Are You Hiding It? Usage Habits of Lifelogging Camera Wearers

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Figure 1: Camouflage of lifelogging cameras: unobtrusively attached to an event badge, paired with headphones to be mistaken as audio player, disguised as jewellery, worn on same-color clothing and decorated with stickers and hidden amongst buttons and pins. [left to right, top to bottom]

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Abstract
Though still a rare sight, body-worn lifelogging cameras such as Mofily's YoCam or the Narrative Clip have become increasingly popular amongst tech-savvy audiences. In this paper, we investigate whether users of those devices prefer to wear them openly or in a concealed, less obtrusive manner. We discuss the camouflage of lifelogging cameras based on results from an online study (N=117), including the *why (not)* and *how* as well as qualitative insights on how social contexts influence usage habits. The results of our study provide empirical evidence that deliberate concealment can be perceived unethical, and that moderate noticeability is favoured. We furthermore found contrary effects of lifelogging cameras in interpersonal relationships, including self-censorship by the user, avoidance behaviour by her/his peers and conversation starting character of the device itself. We conclude by highlighting design challenges concerning ubiquitous, body-worn cameras.

Author Keywords
Lifelogging; Device Usage; Social Aspects.

ACM Classification Keywords
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Introduction
How a photographer is perceived largely depends on whether she is holding a traditional camera in front of her

Figure 2: Users of the "Narrative Clip Lounge" (a public Facebook group) are discussing a particular method of camouflage. [screenshot taken on 10.04.2017]

face or has a miniature camera pinned to her clothes taking pictures every 10 to 30 seconds [17]. Additionally, in contrast to traditional cameras, body-worn cameras (e.g., Mofily's YoCam[1], iON's SnapCam[2], Narrative Clip[3] can also be worn in many different ways, including openly and undisguised to fully concealed or camouflaged as illustrated in Figure 1. Utilizing those lifelogging cameras for secret photography might however, be perceived as "creepy" or ethically questionable (Figure 2). In this paper we investigate the social implications of these lifelogging cameras based on how they are used and worn. We discuss two research questions in detail:

R1: *Are lifeloggers hiding their lifelogging cameras?*

R2: *How are usage habits of lifelogging camera wearers influenced by social contexts?*

We provide insights based on a comprehensive online survey (N=117) amongst users of lifelogging cameras, conclusively answering the first research question (R1). Purposive sampling via social media allowed us to sample real-world experiences and habits from actual device users outside a constrained academic or laboratory setting. Additionally, we present a number of qualitative insights from a user's perspective regarding the effect socio-environmental relationships on actual usage behaviour, thereby contributing to an understanding of the social implications of lifelogging cameras (R2).

Related Work

Early explorations, e.g.,Microsoft's SenseCam [4] paved the way for today's lifelogging cameras that are commercially available in an increasing number of shapes and sizes. In this section, we look into research that discloses or hides these devices in a public context and go into detail on the paradigms of unobtrusive, subtle, and candid interaction.

Cameras in Public Spaces

Implications of wearable cameras in social interactions and in public spaces have been addressed by several researchers that uncovered privacy concerns and lack of social acceptance [7, 15, 17]. Hoyle et al. [5] investigated privacy behaviours of lifeloggers, particularly with respect to privacy of bystanders. From a wearer's perspective they investigated how consent from bystanders could be collected, as well as privacy attitudes including awareness, control, and disclosure. The authors list the academic setting (with participants having been equipped with a custom camera by the researchers) as one limitation of their research: "Due to legal concerns, [..] participants were explicitly forbidden from wearing their devices in many locations in which they could have been recording on their own volition." In our present research, we overcome this limitation by collecting real-life experiences from lifeloggers that have been using the device regularly in their private lives.

Experiences from a bystander's perspective have been discussed by Denning et al. [2], who report results from on-site interviews in cafes and derive design axes for privacy mediation. Koelle et al. [7] investigate user attitudes towards smart glasses usage from a user and spectator perspective, highlighting that knowledge about usage intentions positively affects how the bystander perceives device usage. They further identify the conflict between the desire to make use of a wearable camera device and the right to remain in private. However, individuals as well as authorities or "disembodied institutions" [17] that deploy and control CCTV cameras have been linked to the discussion about body-worn cameras in public spaces. Steve Mann, an advocate of wearable cameras, criticises the hypocrisy of

[1]Mofily: YoCam, http://www.getyocam.com/, accessed 10.04.2017
[2]iON: SnapCam, https://usa.ioncamera.com, accessed 10.04.2017
[3]Narrative Clip, http://getnarrative.com/, accessed 10.04.2017

being ubiquitously monitored by CCTV (Surveillance) cameras, but not allowed to take pictures or record imagery of ones own (Sousveillance) [8]. He further stresses “Veillance Freedom”, particularly which circumstances allow or should allow secret recording by individuals with wearable cameras. With our research, we add to this complex issue by providing insights on lifelogger’s attitudes towards hiding their devices and towards secret recording. We contribute an empirical view by documenting what they consider (un)ethical and/or a privacy violation.

