From Strangers to Friends: Augmenting Face-to-face Interactions with Faceted Digital Self-Presentations

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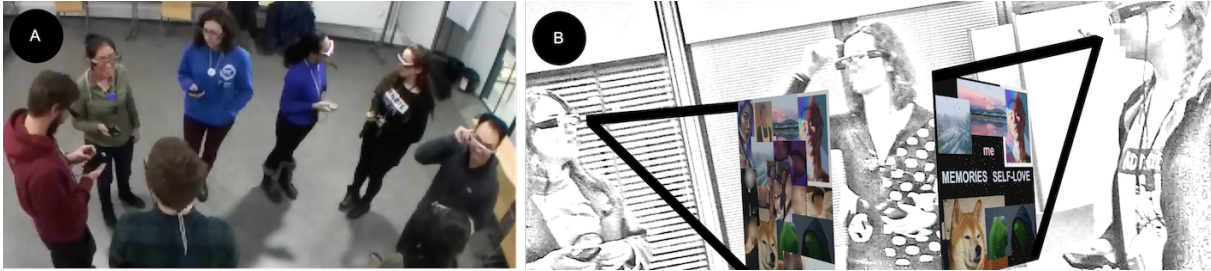Aalto University
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Figure 1: We studied how digital profiles are used in face-to-face interactions when a friend and strangers are collocated. Participants had access to the profile based on the social relation through head-mounted displays. A) A snapshot from an overview camera recording of one of the gatherings where strangers and friends are collocated, and B) An illustration of accessing the Digital Profiles, where the *private profile* of the participant who is standing in the middle was accessible by her friend (a profile on the left) and the *public profile* was accessible by a stranger (a profile on the right).

ABSTRACT

Sharing a digital presentation of self amongst collocated people can be used to enhance social interactions by supporting conversations. However, as there are different levels of disclosure within social relationships, it is currently unknown how to facet people's digital content towards others. This research investigates faceting digital self-presentations according to the audience by looking at the differences in the creation and usage of private profiles (shared with a friend) and public profiles (shared amongst strangers) in face-to-face interactions. Digital profiles were accessed through head-mounted displays in social gatherings. Over three gatherings with twenty participants, we identified the importance of having different profiles. We found that, for strangers, public profile supported starting and maintaining conversations. For friends, the private profile was designed to support deeper social penetration, and for close friends, the private profile was designed from the friendship maintenance perspective. Additionally, participants wished to disclose content from their private profile to strangers as the conversations developed. These results suggest that there is a need for a tailored way of faceting digital self-presentation towards multiple audiences. We propose using augmentations that consist of a base profile that is shared with all collocated others, and a dynamically tailorable part, which can be targeted to specific individuals.

CCS CONCEPTS

• **Human-centered computing** → **User studies**; **Social content sharing**; **Empirical studies in collaborative and social computing**; • **Security and privacy** → *Human and societal aspects of security and privacy*.

KEYWORDS

digital self-presentation, face-to-face interaction, multiple audience problem, tie strength, head-mounted display, social media, augmented reality

1 INTRODUCTION

Social interactions amongst people, especially within close relationships, are important for people's well-being and quality of life [24]. Even short interactions with strangers, for example in buses and trains, can improve people's moods [12]. With the upsurge of ubiquitous mobile and wearable devices, there has been a digital revolution in the enhancement of social interactions amongst collocated individuals. These systems typically aim to improve awareness of strangers to connect with each other and facilitate

the ice breaking phase and support maintenance of conversations [27, 36, 37, 47, 51, 54, 56].

As the purpose of these systems suggest, these studies thus far have been limited to facilitating interactions between strangers i.e., people that have not been in prior contact. Yet, there are many consumer applications supporting face-to-face (F2F) interactions amongst friends [14, 60, 65]. For instance, Octi [65] a social augmented reality app displays a virtual belt around people of their social media applications and photos. Despite this growth in the industry, there is very little research investigating how technologies can support social F2F interactions between closer relationships, such as friends and close friends, beyond the current stranger focused landscape.

To gain an understanding of how to augment F2F interactions upon closeness of relationship, we ran a study in which 20 participants first created a faceted profile; one profile aimed at a particular friend (later termed *private profile*) and one profile aimed at strangers (coined *public profile*). Participants then attended a gathering where they could view each other's profiles depending upon the relationship. Profiles were accessed through head-mounted displays as illustrated in Figure 1. This builds upon prior studies on investigating how F2F interactions can be augmented with wearable devices amongst strangers (e.g., [36, 47]) or friends (e.g., [43, 60]). In these prior works the usage of augmentations in F2F interactions have been investigated either within strangers or friends, but not both at once, although it is common to have different closeness of relationships collocated in everyday life [39, 69]. In this study, we contribute by providing:

1. Knowledge of how digital self-presentations differed depending on closeness of relationship,
2. An understanding of how people use and perceive the faceted digital self-presentation when the different closeness of relationships are collocated.

Our research is pertinent to social technology designers and researchers: for interaction designers our research gives indications on how to support faceting in digital self-presentations in F2F interactions; for researchers in social technologies we provide initial insights on how digital self-presentations are created depending on the closeness of relationships and towards multiple audiences.

2 RELATED WORK

2.1 Faceted Self-Presentations in Multiple Audience Problems

Drawing from social identity theories, the multi-faceted nature of human beings was first identified by Goffman [18]. For instance, people may maintain an occupational role in their workplace whilst playing a family role amongst their family [21]. These roles are performed to 'audiences', which vary according to many dimensions such as gender, interests, occupation, spiritual life, and community [18, 40, 59]. The separation of self-presentation towards different audiences is called faceting [18]. In this paper, we focus on faceting according to closeness of relationship.

