
The Privacy Mediation Cards – A Participatory Design Approach towards Respectful Smart Glasses

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Figure 1: How to design socially acceptable and privacy-preserving smart glasses? The Privacy Mediation Cards provide overview of conceptual and state-of-the-art technologies, and make this knowledge accessible to non-experts.

ABSTRACT

Smart glasses provide exciting possibilities, but also raise concerns about bystander privacy. While there is a range of technical opportunities that enable privacy mediation between smart glasses users and bystanders, these options are often not well communicated to non-experts. We present the Privacy Mediation Cards, a dedicated card deck that provides a structured overview of conceptual and state-of-the-art procedures and technologies for privacy mediation. The card deck targets non-experts with varying technical background, and succeeds in facilitating participatory design sessions.

KEYWORDS

participatory design, smart glasses, privacy mediation, social acceptability, head-mounted displays

INTRODUCTION

Recent commercialization attempts of head-mounted non-immersive displays, so-called smart glasses or data glasses, evoked a societal discourse on how these devices might or might not be used in public spaces. In particular, they were deemed unrespectful, and were subject to social acceptability issues and privacy concerns caused by the integrated camera [3, 4]. In contrast to stationary, often publicly owned CCTV cameras, such personal, body-worn camera devices intensify bystanders' privacy concerns (c.f., Wolf et al. [10]). While the public discourse often juxtaposed complete ban and unrestricted usage, we argue that there is a range of options between those two extremes. Nevertheless, engineering socially acceptable, privacy-preserving smart glasses requires a careful selection from

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Push	Pull	
Proactive	Reactive	
Opt-in	Opt-out	
Recording-time	Sharing-time	
Compliance-dependent	Compliance-independent	
Enforced	Suggested	
Place-based	Proximity-based	Identity-based
User-based	Bystander-based	Third-party
Technical	Physical	Social

Figure 2: Design axes for privacy-mediating technologies, as proposed by Denning et al. [2].

Design & Development Process

1. Define Topics & Synthesize Themes

structured analysis of literature and state-of-the-art on privacy mediation. Inclusion of both conceptual/prototypical approaches, and off-the-shelf technologies.

2. Target Boundaries overview character; Target range of 30-40 cards.

3. Scrutinize Range of Themes establishing structure and hierarchy; Definition of categories, and sub-categories. Inclusion and exclusion of themes/concepts.

4. Reduce, Split or Merge Items iterative refinement of concepts, resulting in 34 cards.

5. Visualize creation of one illustration per card, visualizing the card's main concept.

6. Incorporate Feedback iterative refinement (steps 3-5) based on (expert) feedback, and design-in-use studies.

Sidebar 1: Iterative development of the card deck; Approach based on [7].

a range of available privacy-mediating procedures. Based on in-situ interviews with bystanders of smart glasses, Denning et al. [2] explored design directions, and provide an systematization of privacy-mediating technologies and procedures (see Figure 2). The state-of-the-art of privacy-enhancing technologies (PETs) has been systematically reviewed by Krombholz et al. [6], and Perez et al. [8] proposed a taxonomy of methods for bystanders' privacy protection. However, the intended audiences of those systematizations are researchers and professionals, i.e., experts. In consequence, knowledge about privacy-mediating procedures is not yet readily available for non-experts (e.g., citizens), which hinders non-binary, and factual public discussion, as well as participatory and interdisciplinary design. In this work, we introduce a tool, an illustrated card deck (Figure 1), that makes knowledge about privacy-mediating procedures accessible for stakeholders with varying technical background and serves as a facilitator for participatory design sessions. The Privacy Mediation Cards synthesize privacy mediating technologies and procedures for smart camera devices into intelligible explanations, provide structure and categorization, and illustrative visualizations. The card deck aims to make informed discussions possible, and to allow for design processes that engage a wide range of relevant stakeholders, such as citizens, social and political scientists, or jurists, but also developers and UX designers. To this aim, we report first observational results from design-in-use studies, where we tested the applicability of the card deck in participatory design sessions.