Unobtrusive, Subtle or Candid Interaction?
In 2005 Reeves et al. [12], asked “How should a spectator experience a user’s interaction with a computer?”. They proposed a taxonomy that characterizes both, the user’s manipulations of an interface, and the effects of the interaction as *hidden*, *partially revealed*, *fully revealed* or *amplified* for spectators. Though (back then) the authors did not cover body-worn cameras, their taxonomy can also be applied to today’s lifelogging cameras.

Depending on the situation, the presence of electronic devices or interaction with them may be perceived irritating, disturbing or inappropriate. While end users have been coping with this by e.g., checking their phones secretly under the desk [1] or announcing outright what they are currently doing with a device, HCI researchers have presented different ways of increasing either the unobtrusiveness of the device itself, the interaction with the device or both. Pearson et al. [10] present *Chameleon Devices* that actively “blend in” by adopting the visual appearance of their background. Rekimoto et al. [13] advocate that in social context both input devices as well as interaction styles shall be as unobtrusive as possible, i.e., be designed in a way that they do not limit social interaction (e.g., hand shaking) and integrate seamlessly in the user’s outfit. Profita et al. [11] were able to show that the forearm is the most desired input location out of a large number of options. In common with all these interaction styles is that they aim to minimize social awkwardness by drawing little attention to the device itself. Another strategy is to exploit the subtlety of illusory activities such as handling a coffee mug to disguise the interaction [1]. Anderson et al. utilize inconspicuous everyday actions or objects (e.g., by displaying notifications on the bottom of a mug) as a means of interacting with a system without it being noticed; they define this concept as *subtle* interaction.

In contrast, Ens et al. [3] propose *candid* (*revealed* or *amplified*) interactions that leverage situational awareness on the observer’s side by explicitly pointing out core motives (e.g., application type or purpose) of the interaction. Proposed design options include (e-ink) displays attached to the back of smartphones [6], broadcasts of status messages, and accessories such as wristbands or jewelry communicating the current activity [3].

Methodology

In the subsequent section, we go into detail on the questionnaire used in the survey, the method of recruitment, and discuss participants demography as well as potential limitations.

Apparatus and Analysis Method
The online survey consisted of 6 two-tiered questions where participants could answer each question through a 5-pt Likert scale (1-never to 5-frequently) as well as a free-text explanation. The questions focused on the frequency of particular events such as being asked to take the camera off. All questions were asked in a neutral, non-judging way. To clearly delineate stashing the camera in one’s pocket, we rephrased the term “hide it” to “make the camera less stand

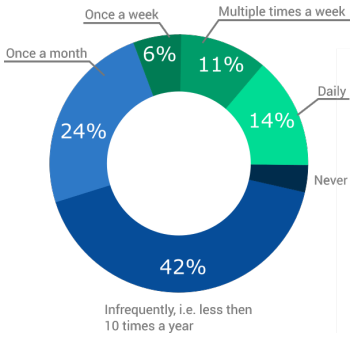

Figure 3: Usage frequency of their lifelogging camera as indicated by the participants (N=117). Four participants (3%, "Never") did not use their device (anymore) at the time of evaluation.

out." We furthermore anticipated bias from social desirability (acquiescence) through additional projective, indirect questions, e.g., whether they knew of other people concealing their lifelogging cameras. In addition, wearing frequency, camera position and demographics were recorded. Qualitative results were analysed using the procedure of inductive category development [9]. Re-occurring themes were summed up (occurrences denoted as n); duplicate entries by individual participants were removed.