Strangers and known people are often mixed in daily F2F interactions [42]. This mixture of closeness of social relationships induces

a social situation known as *multiple audience problem* [16, 17]. Multiple audience problems cause tension as individuals try to perform themselves differently depending on the audience and norms of the F2F settings [18]. For example, self-presentation towards a friend is typically more modest than towards a stranger [66], even when collocated. Although people traditionally aim to avoid multiple audience problems [39], it is common that people need to give two different impressions to two different audiences in the same social situation [69]; such as one towards strangers and another towards friends [39]. To manage multiple audience problems, different people use different strategies; such as whispering and gestures, and amongst stronger ties, conveying clues that are understandable only by a certain group [9, 16, 17]. Yet, as mobile devices become part of our daily interactions with each other, most of the research into faceting has not included the digital aspect [5, 16, 17, 69].

2.2 Faceted Self-Presentations in Online Social Media

In addition to F2F interactions, the importance of keeping information separate according to the audience has been found to be important in online social media networks [10, 15, 23, 29, 34, 38]. Techniques to control digital self-presentation in social media networks include, for example, using different social media networks for different purposes [48], using multiple social media accounts within the same application [64, 67] and using audience settings [32]. The ability of the user to manage their privacy and access control settings in social media are particularly important regarding closeness of relationship [29, 71]. In particular, closeness of relationships have been found to be a primary factor affecting media sharing decisions [29, 71]. For example, Jones and O'Neill [29] noted that users were twice as likely to share photos with users classified as strong ties (such as close friends) than with those considered weak ties (such as acquaintances).

People pursue deliberate goals and disclose different information on the perceived social media features mediating between disclosure intimacy and privacy [2, 55]. This is partly due to the ability to share information online has come with the juxtaposition of public self-disclosure no longer consisting of dyadic exchanges but instead often aimed at an unknown audience [2]. This can lead to a phenomenon called 'context-collapse', for instance in Twitter where multiple audiences are merged into one [44]. Hogan [23] argued that, in collapsed contexts, users of social media typically choose to present themselves according to the 'lowest common denominator'. This means that users avoid posting anything that would be problematic to someone in the audience, such as a 'friend' amongst all 'friends' on Facebook. Although the posted content might be relevant or interesting only to some of the friends, for the rest the posting should not be offensive.

Building on this, it is largely unknown how the techniques and strategies for managing multiple audiences in social media apply to digital self-presentation in F2F interactions. For example, whilst Tufekci [67] found that users of online social media facet their self-presentation by limiting the visibility of profiles (e.g., using nicknames) rather than adjusting the information within their profiles, this technique is less feasible in F2F situations as pseudonymity is violated.

2.3 Supporting Faceted Digital Self-Presentations in F2F Interactions

There is little work studying how to support multiple closeness of relationships when a digital self-presentation co-exists within F2F interaction. One example of a system that has allowed faceting according to closeness of relationship is a music-sharing application for collocated strangers and friends [19]. This peer-to-peer music-sharing system enabled sharing songs to collocated users within the range of the same WIFI network. Researchers found that most of the motivations for people to share varied according to closeness of relationship [19]. For instance, when sharing with strangers, some of the users preferred automatic sharing in a non-intrusive and less social way that would not evoke F2F interactions [19]. On the other hand, the main motivations to share with friends included sharing songs that a friend would like, 'memory aids', 'to get something to talk about', and to prank. As this study indicates, there is potential for digitally shared information to enhance F2F interactions amongst known people. However, as the study only shared music, which could be argued is non-personal information, there is yet work to be done to scaffold these findings towards richer and more personal self-presentation. Jung et al. [30] scratched the surface of this research area by looking at the use of a mobile app that allowed nearby people within Bluetooth range to access each others' user-generated profiles. The profiles consisted of an image, a short description, and a 'guestbook' that allowed profile visitors to leave messages. Here they found that users had privacy concerns about sharing information with a 'non-trusted' person. Jung et al. [30] suggested limiting the access of the guestbook feature to only close friends as a potential approach to facet the content and improve privacy. However, the option that would have enabled faceting was not implemented, and thus the experiences with this feature remain unknown.

Speculative investigations have also been undertaken by interviewing individuals on what they would like to share in profiles according to social relationships in F2F [46]. Within this speculative scenario using mockups, the stronger the closeness of relationship was perceived to be, the more and deeper personal information participants were willing to share in their profiles [46]. This aligns with current social identity theory on relationship practices where a correlation exists between individualized trust and self-disclosure [70]. Similar to [46], Kao et al. [31] conducted a hypothetical evaluation of how people wish to share faceted information in F2F interactions. Kao et al. [31] developed a prototype that allowed the interchange of private and personal information on a display attached to a coffee mug. By interviewing people Kao et al. [31] found that most of the users appreciated the ability to switch between displaying private and public information. However, the mug was not actually used in F2F interactions. Therefore, it is unknown how multiple digital facets are used in multiple audience problems and what their impact might be in F2F interactions.

To conclude, previous research indicates that augmentations are useful for facilitating collocated strangers to 'get to know each other' by providing topics for starting and continuing conversations. Additionally, the technology can have supportive roles amongst people with stronger ties, as well. Moreover, previous studies also show that people's self-presentation is faceted according to closeness of relationship in both offline F2F interactions and in online social media. However, there is no knowledge beyond hypothetical considerations [31, 46] on how the faceted digital self-presentations reflecting closeness of relationships are created, used, and perceived in F2F interactions that have multiple audiences.

2.4 Research Questions

Reflecting upon the above discussion, we carry out a study to investigate the how faceted digital self-presentations are created, used and perceived in F2F interactions with *private profiles* (created for and shown to a particular friend) and *public profiles* (created for and shown to strangers):

RQ1: How do individuals choose to represent themselves in a faceted profile depending on closeness of relationship?

RQ2: How is the faceted profile used and perceived in F2F interactions inducing multiple audience problem?

Having the *private profile* designed for a particular friend (instead of a group of friends or friends in general) allowed us to investigate the effect of closeness of relationship on faceting as the closeness of relationships between groups of friends may vary.

