

Uhde, Alarith; Dreyer, Lianara; Hassenzahl, Marc

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The Witness Experience Inventory

Alarith Uhde^{1,2,*}, Lianara Dreyer³ and Marc Hassenzahl⁴

¹College of Information Science and Engineering, Ritsumeikan University, Osaka, Japan

²Tokyo College, The University of Tokyo, Tokyo, Japan

³Berlin Social Science Center, Berlin, Germany

⁴Ubiquitous Design/Experience and Interaction, University of Siegen, Siegen, Germany

*Corresponding author: uhde@fc.ritsumei.ac.jp

Abstract

Interactions with technology are part of social life, for example in cafés, trains, or parks. This social situatedness not only changes how users experience these interactions. It also influences the situated experiences for other co-located people (“witnesses”). However, despite a large body of research on user experiences, the relation between an interaction and witness experiences, and ways to design for them, remain underexplored. To address this gap, this paper introduces the “Witness Experience Inventory”, a research tool grounded in social-interpretivist theories, that offers a pragmatic approach to study how interactions with technology affect witness experiences. Based on an analysis of eight interactive technologies, we illustrate how the Witness Experience Inventory can inform the design of socially situated interactions with technology to avoid negative and create more positive witness experiences. We provide guidelines for applications of the Witness Experience Inventory in future research and its adaptable coding template. Both build on experiences from our own research, but give future researchers and practitioners the flexibility to adapt the tool to the social settings they study.

RESEARCH HIGHLIGHTS

- We introduce the “Witness Experience Inventory” (WEI), a qualitative research tool to analyze and design for witnesses experiences of interactions with technology
- We provide a detailed overview of aspects that are relevant for witness experiences through the WEI’s coding template, to direct future research
- We illustrate how the WEI can inform design decisions to improve witness experiences using three design cases (smartphones, VR glasses, electronic cigarettes)

Keywords: social situation; research method; qualitative; experience design; witness experience; social practice.

1 INTRODUCTION

Interactions with technology are part of social life. Ask any train commuter for a time when some passenger “entertained” everyone else with their phone call. Or go to a stage performance and you will find that it heavily relies on interactive technologies. People take selfies at crowded sightseeing spots, others use drones to film wedding parties. Sidewalk encounters with motorized scooters count as well, just like sharing a table in a café with a laptop user, or “vaping” in the smoking area. Put differently, it would be challenging to find a social gathering today entirely unaffected by interactive technology.

Given this ubiquity, we would expect the Human–Computer Interaction (HCI) literature to offer a solid theoretical grounding about how people experience interactions with technology in social situations. In addition, we would expect tools and guidelines grounded in this theory to inform design decisions. And indeed, we do have both theory and tools/guidelines (e.g., [Dourish, 2004](#), [Koelle et al., 2018](#), [Korsgaard et al., 2022](#), [Rico & Brewster, 2010](#), [Suchman, 2006](#)). However, we argue here that the two are currently not well integrated. On the one hand, we have extensive theoretical work that has contributed to a better understanding

of the complex relations between socially situated interactions and subjective experiences. This work is often more abstract and contributes high-level descriptions of these relations. On the other hand, we have a wide range of tools to assess socially situated experiences, which have grown out of pragmatic needs for data to inform decision-making. These tend to be developed for a specific social setting with a focus on a specific type of interaction, which can cause problems when transferred to other settings or interactions. Some of the findings and guidelines based on these assessments have over time turned out to be less “generalizable” than initially thought ([Uhde et al., 2022, 2023](#)), and the HCI literature struggles to develop reliable advice to design for social situations.

In this paper, we set off to bridge between the theoretical work and the needs of researchers and practitioners. This led us to assemble a research tool based on a combination of existing methods and data analysis approaches, with supportive material for researchers. It is intended to support designing for and evaluating socially situated interactions with technology. We call this tool the “Witness Experience Inventory” (WEI). The WEI combines a semi-structured interview approach with

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an open evaluation format, supported by an extensive coding template (the “inventory”). The interview format is based on Interpretative Phenomenological Analysis (IPA; [Smith et al., 2009](#)), a method focused on subjective experiences, which reflects the WEI’s grounding in previous (user) experience-oriented research (e.g., [Laschke et al., 2013](#), [Uhde et al., 2021](#)). However, we adapted the structure for a user-decentered research focus, informed by social-interpretivist theories of social situatedness and Social Practice Theories (e.g., [Reckwitz, 2002](#), [Shove et al., 2012](#), [Suchman, 2006](#), [Uhde & Hassenzahl, 2021](#)). Finally, the coding template is based on the findings of our own initial research about eight interactive technologies outlined below, and thus provides an informed starting point for future work. As the name implies, the WEI focuses on “witnesses”, which stands for all co-situated individuals who do not directly interact with a technology, but whose situated experiences may be influenced by this interaction.¹ As we illustrate below, the WEI can be used flexibly to study a wide range of interactive technologies and associated witness experiences, and provides concrete insights to improve designs.

In sum, we make the following contributions. First, we introduce the WEI and guidelines on how to use it. We present our pilot study about eight common, socially situated interactive technologies, which followed the WEI interview format and served to bootstrap the coding template. Second, the coding template itself provides a starting point for further research about socially situated interactions with technology, and brings together an extensive collection of aspects that can influence situated experiences. Third, we use three practical examples from the pilot study to illustrate how the WEI can inform the (re)design of socially situated interactions with technology.

2 BACKGROUND

We will first outline the central work on socially situated experiences and common issues around the concept of “social situatedness” that motivated the development of the WEI. To illustrate the core problems, we start with a reflection on existing tools and measurement-oriented approaches to social situatedness. This part mainly refers to the “social acceptability” literature, because it is the currently most thoroughly studied aspect of socially situated experiences. But the same arguments apply more broadly. We then introduce central theoretical work on social situatedness, which indicates why it can be difficult to reliably assess socially situated experiences using strictly standardized tools. Finally, having outlined the key problems with both measurements and theory, we suggest a way to integrate them by defining a potential scope of what a research tool can meaningfully address to inform design for the social. This served as the outset for developing the WEI.

2.1 Measuring Socially Situated, Technology-Mediated Experiences: The Case of Social Acceptability

Whether people choose to interact with a certain technology in the social does not depend on its functionality alone. We know

from examples such as Google Glass and smartphones that people often end up not using a technology at all, or only under certain circumstances ([Koelle et al., 2017, 2015](#), [Uhde & Hassenzahl, 2021](#)). The social acceptability literature is concerned with why people interact with some technologies in social situations but not others, and how they experience such interactions. One of its goals is to develop design principles that reduce non-functional barriers of interaction in social situations (e.g., embarrassment or disturbing others; [Monk et al., 2004a, b](#), [Montero et al., 2010](#)). In more abstract terms, the social acceptability literature looks for ways to improve how people experience socially situated interactions with technology. A detailed review of that literature can be found in [Koelle et al. \(2020\)](#), with more specific discussions of challenges as seen within the field. Here, we focus on three inherent issues of the social acceptability approach, representative of research primarily focusing on measurement. These include: (1) an isolated focus on measurable elements such as the form of an interaction, independent of the interaction’s specific social situatedness; (2) the goal to develop objective measures, even if they may not meaningfully represent the variety of (subjective) experiences; and (3) a framing of social situatedness driven by the needs of measurements.

First, from a practical perspective, it would be desirable if we could isolate situational elements to make them measurable and comparable. For example, social acceptability research has a strong interest in the form of an interaction, and several studies attempt to analyze the form independent of other situational elements. This approach aligns with the problem framing and the aspiration to develop generalizable guidelines for social acceptability. There are various examples in the literature of suggestions for more and less “acceptable” forms of interaction (see [Koelle et al., 2020](#) for an overview), assuming that such forms come with an inherent “acceptability value”. Here, we focus on “subtle” interactions as an example. Subtle interactions resemble casual and natural movements, such as foot tapping, to control a technology. They have been suggested as a way to increase social acceptability ([Rico & Brewster, 2010](#)).

