feedback can be needed at different times. Feedback that is shown *before* an action is executed (cf. feedforward [10]), could be useful to communicate instructional or ambient notifications, while feedback that is provided *during* the interaction could help to visualize sensor states. Feedback that is provided *after* an interaction could help to show results, for instance of an mobile query.

◀ ***Who can see the visual feedback?*** *(D, Visibility)*
While it is obvious that a user should see the visual feedback, an interesting question with regard to social acceptability could be visibility of the output for others. Therefore, we distinguish *private* visual feedback that is only be visible for the user (e.g., by using personal AR glasses), *semi-public* feedback that can be potentially seen by others (e.g., smartwatches [8]) and *public* feedback that shows the hole visualization for everyone (e.g., LEDs in clothes).

First Example Designs & Initial Prototypes

In the following, we will choose promising design options out of our classification to investigate new approaches for unobtrusive E-Textile interfaces aiming to allow rich direct interaction with a decreased level of social obtrusion. We first focus on the following design parameters:

For our prototypes, we will use the Microsoft HoloLens as a state-of-the-art representative of emerging AR glasses. However, the current form factor and weight impact on acceptability issues, we assume that future generations of AR glasses look like normal glasses and are thereby more acceptable and unobtrusive.

Smart Cuff. We started to investigate our envisioned visually augmented E-Textile approach by first building a smart cuff E-Textile prototype that provides five pressure-sensitive interaction zones and can be combined with visually AR overlays to enhance the functional scope (e.g., dynamic controls and menus). To realize the prototype, we use piezoresistive Velostat (Figure 3, A), conductive fabrics (B) and threads (C) to integrate the sensor in the shirt cuff. With this sensor combination, we aim to start the discussion of the future role of visual feedback for unobtrusive E-Textile controls. Therefore, we decided to use *AR overlays* that are directly placed at the E-Textiles sensor supporting the interaction (D) *during* the adjustment of mobile tasks.

Smart Cords. In addition, we iteratively develop a series of *smart cords* (Figure 4, A-D) and introduce a wearable system in which a user can easily grab a garment-integrated cord, pull it away from the body and thereby open a cord-

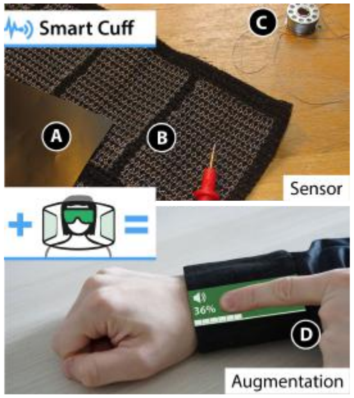

Figure 3: Our second **Smart Cuff** prototype is made of pressure-sensitive velostat **(A)** that is woven in a cuff with conductive fabric **(B)** and thread **(C)**. Our prototype **(D)** recognizes position & pressure input and provides visual feedback.

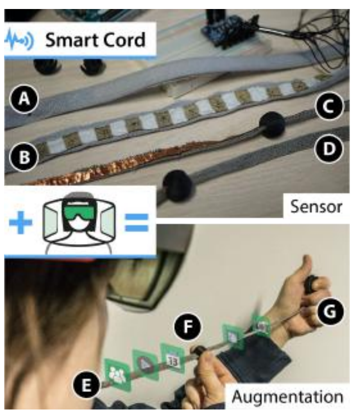

Figure 4: We iteratively develop a series of **Smart AR-Cords (A-D)** providing a cord-based visual interface **(E)** with a moveable slider ring **(F)** and an additional tactile confirmation button **(G)** [6].

attached visual interface for mobile services (E) [6]. The cord can be controlled by two modes of interaction. First, we aim to enhance body-worn coat cord with touch sensing capabilities to lay the basis for our visually augmented cord controls. As a second input modality, we also envision the use of a cord toggle acting as a moveable value slider (F). Further, we propose the use of an additional tactile button at the end of the cord (G) enabling explicit confirmations. With this combination, our visually augmented cord control can be used, for instance, to support precise single value and range selections for adjusting parameters, menu navigation for choosing options or switching states and selections of virtual or real objects in mixed-reality environments.

Discussion and Future Work

We investigate how the promising research fields of smart E-Textiles and high-quality Augmented Reality (AR) glasses can be combined to provide unobtrusive interactions and haptic and visual feedback for fundamental mobile control tasks. By classifying visual feedback for augmented E-Textile controls along the dimensions of feedback type, position, time, and visibility, we proposed a conceptual basis for designing unobtrusive E-Textile interfaces.

While we think that the success of rich and unobtrusive wearable controls is influenced by these design parameters, we started our exploration by choosing a set of promising options out of our classification and built two early prototypes that illustrate our principle ideas. Since we have to finish our implementation of AR overlays to evaluate our approach, we have no evidence for that our proposed techniques improve social acceptance at the current stage of our work. While we assume that our classification could be a valuable starting point for discussing important design criteria, however, additional studies are necessary to examine each design option and thereby gain a better understanding of possible social acceptability issues in relation to these dimensions. We are confident that our approach already now raise interesting issues that have to be discussed in the HCI community.

For future work, we plan to extend and refine our visually augmented E-Textile controls and conduct a user study comparing the usability and social acceptability. Therefore, we want to focus on the comparison between our novel approaches and current interactive solutions, such as mid-air gestures or E-Textile input without direct visual feedback.

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Wearables Should Transcend Cultural Norms and Practices

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Figure 1: Custom designed PCB approximating the form of a false fingernail.