3 STUDY

The study was conducted in two parts: firstly, the participants created the profiles (both *private profile* and *public profile*). Secondly, they accessed profiles during the gathering using head-mounted displays (HMDs, see Figure 1 and Figure 2). For the first part, we studied, through content analysis, interviews, and questionnaires how participants choose to represent themselves in profiles (RQ1). One profile was designed to be shown to a particular friend (*private profile*), who would also join the social gathering, and one designed to be shown to strangers (*public profile*) at the same social gathering. The use of profiles is a user-centric perspective on augmenting F2F interactions by getting the user to curate profiles themselves rather than mining from existing social media resources, such as prior (Facebook [28] and LinkedIn [47]). This approach has been shown to have the benefit of supporting a higher degree of freedom in the design [36, 37]. This has been exemplified by the research showing that the majority of content in profiles have been selected and created outside the users' existing social media networks [36, 37]. Moreover, when compared to automatically generated digital self-presentations [28, 47], this user-generated approach supports an improved control of privacy, as users share only the information that they add to their profile [36, 37, 46].

For the second part, we used a controlled study design building on existing studies on multiple audience problem [16, 17, 66]. In these studies, users participate together with their friend. The social context of the study event was to get to know new people from the university with a friend. This resembles a student welcome event where multiple people are collocated, one being a friend with the rest being strangers. We investigated through interviews, questionnaires, and device logging how these profiles were used and perceived (RQ2) in the study where both audiences (strangers and friends) were collocated.

3.1 System Description

We used HMDs to display the profiles for multiple reasons. Firstly, in this typical collocated social environment amongst students, HMDs have been shown to be preferred over mobile phones and smart watches in 'get-to-know' gatherings amongst strangers [22]. Secondly, Bipat et al. [4] found that 'hanging out with friends' was one of the most popular usage scenarios for the use of camera glasses. Thirdly, HMDs have a display that is not viewable by other users as the display is completely private (only the wearer can see the displayed contents). As such, HMDs enable completely faceted self-presentation, as no information 'leakage' occurs to unintended audiences maintaining facets, staying in line with a sociology construct of the importance of keeping the information from leaking to unintended audiences [18, p.87]. This is unlike hand-held devices, such as mobile phones and smartwatches, that are sometimes viewed by others [11, 22, 58]. Fourthly, whilst HMDs have been shown to degrade F2F interactions to some extent [35, 45], the information can be shown close to the line of sight [50]. Then the information is not easily missed, which is not the case with other types of technology that support F2F interactions [7]. Moreover, similar HMDs have been used in previous studies on F2F interactions without significantly distracting from conversations [36, 37].

By using the application in HMD, participants had access to each other's *private profile* or *public profile* depending on the social relation: *public profile* was accessible by all collocated strangers and *private profile* was accessible only by their friend. The friend did not have access to *public profile*. Participants selected manually whose profile (if any) they wished to view. The HMD application did not automatically show the profile related to the person the participant was interacting with but instead allowed the participant to choose to view whomever manually. Thus, augmentations are selected by tapping portraits in the user interface (see Figure 2A), and not overlaid automatically with respect to users' faces or bodies as has been done prior [52]. Manual selection was chosen to support rich usage of profiles, for example browsing profiles before joining a conversation and viewing profiles outside the on-going conversation [36]. The selection was made using the handheld touchpad of the HMDs (see Figure 2D): participants could click on a face (see Figure 2A) and view that person's profile (see Figure 2B). Users could view only one profile at a time with the profile being presented at the side of the display to avoid cluttering their visual view. Participants had access to both (*private* and *public*) of their own profiles to check what information was on them (see Figure 2C).

In addition to the HMD applications (developed in Android 4.1), the technical implementation consisted of a web server (MAMP), which was run locally on a laptop (MacBook Pro), and a web router. The HMDs were connected to the web server over WIFI. The web server logged the HMD application interactions with each HMD to investigate the viewing of the profiles.

3.2 Creating the Faceted Profile

After signing up for the study participants were emailed instructions on how to create profiles. Participants created the profiles remotely using their own computers and resources. We used this method so that they had access to all possible images and texts that

they wished to include in their profiles. In order to make clear how and in what context the profiles would be used, all participants first watched a concept video on how profiles would be shown in HMDs, similar to [46]. After this, they were asked to create two profiles, one shown to strangers (*public profile*) and one shown to the particular friend (*private profile*) who also chose to take part in the gathering. Participants used Powerpoint or another presentation software, and they were able to use and create any images and text they wished. In order to support the transparency of the background of the profiles viewed in HMDs, a black square canvas was provided as a template by the researcher. We wanted to maximize the transparency in order to enable participants to see the real environment and other participants through the glasses as much as possible.

After creating the profiles, the participants responded to an online questionnaire that included questions about the content they included within the profiles. To see if these profiles could be automatically generated from the current social media content, we asked where this content was gathered from, or if it was created bespoke by the participants themselves for the study.

3.3 Procedure in the Gatherings

3.3.1 Before the Gatherings: Social Relations and Example Application. One to two weeks after the participants had created the profiles, they were invited with their friend to one of the three gatherings. Pairs of friends arrived together at different rooms where they met with the experimenter. Each participant was asked to indicate their relation to other participants in the same gathering by filling in a questionnaire that contained pictures of the faces of other participants with the options: close friend, friend, familiar stranger[1], and stranger. In addition to categorising the relationship between only friend or stranger, we provided one option between them (i.e. a familiar stranger) and one option with a stronger tie than casual friend (i.e. a close friend). The 'familiar stranger' category was included because different roles and motivations have been identified for using technology amongst this user group compared to strangers and friends [57], and 'close friend' category was added to enable indication of a stronger tie than friend, similarly to [53, 72].

As most of the participants had little experience with HMDs, and none with the software, participants also tried out an example profile application with fake celebrity profiles (see Figure 2). In this way, participants learned to use the HMD and the application before the gathering. Once the participants stated they were comfortable with the device, they were given a wearable camera (small Snapcam Lite) to wear around their neck. Participants were then brought to the location of the gathering and given the HMD before entering an empty classroom (size 8 m x 6 m).