Although such generalizable design patterns and effects of the form of interaction on peoples’ experiences would be desirable (e.g., how acceptable they find it), there are practical issues. One reason is that the form is not necessarily the cause of “unacceptability”, and it is unclear in what way it contributes to it. In the case of public photography, for example, a reason for low social acceptability could be that the interaction as such is seen as intrusive of someone else’s privacy (see also [Koelle et al., 2018](#)). If someone takes photos of a stranger, simply making the form of interaction more “subtle” may not resolve the problem, or it could even make it worse. For example, “upskirting” photography became a growing problem in Japan in the 2000s and manufacturers reacted by making the form of interaction less subtle (with an immutable clicking sound; [McCann et al., 2017](#), [Sharon & Koops, 2021](#)). But even if we assume that the form is (part of) the reason for low acceptability, a subtle form may not be suitable for a certain socially situated interaction (as shown for face-to-face conversations; [Pohl et al., 2019](#), [Uhde et al., 2022](#)). Thus, although ideally we could study the form of interaction independently, it ultimately needs to be considered in relation to other variables, which can be interaction-specific.

The second issue is that social acceptability research tends to imply an inherent “true acceptability value” of a certain technology with its form of interaction and other characteristics. However, in practice, people can have fundamentally different judgements of this acceptability, and it is unclear how we could

¹ This use of the term “witness” is in line with some recent work (e.g., [Uhde et al., 2022](#)), but slightly different from earlier uses. In particular, [Reeves \(2011\)](#) used the term “witnessing” to describe whether another person is an “insider” or “outsider” of a group where an interaction takes place (similar to “teams”; [Goffman, 1959](#)), and whether their attention is intended or expected. We use it here to describe to what extent other people are aware of the interaction happening at all, which may shape their experience even if they are not part of the in-group.

resolve their disagreement. There is some awareness of this problem in the social acceptability literature already, which shows in the concepts of “early” and “late adopters” of technologies (e.g., [Montero et al., 2010](#)). This categorization implies that, at one point in time, some people (the early adopters) find interactions with certain technologies already acceptable and start using them, while others (the late adopters) do not—although the group names imply that they eventually will. The problem is that if such groups exist, simple acceptability scores are necessarily normative. Whose opinion should they be based on if people fundamentally disagree? It also seems problematic that this alignment of people on an “acceptance timeline” depoliticizes the technology, although there may be valid arguments both for and against its adoption. To an extent, the acceptance timeline prescribes a seemingly inevitable future of adoption. This, in turn, contradicts the goal of social acceptability research to redesign certain characteristics of technology, such as its form, to make it more acceptable. If people eventually adopt the technology anyway, independent of its form or other inherent characteristics, there needs to be something going on beyond the technology itself that leads to this “acceptability”. In other words, we cannot only focus on characteristics of the technology itself without further context.

An empirical example for such disagreements around acceptability can be found in previous research about witness experiences of phone calls on trains. Some passengers find other peoples’ phone calls “annoying” or “intrusive” ([Monk et al., 2004a](#)). But in other studies, passengers enjoyed listening in ([Love, 2001](#), [Norman & Bennett, 2014](#)). Put differently, the same type of interaction can cause opposing experiences for different witnesses, and there is no common agreement among them.

Third, as a measurement-oriented approach, the social acceptability literature reduces a social situation to measurable factors that supposedly characterize it. But the relationship between these “measurables” and actual socially situated experiences is not clear.

Some of the simpler tools summarize all social situations into one abstract description (e.g., “in public”; [Montero et al., 2010](#)) or rely on a single, representative situation (e.g., “on a busy sidewalk”; [Koelle et al., 2018](#)). Similar to the supposed agreement among people described above, such summaries imply some commonality among “social situations” in how they influence situated experiences. However, some interactions such as phone calls can lead to fundamentally different experiences, depending on the social situation. For example, if the grandparents call during a family breakfast, a phone call may lead to positive, shared witness experiences (at least for some family members). In contrast, a phone call in a library could lead to mostly negative experiences ([Uhde & Hassenzahl, 2021](#)).

Within this measurement-oriented line of thinking, the currently most sophisticated approach to distinguish between social situations is based on measurable proxy markers for situations. Specifically, the “Audience-and-Location Axes” (ALA) differentiate between six “audiences” who witness the interaction (alone, partner, friends, colleagues, strangers, family) and six “locations” where it is performed (home, pavement or sidewalk, driving, passenger on a bus or train, pub or restaurant, workplace; [Rico & Brewster, 2010](#)). The idea is that such markers could indicate in which locations and with which audiences an interaction would lead to more positive or negative experiences, and accordingly be more or less acceptable. Following this line of thinking, the way towards improved measures of socially situated experiences would be to add further markers beyond audiences and locations

(e.g., daytime, temperature, or noise), until they sufficiently “capture” a social situation.

However, this more sophisticated approach is also limited. By sorting audiences and locations into “categories”, it implies a certain coherence within each category and differences between them. But in practice, there can be drastic differences within a category (e.g., two family members can experience the same group call differently). In addition, different categories can overlap (e.g., a family member can also be a colleague). Thus, the meaning of a “family” audience score is not obvious, and its difference to a “colleague” score not necessarily meaningful. The more fundamental critique of this approach is that it attempts to measure social situations as discrete, clearly delimited entities, which are separate from the interaction itself. The interaction is modeled to happen *within* the situation. An alternative view is to understand the interaction as *part of* the situation, interwoven with other elements ([Dourish, 2004](#)). This brings us to the work on social situatedness grounded in social-interpretivist theories.

2.2 Theoretical Work on Social Situatedness

The previous section covered several ways in which it is difficult to simply measure social situations and their relation to user and witness experiences. Here, we will introduce some of the theoretical reasons behind these difficulties. [Suchman \(2006\)](#) outlined many of these in her work on the situatedness of verbal interactions with “intelligent” agents. A key concern she raises is that the idea of a “situation” as a pre-existing and objectively measurable entity, that somehow shapes an interaction, does not match with how actual interactions and experiences relate to each other. Interactions such as verbal conversations often rely on ad hoc actions and reactions. They are based on reciprocal, subjective interpretations and momentary predictions about possible consequences of situated action. Experiences are then shaped retrospectively by post hoc reasoning. For example, the length of a pause between (speech) acts is contingent on other situational characteristics. It can carry various meanings that may change over time and people can interpret them “correctly” or not. In practice, if two speakers start to talk simultaneously after a pause, they will notice the problem and one of them will usually stop talking ([Sacks et al., 1974](#)), which allows for a continued, meaningful conversation. The meaning of such situated elements as the length of a pause is not objectively predetermined. It relies on subjective interpretations, anticipations of each other’s interpretations, and ad hoc repair work.

We can observe similar performances, interpretations, and repair work with non-verbal interactions as well. For example, [Goffman \(1959\)](#) has developed a reciprocal model of how humans interpret each other’s behavior in their efforts to manage social interactions. In that sense, a seemingly simple performance, such as a mobile phone call on a train, could be interpreted by witnesses to mean many things. It can be a power demonstration or a purposeful violation of social norms. It may also just be caused by the cultural unawareness of a tourist. Or it may be seen as a practice that is acceptable or even enjoyable for other passengers. Likewise, the performer can anticipate and suggest certain “misunderstandings” that work in their interest (e.g., “I’m just a tourist who does not know the rules”), which the witnesses may again anticipate and so forth (see [Goffman, 1959](#), for an elaborate discussion of such processes). In sum, previous work grounded in social-interpretivist perspectives on social interactions highlight their fundamental ambiguity. Different interpretations of why or how someone performs an interaction are crucial to understand

the associated experiences. This makes clear, objective analyses difficult.

