# Probing Privacy in Practice

Privacy regulation and instant sharing of video in social media when running

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*Abstract*— **This paper examines privacy as something people do, seeing privacy as a constant negotiation of technical and social aspects of technology use. To be able to examine privacy aspects of live video sharing on social media, we have designed and deployed a technology probe in amateur running events. The findings suggest that audio wouldn't be shared a lot in this context, since it captures audible signs of fatigue. Further, it seems that sharing of performance indicators are problematic, so it is more likely that the probe would be used to mediate the general experience of taking part in a running event. Lastly it seems that very few would be comfortable with immediate sharing and would like to have the option of removing recordings and control its recipients. Overall, we find that when confronted with new mediating information technologies, people are quickly able to re-negotiate their privacy boundaries, using earlier experience with similar technologies.**

*Keywords- privacy; instant sharing, social media; video; mobile interaction.*

## I. INTRODUCTION

Privacy involves a broad range of concerns within legislative practices, social practices, cultural differences and digital and urban/domestic architecture. The activities of regulating our personal space, closing and opening doors, avoiding and seeking others, are privacy performed in practice. As our everyday life is performed with electronic networked services, this is increasingly a concern both for the HCI research community and the public at large [1]. Bellotti and Sellen [2] identified a set of challenges pertaining to privacy in digital pervasive environments as a result of separating the users activity and the site of its effects in digital media spaces. Agre [3] has written extensively on privacy concerns and digital technologies, in particular advocating privacy as an issue not simply of individual needs, but something that arises from social roles and relationships. In this perspective, privacy is a culturally embedded and changing practice of everyday living. However, there is limited empirical research on "doing" privacy as an on-going negotiation of technical and social aspects in everyday situations, with some exceptions [4].

To get a deeper understanding of the privacy aspects of one particular context, sharing live video on social media while running, we have conducted two explorative field studies using what Hutchinson et al. [5] has coined a "technology probe". Our technology probe enabled participants in two running events to capture and share video

on Facebook by opening and closing their hand. To be able to analyze and discuss the results of probing this context, we have revisited Palen and Dourish [6] work on privacy and information technology. In their perspective, the user's choice of sharing or not sharing his / her first-person feed with a larger group, can be framed as a constant negotiation of his / her privacy boundaries, a "process where people optimize their accessibility along a spectrum of "openness" and "closedness" depending on context." [6]. According to them a "genre of disclosure" is a stable and recurrent social practice where representations enabled by technology use are met with certain expectations. When these are broken privacy concerns are raised. Technology has the ability "to disrupt or destabilize the regulation of boundaries" [6].

Our technology probe, a video recording and live streaming device for use in a public setting, have challenged our users to negotiate their privacy boundaries in this context. The aim of this study has then been to investigate *how users participating in running events negotiate their disclosure, identity and temporal privacy boundaries when using a technology probe for instant sharing of video on Facebook and to examine how this is a re-negotiation of previously experienced genres of disclosure.*

After a brief summary of related work, we will explicate the framework of "genres of disclosure" in Section 2, before describing in Section 3, how we have probed the running and sharing context by making a fully working technological probe and deploying it in a real world setting. We will continue with a summary of our findings in Section 4, and in Section 5, we will discuss several patterns in how the privacy boundaries has been negotiated by our users. Lastly we will discuss how these patterns can be seen as re-negotiations of boundaries set up by earlier experiences with similar technologies.

### A. Related work

The technology probe developed in this study has similarities with both sports-tracking and life-logging technologies, and researchers interested in these fields have to some extent discussed privacy concerns with these technologies. The use of tracking devices for training and fitness purposes is common, but mostly for private purposes. But when these applications are networked and become more similar and/or integrated with other social media platforms people may experience expectations of joining and sharing

[7][8]. Ojala and Saarela [8] categorize the motivation for joining and sharing into:

- get feedback and guidance
- get content of others
- reputation and status
- comparing results

Other studies have pointed out the importance of social support and accountability, as strong motivational factors to share exercising data [9][10]. Deborah Lupton has identified self-improvement as the main motivational factor for self-tracking [11], and has developed five "modes of tracking", that include a private mode, but also pushed, communal, imposed and exploited modes [11]. The exploited mode raises privacy concerns and "refer to the ways in which individuals' personal data (whether collected purely for their own purposes or as part of pushed, communal or imposed self-tracking) are repurposed for the (often commercial) benefit of others.