3.3.2 During The Gatherings: Using the Profiles. Participants were instructed that they could interact with and get to know the other participants in any way they liked and that they could leave the gathering at any time. No other aim or task was given to the participants. While participants were free to leave at any time, no

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[1]Defined here as an individual who is recognised by another from regularly sharing a common physical space such as a street or bus stop, but with whom one does not interact.
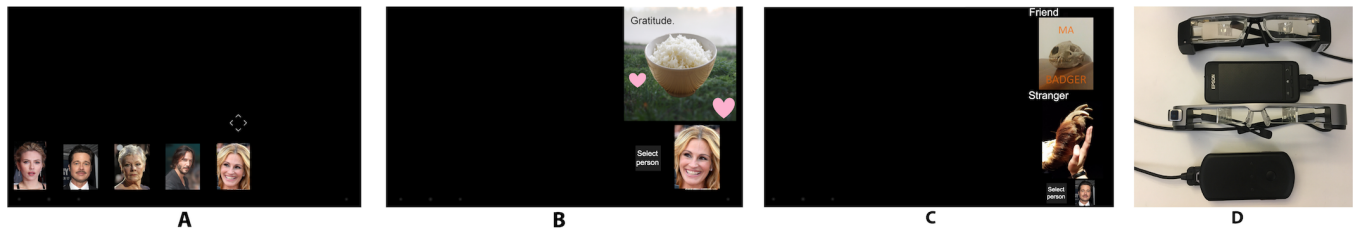
Figure 2: Screenshots of the HMD application. A: Participants selected a profile by first selecting the facial image of that person. B: The profile of that person was then shown in the upper right corner of the display to avoid obscuring the person's face. A 'Select person' button was used to return to the facial images and select another profile. No other interaction (e.g. scrolling) was required. C: Participants had access to both of their own profiles. Note: the majority of the screenshots are black as this represents transparency in the HMDs (EPSON BT-200/300, shown in D). Thus, black areas can be 'seen through' by participants when viewed via the HMD.

participants stopped or left before the event finished. The participant entered in a staggered manner, so all the participants did not arrive at the same time. The time gap between the first arriving pair and the last arriving pair was approximately 10 min. Participants then interacted with each other for at least 40 mins (40 min since the last pair of friends had entered the room). This timing was chosen to give the last pair entering enough time to settle into the study, following prior research guidelines [36].

The gathering was video recorded through an overview camera mounted on the ceiling to record the participants' movements in the room, triangulating data with the wearable video camera. The gathering was recorded from both the overview viewpoint and the interpersonal interactions.

3.3.3 After the Gathering: Questionnaires and Interviews. After the gathering, participants answered questions about the gathering and usage of profiles on a Likert-based questionnaire (1..7 scale, 1 = strongly disagree, 7 = strongly agree). This questionnaire covered the use of the profiles, interaction with other participants, and the interaction within the gathering itself. Participants then took part in a short (5 min) audio recorded group interview that covered their overall experience. To obtain further in-depth personalised data, participants were then interviewed for 40 mins in their pairs in separate rooms about their profiles. The questions included, but were not limited to: what content did you add to your profiles and why? Where was the content from? And, how did you perceive having two different profiles? The interview was semi-structured to allow questions of further depth. Overall each session took 2 hours on average.

3.4 Analysis

Interviews were transcribed and coded using a framework approach [61], using digital creation, reasons for access, and future use as initial codes as they emerged as common themes. The quotes are provided from the transcriptions of the interviews. We used video recordings and device logs (timestamps of opening and closing profiles) as objective data to back up the responses to interviews. Questionnaire results on *private profile* and *public profile* were compared using the Wilcoxon Signed Ranks Test unless no other test is mentioned. We used this non-parametric test due to it being a suitable test for comparing two related samples (*private* vs. *public*

profiles) from the same participants and assumptions of normal distributions were violated for each variable as tested with the Shapiro-Wilk test ($p < .05$).

3.5 Participants

Participants were recruited using mailing lists and through advertisements within the university campus. Twenty participants (aged 20-35, M = 24.0, SD = 4.0, 12 female) participated in both parts of the study. Based on the availability, four pairs of friends participated in the first gathering, three pairs of friends in the second gathering, and three pairs of friends in the third gathering. Most of the participants were university students (N = 17). The rest of the participants (N = 3) worked at the university. The participants were from 12 different countries and spoke English with each other. We attained ethical approval from Aalto University Research Ethics Committee, and participants gave written consent to participating in the study and to publish contents in their profiles.

The relation questionnaire (see Section 3.3.1) revealed that, out of 10 pairs of friends in total, 5 pairs rated their closeness of relationship as close friend and 5 as friend. All the closeness of relationship ratings between the pairs were mutual. All participants before the event knew only their friend and were strangers to the experimenter.