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Abstract
Designing socially acceptable technology is especially important in the case of wearables, where devices are personal, yet often visible to the public in terms of form-factor and interaction modality. While taking inspiration from existing cultural norms and practices can lower the barrier for adoption, and increase the social acceptability of new wearable devices, these devices should transcend those very norms by offering new affordances and abilities outside of existing social practices. We argue that wearables provide an opportunity to rethink and design a new landscape of social norms. In particular, we focus on Cosmetic Computing devices that fuse existing cosmetic practices with new materials and fabrication techniques to expand the landscape of wearable devices.

Author Keywords
Wearables; cosmetic computing; social acceptance; ambient displays.

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

Introduction and Motivation
Over the past few years, wearable technologies have seen massive growth, adoption, and platform diversification;

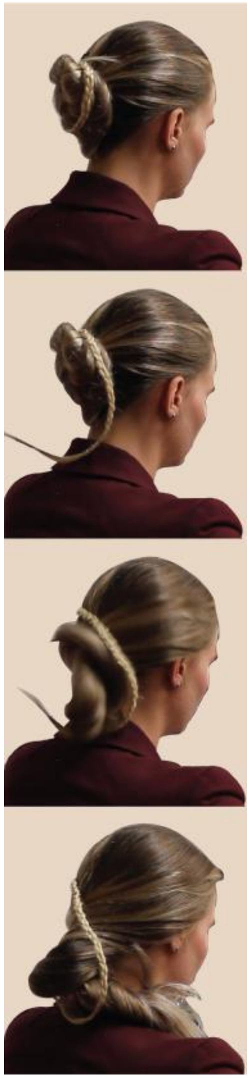

Figure 2: HäirIÖ shape changing capabilities.

however, many of these devices, most famously Google Glass, have been deemed socially inappropriate and are rarely seen outside of Silicon Valley and other technological hubs. Designers can counteract this by designing for social acceptability, rather than for usability. While important in all forms of technology, social acceptability is especially important in the case of wearable technology, where devices are personal, yet often visible to the public in terms of form-factor and interaction modality.

One way to design for social acceptability is to take inspiration from existing cultural norms and practices. This applies to form factors, as well as interaction modalities. For instance, a wearable device in the form of a scarf is socially acceptable because scarves are socially acceptable. Additionally, interacting by tapping your fingers or twirling your hair is natural, embodied, and inherently socially acceptable. While taking inspiration from existing cultural norms and practices can lower the barrier for adoption and increase the social acceptability of new wearable devices, these devices should transcend those very norms by offering new affordances and abilities outside of existing social practices. In some instances, new capabilities can influence user perception of the very cosmetic form factor that the device is emulating. We base our argument around the design and creation of exemplar Cosmetic Computing prototypes.

Cosmetic Computing

Cosmetic Computing is a vociferous expression of radical individuality and an opportunity for deviance from binary gender norms. It is a catalyst towards an open, playful and creative expression of individuality through wearable technologies. It's a liberation call across gender, race, and body types. Leveraging the term "cosmetics", originally meaning "technique of dress", we envision how intentionally designed new-wearables, specifically those that integrate with fashionable materials and overlays applied directly atop the skin or body, can (and should) empower individuals towards novel explorations of body and self expression. Unlike many modern traditional cosmetics that are culturally laden with prescriptive social norms of required usage that are restrictive, sexually binary, and oppressive [10], we desire a new attitude and creative engagement with wearable technologies that can empower individuals with a more personal, playful, performative, and meaningful "technique of dress" — *Cosmetic Computing*.

Beauty Technology & Hybrid Body Craft

Cosmetic Computing is related to the work of Vega and Fuks on Beauty Technology [9] that merges technology with beauty products, as well as the work of Kao on Hybrid Body Craft [4] that incorporates technology with existing practices of decorating, ornamenting, and modifying the body. These emerging areas utilize already culturally accepted practices, such as makeup [9, 7], temporary tattoos [8, 6], and artificial fingernails [9, 5] as sites for technology.

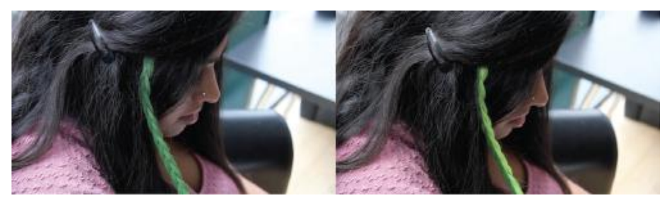

Figure 3: HäirIÖ color changing capabilities.

Exemplar Prototypes

AlterNail (False Fingernails). AlterNails are small interactive devices that attach to fingernails with

Figure 4: AlterWear shoe prototype.

Figure 5: AlterWear hat prototype.

commonly available acrylic nail glue (Figure 1). Each AlterNail has a small e-ink display that is always available and easily glanceable. As objects are touched and handled, the AlterNail is powered wirelessly via inductive coupling. The AlterNail performs simple sensing and computation based on the application, updating the e-ink display as appropriate. AlterNails assume the culturally prevalent form factor of false fingernails; they are similar in size and application to the cosmetic extension. Additionally, AlterNails enable embodied interactions with everyday objects through physical touch, while augmenting the user with new interaction capabilities. Published in CHI'17 [1].