Dourish (2004) discussed this problem of situatedness further, with a particular focus on research in HCI. He identified two seemingly incommensurable approaches, as illustrated above, grounded in either positivist or phenomenological/social-interpretivist research paradigms. The positivist approach encompasses measurement-oriented work such as the social acceptability literature. It is mainly concerned with ways to quantify situational elements, to then study their effects on experiences. Such research uses objective measures of concrete situational features (e.g., the ALA). However, its ability to meaningfully predict situated experiences is limited. It considers elements in isolation and overlooks their mutual dependence, and the subjective, interpretational character of interactions and experiences.

On the other side, Dourish positions phenomenological / social-interpretivist approaches, which focus on situated experiences. This research conceptualizes interactions within a mesh of situated elements that may meaningfully relate to each other. However, these “meaningful relations” between elements depend on the interactions themselves. Following this approach, measuring elements as independent “features” to describe a situation is often not useful. To illustrate this point, think of a living room with a carpet full of Lego bricks as a “situational element”. These can be relevant for the (painful) experience of a “walking barefoot” interaction. But they are less relevant for “sleeping on the couch”. In other words, the relevance of this particular element for situated experiences depends on the interaction of interest.

With today’s computing power, we could still try to collect all elements and possible interactions in a giant database to create a compendium of mutual relevance. But this leaves the problem of situated, subjective interpretations unsolved. The barefoot walker may wonder who put the Lego bricks there, and whether they represent a deliberate offense, a funny prank, or just carelessness. This interpretation (independent of the “real” story behind the Lego bricks) can change their situated experience, which further complicates how we can study them, least of all “objectively”.

Uhde & Hassenzahl (2021) extended this perspective to social situations. They illustrate the social dynamics and meaningful relations between co-located interactions, performed by different people. To that end, they suggest a thought experiment based on a common, “constant” interaction: a mobile phone call. While keeping the phone call itself “unchanged” (at least initially), they construct a range of social scenarios around it, where other people perform various co-located interactions. This highlights how these “witness interactions”, independent of the phone call itself, can affect the experiences it creates. For example, a phone call in a library, where other people read, would usually be experienced as disturbing *because* it disturbs the reading interactions. But during a rock concert, where most people dance and sing, the “same” phone call would not bother anyone, because it does not affect their situated interactions (while the phone call itself would be strongly disturbed). They argue that the relations between co-located interactions, such as “making a phone call”, “reading”, or “dancing” are key to understanding experiences around interactions with technology. Thus, as a way forward, they suggest moving away from situation categories, such as “library” or “rock concert”, and rather take these as shorthand for “a situation where people tend to read and work”, or “a situation where people dance and sing”. These constellations of interactions determine which other interactions “fit in” and which will be experienced as disturbing.

2.3 Social Situatedness As Constellations of Practices

To analyze such constellations of interactions (or “practices”; Reckwitz, 2002, Shove et al., 2012) seems to bring more complexity, compared with simple situation categories. If we want to study how people experience, say, phone calls on a train, we now need to consider all other co-situated interactions, find out how each of them relates to the phone call, and how people interpret each other’s interactions. This will potentially produce ambiguous data (e.g., phone calls have both positive and negative effects on witness experiences), which we need to integrate into something useful. In addition, the specific constellation of interactions can change momentarily, which again transforms situated experiences. Thus, this analysis confronts us with practical challenges.

But this increased complexity also helps overcome problems elsewhere. Situation categories cannot account for intra-category differences (e.g., silent vs. regular compartments on a train), inter-category similarities (e.g., a train that is also someone’s workplace), and category overlaps (e.g., a restaurant on a train). But the social-interpretivist approach can. Similarities and differences can be described based on shared and distinct patterns within the constellation of practices. For example, silent and regular compartments share certain practices (e.g., sitting, working), but not others (e.g., making a phone call). If we introduce a new interaction with technology and study how it relates to these interactions on the train, the specific compatibilities and conflicts can serve as indicators for situated experiences that can transfer to other train situations. For example, the insight that the new interaction conflicts with specific silent compartment practices, but not with the regular compartment practices, can be valuable for designers.

In sum, we have outlined two different approaches to studying socially situated interactions with technology and their associated experiences. Both come with their own challenges. The measurement-oriented approach provides easily obtainable data, but it is often unclear what these data indicate about socially situated experiences. The social-interpretivist work highlights ways in which interactions and experiences are embedded in a mesh of situated elements and interpretations. However, there is a lack of tools to make such a social-interpretivist perspective accessible for practitioners to inform design decisions and understand experiential effects of a concrete, socially situated interaction with technology. The Witness Experience Inventory (WEI) we introduce in the following is designed to address this gap.

3 THE WITNESS EXPERIENCE INVENTORY

Given the practical difficulties of the social-interpretivist approach and the problems with existing measurement-oriented approaches, we first set a scope that we think a pragmatic tool can meaningfully address to produce useful findings. To that end, we made the following decisions for the scope of the WEI:

- 1) The WEI focuses on understanding the relationships between situated elements—primarily co-located interactions of users and witnesses—and highlights subjective interpretations.
- 2) Instead of prescribing a fixed set of social situations, we start from the experiential outcome. Witnesses describe situations that led to particularly positive and negative experiences in relation to an interactive technology. From there, we try to understand how these experiences come about

and which situational characteristics seem most essential for that experience.

- 3) The goal is not to derive an overall “witness experience score”. Instead, the WEI highlights the variety of different witness experiences in relation to an interaction with technology, and experiential risks and opportunities.
- 4) The goal is also not to develop an all-encompassing, generalizable assessment of socially situated, technology-mediated experiences. Instead, we acknowledge the specificities of each situation and interaction with technology, which may be important for how witnesses experience it.
- 5) Finally, the WEI should encourage reflection on possible design decisions and their impact on different (groups of) witnesses. Often, such decisions have positive effects for some groups of witnesses, but negative effects for others. The WEI should make such trade-offs apparent and support reflection.

In line with this scope, the WEI is based on a qualitative research approach using interviews. This helps examine the detailed relations between a socially situated interaction with technology and its surroundings, and keeps it flexible for unexpected situational characteristics. It also helps understand the reasons behind positive, negative, and ambiguous relations among interactions, to later inform design decisions.

We selected and adapted a specific interview method (IPA; Smith et al., 2009), because it is already established in experience-oriented HCI research (e.g., Laschke et al., 2013, Uhde et al., 2021). It is easy to use with limited resources and a small sample, and flexible to be adapted for various situations and interactions of interest. For our initial study, it also allowed us to collect data in the same way as intended for future uses of the WEI, while bootstrapping the coding template described below to facilitate future analyses.

As a general format, the WEI focuses on positive and negative witness experiences of an interaction with technology. Participants first describe their own experience as witnesses. Then we collect a list of other co-located (witness) practices and ask participants to relate them to the interaction, to learn about potential other witness experiences. This format corresponds with the social-interpretivist perspectives outlined above (e.g., Dourish, 2004, Uhde & Hassenzahl, 2021).