PRIVACY MEDIATION CARDS

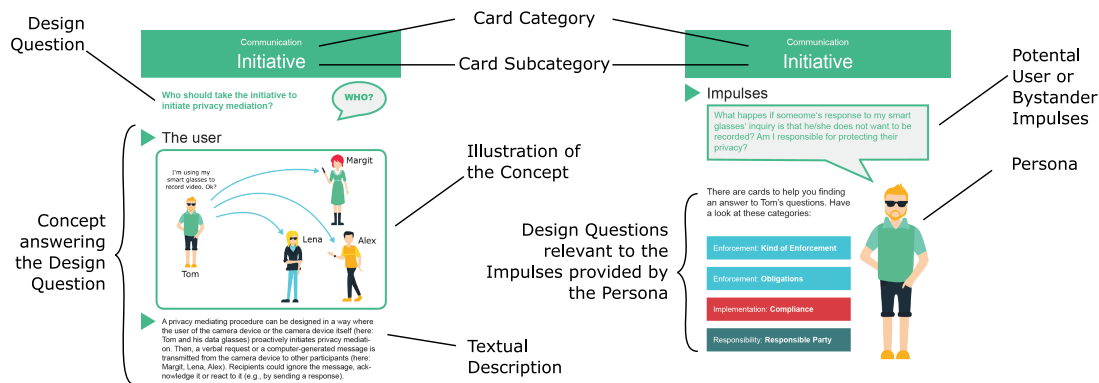


Figure 3: Card layout; Concept on the front side (left), impulses on the back (right).

Category	# cards
Communication	6
Visibility	6
Participation	7
Enforcement	7
Implementation	4
Responsibility	4
	34

Sidebar 2: The deck comprises 34 cards, hierarchically organized in 6 color-coded main categories.

Recruitment & Demography		
	# participants	age range
WS1	15 (4m, 11f) ¹	18-28 (M=23, SD=3)
WS2	11 (7m, 4f) ²	21-30 (M=26, SD=3)
	26 (11m, 15f)	18-30 (M=24, SD=4)

¹) Self-selective participation. Held as part of a student-organized conference on social, economic, and environmental sustainability (Nachdenkstatt, <https://nachdenkstatt.de/>).

²) Recruitment on campus, via quota-sampling to represent a variety of study subjects and professional backgrounds.

Procedure & Timing			
	Intro	Group Work	Discussion
WS1	60 Min	60 Min	10 Min/Group
WS2	45 Min	3x30 Min	10 Min/Group

Sidebar 3: Design-in-use studies: participants (top), procedure (bottom).

The Privacy Mediation Cards consist of 34 illustrated cards that provide a systematic overview of both, available and conceptualized technologies, procedures and concepts that could enable privacy-preserving public usage of body-worn cameras. The selection of cards was chosen through a systematic literature review, and existing systematizations of the state-of-the-art [2, 6, 8]. The card deck comprises six categories: communication, visibility, participation, enforcement, implementation, and responsibility (c.f., Sidebar 2) which are divided into subcategories (2-4 cards) that each pose a design question. Each card suggests one concept or technology answering to its subcategories design question (front), and providing impulses for further exploration (back), as depicted in Figure 2. The card deck's categories, explanatory texts, and visualizations were developed and refined through an iterative process, incorporating results from design-in-use studies, informal peer feedback (gathered at conferences), re-design sessions and reviews with experts.

DESIGN-IN-USE STUDIES

Design-in-use studies yield first impressions of how design tools, such as card decks, might be used in practice [1]. Subsequently, we jointly present results from two design-in-use studies and discuss how the Privacy Mediation Cards were used and appropriated.

Method

We conducted two similarly structured participatory design workshops (WS1 and WS2), spaced half a year. In both workshops the participants were asked to **use the Privacy Mediation Cards to develop ideas for privacy-mediating smart cameras devices that they would consider socially acceptable**. After providing informed consent, participants were introduced to the topic of smart wearable cameras, and how they might cause potential privacy concerns, and issues with social acceptability (Intro). Subsequently, they were asked to work in groups of three and to come up with one concept of a privacy-mediating body-worn camera (Group Work). Each group was provided with one set of cards, and ask to document their solution on a poster. Finally, each group presented their solution orally in plenum (Discussion). Timing and recruitment differed between WS1 and WS2, as documented in Sidebar 3. Final presentations were video recorded, and transcribed for later analysis.