HäirIÖ (Hair Extensions). HäirIÖ consists of electronic hair extensions that augment hair with touch input and visual output. HäirIÖ uses thermochromic pigments and SMA to output visible change in color and shape, reflecting and enhancing the natural and cultural malleability of hair (Figures 2 & 3). Additionally, HäirIÖ uses Swept Frequency Capacitive Sensing to interpret how users interact with the extension, affording natural and embodied interaction in the form of touching, stroking, twirling, and styling hair. Published in TEI'18 [3].

AlterWear (Dynamic Clothing and Accessories). AlterWear combines NFC and e-ink technologies to enable battery-free, dynamic wearable displays. These displays can be incorporated into a number of different form factors, and fuse interaction, information, and fashion while remaining lightweight and low maintenance. While AlterWear can take many forms, we chose to closely approximate existing clothing and accessories to support adoption and social acceptability (Figures 4 & 5). While not inherently cosmetic in nature, we believe that AlterWear can inspire and inform the creation of *Cosmetic Computing* form factors [1]. Forthcoming in CHI'18 [2].

Initial Reactions from Users

Perhaps the most telling is our interactions with users throughout various user studies of our exemplar prototypes. Participants in our study of fingernail technology universally appreciated the natural interaction modalities supported by the device. Additionally, several participants viewed the device as "extension of self", rather than a discrete wearable.

> I wouldn't have to worry about [AlterNail] everyday: having to charge it, or having to remember to put it on. Especially for me, with my [prosthetic] leg, it's like all these pieces kind of have to come together everyday, so one less thing to worry about would be nice.

Participants in our study of HäirIÖ were particularly impressed with the natural appearance and interaction modalities of the wearable.

> It seems like [HäirIÖ] is a part of you.

Another participant immediately began twirling and stroking the hair, saying:

> [HäirIÖ] doesn't feel unnatural. My body is just immediately accepting of it, like, "yes, I'd like to play with it now." My body definitely keyed into it naturally: "Oh, hair."

Participants from our study of AlterWear appreciated that the technology was seamlessly integrated in a familiar form factor.

> It's not something I would have to wear on top of something else, like you have to wear your shoes.

Overall, our participants from various user studies have been remarkably receptive to new wearable devices in cosmetic form factors.

Conclusion

Designers developing for social acceptability should leverage existing cultural practices, yet provide functionalities and affordances that transcend those very norms. For wearables in particular, familiar form factors and natural interactions that foreground the physical affordances of the body can lower the barrier for adoption, and increase the social acceptability of new wearable devices.

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Social Acceptability and Respectful Smart Assistants

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Abstract

Underneath the friendly facade, do you feel like there is something sinister going on with Siri? This paper highlights some of the problems with modern smart assistants, particularly in the way that they construct a relationship with their users which is manifestly different to the technical and legal realities. The notion of *respect* is offered as a means of conceptualising the types of interactions we might want with such devices in the future and identifying flaws in the current iteration of smart assistants.

Author Keywords

Respectful Behaviour; Social Acceptability; Smart Assistants; Dissonant Relationships

ACM Classification Keywords

H.5.m [Information interfaces and presentation]: Misc

Introduction

Many have described the constant surveillance which arises as a natural consequence of the Internet of Things (IoT) to be disconcerting. The leaking or exfiltrating of data by applications makes people feel vulnerable. In each individual case there are often ways to identify and correct the specific offending features that users find socially unacceptable, but is there an overarching theme? I believe that there is, and that this theme can be summarised as a lack of *respect*.

Enter the Smart Assistant

Existing in their modern guise since 2011, smart assistants have unfortunately come to embody both of the undesirable points above. Products such as Google Home and Amazon Echo collect data from around the home, and send unknown telemetry back to their creators. Devices are anthropomorphised (e.g. by giving them names), and considerable effort has gone into making the relationship that users have with their assistants feel friendly and informal.

But the *legal* relationship that users have with device makers is very different, and when this dissonance between perceived and actual relationships is brought to the fore its social unacceptability becomes apparent. Using the Alexa platform as an example, Amazon was issued a warrant in 2016 for audio recordings collected by an Echo unit in relation to a police investigation (which were subsequently released to law enforcement)[1]. The event prompted concern as users began to realise that their assistants were not quite as they had been led to believe.

These issues have arisen due to the fact that voice interfaces allow for interactions with smart devices which approach natural conversation in a way not possible before. For evidence of this, see the pop-culture references included with many current smart assistants in an attempt to simulate conversation between friends.

Smart assistants *could* be restored to a socially acceptable state by making their interfaces reflect the agreement with the device manufacturer (but this is unlikely). More plausibly, device behaviour could be changed to be more in line with the projected facade.

[1] While the recordings were turned over with the permission of the device owner, Amazon did not need that permission in order to disclose the recordings to law enforcement.

Possible Examples of Respectful Behaviour

Voice activated devices could offer the use of local processing models as well as those based in the cloud

Sensors might only record enough information to carry out their task (such as voice data garbled enough that one can only distinguish between speakers, and not discern what is being said).

Energy monitors could, instead of reporting real time statistics that can identify individual household events (such as use of a washing machine), send back usage quantised to each tariff.

Respectful Behaviour

When we conceptualise respect, we think about adhering to boundaries (including laws and regulations), but we also think about acknowledging traits in another which *demand* respect (including rights) and caring for others (supporting their long term goals) [1].

But how might a *machine* embody, or at least emulate, respect? Being transparent is an obvious starting point, but respectful behaviour could also be extended to include adherence to personal boundaries within the home or to the tailoring of functionality to user preferences; instead of issuing an ultimatum with respect to privacy (or rather, lack of), a device could offer to turn off specific functionality which required sending data outside of the home (see sidebar).