4 RESULTS

4.1 Creating the Faceted Profile

4.1.1 Chosen Contents. The majority of content was different between *private* and *public profiles*: 68 % of images and 79% of words were distinct (see representative *private* and *public profiles* one below the other in Figure 3A). The differences were due to distinctive roles for profiles according to closeness of relationship. Typically the *public profile* was designed by the participant to be a conversation starter (similar finding with previous studies [36, 37]) with the *private profile* holding content that was felt more personal by their creator. When the relationship with the friend they brought with them was rated as a friend (but not as a close friend), which was the case for half of the participants, they discussed adding more personal content in their *private profile* than their *public profile* (P7: *"it was more for her to know more about me...So I put these clouds and the flight, because when I came to this country, it was my first flight."*
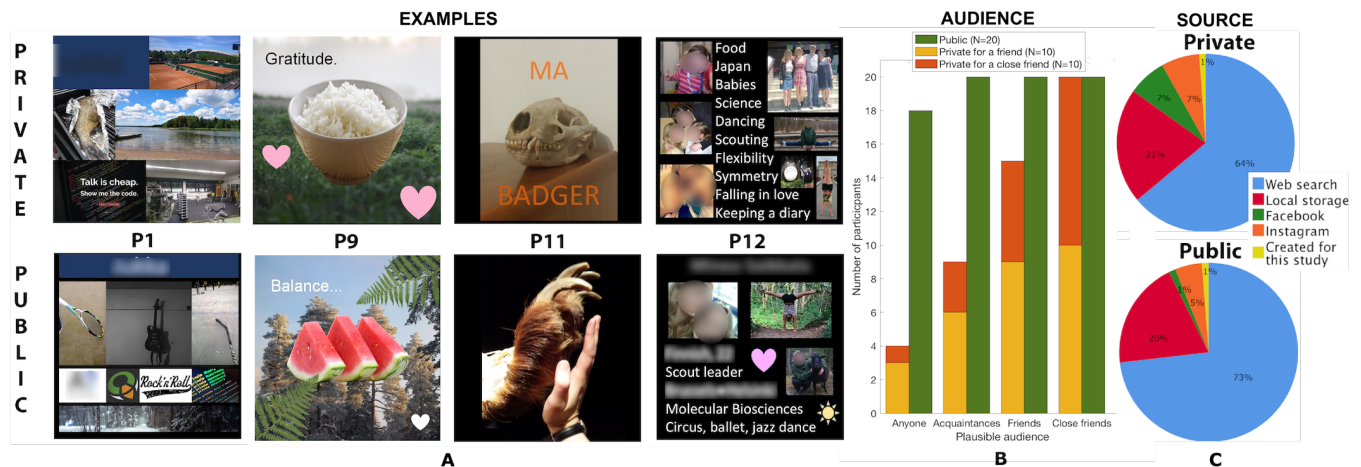
Figure 3: A) Representative examples of profiles, illustrating the types of media and composition used in the *private* and *public* profiles. Identifiers are below the images and are referred to in the text. Note that personally identifying information has been blurred in the figure, but was not blurred during the study. B) Plausible audience for *private* and *public* profiles. C) Image sources for *private* and *public* profiles.

— F, 23). Whilst most of the contents in *private* and *public profiles* were different, some participants discussed a strategy of adding or editing information in the *public profile* to make it more personal (P3: *"so this [private profile] is the same as with a stranger, just that I add some personal detail."* — M, 26). Although the *private profile* included content that was felt more personal, participants did not want to disclose their most private information. This was due to privacy concerns related to the digital format (P18: *"Because it's digital, so you don't want to put anything too personal or anything like that even with your friends."* — F, 25).

When participants rated their relationship with their friend as a 'close friend' (10/20), the intended roles for the contents in *private profile* were geared more towards maintaining friendships, such as communicating common memories (P12: *"I started with the ones [pictures], like us two, that, things that we have in common, this is from a scouts trip, so, we did scouting together, so it was like a common memory for us [P12's private profile shown in Figure 3A]."* — F, 22) One important instance that was noted in the case of close friends was showing recent history and plans for the near future in the *private profile* (P2: *"I wanted my friends to know what I am up to, and what's my plan, and how I am doing, and things like that."* — M, 22). The displayed plans were not for the individual curator, but instead for presenting ideas on what close friends could potentially do together (P1: *"We go to the gym together, but I wanted to show him this is another gym, that we don't go together to."* — M, 26) as shown in Figure 3A (see P1).

Adding more personalised content through humour was found to be a way to represent oneself in a lighter way (P3: *"it's kind of funny to look at it [private profile — M, 26], I think that kind of personalises me as well, I like to make jokes and stuff like that. And I think friends know."*) and inside jokes (P20: *" And the friends one is just basically an in-joke, or a reference that I knew that my friend would get, so that's basically the reason I put it there, it does somehow tell something about me, but it's more like a fun reference."* — M, 22) .

Overall, participants were less concerned about the contents in the *private profile* presenting more negative aspects of themselves (P8: *"I had more negative traits like always being late and stuff. Just like, more humorous and not something I would share publicly."* — F, 22). Choosing content in *private profile* that does not support an ideal self-image is in line with findings from a study by Tice et al. [66], who found that self-presentation towards a friend is more modest than towards a stranger in F2F interactions, and with Bazarova et al. [3], who showed that people shared more negative emotions in private messages than they broadcast to all friends on Facebook.

The other major difference in *public* and *private profiles* was that the *private profile* was not necessarily about the participant themself, but about their friend (P4: *"I know he likes peanuts, so I put up a picture of peanuts."* — F, 29). It is in this way that the findings indicate that the participants treated the *private profile* more like a message board for communicating contextual information that was jointly understood. Thus the *private profile* appeared to be no longer just a singular self-presentation but also a joint presentation (P12: *"It [private profile] is more of us two."* — F, 22).

In summary, these results indicate that contents in *private profiles* amongst friends were designed to scaffold towards friendship development through disclosing more personal information than providing 'basic' statistics, although the mutual experiences amongst friends were presented far less than in the case of close friends. We identified that in the case of close friends *private profiles* were created following strategies towards friendship maintenance [53]: *Positivity* (e.g. trying to make each other laugh) was represented by 'inside jokes', *supportiveness* (e.g., letting each other know you want to continue the relationship in the future) by plans for the future, *openness* (e.g., sharing private thoughts) by personal information, and *interaction* (e.g., going to social gatherings together) by common memories and things recently done together. Thus, the content contained within the *private profiles* was not only about the

persons themselves, but rather aimed at strengthening the connection with a friend, and hence forming a sort of joint representation. This is manifestly different from the egocentric approach in *public profiles* found in [36, 37], where the profiles were primarily about the creator.

4.1.2 Plausible Audience.

Although most content was distinct between *private profiles* and *public profiles*, this dichotomy for profiles was not clear-cut in our case. For most of the participants (18/20) the plausible audience (i.e. with whom they were happy to show the profile based on their responses to questionnaire and interview) of their *public profile* was practically anyone. However, the plausible audience for *private profile* was more spread out across different closeness of relationships, as shown in Figure 3B.