Privacy concerns have been raised by wearable computing and life-logging pioneer Steve Mann [12]. Data from logging your own life, can according to him, be misused by other people, government and media. He problematizes that history becomes a "freezer not a dustbin", something that can have negative social consequences. Two recent studies have investigated privacy aspects of life logging using wearable cameras, from the life-loggers perspective [13] and from the bystander perspective [14]. From the life-logger perspective, people preferred to manage privacy in situ, as a result of the perceived sensitivity of the context. Most of the users in the reported study were concerned about the privacy of bystanders [13]. From the bystander perspective, people reported indifferent or negative responses to being recorded by a wearable camera. Many users expressed interest in being asked for permission and in devices for blocking the recording [14].

Generally, users are aware of privacy issues with sharing information on social media [8][9], and tend to prefer a friends-only social media profiles [15]. When digital media sharing crosses boundaries into public domains, both intentionally and unintentionally, users are less able to control their identity [16].

## II. PRIVACY

In 1890, Warran and Brandeis [17] published their seminal article "the right to privacy" where they write:

Instantaneous photographs and newspaper enterprise have invaded the sacred precincts of private and domestic life; and numerous mechanical devices threaten to make good the prediction that 'what is whispered in the closet shall be proclaimed from the housetops' (ibid).

From these early discussions on the conditions for protecting privacy and ways of regulating privacy by law, there is an increasing focus on privacy as our everyday lives are partly performed online. The list of mechanical devices could today be extended to electronic devices that capture, store and potentially distribute dynamic information from the peoples context, such as audio, video, location and biometric data. Palen and Dourish [6] have proposed a framework for a nuanced understanding of privacy in a networked world. Their framework builds on the seminal work of Altman [18][19], and identifies three boundaries that are central to the negotiation of more or less openness and closedness.

The first and most basic boundary is the *disclosure boundary*, that is, what information to reveal or keep from others. For example, should I share this picture of my new bulldog on the net, or should I keep it for myself?

Secondly, the *identity boundary* is defined by the role taken on by the user. A user can for example represent an organization, such as the member of the dogs rights organizations, or represent herself personally.

Finally, the *temporal boundary* is about the effects of persisted information. Unintended recipients can interpret the information left behind in a networked system at a later time, and there is little or no way of controlling the interpretation of information, or the context in which it is interpreted. For example, the article about dogs right in your local newspaper or social network you shared in 2007, discussing a city plan, can be read and interpreted in 2016 in a very different discussion about the housing of dogs.

One of the most important insights from Altman's work is that privacy is not a static set of rules, but rather a dynamic process, a constant negotiation depending on the situation. In other words, privacy is something that is actively negotiated and performed. Grudin [20] puts this in the context of situated action, which is what allows the constant negotiation just described:

Why then the uneasiness, the widespread attention to privacy? It may reflect an awareness at some level of something more fundamental than privacy that is being challenged: The steady erosion of clearly situated action. We are loosing control and knowledge of the consequences of our actions, because if what we do is represented digitally, it can appear anywhere and at any time in the future. We no longer control access to anything we disclose [20].

Indeed, where are the boundaries of situated action when the information about the situation is broadcasted with networked technologies? With viewing privacy through the framework proposed by Palen and Dourish [6] as an activity, something that users "do" and negotiate instead of "have a right to", there is a possibility of gaining insights into ways that this is practiced.

## III. PROBING

Technology probes as defined by Hutchinson et al. [5] are simple, flexible, adaptable technologies deployed to find out about the unknown. Probes are not prototypes and should be used in the early stages of projects to investigate new perspectives that can constrain and open future designs [21]. Technology probes support playful interactions with new technology in new contexts and provoke participants' reactions [22].