Conclusion

Modern smart devices marketed for the home are often perceived as creepy or unsettling, with a disconnect between the legal and technical relationships users have with their devices, and the relationship they believe they have. The notion of respect offers a way of conceptualising both the behaviour we might desire smart devices to possess, as well as highlighting the deficiencies in the products available today.

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Session 3

Methods, Models and Theories

My Device, My Self: Wearables as a Specific Case of the Social Acceptability of Technology

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CHI'18 Workshop on (Un)Acceptable!?!—Re-thinking the Social Acceptability of Emerging Technologies, April 21, 2018, Montreal, QC, Canada.

Abstract
As technology proliferates and morphs, it is increasingly difficult to talk about its social acceptability in a *general* sense. Because human computer interaction is such a broad field, and because the underlying fields of study are very different for varying forms of technology, carving off particular topic areas is necessary. This paper discusses a specific case of technology social acceptance: wearables. The WEAR Scale measure was developed to assess the social acceptability of any given wearable device or prototype. WEAR Scale research showed that a wearable is a form of technology for which aspirational desires and avoidance of social fears play key roles in whether a device is found to be socially acceptable or not. For other forms of technology, very different factors drive social acceptance. Therefore, the research agenda for the social acceptability of technology should use a "divide and conquer" approach rather than attempt to form generalizations about the social acceptance of all technologies.

Author Keywords
Wearable; WEAR Scale; social acceptability; technology acceptance; user research; culture.

Defining the Terms

For the purposes of the WEAR Scale, a **wearable** was defined as a computer or electronic device that is personal, personally-owned, and worn on the body (on skin or clothing) but excluding wearables that are not visible (e.g., inside or under clothing).

To define **social acceptability**, we first need to understand that it is connected to human actions. Putting something on one's body, including a technological device, is an action that falls somewhere on a continuum of social acceptability. A person will use existing knowledge and gather information about current surroundings to make decisions about the social acceptability of their actions. Observers' reactions then serve as feedback (positive or negative) on the social acceptability of a person's actions, such as wearing a certain device [11].

ACM Classification Keywords

H.1.2. Human/machine Systems: human factors; J.4. Social and behavioral sciences: Sociology; K.8.m Personal Computing: Miscellaneous.

The Big, Wide World of Technology

For researchers, keeping up with the evolution of technology is a challenge, and the crucial topic of social acceptability is no exception. Some of the more well-known models that have been in use for decades, like the Technology Acceptance Model [2,3] or Unified Theory of Acceptance and Use of Technology [19], were conceived for information technology in an MIS (management information system) context. But now that computers and information technology saturate our lives in a wide variety of forms and functionalities, how can researchers competently address the topic of social acceptability?

One path forward for researchers is to hone in on particular areas of interest for close examination. This is what I did for my dissertation work, in which I chose to purse the main research question: what are the factors affecting the social acceptability of *wearable* technologies? After some initial exploration, I decided the best way to address this question was through scale development, using the methods outlined in DeVellis's *Scale Development* [6].

An important first step in scale development is to define the construct that is being measured (see sidebar). In this case, I decided that for the construct and measure to make sense, the scale's definition of "wearables" needed to be restricted to devices that are worn in public and viewed by others. While this excludes some devices that are typically called "wearables," this was necessary for the measure to work. HCI researchers exploring the realm of social acceptability should similarly set parameters on their topic as it makes sense. Many advances in science are a result of specialization. Human computer interaction is a broad field, and as researchers we sometimes try to cut too broad a swath.

Further below I examine some of the factors and research that make wearables a unique case of technology acceptance. But first, some background on the development of the WEAR (Wearable Acceptability Range) Scale is presented.

Building the WEAR Scale

Developing a scale to measure a latent construct—like social acceptability of a wearable—requires going through a process [6]. The first step was to determine exactly what was being measured by reviewing the literature and also conducting an interview study. Next, 97 possible scale items were written based on the literature and interview data. For example, an interview finding was that a socially acceptable device is useful and easy to use, which then became a scale item.

For the scale format I decided upon a 6-point Likert scale that ranged from Strongly Agree to Strongly Disagree. Next, three experts reviewed the scale items and provided feedback, which resulted in a revised scale of 50 items. A sample of people then responded to these items, as well as to related items for conducting validity testing. Participants responded to the items *about* a particular device in three different studies; one study used a Bluetooth headset as the stimulus, and another study used Apple Watch and

WEAR Scale Items [13]

1. I like what this device communicates about its wearer
2. I could imagine aspiring to be like the wearer of such a device
3. This device is consistent with my self-image
4. This device would enhance the wearer's image
5. The wearer of this device would get a positive reaction from others
6. I like how this device shows membership to a certain social group
7. This device seems to be useful and easy to use
8. This device could help people
9. This device could allow its wearer to take advantage of people*
10. Use of this device raises privacy issues*
11. The wearer of this device could be considered rude*
12. Wearing this device could be considered inappropriate*
13. People would not be offended by the wearing of this device
14. This device would be distracting when driving*

* Reverse-scored

Google Glass. This allowed me to look for commonalities among three quite different wearables in forming the final scale.

The last step was to evaluate the items using exploratory factor analysis, adjust the scale as needed, and test its validity and reliability. The common solution shared by all three datasets showed good validity and reliability and became the final 14-item WEAR Scale (see sidebar). It can be used not only to evaluate but also design for a socially acceptable wearable.