Whilst participants were asked to create a *private profile* to be shown to a particular friend, in the interviews participants talked about the plausible audience for their *private profile* as varying from strangers to a particular close friend. For most of the participants the plausible audience for *private profile* was larger than the audience it was primarily created for (a particular friend). Yet for *public profile*, the plausible audience was the same as intended or narrower than the audience it was primarily created for (a collocated stranger). For example, for approximately a half of the participants (9/20) were willing to show *private profile* for acquaintances. Thus, it is fuzzy as to what is private and what is public information in digital content for F2F interactions. The allowed audiences along with their closeness of relationship were not easy to categorise, as the responses were either specific (P16: *"Anyone who knows me at the University, especially who used to work with me in the previous VR project last semester."* — M, 35) or were too ambiguous (P2: *"At least friends, and perhaps friends' friends and colleagues."* — M, 22). As such, whilst participants were told that their *private profile* was shown only to their collocated friend, clear boundaries did not exist for whom the *private profile* could be shown to.

4.1.3 Content Source.

Most of the images (73%) in the *public profile* shown to strangers were fetched using a web search (see Figure 3C). This was also the case for *private profiles*, where 64% of images were sourced through a web search. As such, most of the images were acquired outside the social media accounts for both profiles. There was no statistically significant difference between the number of images sourced using a web search for *private* and *public profiles* (W = 31.5, p = .55). This is unexpected as we would have assumed *private profiles* to include significantly more images from social media, as users have chosen this content to be part of their current digital self-presentation towards friends online. This result implies that contents in *private profile* were chosen differently than content shared in social media.

4.2 Using the Faceted Profile in Conversations

Our results demonstrated different uses for profile depending on the audience: stranger, friend, or close friend. In every gathering, *private profiles* were discussed when a pair of friends were alone before the other participants had entered the room. However, when strangers where present, most of the participants (17/20) left *private profiles* out of conversations. We found two main reasons: Firstly,

participants found it impolite to talk with a friend about interpersonal subjects when there were strangers within the conversation group (P10: *"I don't want to speak only to her, because it would have been rude."* — F, 21). Secondly, participants did not want to disclose a friend's more personal information to others (P9: *"I think that talking about some things in that one would not have been appropriate, I think, because it's…more personal.",* — F, 20). Exceptions in this standard behavior existed in the case of close friends. Some of the close friends (3/10) felt it was appropriate to bring a close friend's content into the conversation, because they knew their meaning and how to refer to it without offending their close friend. For example, P12 did this in a conversation group of eight people consisting of a pair of friends (P12 and P11) and six strangers (P12: *"I wanted to say something about her too, because it was cool that she put it there [see P11's private profile in Figure 3]A…I kind of felt that I knew that if she gets to explain it, it's okay for me to bring it up."* — F, 22). These results imply that the boundary regulation that a person exhibits online [38], and here in F2F interactions, also exists for known information between friends; if a participant is unsure about the level of disclosure warranted, they will not divulge any information to avoid leaking [18].

The *public profile* proved to be useful for starting conversations (ice breaker) and getting to initially know strangers. Participants agreed with the statement 'My *public profile* helped to initiate conversations' (M = 5.5, SD = 1.5). This result is in line with previous studies [36, 37] that profiles help strangers to start conversations.

4.3 Reflections on Having the Faceted Profile

Most of the participants (16/20) liked having the faceted profile instead of a single profile. This was due to participants wanting to disclose different things to their collocated friends and to strangers (P10: *"I loved it, because I feel like even though these are very simple icons [see P9's private profile in Figure 3A], I feel like they bear a different kind of level to me emotionally, and I loved it. So these to friends and these to strangers, and it was nice to separate them."* — F, 21). However, a minority of participants (4/20) thought it is not necessary to have a *private profile*, preferring to rely instead upon currently employed social media (P14: *"We are friends on Facebook, and then, everything I post he knows, everything he posts I know…It makes sense to have a profile for other people, but not for the friend…"* — F, 30).

The perceived usefulness of profiles for supporting 'getting to know each other' differed significantly in terms of relationship between users. When profile was used amongst strangers, participants somewhat agreed with the statement 'I found the other persons' *public profile* useful in getting to know him/her' (M = 5.1, SD = 1.1). Also the participants who rated their relationship as a friend but not as a close friend (10 out of 20 participants) somewhat agreed with the statement 'I found the other person's *private profile* useful in getting to know him/her' (M = 4.5, SD = 2.0). The mean response to the statement was statistically significantly different (Mann-Whitney, U = 18.50, p = .015) amongst friends than close friends (10 out of 20 participants). Close friends clearly disagreed with the statement (M = 2.3, SD = 1.4). This result is in line with the characteristics of contents in *private profiles* amongst close friends, who designed them more from the friendship maintenance rather than friendship

development perspective. This further provided evidence that a diverse range of profiles should be available to support varying closeness of relationships.

However, having two separate and static sides of the profile (*private profile* and *public profile*) was not found to be the optimal approach (P2: *"if you are interacting with complete strangers, you don't want too personal information, but if you would like people to get to know you, this should be something between friends and strangers"* — M, 22). Participants discussed that they would have liked to disclose things from their *private profile* to the *public profile* (P3:*"If you somehow manage to consider a stranger as a friend, then, that moment you realize you can just let them see those [contents in private profile]"* — M, 26). This dynamic self-disclosure would have supported the changeability of social relationships better (P10: *"It would've been cool if we could've unlocked the friends one [private profile] to the other people..., so they could've seen this one [private profile] as well, rather than just this one [public profile] as we got to know each other more."* — F, 21). Given that participants agreed only slightly that the *public profile* was useful for getting to know others (as discussed above), disclosing content from *private profile* would have supported the acquaintanceship process more. Therefore, the requirement for having a dynamic profile was higher for *public profile*, as participants wished to disclose more information as the strangers became more familiar.

Over half of the participants (12/20) commented that they should have been able to access their friend's *public profile* in addition to *private profile*. This would have decreased the missing context when strangers were talking with a friend about friend's *public profile* (P9: *"Yeah, it was alienating 'cause I was the only one who didn't know about that one. And it was interesting, because at the same time we are - I'm close to her, and all of that was still - it was an interesting experience that I didn't expect to happen."* — F, 20). This finding suggest that profiles directed towards weaker closeness of relationships should be also available for stronger ties in order to support establishing common ground.