Recruitment, Demography and Device Ownership

Our survey targeted users of lifeogging cameras, a very specific and not easily accessible user group. To facilitate recruitment, we used Narrative Lounge[4], a Facebook group (2.5k members at the time of evaluation) as the base for purposive sampling. Responses were collected anonymously, data collection and recruitment method were approved by an internal institutional review process. We recruited 117 participants (18 female, 3 other), between the age 19 to 84 ($M = 42$, $SD = 13$), located in Europe (42%), the US/Canada (30%), and Asia (21%) followed by Oceania (5%). Middle East/North Africa, South/Central America and Africa were represented by one participant each. A large majority of participants indicated a University or college degree (n=77, 69%) or doctorate/postdoctoral lecture qualification (n=10, 8.5%) as highest level of education (ISCED[5] level 6 and above). Twenty-four participants (21%) had obtained a High School Diploma or Associate degree (level 5), and overall 6 participants indicated ISCED levels 4 or below. Participants were asked for the kind and brand of lifelogging camera they owned (multiple selections possible). Since we used the Narrative Clip Lounge Facebook group for recruitment, the obvious majority (116 - 99%) of participants owned a Narrative Clip generation 1 or 2. Participants however, also owned other devices including the Autographer (4%), 61N (1%), YoCam (1%), iOn SnapCam (2%), meCam Classic (2%), SnapChat Spectacles (1%), and Perfect Memory (1%). With the exception of the SnapChat Spectacles, all those devices share a common form factor, having a rectangular, square or circle shape with a diameter between 1 and 2 inches that provides various ways of being attached. Reported usage frequencies (Figure 3) were widely spread, with 31% of the participants using their device at least once a week. Participants were not provided an incentive for taking part in the study.

Limitations

With a 5% response rate of the sample (members of the "Narrative Lounge"), results are likely to be representative for the group's members if a non-systematic non-response bias is assumed. However, the sample as well as the user group "lifelogging camera wearers" might be inherently biased through an over-proportionate number of typical early adopters, i.e., males with above average income and education. Thus, the results might not be generalisable to the population at large, which would affect our results' future applicability if lifelogging cameras were to become broadly adopted. Moreover, since the survey did not cover the bystander's point of view, some aspects of wearable cameras in a social context might have been missed. The sampling procedure, while providing access to users with long-term real-life experiences, also induced a bias towards Narrative Clip users. However, as a large number of lifelogging cameras share the Narrative Clip's form factor, including size and available attachment methods, we believe that the results regarding wearing styles are to a large extend transferable to other, similar devices. Nevertheless, devices with a substantially different form factor, such as wrist- or headworn cameras might induce different usage habits. Regard-

[4] Narrative Lounge, https://goo.gl/CtEqeH, accessed 10.04.2017

[5] International Standard Classification of Education (ISCED), http://uis.unesco.org/en/isced-mapping, accessed 10.04.2017

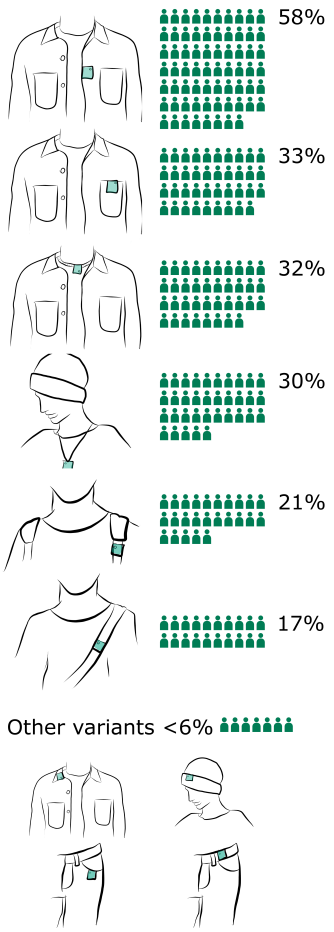

Figure 4: Top to bottom: most frequently chosen wearing positions: by the lapels, at the pocket of a jacket/shirt/blouse, in the center of the collar, as a necklace, clipped the straps of a backpack, or to a messenger or handbag

less, we believe that the discussed usage habits in social contexts might also apply to other body-worn cameras.

Results and Discussion

In this section we summarize and discuss the online survey's results and highlight key findings and core motives.

Where and how to wear?

The majority of participants (58%) indicated that they wore the camera on their lapels. They also chose to wear it at the pocket of a jacket/shirt/blouse (n=38, 33%), in the center of the collar (32%) or as a necklace (30%), as visualised in Figure 4. Options such as clipped to the waistband/belt (3%) or pocket (4%) of trousers, jeans or skirts were selected rarely. Participants considered those variants to be less obtrusive (n=3), as they were outside an observer's line of sight. However, positioning the camera below the waistline also affects the field of view, which was named as one reason for choosing their wearing position (*POV*, n=47). This also implies that current form factors might be reconsidered to allow wearing positions closer to the human POV, as suggested by Wolf et al. [16], who found that images from a head-worn lifelogging camera are perceived to produce the most relevant and most desired imagery. However, as the participants further named *convenience* (n=23) and *unobtrusiveness* (n=14) as decision criteria, a head-worn lifelogging camera (e.g., 3RDi Third eye[6]) might face acceptability issues.