In conducting factor analysis to arrive at the final items for the WEAR Scale, it was also determined that these 14 items loaded onto two factors. I identified Factor 1 as pertaining to the fulfillment of aspirational desires (nos. 1-8 in sidebar). I identified Factor 2 as largely relating to the avoidance of social fears (nos. 9-14 in sidebar).

The Special Case of Worn Technology

More than any other computing devices or technology, wearables are about the body and the self. This was a foundational finding in developing the WEAR Scale. What does it mean to place an object on one's body, how does it change one's self—these were fundamental questions that drove the results. A wearable is an accessory, or adornment, and is therefore a form of dress—that is, a purposeful manipulation of the body, in the same category as clothing, cosmetics, and hair styling [12]. One's dress largely defines one's appearance, and it is a major factor in how people relate to one another [4,12].

Today we have a form of dress—wearables—that can be even more impactful in the social realm than typical clothing. A wearable can interrupt or modify interpersonal communication. In the case of Google Glass, the user could surreptitiously video record. No wonder Glass experienced severe backlash and quickly fell from grace; it was "creepy" and "not cool" [15,18].

Indeed, fear of the new is how much novel technology is greeted. Corrective lenses for eyesight were one of the earliest wearable technologies and they too had a slow and uneven path to social acceptance. In the 20th century, as eyeglasses grew in popularity, critics continued to voice their concerns. The previous style (the pince-nez) was applauded as being invisible, while modern tortoiseshell eyeglasses were derided as heavy and obtrusive, like two aggressive automobile lamps [17].

All forms of technology must travel a path to acceptance. But wearables are a unique case in that *social* acceptance plays a large role; also, once *everyone* is wearing something, it's no longer desirable. This need for individuality is well-documented in fashion research [20]. We want to be unique, because what one wears is as "a kind of visual metaphor for identity" [1, p. 139].

Identity, the Social Space & Wearables

We establish our personal identity in part by our appearance and dress, which also then serves as a form of communication with others [12]. For example, anthropologist Mary Douglas observed how shaggy hair is a sign of rebellion [7]. It's a symbol of people who have a high degree of freedom to critique society, like academics and artists. On the other hand, smooth hair signals conformity to society's rules and regulations, and as such is favored by bankers and lawyers.

We all belong to certain social groups—work, school, family, etc.—and within those groups, a certain range of clothing styles are considered acceptable. More broadly, we inhabit a culture, and a person who dresses inappropriately is "subversive of the most basic social codes and risk[s] exclusion, scorn or ridicule" [8, p. 7]. Dress is crucial to defining personal identity and is closely connected to one's sense of self [8,10].

In fact, clothing helps us identify group members and also reinforces group unity. Classic psychology research showed that if a person wants to belong to a group, that person will be motivated to conform to group norms, including norms of dress [5,9]. These findings can provide insights about wearable acceptance. For example, if a wearable is generally worn by members of a group, individuals who wish to belong to that group will desire to adopt the wearable. On the other hand, a person who is specifically *not* attracted to that group will be less likely to accept and adopt the wearable, and may even actively reject it.

Attraction to those who are similar to us extends beyond group dynamics and applies to individual encounters as well. For example, Nash [16] studied the social interaction of runners who passed each other. He found that those who were dressed differently tended to engage in a short nonverbal greeting. But runners that were dressed alike tended to engage in a longer conversation. Extended to wearables, it is likely that the social acceptability rating of a wearable is influenced by the wearer's similarity to the viewer [12]. If I perceive you as similar to me, I will be more likely to find your wearable device socially acceptable (than if I perceive you to be dissimilar to me). These are all factors that influence the social acceptability of wearables and are represented in the WEAR Scale.

Measuring the Social Acceptability of *Other* Technologies

In this paper I examined a particular case of technology social acceptability—that pertaining to wearable devices. The factors affecting the acceptance of other types of technology in many ways deviate from the case of wearables. For example, the social acceptance of autonomous vehicles has little to do with aspirational desires, social fears, personal identity and sense of self, and much to do with personal safety, security, and risks [14].

The social acceptance of technology is a wide and deep topic, thus challenging researchers. Using the example of wearables technology, this paper described how the form a technology takes will greatly impact the fields of study that informs its social acceptability. Because a wearable is placed on the body for public view, it is greatly intertwined with personal identity and aspirations, and avoiding social scorn. Social acceptance of various other types of technology involves very different factors. A "divide and conquer" approach rather than generalizations about the social acceptance of all technologies should form the foundation of the research agenda for the social acceptability of technology.

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Acceptability by Design: Integrating Gender Research in HCI

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Abstract
This paper discusses social acceptability of technology from a gender studies research perspective. It asks how questions regarding power relations, social inequalities, situated and partial perspectives (in contrast to universalism) relate to knowledge production in computing, and how this critical thinking can be made productive for human-computer interaction and the design of interactive systems. To integrate theoretical insights from gender research into practice, the "Gender Extended Research and Development" (GERD) process model is proposed.

Author Keywords
gender; diversity; values; social acceptability of technology; information system design; interactive systems; human-computer interaction; GERD model; sociotechnical approach.

ACM Classification Keywords
Human-centered computing~HCI theory, concepts and models

Introduction
A broad societal acceptability as well as acceptance from individual users and user groups are important for new technological developments - if they want to be functional, successful and socially responsible. The

Acceptance can be defined as user acceptance of a certain technology – an empirical, observable and thus measurable variable. **Social acceptability** is a broader concept that characterizes technology's congruence with values, norms and ethics.

Gender studies deals not only with relations among genders, but critically reflects on systems of classification as such (man/woman, nature/culture, human/animal) and asks how these systems (re-)produce inequalities. **Gender** must be understood as intersecting with other social markers, such as race, ethnicity, religion, dis_ability, sexual orientation.