4.4 Reflections on Future F2F Augmentations

Although some participants had already added recent things in their *private profiles*, some participants discussed that there is more potential in adding more content from recent history to their *private profiles* (P2: *"Something I would like personally to show him...what I've done during the day or weekend or something like this. Maybe even like snaps, so instead of sending some kind of snap, I would have pictures here."* — M, 22). Some participants commented that this content could be fetched automatically (P16: *"In the future, you can integrate it smoothly with social media like for example a recent status on Facebook or the most recent post on Instagram... so it's something more interesting - that you don't have to update it yourself, you don't have to put information there all the time when you want to change something."* — M, 35). One participant said that recent information could even be biometric (P2: *"I was thinking that...in the future they would have, be some biometric measurements, like what kind of exercise I've been doing today and this kind of things would be fun to show him."* — M, 22). This reflects what Liu et al. [43] discovered, that sharing bio signals through smartwatches can operate as a social cue for starting conversations between friends. However, Liu et al.

[43] also found that sharing bio signals did not support maintaining conversations beyond the 'first level of communication'. This is where user-generated profiles could play a role, as previous studies [36, 37] have demonstrated that user-generated profiles can help to sustain and enrich conversations amongst strangers by allowing people to bring up interesting topics for conversation. However, this should be investigated further amongst known people.

5 DISCUSSION

The discussion is framed around our two research questions; how individuals choose to represent themselves in a faceted profile and how the faceted profile is used and perceived in F2F interactions.

5.1 Self-presentation in the Faceted Profile

Whilst participants included similar amounts of content from similar sources in their *private profile* and *public profile*, the content was mostly different (68% of images and 79% of words). Moreover, we found that participants used different creation strategies for *private profiles* depending on the classification of a friend or a close friend. In the case of friends, but not close friends (10 out of 20 participants), *private profiles* were more revealing versions of *public profiles*. This included humorous content such as inside jokes and also negative aspects of themselves such as bad habits. Displaying these more negative traits in the *private profile* is akin to Tice et al. [66] findings, where self-presentation without digital augmentations towards a friend is often more modest than towards a stranger. This partly supports deeper disclosure and social penetration between friends [1, 20]. When participants categorised their relationship as close friends they often chose to use content that followed strategies for friendship maintenance [53], such as common memories and common plans for the future. In these instances, the *private profiles* instead were created as representations of the relationship. This indicates that they also reflected the interpersonal or 'relational self' [63], and not just the 'individual self' [63], which was the case for *public profile* in this study and previous studies with strangers [36, 37]. In this and previous studies [36, 37], participants designed *public profiles* as 'tickets-to-talk' [62] and conversation supporters.

We found that participants who employed ambiguity in their *public profile* also used this strategy in their *private profiles* (see P1, P9 and P11 in Figure 3A). Ambiguous content in *public profiles* typically was manifested through images. These images served as good ice-breakers, as they evoked questions from other participants. Moreover, use of ambiguous content in *public profiles* enabled the participants to have more control over what and the level of disclosure during the conversation. Thus participants themselves could decide what and to whom to reveal about themselves, mitigating the disclosure levels. However, in the case of *private profiles*, the contents that appeared ambiguous to a non-friend held meaning to a friend. This reflects with results by Fleming et al. [17], who found that in multiple audience problems friends can include cues in their messages that are not understood by strangers. Thus, it seems that participants employed partly similar strategies (i.e., hidden messages) for digital profiles as they do in F2F interactions without technology. This is further supported by findings that communication between friends through wearable ambient displays is acceptable if messages are hidden [25].

5.2 Use and Perception of the Faceted Profile

Most of the participants (16/20) found the ability to facet profiles according to closeness of relationship important. The *private profile* were referred mainly before the strangers joined the conversations. In the case of close friends were some of the contents from the *private profile* brought into the conversation with strangers. This was disclosed when the close friend was sure that revealing content from a friend's *private profile* would not 'leak' unintended information. This is in line with the sociological construct of the importance of keeping the information from leaking to unintended audiences [18, p.87].

Some participants wanted to disclose more in their *private profile* to strangers as they became more familiar with other participants. Thus, a way to modify facets and adjust the disclosure similarly to how individuals disclose in social interactions [1, 18] should be considered. Less than half (9 out of 20 participants) would have liked to show their *private profile* to acquaintances (see Figure 3B), making privacy and social inclusion mitigate against each other. Therefore, instead of increasing social inclusion, the categorical private/public faceting of digital profile also has the risk of also increasing social exclusion. This raises the question of how the faceting should be implemented beyond using static private/public categories. In online social media, one feasible solution is to enable grouping of the audience, so that these groups are created and curated iteratively by the user themselves [32]. In F2F social situations, however, this grouping is muddled beyond just relationships, but also grouping the audience should follow the dynamics and proxemics of F2F interactions (e.g., joining a conversation group), Based on the findings of the study, only the information that is shared among all the persons taking part of the conversation would be referred to. Some participants discussed that this could be implemented by 'unlocking' items in digital profile for participants in the same conversation. Based on this study and Goffman's theory of information control [18, p.87], this unlocked content should be made explicitly clear for all the persons taking part in the conversation so that persons would know this information can be referred to in the conversation.

In order to improve the categorical private/public approach further, one strategy would be having a 'base' version of digital self-presentation shown to all the collocated people, with more personalised additional layers shown to different persons or groups of persons. The use of a 'base' digital profile is further supported by the studies findings, that whilst most (approximately 70%) of the content between *private* and *public profiles* was different, some (approximately 30%) of the content was the same, and thus provides a basis for the base digital profile. We expect users to create these base and public digital self-presentations according to the 'lowest common denominator' [23]; that is, they add content that is not relevant to all the collocated others but is not problematic for any of them either. This is due to the base digital profile would be shared with all the collocated people and would be static, and thus, resembles an exhibition more than a performance. The lowest common denominator strategy persists especially exhibition-type self-presentations in collapsed contexts online [23]. Here, in collocated interactions, the exhibition is shown together with F2F performance of the user which makes the user more accountable

about the exhibition than online, and thus the 'context collapse' phenomenon is very strong here. Thus, in order to go beyond context collapse, the tailorable part of digital profile would provide support for more personal and potentially more controversial and humorous content towards particular persons.