3.1 Interview Study: Overview

To turn the theoretical considerations into a practical tool and test its usefulness, we ran an interview study following the WEI interview format as described below (see also Figure 1). This study served three main goals:

- Study Goal 1:** To create initial empirical data about the complex relations between interactions with technology and witness experiences
- Study Goal 2:** To test and refine the WEI interview procedure, and to bootstrap the coding template, which can be used as an informed starting point for the evaluation of future work
- Study Goal 3:** To test how the WEI can be used to produce insights for (re)designing socially situated technology

3.2 Method

3.2.1 Participants

We recruited 15 participants through an agency (*female* = 8, *male* = 7, *mean_{age}* = 34.73, *sd_{age}* = 14.57, *range_{age}* = [18,60]) in a large city in Germany and ran the interviews in one of

Witness Experience Inventory How to Use/Study Flow

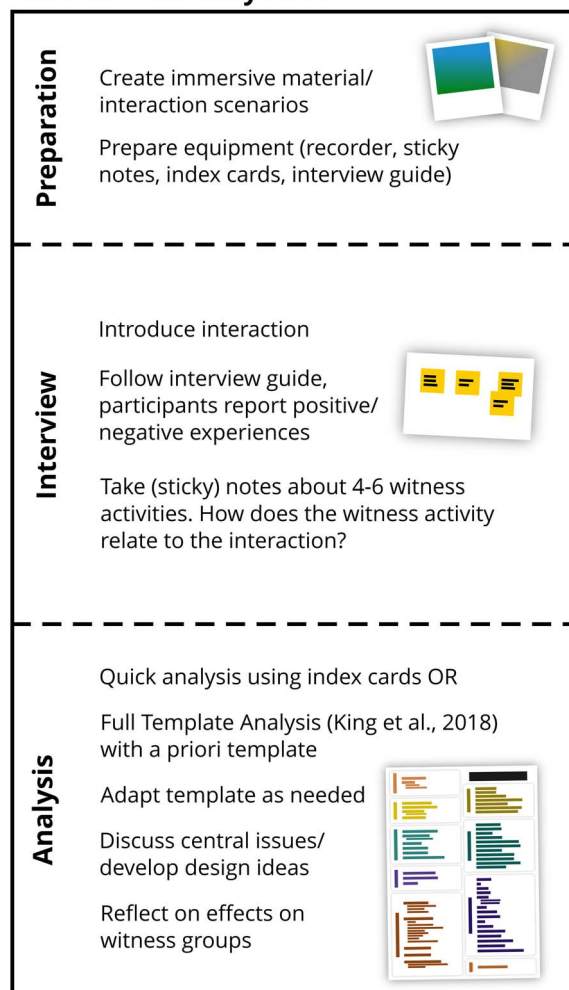


FIG. 1. The procedure for the WEI, as used in the study and with some recommendations for future uses: We had no restricted number of witness practices in our study and ran a full template analysis with a minimal a priori template. In our study, we repeated the procedure with each participant for two to three interactions.

their interview rooms. Participants had various backgrounds and occupations, including office clerks, high school and university students, an electrician, and a project coordinator. The interviews lasted for around 47 minutes on average.

3.2.2 Procedure

The interviewer welcomed the participants to the interview room, briefly explained the purpose of the study and his interest in how people experience technologies in social situations. All participants then signed a consent form that informed them about the anonymous data analysis, video and audio recording, and their right to quit the interview at all times without negative consequences.

The interviews followed a semi-structured format, focused on two example interactions with technology and their associated witness experiences. We also prepared one backup interaction in case participants had insufficient experience with one of the examples and could not describe how they think it would affect witness experiences. We counterbalanced the choice of interactions between participants. For each interaction, we asked



Fig. 3. The eight example technologies used in the study, roughly aligned on the two axes from “inward” to “outward” orientation, and from “established, typical” to “unusual”. The photos in the figure are the ones used as illustrative material in the study.

Uhde et al., 2025, or supplementary material for details about the template development).

During the analysis, the two coders first used the a priori template to separately code three interviews that covered all eight example interactions. After this first round, they held a debriefing session to discuss unclear text passages and any changes to the template, which led to a first iteration of the template. Then they each coded three further interviews, agreed on a second iteration of the template, and repeated this step another time to develop a third iteration based on all 15 interviews. Finally, the first author used this updated template to code all 15 interviews a second time. This led to a few minor changes both coders subsequently discussed and agreed on for the final version of the template.

4 RESULTS

The final template (see Figure 4 for an overview) provides detailed descriptions of various situational elements that can be relevant for shaping witness experiences. Here, we summarize the most central aspects from our study, given the specific technologies and cultural settings, in three key themes. Following this general summary, we describe three design cases to illustrate how the findings from the WEI can be used to inform design decisions, and which align with these themes.

4.1 Overall Analysis

4.1.1 Ambiguities

We have already argued that interactions with technology can lead to different witness experiences. For example, some people find phone calls disturbing (Monk et al., 2004a) and others like to listen in (Love, 2001). Our study provided further insights into these ambiguous witness experiences. We distinguish between witness-related and user-related aspects of ambiguity.

Witness-related aspects: individual differences, mood, social roles, and group memberships.

One reason for the ambiguity simply relates to individual differences among witnesses. For example, one participant described a situation where she made a phone call in a café. A woman nearby was notably annoyed by this: “she sat with her back towards me, and she was very annoyed by my phone call. So she turned around again and again” [I1]. In a different situation, with a different witness but also in a café, the witness experience was quite different. The participant made a phone call about her son who had some problems in school: “then she listened in and heard all of that, although I thought nobody would hear that. And then she somehow talked to me and we... talked about it... we somehow became friends over this, she also had a similar issue with her daughter and yes... that seems to have come across as... positive” [I1].

Relatedly, the current mood of the witness can affect their experience. One participant described a scenario of a phone call on a train:

“I sometimes notice that, when I make a phone call somehow, you look at the other passengers a bit, you know? How does he look, is he relaxed, is he a bit grumpy? [...] People’s frustration tolerance can be a bit problematic sometimes, you know? I see that again and again, you wait for the train in Frankfurt, you know? And the train doesn’t come or is 30 minutes delayed, people are already fuming, so it’s a bit difficult uh... to go about your business, make phone calls etc.” [I10].

Individual differences and interpretations of other people’s mood can be difficult for designers to address. By redesigning the phone call interaction in these examples, designers can support either side. They can side with the witnesses who feel disturbed, by making the interaction less notable (see e.g., Kimura et al., 2019, Li et al., 2019). But they can also support the positive experiences (e.g., Desmet & Hassenzahl, 2012). It may be difficult to develop a solution that caters for both groups of witnesses.



FIG. 4. Overview of the themes, subthemes, and subsubthemes of our analysis, which are included in the coding template. See Uhde et al. (2025) or the supplementary material for full code descriptions and further details.

A different type of ambiguity relates to the different social roles of witnesses. One participant described how he was responsible for setting up VR glasses to attract potential new employees during a job fair. The candidates could use the VR glasses and others could watch them. But his own witness experience was different because of his role: "if I am part of the crew at the stand, I need to make sure that nothing happens to the future candidates. In that case I have a different task than the interested

visitors who look for a job and see 'ah, they do something over there, that seems fun, I want to have a look!' So it's different, depending on the target groups" [16]. This type of ambiguity can be easier to address. In this case, designers may prioritize the experience of the candidates over the employees. They are also not in an inherent conflict as in the phone call example above, and there may be straightforward ways to design a positive experience for both.

Finally, another type of witness-dependent ambiguity has to do with what we broadly call group memberships.² Participants reported various examples, such as particular problems for witnesses hard of hearing in loud environments, and differences between age groups or people with different cultural backgrounds. But other group memberships may be more particularly tied to specific types of interactions. One participant (a member of the “non-smoker” group) compared his witness experiences of someone smoking regular cigarettes versus electronic cigarettes:

“I find [smoking the electronic cigarettes] that my girlfriend uses better, because I have the direct comparison. From when she still smoked cigarettes, and her son also still lived at home and also smoked cigarettes. I’m more comfortable with [electronic cigarettes]. The smell doesn’t stay in the clothes as much, it doesn’t smell as bad” [16].

Some of these specific effects that depend on group memberships (e.g., gender, ethnicity) can pose particular ethical challenges, which we will discuss further below.

User-dependent ambiguities: different ways to interact.