*"The **I-methodology** refers to a design practice in which designers consider themselves as representative of the users."* [7]

approach presented here, views social acceptability through the methodological lens of gender studies. Major concerns are who defines social acceptability and whose values and norms are accounted for. Furthermore, the question remains what a complex, diversified account of social acceptability means for technological development. Hence, this paper provides a short insight into relevant gender studies concepts, followed by a process model that integrates these theoretical insights into interactive system design.

Questioning Universalism, Introducing Diversity

Gender studies question the premises of universalism and its link to knowledge production and technological development. By showing that there is no "view from nowhere" [6], gender studies emphasize the social, political and cultural embeddedness of science. Values and social norms are context-dependent, they change significantly throughout history and they mirror the power relations that exist in a particular society [10]. Thus, what is claimed to be universal and broadly applicable represents only a certain point of view. Importantly, *what* counts as acceptable and *who* has the authority to decide upon it, is contested. Due to societal power structures, which are influenced by gender in intersection with other social markers, not everybody can equally participate and is heard in this process. Based on this, notions of social acceptability need to reflect critically upon power relations that are embodied in technology and that provide the context for its design and use. In particular, more awareness of situatedness and marginalization is needed to diversify standpoints. An important question is: From whose perspective is a certain technology socially acceptable?

Biases and "I-Methodology"

Prominently, power relations and unquestioned universalism have been criticized in computing research and development through identifying the concept of "I-methodology" [7]. The biases that result from the narrow vision that is produced with I-methodology are still countless [3,9]. Approaches like human-centered design [11], value-sensitive design [5], and participatory design [8] bring specificity, context and means for user participation to the design of HCI and interactive systems. A consolidated approach which integrates gender and diversity research into computing R&D is still missing, however. Acknowledging questions of social acceptability by factoring in multiple standpoints of users and usage contexts and marginalized perspectives *while developing* interactive systems, is challenging. In the following, the "Gender Extended Research and Development" (GERD) model is introduced as a means of filling this gap.

The GERD Model

The goal of the GERD model is to make concepts from gender research understandable and usable for work in computing and interactive systems development. By doing so, the model aims at "acceptability by design." Grand terms like "social acceptability" or "social responsibility" are contextualized and situated by relating them to societal power relations, to in- and exclusion depending on gender, class, dis_ability etc., *and* to their role at each step along the R&D process. The model follows the sociotechnical approach: sociopolitical and technological factors are seen as interdependent throughout the whole development process [4].

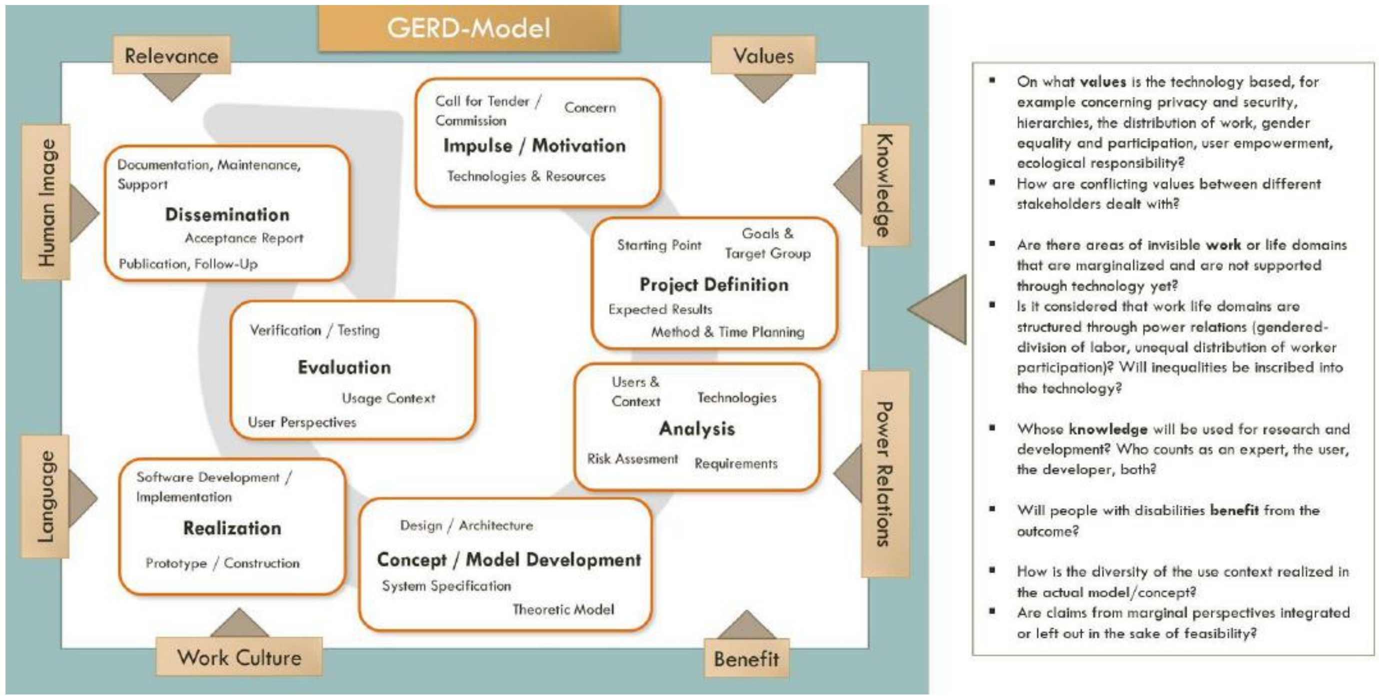

Figure 1: Seven core phases of the GERD model with reflection aspects and example questions informing the process.