Hutchinson et al. designed technology probes with three goals in mind:

- understanding the needs and desires of users in real-world setting
- field-testing the technology
- inspiring participants and researchers to think about future technology and its use

Studies have deployed technology probes, focusing on only one or several of these three research goals. In [23], simple step counters are used as ready-made technology probes to study teenagers' motivation for exercising and to find out important lessons for the design of future devices. In [24], technology probes are applied to measure and assess texting and updating functionality of situated displays. In [25], a mobile technology probe is designed to better understand if and when intimate couples desire to hold hands when apart.

Similar to [25], we have designed a mobile technology probe. Our research goal is to understand privacy with instant video sharing on social media while running. We have tried to create a realistic situation for users to experience instant video sharing in practice. To make sure that we were able to probe for privacy concerns in our research design, we have strived to design the probe to be simple, wearable and robust, something that is especially important for intimate, mobile context [25].

*A. Hardware and Software*

Our technology probe in Figure 2, consists of two parts: a mobile phone for recording and sharing videos to Facebook and a sport glove that functions as a remote control for the mobile phone. We fitted the glove with a flex-sensor and a wearable Arduino mini-processor called LilyPad. Flex-sensors are a form of resistors that change their resistance depending how hard they are bent. The LilyPad can detect these changes and transform the analogue resistance values to integer values. In the probe, these values are sent via Bluetooth to a mobile phone. The application on the phone maps the values to specific functions. Single or multiple fingers can be fitted with sensors, and this setup can support detection of many different hand gestures. In our study, we needed two functions, on and off, mapped to recording and sharing video on Facebook, so we only fitted one sensor to the middle finger on the glove. All technical components were hidden inside the glove. A red recording led was the only visible part and the glove appeared as a normal sport glove from a distance.

*B. Design*

"Probes are meant to collect usage data, but if users are deterred from using them because of their appearance, design should become a priority" [25]. Studies have shown that the wearability of the smart phone is not optimal for interactions on the move, for example running and walking [26][27]. To improve wearability of the phone we made careful design choices regarding placement of the phone, how the users should interact with the phone and the mapping between these interactions and the phones functions for recording and sharing video.

*1) Placement:* The first set of design choices concerned the placement of the phone while running. Gemperle et al.

[28] recommend placing larger and heavier devices on non-moving parts of the body throughout the movement. To be able to capture video in a first person perspective, the phone needs to be positioned on the front of the body directed forward. We solved these requirements by mounting the phone in a neoprene hip belt with a see through pocket facing forward.

*2) Interactions:* Secondly we addressed the problems with touchscreen interactions while running. These interactions are in effect not possible in this situation, without disturbing the running experience. Users often have to stop to look at the screen and press a button [27]. We aimed to design a more unobtrusive input mode using a sports glove with movement sensors.

*3) Mapping:* The last design choices concerned the mapping of gestures to functionality. Rico and Brewster [29] recommend using gestures that are familiar in feeling or appearance. For our technology probe the start and stop recording functions need to be mapped to suitable hand gestures. They should be simple enough to perform while running and they should not have other predefined meanings. Simple hand gestures that we observed during the design process were making a fist, tapping fingers together, open hand, spread fingers, waving right/left. We ended up tying distinct hand gestures metaphorically to the mapped functions;

- hand open (record and share)
- hand closed (stop recording and sharing)

*C. Deployment*

We deployed the probe in two running events taking place in Strömstad, Sweden on November the 8th and Wolfen, Germany on December the 28th, 2014. The three main criteria for choosing the events were that they had good 3G coverage, they were accessible to the researchers and that they were semi-professional with medium distance tracks (5 and 10 km). We recruited three participants for the first field trial and three for the second, from local sports clubs and directly at the events. We paid their registration fee and they received a 10€ flower present card for participating. In Table 1, we have listed the participants with age, gender and experience with sports tracking and social media.