Witness experiences also in part depend on how specifically the user interacts with the technology. This aspect is different from the “form of interaction” as often studied and discussed in Section 2. Usually, research with a focus on form prescribes certain “valid” forms and compares variations between different “valid” forms (e.g., [Ahlström et al., 2014](#), [Rico & Brewster, 2010](#)). But what we found and describe here are differences *within the range* of valid forms that are not directly defined by a designer. Again, one participant described a witness experience of a phone call: “well, I would . . . if it’s a short call, then it’s okay. Sometimes there are things you have to discuss. But if it’s a long conversation, maybe just about some gossip or so . . . then I would expect the person to go somewhere else” [113]. Within the range of possible forms of a phone call (e.g., long vs. short), the user needs to find a way to interact that is suitable for the specific social situation.

A special case of this has to do with interactions that require a certain skill to be performed well. For example, participants attributed such skills with professional (wedding) photographers: “if it’s a good photographer, the people don’t even notice [...] They blend in with the crowd and just do that on the side” [12]. Another example were good DJs: “They have to get the crowd excited, you know? Build the set exactly so that it goes up and down, so that you don’t get pushed all the time, but you’re just drifting with it” [114]. Designers can influence the possible range of interactions, and they have some control about the degree to which users can express their skills through the interaction ([Janlert & Stolterman, 2010](#), [Sramek et al., 2023](#)). Nevertheless, the skills and concrete ways users interact with the technology can shape witness experiences beyond the designer’s control.

4.1.2 Technology Design and Constellations of Practices

The ambiguities and their effects on witness experiences described so far relate to individual characteristics of users and witnesses: Their preferences, mood, roles, group memberships, and skills. This second theme focuses on what they do: their co-located practices and how these practices relate to each other. We found ways in which different relationships between practices can lead to positive, negative, and neutral witness experiences.

Interaction as part of a positive script.

Some interactions integrate well with others, and participants saw this as a reason for positive experiences. One example is the phone call in a café described above, which led to a friendship. The same participant also reported another, similar experience:

“I was . . . at the playground, my son was playing, and I made a phone call. Next to me there was another woman. I talked . . . we talked about face lifting, so that went on with my friend. And the other mother there somehow heard that. So at some point she got involved, so we talked among the three of us” [11].

In both cases, the open phone call practice seemed to connect with others sitting nearby, who were not particularly engaged in a focused task and open to interact. Another frequently mentioned example was a practice of posing for a photo. One participant talked about this practice during a wedding, when a photographer approaches a group: “. . . and he says ‘I will take a photo of you now’, then you stand together, put your arms around each other, hold your drinks up or so” [12]. This practice can change over the course of the evening: “I always like that. Because when people dance, then it is already a bit later during the party, right? So you pose a bit different on purpose. I don’t know, you come together, one guy throws himself on the ground in front. These typical photo bombers. That’s when the fun happens!” [12].

In both cases, the witnesses get involved in a shared form of interaction with the user and their technology. They indicate how an interaction with technology can be part of a broader positive script, which relates to other co-located practices that jointly lead to positive witness (and user) experiences.

Conflicting scripts.

Conversely, there are also incompatible practices, which can cause negative witness experiences. Phone calls are well-known for this (e.g., [Monk et al., 2004a, 2004b](#)). There are different variations of how phone calls can conflict with witness practices. For example, they can disturb other guests in a café, as described above. Another example are phone calls performed by someone who is engaged in a conversation with the witness: “Yeah, I hate it if you meet someone and the person is on the phone all the time” [113], or “I find it very uncomfortable at the hairdresser, if someone makes a phone call, because . . . or if I get a phone call, I don’t pick it up. Because they make my hair, and you talk to the person, they talk with you and . . . that is just not appropriate. That is rather negative” [11].

Parallel scripts.

Finally, in some cases the user and the witness practices can simply continue in parallel, without affecting each other. In relation to the scenario of a phone call on a train, one participant reported that some witnesses who listen to music would not be affected: “those people usually use earplugs. So they neither passively notice if you sit next to them, nor would they feel disturbed, because they listen to the music. But even if, they would just turn the music a bit louder” [17]. Here, listening to music isolates the witness practice from their surroundings and the two practices can continue in parallel.

In sum, these examples of positive, negative, and neutral relations between the interaction with technology and witness practices indicate reasons for some of the differences among witness experiences beyond witness or user characteristics.

4.1.3 Situational Legitimacy

The third theme relates to how “legitimate” witnesses find the performance of an interaction for a certain situation. Legitimacy does

² We use the term “group membership” here to cover various individual characteristics like ethnicity, gender, age, but also groups of practitioners such as smokers, commuters etc. The term is relatively vague on purpose, to keep it flexible for ad hoc group definitions that may be relevant for a particular interaction and situation.

not necessarily have a direct relation to practice constellations. Instead, it seems to regulate how an interaction fits into a broader system of practices and values—even if there are no “direct” conflicts, such as with phone calls that interrupt a conversation.

We summarized this notion with a new term in the context of HCI: “situational legitimacy”.³ Situational legitimacy offers an alternative lens to think of what we usually call “social acceptability”. It can account for different experiences between situations, uncertainties in the assessment, and different opinions among witnesses. Participants used various references to reason about how legitimate certain socially situated interactions are, referring to potential intrusions of privacy, expected atmospheres at certain locations, unclear purposes of an interaction at a certain location, the concrete form (e.g., loud phone calls) and content (e.g., gossip phone calls), social norms, unclear rules, and rules set by a local authority. All of these offer interesting starting points for future research. Here, we will focus only on three facets: privacy concerns, expected atmospheres in certain locations, and unclarity about legitimacies.

Possible intrusion of privacy.

Intrusions of privacy were a common concern, especially with cameras and drones—even if it was not clear whether witnesses were actually being filmed. For example, we did not specify whether the drones on the example photos had a camera (in fact, we did not expect such an interpretation). But three participants talked about experiences of privacy intrusions with a drone: in a sauna, at a beach, and in their private room at home. It was sometimes not clear whether a drone has a camera equipped, who is filming and why, which were shared concerns among participants and led them to experience the drone interaction as illegitimate.

Besides the drones, we also found concerns about privacy that were less obvious. One participant talked about a situation in a café, while flirting with someone: *“You feel spied on. If you work on your laptop, you are focused on what you do, but you don’t cut off your ears. So it can also be inappropriate if someone is sitting nearby, staring at their laptop. In that situation you don’t feel comfortable, because flirting is also something intimate”* [I3].

As these cases reflect, actually filming or listening in is not necessary for privacy concerns. It is about how witnesses interpret the possibility of an intrusion. This is in line with earlier research, for example about smart glasses (Koelle et al., 2018) and highlights the importance of subjective interpretations.

Expected atmosphere and “hierarchies of legitimacy”.

Some conflicts between co-located practices can be resolved by referring to a hierarchy of legitimate practices that goes along with certain locations. One participant speculated about using a laptop in a pub:

“a pub—that is a closed space with a clear purpose. I mean, I go to a pub with the goal ‘I want to have a fun evening!’ And usually everyone who goes there does that. So if a person comes to the pub with a different goal, that’s weird. That is as if you went to a football stadium but don’t want to watch football. That doesn’t fit. Or if you want to read in a stadium. That doesn’t fit with the overall atmosphere” [I3].

Here, working on the laptop does not immediately conflict with other pub or stadium practices. But it would still be considered illegitimate, because it does not “fit the overall atmosphere”. To

compare this with other situations where different hierarchies apply (e.g., a library), the laptop user in a pub has no authority to demand from others to be considerate of their interaction.

Gray areas.

For some interactions, the legitimacy is still under negotiation. In our study, this was a common topic around smoking electronic cigarettes, which are still relatively new, and it is sometimes not clear how they align within the hierarchy of legitimacy:

“Exactly, situations where smoking is normally forbidden. So people say ‘well, that is a technology that is clean, that is no classic cigarette. I don’t disturb anyone with that!’ And the other people should even be grateful, because then it smells like peach or passion fruit or so. And I need to say: that smells terrible. You know? [...] The communication or how people behave towards society, that’s sometimes a bit problematic. Recently I was in Munich at the airport, there is a smoker’s lounge, you know? There were some people with electronic cigarettes, they just smoked on those seats, so not in the smoker’s lounge. [...] And then a lady spoke with them, and they said ‘well, that’s not a cigarette, it’s an electronic cigarette, that’s different’ [...] But for the other people it can be problematic” [I10].