Fig. 1 gives a basic overview of the GERD model. It consists of seven core phases with examples of sub-tasks framed by reflections aspects and a set of guiding questions. Six of the core phases have been identified through combining existing software engineering and HCI process, design and research models [1,2,10]. Phase "impulse/motivation" was added to the cycle to highlight which societal topics are covered in computing or where resources for research come from. The eight reflection aspects correspond to basic concepts from gender research. In the GERD model, they connect the technological design with issues of social inequality and the questioning of universalism, all the way through the

R&D cycle. A detailed version of the model[1] explains each reflection aspect with respect to each core phase and gives a set of guiding questions to consider. Fig. 1 gives examples of guiding questions for reflection aspects "values", "work", "knowledge" and "benefit"[2].

Concluding Remark

This paper discussed social acceptability of interactive systems design against the background of gender studies. Concepts of universalism, such as "the view from nowhere" and the "I-methodology" were questioned in favor of situated, localized, diversified perspectives on knowledge and technology production. While gender studies provide excellent resources for discussions on social acceptability, expertise from the field still lacks interdisciplinary transference to computing R&D. The GERD model addresses this gap with its aim to operationalize knowledge from gender studies for HCI, interactive systems and information systems design.

Acknowledgments

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[1] A full version of the GERD model is currently available only in German, in form of a website: http://www.informatik.uni-bremen.de/soteg/gerd/?action=modell and as a book chapter: https://elib.suub.uni-bremen.de/edocs/00104194-1.pdf.

[2] In Fig. 1, the questions are not matched to the specific core phases as in the full model due to the briefness of this paper.

On the Need for Standardized Methods to Study the Social Acceptability of Emerging Technologies

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Abstract

Social acceptability of technologies is an important factor to predict their success and to optimize their design. A substantial body of work investigated the social acceptability of a broad range of technologies. Previous work applied a wide range of methods and questionnaires but did not converge on a set of established methods. Standardized or default approaches are crucial as they enable researchers to rely on well-tested methods which ease designing studies and can ultimately improve our work. In particular, there are no validated or even widely used questionnaires to investigate the social acceptability of technologies. In this position paper, we argue for the need of a validated questionnaire to assess the social acceptability of technologies. To open the room for discussions, we present an initial procedure to build a validated questionnaire, including the design of a study and a proposal for stimuli needed for such a study.

Author Keywords

Virtual reality; social acceptance, virtual reality glasses.

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Introduction & Background

In our recent work, we aimed to investigate the social acceptability of using mobile virtual reality (VR) glasses in public. To our surprise, we could not identify well-established methods to study the social acceptability of emerging technologies. Looking at previous work, we found individual approaches and diverse methods. As we found no well-established mean to measure the notion of social acceptance, we adapted a questionnaire from the previous work [11] and followed our own procedure. As the questionnaires on social acceptance we reviewed, including the questionnaire we used, have not been developed applying well-established scientific methods [5], research on social acceptance might leave room for improvement.

The lack of well-established methods hinders research on social acceptability for some reasons. Without well-established methods, researchers and practitioners have to invest the effort to develop their own approaches. The lack of a default approach that is used in the typical study makes it hard or even impossible to compare results across studies. The quality of the methods used in many studies will be limited as not all researchers are experts in developing questionnaires and designing studies.

Questionnaires are a well-established instrument within human-computer interaction (HCI) to collect empirical data. Standardized questionnaires exist that enable to measure a variety of dependent variables in controlled experiments, such as task load [6], usability [3] or fatigue [2]. Such measurements ensure that most studies in HCI come with very reasonable design, techniques can be compared across studies to a certain degree, and new researchers must not reinvent the wheel.

In research on social acceptability, a common approach is using images or video showing the use of the technology and measuring social acceptability with a set of self-defined questions. Ronkainen et al. [14] asked participants "Would you use this feature on your own phone?" and provided a set of answers. Rico & Brewster [13] as well as Ahlström et al. [1] asked participants where (e.g., at home, while driving, and at work) and in front of whom (e.g., alone, partner, and strangers) they would use the presented interactions. Provita et al. [12] developed a questionnaire with 13 items around the themes interaction, user, and device to assess the social acceptance of technologies shown in videos. Koelle et al. [8] used abstract pictograms as stimuli and utilized a questionnaire with five semantic differentials (tense-serene, threatened-safe, unsure-self-confident, observed-unobserved skeptic-outgoing).

Montero et al. differentiate between user's and spectator's social acceptance [10]. In a survey, they ask the open question "What would you think if you saw someone else performing this gesture" as well as how participants would feel on performing the gesture at home or in public on 6 point scales. Most related to our work is Kelly & Gilbert's WEarable Acceptability Range (WEAR) scale that aims to predict the acceptance of wearable devices [7]. The author provides a comprehensive list of 50 questions. Unfortunately, the questionnaire has not been validated but only been tested with a single device. Furthermore, the questionnaire specifically targets wearable devices, and the number of questions has to be reduced to remain usable in a study.

In this workshop paper, we propose to develop a standardized approach for assessing the social acceptability of emerging technologies and prototypes. To provide a basis for discussion, we present a working definition, questionnaire construction, and study aiming to develop a validated questionnaire to assess social acceptability. During the workshop, we hope to get feedback on our approach.