Selected Results

Overall, 26 participants attended one of the two workshops (see Sidebar 3 for demography). In the end of the Group Work phase all nine groups had come up with ideas for privacy-sensitive, socially acceptable body-worn cameras. Due to time limits, the solutions' level of detail varied between WS1 and WS2. In both workshops, the participants adopted the cards' phrasing and terminology, which was noted as advantageous for creating common ground.

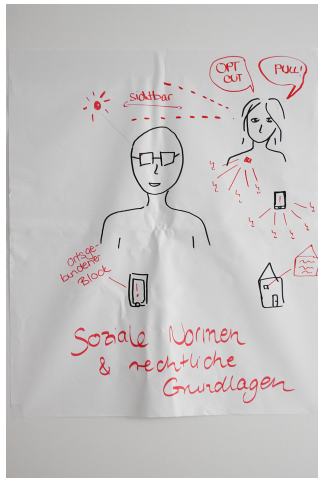


Figure 4: The group work's results were presented orally with the aid of a poster; Concept poster WS1/4.

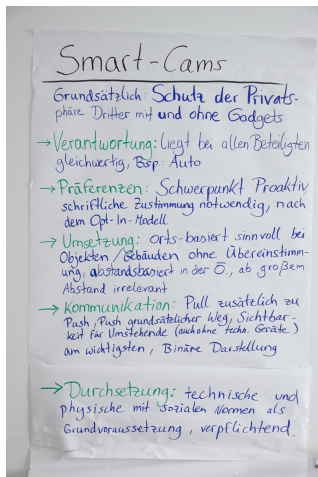


Figure 5: Privacy protection “with and without gadgets”; Concept poster WS2/1.

¹We denote Workshop 1, Group 5 as WS1/5.

Privacy and Functionality. All participants recognized the presence of camera-equipped devices, such as smart glasses, in public spaces as conflictual. Participants noted reoccurringly the difficulty of balancing the protection of privacy (with the help of technical measures) while at the same time keep the restriction of the functionality, and the impact on the user’s freedom to a minimum (WS1/2, WS1/4, WS1/5)¹. While participants highlighted the importance of social norms and legal fundamentals (c.f., Figure 5), they also note that those might not suffice: “I think social norms are incredibly difficult, e.g., once it gets international” (WS1/4).

Only one group (WS1/) favored a complete ban on public use of smart glasses and other wearable camera devices. In particular, participants stressed practicality and comfort as requirements. However, they also noted, that privacy protection and functionality are not necessarily antithetical: “[...] when I use the [visual, AR] navigation function of my smart glasses to find my way through the city center, it’s OK if all people are blurred because it is not the face of a stranger that matters to find from A to B, but whether [the tracking] sets the arrows on the street correctly” (WS2/1).

Initiative and Information. Seven of nine groups argued that a process of privacy mediation has to be initiated by the user, and that bystanders should not have to take action to protect their privacy. They favored procedures that ensure privacy by default (c.f., Figure 2, “Opt-in”). In contrast to [2], blocking devices or “Opt-out gadgets” (c.f., Figure 4) were seen critical: “There must be options without technology clearly communicate [whether] one wants to be recorded or not” (WS1/2). However they also noted the possibility that bystanders might be indifferent, and not care about the presence of a (head-mounted) camera device. All groups stressed “that the recording device must be recognizable” (WS2/3), but noted that they were unsure about the design of suitable status indicators (c.f., [5, 9]).

CONCLUSION AND FUTURE WORK

Privacy concerns negatively influence the social acceptability of smart glasses. We presented a card deck, the Privacy Mediation Cards, that facilitate addressing this issue in participatory design sessions. Our results indicate that the card deck helps participants with varying technical background to find common ground and to successfully come up with design solutions. In-depth research of those and similar solutions for privacy mediation between (smart glasses) users and non-users is timely, as head-mounted display use in public could be expected to become reality: “I think the future will actually make people wear [smart] glasses” (Participant in WS2).

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RESOURCES

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Webpage

<https://privacymediationcards.uol.de/>

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