Here, the legitimacy of smoking electronic cigarettes is being renegotiated. Although not directly in conflict with witness practices, this led to negative experiences.

4.1.4 Summary

This overall analysis of our study, based on eight interactive technologies and associated witness experiences, indicates how witness experiences can vary even with the same interaction and where these variations come from. Individual differences between witnesses and the specific way the user interacts with the technology play a role. In addition, the current practices of witnesses and how they relate to the interaction can account for further variations in witness experiences. Finally, the various, co-located practices all organize in a larger hierarchical system of situational legitimacy, that can vary between situations and is renegotiated over time.

The interviews revealed further relevant aspects for witness experiences not detailed here (see Figure 4 for a summary).

4.2 Practical Application

So far, we have summarized the interview findings, which illustrate the complex relations between interactions with technology and witness experiences (Study Goal 1). We have also summarized key parts of the coding template (part of Study Goal 2). In this section, we illustrate how the WEI findings can help rethink the design of socially situated technology (Study Goal 3).

To that end, we selected three cases from our study to illustrate how the WEI can inform conceptual redesigns. The examples align with a problem focus for each of the three themes illustrated above: Ambiguous witness experiences, (in)compatible practices, and situational legitimacy. The suggested solutions are based on discussions between the authors, grounded in the study findings.

In practice, each social situation comes with its particular characteristics that can influence witness experiences but do not directly relate to technology design. For example, the specific constellation of passengers on a train can vary, and their experiences along with it. Designers have no control over this. But overly emphasizing these fluctuations risks overlooking what can be changed about the interaction. Thus, we limit the design cases to aspects that directly relate to technological redesigns.

³ A similar term, “situated legitimacy” is used in research about democratic leadership in rural areas (Connelly et al., 2006), but given the different research fields we do not expect any confusions between the two.

4.2.1 Addressing the Ambiguous Effect of Phone Calls

Problem: How can we better balance positive and negative witness experiences?

Phone calls create a particularly tricky challenge. The exact things that are disturbing for some people can be a source of joy for others. An example are private conversations of strangers. Some people mentioned that they would rather not overhear them, whereas they also led to social connections as described above. One participant also described how they can simply be a source of joy: *"I was out for dinner with my sister and my cousin, and the guy behind us made a really loud phone call and said some funny things. I mean, we found it funny, things like 'man, I can't believe it's so cheap here, and you even get a dessert!' That was funny for us. Well, and sometimes you hear things even though you don't know the people, things like 'she broke up' or so" [113].*

Such "voyeuristic" pleasures have already been explored in previous work (Desmet & Hassenzahl, 2012). On the other hand, recent design proposals strongly side with witnesses who feel disturbed (e.g., Kimura et al., 2019, Li et al., 2019). Both of these options seem to opt for one side, rather than addressing what seems to be an incommensurable challenge. Here, we looked for ways to improve the witness experiences without giving up the tension between the two camps.

We set a challenge to at least improve one group's witness experience with no or minimal negative effects on the other group's experience. This led to less invasive changes, at the cost of smaller positive effects for the group that benefits.

Solution 1: Boundary Conditions.

One participant described how he scans other passengers' mood on a train before making a phone call. The rationale behind this is that the witnesses may already be irritated, and a phone call could further amplify their negative mood. As a technological analogy, the phone could collect sensor data about the surroundings or use other predictors for irritated mood (e.g., train delays). If a certain threshold is reached, it warns the user of negative effects or suggests ways to reduce them (e.g., talk silently, go outside).

Such a solution resembles "context-aware" design (Dey, 2001, Schmidt et al., 1999), but keeps control with the user.

Solution 2: Voice Modulations.

Current design proposals for "silent speech devices" eliminate the caller's voice entirely, use data such as scans of their oral cavity to derive what they are saying (with no voice), and then synthesize that speech to the conversation partner (Kimura et al., 2019, Li et al., 2019). However, what we learned from our study was that a full elimination of the voice may not be necessary. Talking in a hushed voice already improves the witness experience for people who otherwise feel disturbed. Accordingly, the phone could use the information about what the user is (silently) saying and play it back in a hushed voice.

Alternatively, it could also change the content of what the user is "saying". This content could be based on previous interesting phone calls. In fact, the same process could also be used for regular phone conversations, in case the user needs to share some confidential information halfway through the call. For that section, they could activate a silent speech mode, and the phone could mask the conversation for the witnesses with prerecorded speech. In sum, these examples outline alternatives to completely muting the sound, looking for a mutually beneficial middle ground.

4.2.2 Integrating VR Glasses With Surrounding Practices

Problem: How can we overcome user isolation?

Second, we want to show how information about the interplay of co-located practices can help solve practice conflicts. VR

glasses posed a particular challenge here, because they isolate the user from their surroundings to an extent. Previous work has already addressed this problem with different approaches to share visual information between the user and witnesses (Bajorunaite et al., 2023). Most prominently, the recently introduced Apple Vision Pro VR glasses feature a mechanism that imitates visual contact between the user and others.

However, our study indicates that this visual contact alone may not better situate VR glasses in the social. One participant commented how VR glasses isolate users not only perceptually, but on the level of practices, for example at a family event: *"that is the core of it: having fun, eating . . . if somebody sits there and mainly uses a technical device, I find that weird. In that case I think 'does he not want to have anything to do with the rest of us?' Somehow you imply that" [18].*

Not "having to do" with the surroundings was not only a challenge for VR glasses—we also found similar experiences with laptops and smartphones. These technologies do not have a visual barrier as the VR glasses, but they still afford interactions that separate the user from their surroundings. Thus, our design solutions focus on ways to get the VR user to "have to do with" the others.

Solution 1: Apps that have to do with the surroundings.

Looking at positive witness experiences for laptops and smartphones, we found three cases where the user took a role of being "at the steering wheel" with their technology, while still being directly connected with the group. The two laptop examples were about booking a vacation together, and using a tool to design invitation cards while taking comments from witnesses. In the smartphone case, the caller tried to coordinate a meeting between his group of friends and another remote friend on the phone. All of these interactions make direct connections to co-located witness practices.

The VR glasses could be useful if they provide the user with information that directly concern the group they are with. For example, they could be useful for a cooperative escape room game in which the VR user profits from the "superpower" of virtual visual information, but is at the same time dependent on the other group members who have local visual information. This mutual dependency helps the user and witnesses "have something to do" with each other again.

Most of such visual information could of course also be displayed on a laptop. But the extra limitation of VR glasses to have a reduced situational awareness may be used playfully as a "feature", even if it is usually considered a design issue. Otherwise, information that is particularly suited for VR environments (e.g., controlling drones or virtual characters) rather than laptops may be a good fit for such collaborative experiences.

Solution 2: Make surrounding practices more compatible.

One participant commented that a solution for positive witness experiences for example at a wedding party would be that the hosts officially announce it as part of the event, if the content relates to the event (e.g., recordings from their childhood). On the one hand, such an announcement by a local authority can increase situational legitimacy of the interaction. On the other hand, it facilitates surrounding practices and creates stronger relations to the VR interaction: participants who have already used the VR glasses can talk about the experience, people can help each other set it up, and share each other's excitement. In addition, a puzzle game or other form of playfully using the VR glasses to support social connections among the guests can be useful.

All in all, we found this perspective to promote actual shared practices between users and witnesses rather than merely sharing eye contact fruitful in the context of VR glasses.