TABLE 1. PARTICIPANTS

| # | Event | Age | Gender | Sports Tracking | Social media |
|---|---|---|---|---|---|
| #1-1 | Strömstad | 30s | Male | Yes | Moderate |
| #1-2 | Strömstad | 30s | Female | Yes | Active |
| #1-3 | Strömstad | 40s | Female | Yes | Moderate |
| #2-1 | Wolfen | 20s | Male | Yes | Moderate |
| #2-2 | Wolfen | 20s | Male | Yes | Moderate |
| #2-3 | Wolfen | 20s | Female | Yes | Moderate |

In Strömstad, the researchers met up one hour before the start time at 12 pm. The first half hour we registered the informants for the 5km track and checked the probes. Until

Figure 1. Starting any minute


Figure 2. The equipment

the start at 1 pm we fitted the technology to the individual participants and gave them brief explanations of how they could use it. They tried out the gestures, and at the same time we calibrated the on / off thresholds to their hand movements. We explained how the video they were going to record was shared on Facebook. The informants used from 24 to 34 minutes to complete the track and from 1:45 pm we conducted semi-structured interviews with each of them. We had prepared a set of guiding questions focusing on the participants' experience of instant video sharing using the probe in regard to negotiating their privacy boundaries.

In Wolfen, we followed the same procedure as in Strömstad, with some small differences. The race started earlier at 10 am, and one of the participants chose to run the 10km track.

We used open coding to analyze the collected data independently from each other, followed by a collaborative session, were we resolved small differences and agreed on the main findings.

## IV. FINDINGS

All six participants, in the two separate field studies, expressed that the events were well organized and as they expected. It seemed that they felt at home in what they saw as small and friendly happenings. Figure 1 shows runners in Strömstad just before the start. The participants were more or less competitive or serious about the races, but all six said they enjoyed the experience. It didn't seem that participating in the study by using the technological probe, took away from their participation in the events themselves. In the following we denote the participants using two digits, the first for the event and the second for participant (#event-participant).

When it came to placement of the probe as shown in Figure 2, the most competitive of the three in the first field study #1-1, thought that the extra weight of the smartphone and belt on the chest was bothersome. He said the belt wasn't tight enough so it moved enough to irritate him. In the second field study one participant mentioned that it is important that the belt was positioned right. For him the belt was strapped on too low and he had to move it up while running. The other four participants in the two field studies did not report that they were bothered at all, and said they forgot about the placement of the mobile phone after a short while.

All six participants said that the hand gestures were easy to perform and appropriate for controlling the video stream.

It is very natural to extend the hand. […] so to turn it on with that is better than using a closed hand. #1-1

There is no middle way. Either you open or you close your hand. This simple. #2-1

None of the participants proposed an alternative hand gesture that could have worked better for this purpose. All of them said they "forgot" the interface after a while, but they all kept on using it and continued recording video throughout the races.

### A. Privacy Boundaries

The participants had few reflections on how "being a camera" in public can be problematic to others.

No I did not think about them [*other people*]. Do I need to think about them? #2-3

They recorded a lot when they had people nearby, in the starting area especially, and also when they were running almost alone.

*1) Disclosure boundary:* Their attention was on when the camera should be turned on, the framing of the image and what sounds were recorded. Three of the participants had a competitive focus during the races and turned on the camera when they improved their position.

…I thought it was funny when I ran down the hill, because I am really fast at running downhill, then I usually overtake many of the other runners. So I turned on the camera on top of the hill, then let go… and thought this was really fun. #1-1

Participants #1-2, #1-3 and #2-3 were concerned about the framing of the image. The first said that she was worried because she is short, and that she filmed only the road and nothing else. The second said she tried to keep a dangling headphone-wire away from the camera. The third was worried about her hands swinging in front of the camera. Figure 3 shows two screenshots from the captured video.

Most of the participants were acutely aware of the sound captured when recording. Participant #1-1 gave comments intended for a listener. Participant #1-3 said she was really worried about recording heavy breathing and other audible

signs of fatigue. Participant #1-2 turned the camera off because she needed to say something she didn't want anyone to hear. She felt that the sound was more important than the image.

> …one thinks about, yes, first and foremost what one says, for what one sees can't be influenced. But what one says, I thought about that a lot. #1-2

Participant #2-3 hadn't been aware of the audio and was embarrassed afterwards because she talked a lot with other people while recording.

*2) Identity boundary:* All participants expressed that sharing video from participating in a sports event on social media could be positive for their image.