Ice-breaker or offending object?

While 105 participants (90%) reported others being curious about their lifelogging camera (Q1, $Mdn = 3$, $SD = 1.3$), participants also had the impression that their lifelogging camera was usually not noticed (n=7) or noticed but not identified as a camera (*unknown object*, n=23). P58 states: "I am surprised how few people ask about it. Maybe once a week or so someone asks me what the white square on my lapel is." Participants reported lifelogging cameras to be mistaken as jewellery (n=4) or confused with a walk-distance meter (P87). This can be explained by the novelty of the device type as well as the lack of visible affordance: "It is not obvious what this thing is doing" (P21). Currently, it is unclear, whether the lack of visible affordances increases (c.f. Rekimoto et al. [13]) or decreases social acceptability, as suggested by Ens et al [3] and Koelle et al. [7]. A minority of participants (29%) had ever experienced angry reactions (Q2, $Mdn = 1$, $SD = 0.7$), and 35 participants (30%) have been asked at least once to take it off (Q3, $Mdn = 1$, $SD = 0.8$). Requests to remove the camera have been reported for a broad spectrum of contexts, including *personal* n=11), (*public*, n=5) and (*professional* n=5) occasions. With no (monotonic) correlation between usage frequency (Figure 3) and observed answers ($r_S(115) = 0.08$, $p > .05$), usage frequency seems to not affect the likelihood of experiencing angry reactions. Daily users of lifelogging cameras might, however, have grown accustomed to e.g. accusing looks, and thus become less sensitive to implicit negative, or angry reactions, as enquired in Q2. Experiencing such reticent disapproval such as angry looks (non-verbal disapproval, n=7) has been reported by a small number of participants. Consequently, these participants either took down the device (n=5), or ignored the looks (n=2). "I was never directly asked to take the camera off, but people's discomfort often made me take it off of my own accord." (P42) Similarly, other participants witnessed perceptible unease (n=13) of peers and bypassers. They furthermore reported their peers to have verbalised concerns such as whether (their) permission was required for the recording (*permission*, n=7), whether and where recorded imagery would be stored, processed, used or shared to (*purpose*, n=5), as also discussed by Denning et al. [2]. Two participants

[6] http://www.3rditek.com/, accessed 10.04.2017

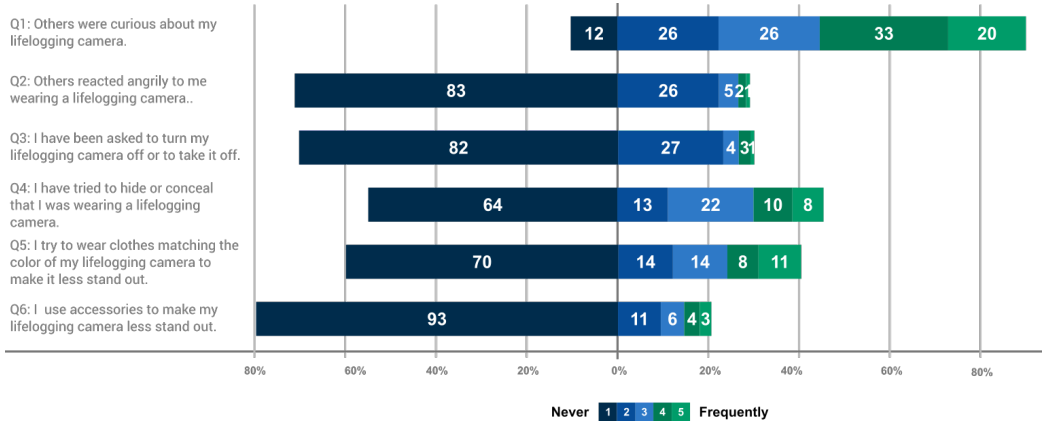

Figure 5: Detailed results of Q1 - Q6; based on 5-pt Likert scales ranging from 1 (*never*) to 5 (*frequently*).

reported having experienced explicit *avoidance behaviour* by friends and family when wearing their lifelogging device. Explicitly negative reactions were reported by nine participants. Contrarily, several participants reported that their lifelogging camera functioned as a conversation starter or ice-breaker (n=10). P14 explains "I'm an IT consultant, so often wear clip at conferences. Great way to connect with fellow nerds." Participants also reported experiencing explicit positive reactions (n=11), such as acquaintances making "funny faces" (P19), or greeting and acknowledging the device and its wearer: "When I wear it to school, students notice right away and smile and wave at it/me." (P25) This evidence implies that lifelogging cameras might both foster social interaction with loose contacts, but also prevent more personal or intimate interactions with relatives and friends; However, this is to be confirmed by future research.