4.2.3 Electronic Cigarettes and Situational Legitimacy

For problems around situational legitimacy, technical solutions alone may often not be sufficient. For example, privacy issues surrounding camera drones may require legal regulations that at least make problematic interactions more difficult. But where exactly the line is between legitimate and illegitimate video recording can be hard to implement technologically. However, the case of electronic cigarettes indicates how technological redesigns can help.

Problem: How can we clarify the situational legitimacy through design?

Whether smoking electronic cigarettes outside the smoker's lounge is legitimate seemed to be an unresolved question for participants. When reasoning about this, some argued in favor of its legitimacy, because they falsely assumed that users only exhale steamed water, which they considered unproblematic from a health perspective. This is not true, and research indicates that exposure to this smoke has similar detrimental effects on health as regular cigarette smoke (Callahan-Lyon, 2014, Silva *et al.*, 2021). Others argued that this is a smoking practice and thus the same rules as for regular cigarettes should apply.

Solution 1: Opt-In and Opt-Out Interactions.

One side of this debate are legal regulations: if there is a smokers' area, political decisions could clarify the position of electronic cigarettes. However, such regulations only help if people respect them, for example through appropriate enforcement. A preliminary or locally more flexible solution could be implemented through "opt-in" and "opt-out" gestures for the witnesses that can block the function of the cigarette. For example, an established hand gesture could indicate "I don't mind if you want to smoke here" (opt-in) or alternatively "please stop disturbing me with the smoke" (opt-out). This would allow witnesses to indicate whether they feel disturbed by the electronic cigarette or not, and shift control towards them. The user could then move further away to reactivate the electronic cigarette. Koelle *et al.* (2018) suggested a similar approach for smart glasses, and they explored different opt-in and opt-out witness hand gestures to indicate whether filming them is okay.

Solution 2: Counter Misconceptions.

On the other side, technological design can also be used to influence the reasoning about legitimacy. It could address current misconceptions about the health effects. Currently, the exhaled smoke of electronic cigarettes looks similar to vaporized water, which may lead some people to perceive it as such. Redesigning the appearance of the smoke to resemble conventional tobacco smoke could be a way to clarify the detrimental health effects, so people's reasoning about the situational legitimacy is not based on false assumptions. In addition, signs on the ingredients and cigarettes to inform users about the detrimental health effects can be used, although the information would need to reach witnesses as well.

4.3 Practical Guidelines for Future Applications

We have described our study and the central findings above, including the coding template for the analysis of WEI interviews. In this final part, we reflect on the interview method as we have used it, and suggest some refinements to support researchers and designers who use the WEI in future studies (Study Goal 2). Thus,

this section provides a summary of recommendations for future work with a consolidated outline of the WEI.

Overall, the procedure of our case study proved effective to learn about the variety of witness experiences with the eight interactive technologies. We generally recommend the following procedure (see also Figure 1):

- 1) Introduce participants to the interaction using immersive material (e.g., photos, videos, a prototype).
- 2) Conduct two rounds of questions, one about a positive scenario and one about a negative scenario (around 30 minutes per participant in total). During the interview, create an index card for each scenario, with sticky notes to represent each witness experience. Follow the interview guide as described below. Record the interview.
- 3) Either conduct a quick analysis based on the index cards alone or transcribe the interviews and run a Template Analysis with our coding template as a starting point. Adapt the template as necessary—we developed it in an urban context in Germany with a particular selection of technologies, so there will be some differences in other settings.
- 4) Develop initial design ideas based on the analysis.
- 5) Reflect about the various impacts of the (re)designed technology on different witnesses.

4.3.1 Interview Guide

We have included the interview guide as described in Section 3 in Uhde *et al.* (2025) and the supplementary material. Overall, this guide worked well in our study. One possible change is to leave out the question about how the interaction could be changed to further improve the witness experiences, which was sometimes hard for participants to answer.

4.3.2 Material

The technologies we studied were all relatively common, so we could use photos as simple illustrative material. To use the WEI in future research to inform the design of new technologies, researchers should spend some thought on how to present the technology to make sure participants can imagine interacting with it and relate it to other potentially co-located practices. The most important function of this material is to allow participants to immerse into a situation where someone interacts with that technology, and other people around them do other things. The more the material can support this, the better.

4.3.3 Analysis

Using Index Cards and Sticky Notes Only.

For some of the technologies from our study, the index cards and sticky notes produced during the interview already contained most details about how the interaction affects witness experiences. Although we conducted a full Template Analysis of the material, a shorter form of analysis only based on the index cards and sticky notes may be enough in some contexts. However, in that case it is important to document the interview thoroughly on the sticky notes and if possible include an additional interviewer dedicated for this task.

Figure 2 shows some example sticky notes and highlights some insights. The card on the top left was from an interview with an extraordinarily talkative participant. When asked about the most common things people do in a park, that participant answered with a long list of practices, which made the index card somewhat chaotic. Later during the interview, many of these practices led

to similar witness experiences and added only limited value. We recommend aiming for around 4 to 6 practices.

The card on the top right is about a drone that is used during a funeral. The witness experiences here fell into two categories: For one practice (talking after the ceremony, for example in front of the church), the drone was described as not particularly pleasant, but not too problematic either. For the other practices, it was described as disturbing. The sticky notes here are ordered from most (while crying) to least but still disturbing (when offering condolences to the closest relatives). Summarizing and ordering the practices this way helped streamline the interview and facilitated discussing such a sensitive topic.

The two lower cards show an example with some more documentation about how the practice relates to the interaction with technology (left) and a lack of such documentation (right). On the left, small arrows and comments indicate how this practice relates to the drone interaction. For example, “children play” (practice) is related because they watch the drone flying around. The sticky notes on the right only contain the name of the practice (e.g., “singing”), which provides only limited information for further analysis.

Notably, sometimes participants started to describe a positive scenario (e.g., “phone calls on a train”), but then reported mostly practices with a conflicting relationship. We noticed this only after transferring the sticky notes into a digital format with color codings, and such insights may be difficult to see from the index cards alone. One improvement could be to attach small red and green stickers to each practice to indicate an overall positive, negative, or ambiguous relationship.

Even if a researcher only plans for this short analysis format, we recommend also recording the interviews in case a more thorough Template Analysis is necessary.

Conduct Full Template Analysis.

For a full analysis, we recommend following our Template Analysis process, which is based on King et al. (2018). The researchers first familiarize themselves with the coding template and the descriptions of each code. This template can then serve as a priori template for the study.

This approach has three advantages. First, researchers can benefit from the work we have already put into that template, including steps to refine the codes and to group them into a hierarchical structure. Second, including the a priori template does not mean that it cannot be adapted. Quite contrary, we invite researchers to adapt the template to what seems most meaningful in their specific context. Our study is based on a German, urban sample, and certain aspects may be emphasized that are not suitable for other contexts. Third, these changes to the template could be interesting on their own to better understand how different contexts highlight different aspects of social situations.

4.3.4 Initial Concept Design/Problem Framing

The three design cases described above illustrate how the findings from the Template Analysis can be used to inform design. The three themes of ambiguities, technological design and constellations of practices, and situational legitimacy provide various starting points to develop design concepts and can be used as a point of reference.

Alternatively, researchers can use the final template from their own analysis to summarize it into new themes, and use these to ground their design concepts. We found it helpful to focus on one core problem for each technology (e.g., how VR glasses isolate

users on the level of practices). We recommend checking each theme with related quotes from the data set.

4.3.5 Reflection

Finally, once the initial concepts are developed, designers should take a step back and think about how their ideas for a (re)design would affect different groups of witnesses. As a basic checklist, we recommend referring to the list of protected groups (e.g., in the USA), prohibited grounds of discrimination (e.g., in Canada), or the European Convention of Human Rights as a starting point to find indicators that certain groups of witnesses may be particularly affected.