> It wouldn't matter if some of this were published, because then people would see that I am active and… yes, I have to admit that this appeals to me, it lowered the threshold for… the social. #1-1

Participants #1-1, #1-3, #2-1, #2-2 were skeptical though, and related that they rarely exposed themselves in this way. Participant #1-1 and #1-3 said that sharing from sports activities could be seen as bragging, and they would be careful of coming across as betters on social media. They both expressed irritation with other people sharing their training activities on Facebook.

> …when people share training logs, I have cycled 70km for example, deserving beer and taco, then I think this is bragging. #1-1

But both these informants were more positive to sharing if the content were without tracking information.

> I think, yes - sharing a film, that's nice, but sharing how far you have run, how fast and all that, that is for me, not others. Film is fun of course, that could be amusing. #1-3

In contrast to the skeptical participants, informant #1-2 and *#2-3* said they loved to share from activities they participate in, including sports, and that they saw no problems with using the probe to do this.

> Yes, I share a lot, also from sports activities. I love running so this is nothing strange. #1-2

> It was cool. It is a new way to communicate with friends. Facebook is made to share things. *#2-3*


Figure 3. Screenshots from captured video

*3) Temporality boundary:* When it came to what the participants wanted to happen with the shared videos from the event, they answered differently. Participant #1-1 said

that he wanted control of the videos. He would have preferred to have them sent to his private inbox for editing before they were published. The most likely thing he would make is a "best of" edit from the competition. But when the videos were already published he was not certain what to do.

> …to me it is unpleasant that the videos are out there, then I can just ask for them to be deleted. Except when I cross the goal line or something. I'll see about that. #1-1

Both participants #2-1 and #2-2 wanted to keep the videos on their computers. Participant #2-1 didn't mind having them online since he is in good shape. In contrary to this, participant #2-2 wanted them removed or shared with selected friends only. Participant #1-2 didn't see any problems with the videos being published. She expressed no desire to erase them and hadn't really thought of this as a problem. She said that maybe someone would look at them, maybe not. Participant #1-3 was more skeptical, but was also comforted by the videos limited appeal. She was more worried about the audio of her huffing and puffing.

> …if it is interesting to others then it can be out there, but I don't know if that is the case. I don't know that [laughs]. If it is a video, where I reveal myself, for example with breathing and puffing in the background, then I think I would have removed it. #1-3

Participant *#2-3* said she would keep the videos that are fun and remove videos less interesting to others.

> It depends, how they look. So if there is anything funny, for example when Lars passes me, if this was good, when I would keep it online and write a comment under. *#2-3*

## V. DISCUSSION

When it came to running the events the participants had different agendas, but they participated according to what was expected of them. They followed the logic of the event, the instructions from the organizers, ran the designated track and put effort into the running according to physical capabilities. They related to their time and rank in the race and happily received their prizes. None of them did anything that could be conceived as "outside" the social obligations of the events themselves. None of their actions were "out of place" [30]. The wearing of and interaction with the technological probe seemed to be unobtrusive to the participation in the event and the participants quickly understood the function of the technology and the mapping between gestures, actions and feedback.

### A. Negotiating openness / closedness

When using the three privacy boundaries to understand the results of this study it is evident that the participants negotiated these boundaries differently. There are findings from the trials that point towards openness, and some that point towards closedness. It is important to note that the privacy boundaries are negotiated together. It is difficult to consider one boundary without taking the other two into account.

The first, and maybe the most interesting pattern we see, mostly concerning the disclosure boundary, is related to sensing. None of the participants thought that the first-person image was problematic, but several of them were more concerned with the audio. Both talking and audible signs of exhaustion were mentioned as problematic to share with others. It seems that the first person view, where the participant was not visible in the image, was conceived as less private than the audio. The users understanding of the video image recorded by the probe facilitated more openness and their understanding of the nature of the audio triggered privacy concerns and more closedness. An interesting follow-up study would be to repeat the experiment with the camera mounted so that the runner could be part of the image.