Hide it, highlight it, or just blend in?

When asked whether they ever attempted to hide their lifelogging camera, 53 participants admitted to doing so at least occasionally, while a small majority of participants stated to never hide it (Q4, 64, 55%, c.f. Figure 5). Apart from avoiding negative reactions (*anticipated objections*, n=12), and undesired attention (n=7), authenticity (n=10) was named as the prominent reason for camouflaging lifelogging cameras: "So that people appear to be in their natural state if they do not know the existence of a camera." (P27). Amongst other strategies (Figure 1), wearing clothes matching the camera's color was reported as well-known obfuscation method, however rarely used in practice (Q5, $Mdn = 1$, $SD = 1,4$). Instead, some participants just tried to not call attention to the device even though it was worn in the open (blending in, n=11). P25 stated "I don't hide the camera. I rarely point out that I'm wearing one, though." In contrast, other participants (*justification*, n=5) purposely highlighted life logging device. P113 remarked, "I actually try to make it stand out, not be accused of 'secretly filming' others." (P113) This interesting strategy is backed by a prior study where participants described recording from AR glasses as different and potentially less acceptable as other types of recordings as it was more subtle [2]. Moreover, several participants stressed that it was unethical to hide the camera (*ethical concerns*, n=6).

Between Circumventing Regulations and Self-Censorship

Some locations (e.g., museums) typically bar photography. These restrictions usually apply to all types of imaging devices, including traditional analogue cameras, digital cameras, camera phones and body-worn cameras. Unsurprisingly, participants reported that they were required to take off their life logging camera at those places (*no-camera rules*, n=12). Several also stated that they had deliberately used their lifelogging camera to outsmart no-photography rules (*circumvent regulations*, n=8), and some even admitted to concealing the truth about their device when asked. P90 explained "Once I told airport security that it was jewellery and the answer was not questioned – but I felt justi-

fied since airports have their own cameras." This attitude is explained best by the concept of *Equiveillance*, which advocates the individual's right to record his or her environment while being recorded himself/herself [8]. On the other hand, a large number of participants employed some form of self-censorship (n=9), i.e., to use their lifelogging camera only at locations or events where they perceived it as appropriate and permitted. "When meeting people (e.g., at work, for a beer) in situations where only a few people are present I usually take off the camera without being asked." (P90) This corresponds to behavior observed in the context of mobile gestural interaction [14], where the perceived "appropriateness" as well as the users willingness to interact depends on location and context. This self-controlling behaviour might be a successful measure to prevent angry reactions or requests to remove the device. Elaborating on Q3, P113 responded *"Never. I know where I can use it or not."* This aligns well with prior work, where lifeloggers were found to actively ensure the privacy of bystanders [5].

Conclusion and Future Work

In this paper, we presented results of an online survey (N=117) investigating real-life usage habits of lifelogging camera wearers. Our empirically backed analysis shows that (A) most lifelogging camera wearers prefer their camera to be noticeable by bystanders, as (B) wearing a lifelogging camera in a too unobtrusive or concealed fashion might be considered unethical. Furthermore, some tend to explicitly highlight their camera, in order to communicate outright that they are wearing a camera, and (C) employ self-censorship to comply with what they perceive as ethically and socially acceptable usage behaviour. In conclusion, body-worn cameras face an an interesting dichotomy: On one hand they pose a threat to personal privacy as well as corporate confidentiality by facilitating secret, unpermitted photography, on the other hand lifeloggers often take explicit measures to protect bystander privacy and lifelogging cameras can sometimes even foster interactions by playing the role of a conversation opener. Our future research will extend the current investigation by surveying demands of potential bystanders. This will allow to generate design recommendations involving both, the wearer's and the bystander's perspective. With hardware manufacturers building increasingly smaller sensors, this will be one crucial aspect, as designers of body-worn cameras will have to decide on form factors that balance unobtrusiveness and noticeability, as well as visual appeal.

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