The WEI does not quantify ratios of how many members of these different groups would be associated with different witness practices that may be in conflict with the new interaction. But the data set may give researchers some hints. For example, positive witness experiences of overhearing phone calls were primarily reported by women in our study. Conversely, privacy concerns around camera drones were also primarily reported by women. When weighing up effects of a new technology, such first assessments can help reconsider priorities in the design or indicate a need to collect statistical data about such distributions.

A second point of reflection can be to anticipate how the new interaction would shape social spaces if adopted on a large scale. For example, participants reported problems with large numbers of motorized scooters in the city that led to chaos, and sightseeing spots full of tourists taking photos. Some of the problems may be anticipated and considered before “experimenting” with the technology in the wild.

Third, one point of control for designers is the degree of freedom they leave to users to decide how they use a technology. In the case of motorized scooters, there were only limited regulations initially, which led to several accidents (including one of the participants who got hit by a drunk scooter user). In the meantime, Germany has put in place speed limits that restrict the user’s freedom. However, there is an unclear balance between making such restrictions to protect users and witnesses and giving them more freedom to reinterpret the interaction with technology in fun ways that create positive experiences. As a practical example, scooters can be designed to have a weight sensor that restricts dangerous use by multiple people, while still allowing for or encouraging fun forms of interaction using colorful costumes, as reported by one participant.

5 DISCUSSION

In this paper, we introduced the Witness Experience Inventory (WEI), a qualitative research tool to support designing for and evaluating witness experiences associated with interactive technology. The WEI can be used flexibly to learn about a wide range of interactions and how witnesses experience them. It provides detailed insights into the diversity of witness experiences associated with an interaction and indicates reasons behind these witnesses experiences. We developed the WEI through a qualitative interview study based on eight example technologies, which illustrated ambiguities among the witness experiences, positive, negative, and neutral relationships among co-located practices, and complex, situational legitimacies. We also include detailed guidance to use the WEI in future studies and to generate design insights, informed by our own practical experience with it.

The WEI bridges between previous work that highlights the interrelatedness of situational elements, subjective interpretations, and how they shape situated experiences on the one hand

(e.g., Dourish, 2004, Shove *et al.*, 2012, Suchman, 2006, Uhde & Hassenzahl, 2021), and work focused on practical needs for concrete insights about specific technologies on the other (e.g., Koelle *et al.*, 2020, 2018, Rico & Brewster, 2010). We started with theoretical considerations and the complexity of situatedness they imply. Based on that, we suggested a scope for a research tool that covers this complexity, but makes pragmatic compromises, especially in terms of measurability. The result is a qualitative research tool that keeps some flexibility for future applications (e.g., to account for situational differences), but provides informed defaults.

5.1 Considering the Witness in a User-Centered World

Technology design over the past decades has primarily framed interactions based on a paradigm of user experiences (e.g., Hassenzahl, 2010, Hassenzahl *et al.*, 2010, Hassenzahl & Tractinsky, 2006). In our economic system, the user is typically also the person who purchases a certain technology, and accordingly, companies have a particular interest in catering for that person. In that environment, motivating product designers to also consider witness experiences may be challenging. In addition, apart from a few exceptions (e.g., Mitchell & Olsson, 2017, 2019, Olsson *et al.*, 2020, Uhde *et al.*, 2022, 2023), previous work often implicitly framed other people as “problems” or at least “disturbances” to a successful user experience. Such problem-oriented framings often overlook the positive potential of using interactive technology as a source of positive experiences in social settings.

As we could show with the WEI, positive witness experiences can go along or even be a condition for positive user experiences. A photographer needs something or someone to take photos of—which are often other people or “witnesses”. These interrelated effects have often been overlooked, and the WEI can help better consider them not only to produce more positive user experiences, but also to improve the relations between the interaction and surrounding practices. In addition to these more positive experiences people associate with a technology, this broader perspective can also help change the perspective about the product and lead to innovative new concepts (see the design cases above).

5.2 Practical Theory

One way how our study and the WEI can contribute to advancing theoretical work on social situatedness of interactions with technology is through the collection of concrete instances of co-located practices, how they affect each other, and how people (subjectively) make sense of these relations. There is value in describing abstractly how a practice like “making a phone call” can influence witness experiences across social situations (e.g., Uhde & Hassenzahl, 2021). However, using the WEI, we can make these abstract or assumed relations concrete. We can trace the path from how a phone call produces “speech noise”, to how this affects co-located witness practices (e.g., turning music louder, having fun while eavesdropping in a restaurant), and how witnesses reason about their experiences. Thus, the abstract notion of “things relate to each other” becomes specific: We better understand *how* and *why* they do. With a larger collection of such traces in the future, we may be able to further refine theory and find new ways to make such insights practically useful.

5.3 Limitations

Some limitations of our study and the WEI need to be mentioned. First, the study was based on 15 participants from an urban environment in Germany. Although participants came from various socio-economic backgrounds, they all shared a similar cultural

context, which may have influenced the analysis by emphasizing aspects relevant to that context. That said, we think that the method that focuses on exploring varieties of witness experiences, and the approach to inform but not prescribe future studies with the template gives future researchers the opportunity to appropriate the method to their needs and prompts them to reflect on cultural specificities in their own context.

Second, although we varied between more and less common interactions with technology, we applied the WEI only with examples of already existing interactions. Applications for technologies that only exist as concepts or prototypes may be more challenging, because it may be more difficult for participants to immerse into suitable scenarios. Nevertheless, we would be particularly interested to see how the WEI can be used for example in future speculative design work or as part of the design process of new interactive technologies, even though the present study does not provide such insights.

Relatedly, this initial study is somewhat particular as it covers not one specific technology, but a broader set. When looking at our suggested design solutions, we noticed that this contrast between different technologies has sometimes facilitated idea generation. For example, the notion that users of VR glasses have “nothing to do” with witnesses was emphasized by similar comments about smartphones and laptops. In addition, there is a lot of research already about some of the problems around VR glasses and smartphones in social situations, and we are not the first to address this. Thus, generating new ideas based on the WEI data was not always easy, although we think that it has helped clarify some fundamental tensions and ways to overcome them. In future work that only focuses on one technology, which may have already been studied extensively, new idea generation may remain challenging.

Third, as opposed to other tools in the field, the WEI only focuses on the witness and their experiences. This has been an understudied focus in HCI in the past (e.g., Baumer & Brubaker, 2017), and one motivation of the work was to fill that niche. Nevertheless, it would be interesting to also study how different practice constellations affect the socially situated experience of the user.

Fourth, the WEI is currently only validated by our own study and local context. We have not conducted further case studies with practitioners to learn about potential challenges for their purposes. Thus, its usefulness so far is only warranted by our own ideation as seen in section 4.2. We plan to conduct future studies to further test the WEI’s validity and encourage practitioners to run their own studies.

Finally, all technologies studied here are already established to some degree. Nevertheless, some users had no or only limited experience interacting with them that they could report. In such cases, they occasionally reverted to how they imagined such an interaction would affect them as witnesses. If used in future work for technologies that are not yet widely available, researchers may need to focus more strongly on providing immersive material so that the participants can meaningfully immerse into the witness perspective.

6 CONCLUDING REMARKS

All in all, the WEI is a new and theoretically grounded tool to study how witnesses experience a socially situated interaction with technology. It is designed to help researchers and practitioners better understand and design for socially situated interactions. As opposed to previous, measurement-oriented assessments of socially situated experiences that strive for objectivity and study isolated elements (e.g., isolated effects of the form of interaction),

the WEI brings these elements back together. Through the relations of for example the interaction and surrounding practices, it can uncover relevant situational characteristics that underpin witness experiences. We hope that this work inspires further research that takes a social-interpretivist stance on socially situated experiences and helps practitioners integrate this perspective in their design process.

DATA AVAILABILITY STATEMENT

The (translated) interview guide and coding template can be found in Uhde et al. (2025) and the supplementary material. The interview recordings and transcripts will not be shared publicly to preserve the participants' anonymity. Please contact the first author for possibilities to access these data.

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