The second pattern, mostly related to the disclosure and identity boundary, is about what the participants chose to record and their explanations of why they did so. We see two main stories told, with emphasis on the competition and with emphasis on the experience. Three of the participants recorded when something interesting happened in the competition, for instance overtaking other runners in the race. The other three didn't care much about this aspect, but recorded what they thought was interesting like nice scenery or social interactions. This pattern seems to point towards openness, all participants recorded a lot and with some narrative intentions. The interviews seem to indicate that the reason for this was that the probe didn't record and share any performance indicators, like pulse and speed. The recordings were not revealing their standing in the race or other precise measures of performance. This seemed to be important to the participants independent of how well they performed in the race. It seems that quantitative measures of their performance would have triggered more privacy concerns and lead towards more closedness.

The third pattern, mostly related to the temporality boundary, is the participants' wish to have control of the recordings. The decision they had, of turning the recording on and off, was not enough. All the participants except one wanted to be able to delete unfavorable or boring recordings before or after they were published to Facebook. Most of the participants wanted to share the recordings with a selected group of people if they could, controlling not only what they shared but also with whom. These findings seem to indicate that the participants were uneasy about the immediate and indiscriminate sharing done by the probe, pointing towards more closedness. But at the same time many of the participants were intrigued by the experience with the technological probe. It seems that they were open to experimenting with the format as long as they could have the option of removing recordings afterwards and have more control of their recipients. This is relatively easy to do on a social media platform like Facebook and this finding points in the direction of openness. Maybe the participants would be inclined to share more easily as a result of more experience with the probe.

*B. Re-negotiation of privacy boundaries*

The concept of "privacy genre" is mainly a descriptive term, since genres are historically situated as social practice. In our study we have developed a probe that gave our informants experience with new technology, exploring what could be called a proto-genre, but not a genre. The sharing of live video on Facebook while running is not exceptionally new or outlandish, but still not something that many people do as part of their everyday activities. So what we have been probing is mainly how people are able to negotiate privacy boundaries when using new and not commonly used information technologies. In this perspective, we have found that people rely heavily on previous experience with similar technologies when negotiating privacy boundaries "fresh". They rely on earlier and established genres of disclosure related to, in our case combinations of sports tracking, photography and social media. In this study, we were surprised by how quickly and consciously this process was undertaken by our informants, and how efficiently new boundaries where negotiated building on old. At the same time, we found that unfamiliar aspects of the proto-genre articulated by the probe, triggered the most intense and partly unresolved negotiations of privacy boundaries; the clearest example being the recording and live sharing of "first-person" sound.

These findings attest to the usefulness of the concept of genre of disclosure both as an analytical tool but also as a perspective useful when designing and exploring mediating technologies. People's practical everyday experience with negotiating privacy, framed and understood as a social situated dynamic, can give good guidance of what will trigger privacy concerns and what will not. This study is an initial exploration of designing and deploying technology probes to investigate privacy concerns with mediating technologies. Our results indicate that technology probes can be designed to disrupt or destabilize existing genres of disclosure, giving researchers the opportunity to study these closer, mining the interstices between them.

## VI. CONCLUSION

In this study, we have explored privacy concerns with instant sharing of video in social media. To understand the co-dependent technical and social aspects of instant sharing and privacy, as framed by the concept of "genres of disclosure" [6], we have developed a technological probe and conducted two field studies at running events in Sweden and Germany. In each field study three participants were fitted with a working probe sharing video instantly to Facebook by opening and closing the hand. The probe performed according to the intentions of the research design, opening up for investigating privacy in practice.

The findings suggest that audio wouldn't be shared a lot in this context, since it captures audible signs of fatigue. Further, it seems that sharing of performance indicators are problematic, so it is more likely that the probe would be used to mediate the general experience of taking part in a running

event. Lastly it seems that very few would be comfortable with immediate sharing and would like to have the option of removing recordings and control its recipients. Overall, it seems that people, when using new mediating technologies, rely heavily on earlier experience with similar technologies when negotiating the privacy boundaries, emphasizing the historically situated nature of privacy in practice.

We believe that probing wearable technology in the field has been important for this study, and see how our findings open up for further studies with similar mediating technologies, in other mobile contexts.

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