Figure 1: Photos of a person interacting with mobile and wearable systems.

Developing a Social Acceptability Questionnaire

From our own research on social acceptability, we learned that social acceptability depends on the perspective of the surveyed person. “Is it acceptable for me to *perceive you* with a novel device”, or “is it acceptable for me to *have* this novel device while being surrounded by people?”. The context in the second options depends on the ability of the surveyed person in perspective taking with the person wearing or interacting with the stimuli. This potentially confounds the searched construct(s), when each question does not ensure that the asked person can emphasize with the person wearing the device. For practicality, the type of questionnaire is important: In HCI, e.g., it is practical to ask anonymously for impressions via online surveys and to ask participants for their acceptability of humans with the device. Additionally, the questionnaire must ensure that the researcher can compare both, the social acceptance of the device itself as well as the ways of how the device is used.

Working Definiton

To develop tools or procedures to assess a concept, it is necessary to define the concept. Authors from social psychology state that "Social acceptance means that other people signal that they wish to include you in their groups and relationships." [9, 4]. DeWall and Bushman further describe that "Social acceptance occurs on a continuum that ranges from merely tolerating another person’s presence to actively pursuing someone as a relationship partner. Social rejection means that others have little desire to include you in their groups and relationships" [4]. While social acceptance is well-defined in interpersonal relations, the definition of social acceptability for technology is still not sufficient. Therefore, we develop a working definition assuming that technologies can cause social acceptance *and* social rejection. Adopting the meaning from social psychology, we use the following working definition:

Working definition: *Social acceptability of a technology describes the effect of using the technology on social acceptance and social rejection. A technology with high social acceptability increases the desire of others to include users of the technology in their groups or relationships. A technology with low social acceptability increases the desire of others to exclude users of the technology from their social groups or relationships.*

Questions

Previous questions asking for the acceptance of devices or interactions can be categorized into the following dimensions: usability benefits (“Is doing/wearing this okay, when this provides me a certain feature worth to do/wear it?”) [14, 10, 7], social environment (“Is it okay to do/wear the device when I’m together with friends/collegues/strangers?”) [14], perspective (“As an observer, I do not care, but I would never do/wear this’) [10], comfort (“To do/wear this, looks somehow uncomfortable, thus, I do not accept it.”) [7], the presented scenario (“Is it the right time/location/situation to do/wear this?”) [14, 7, 10], and the individual technology affinity (“Is the surveyed person rather (not) affine to new technology?”) [8]. While asking for usability benefits, it is necessary to convey that the surveyed person knows about all (dis-)advantages when using the device. The first step of the questionnaire development should consider the impact of each factor on the construct(s) that should be finally measured using the dependent variable(s).

Index Construction

Semantic differentials deliver high contrasts, but it is likely, that social acceptance is a construct with a rather negative tendency ranging from “I wouldn’t accept it.” to “I wouldn’t mind” instead of “I’d accept it”. We aim to target 8-12 questions, which will finally provide parametric data based on 7-point Likert items. For the questionnaire construction, we start with a set of items given by the literature review. We unify the formatting of the questions and conduct an online survey using a mixed-design approach with multiple conditions and question sets. We will collect pictures from the authors' research papers with a person using new prototypes, technologies, and interaction techniques. Stimuli selection should broadly cover and modulate the spectrum of social acceptability (e.g. Figure 1). Images must be replicated to ensure that all images have the same style. Consequently, we captured a single person using/wearing the device in front of a neutral background as stimuli example.

For index construction, it is useful to have a corresponding measure of the subjective or perceived acceptability to check whether the objective manipulation has the intended effect. *Interpersonal warmth* and *aesthetics* are useful to include, because they are dominant dimensions in the social perception of other humans. In the initial round, we will present 10-20 stimuli with multiple sets including 20-30 questions asking for usability benefits, social environment, perspective, comfort, scenario, and the acceptance itself. Participants will be asked if they would describe themselves as open to new technologies, familiar or interested in new techniques. Openness to new technologies must be considered to learn how one's own affinity to new devices and prototypes modulates acceptability and if the final questionnaire must include individual attitudes for the subjects' weights.

Validation

Constructs will include sanity-check-items verifying the correctness of the indices. Sanity checks will likely have high validity and correlate with other constructs but not necessarily meet the criteria of the constructs we are interested in. If the factor analysis items can vary from the dimension of the sanity check (low factor loadings), new items should be added in the next round. This process must be repeated until the items of each construct provide high correlation without showing a high correlation with the warmth or aesthetics construct. Multidimensional scaling (MDS) and principal component analysis (PCA) will help to assess the structure of the data. The analysis must ensure that the items belong to non-overlapping and distinct regions and measure the corresponding concepts. Constructs should be decorrelated and should have good discriminant validity and high reliability. Then, the factors warmth and aesthetics should be isolated from other constructs. Potential emerging constructs should be considered separately.

Conclusion & Future Work

Social acceptability is important to predict the success and optimize the design of technologies. In this workshop paper, we argue that standardized approaches and questionnaires to study social acceptability are important to foster research in HCI. We provide a working definition of the term social acceptability by adopting work in social psychology. Based on a review of previous work, we propose a method to develop a reliable and validated questionnaire to assess social acceptability.

To develop a useful and usable questionnaire assessing social acceptability, it is necessary to discuss the definition of the underlying concepts as well as the procedure with the community. With this paper, we hope to provide a first step towards standardized approaches to assess social acceptability.

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Thank you all for contributing to this workshop.