From the conversation support perspective, having the base digital profile shared amongst collocated persons induces information symmetry (all persons can see the same thing), which helps to establish common ground for conversations [8]. Also relating to conversational aspects, the interaction with technology during F2F conversation may disrupt the conversation [50], and therefore the interaction with the devices should be minimised as users' attention should be directed more towards the collocated people rather than devices when the goal is to enhance social interactions [51]. Thus, having a static base digital profile requiring no interaction from the user and interactive and more targeted layers would be a good compromise from the disclosure and the conversation perspectives. Personalised information towards individuals can be expected to support the acquaintanceship process whereas base profile amongst all collocated persons facilitates ice-breaking and establishing common ground.

The use of digital self-presentations amongst known people seems to be more nuanced than amongst strangers [13, 25]. So far, the use of technology amongst known people has been considered more as a distraction rather than supporting the F2F interactions [68]. This is especially the case for those within close relationships [49]. In our case, collocated friends is a subset of friends as physical proximity limits the audience, and thus enables the use of more tailored content to collocated friends compared to all friends in social media. Social media and communication towards a specific friend or friends, as opposed to general broadcasting amongst all friends, has been shown to increase well-being within closer relationships [6]. This supports the fact that digital self-presentation also has the potential to be useful amongst stronger ties and emphasises the need to tailor digital self-presentation towards specific friends.

5.3 Design Implications

Based on the results of the research questions, we recommend future designers and researchers to consider the following when augmenting F2F interactions with digital self-presentations.

Future systems augmenting social interactions should enable choosing content from and outside social media accounts. Users selected the majority of the content to the augmentations outside social media accounts (see Figure 3C). This finding was not only limited to profiles shared amongst strangers (as prior [36, 37]) but was also evident in profiles shared amongst friends. However, some of the content in the profiles was chosen from social media, thus both sources for adding content to augmentations should be supported.

Future systems augmenting social interactions should consider digital self-presentations that have a static 'base' part and dynamic parts. While most of the participants (16/20) preferred the opportunity to facet the content towards the different closeness of relationships (a friend and strangers in our case, the categorical approach (private/public) for digital self-presentation does not seem to be an optimal solution for supporting F2F interactions. As this study has demonstrated, different creation strategies are used for friends and

close friends. Additionally, this curation process needs to be structured towards F2F interaction as users wished to disclose content during conversations from their *private profile*. This could be implemented by having a 'base' digital profile, to which users can add disclosing elements to target content towards a particular person or persons before and during the conversations. This finding is supported by the fact that some content (approximately 30%) was the same in private and public profile. Moreover, having a 'base' profile would remove the alienating feeling experiences by the participants when as a friend they were seeing completely different profile than others.

Future systems augmenting social interactions with digital self-presentations should make clear what information is visible to other users taking part in the conversation. As our study demonstrates, participants did not reveal information about their friend's *private profile* if they were not sure it was appropriate. Therefore, people followed Goffman's [18] information control. This result implies that users of digital augmentations for conversations should know what information is shared amongst the other persons participating in the conversation. Only then would it be clear to the people taking part in the conversation that the augmented information can be used to start and maintain conversation.

5.4 Future Work and Limitations

This study is a stepping stone towards multi-faceted augmentations, as it demonstrates the importance of faceted support in multiple audience problems. We began our investigation on closeness of relationships with two categories: private for a particular friend and public for strangers. More studies are needed to establish knowledge of how multi-faceted self-presentations may support closeness of relationships. However, in our study, this approach allowed participants to target the facets exactly to the audience they intended, and thus no unintended leakage occurred. We chose to investigate the creation and use of *private profile* for a particular friend instead of a group of friends. This allowed us to find different creation strategies of *private profile* for a friend and for a close friend. This finding would most have been likely masked if *private profile* were to have been designed for a mixture of friends and close friends. However, future work should investigate the creation and use of digital self-presentations for groups of friends.

The studies on multiple audience problems in F2F have been conducted without technology although mobile devices have become part of our daily F2F interactions. Mobile devices allow private messaging amongst friends in F2F interactions, and thus technology provides new possibilities to manage multiple audience problems. This study suggests that the technology should support the sociology constructs presented by Goffman on strict information control [18]. In terms of displaying information, the HMDs used in this study support this information control as they present information privately. However, the use of more 'semi-public' displays currently used in everyday social interactions, such as smart watches and mobile phones, could cause information leakage more easily as they present more publicly accessible screens [11, 22, 26, 58]. Recently, Hirskyj-Douglas et al. [22] investigated how the devices were used to access profiles in F2F interactions, but in line with multiple other studies, most of the participants were strangers and the impact of

closeness of relationship on device use was not explored. Therefore, investigating faceted digital self-presentations with devices having more public screens in a mixture of closeness of relationships would be an interesting topic for future research.

This study follows a line of research where the multiple audience problem is studied in controlled environments [16, 17, 69]. While 'lab-based' approach is a common limitation in such studies [41], investigating multiple audience problems in the detailed manner 'in-the-wild' is extremely challenging especially with the novel technology we employed. We acknowledge that contextual factors beyond controlled environments will have an impact on self-presentation. More work is required on how to scaffold a digital self-presentation towards closer relationships beyond strangers and friends audiences. For example in an occupational context, having non-faceted (i.e., symmetrical) self-presentations for each member in team-building independently from social relationships would support social equality within the team. Thus, more studies are needed to establish knowledge of how multi-faceted self-presentations may support social interaction in contexts beyond this study.

It is unknown what roles digital self-presentations can have in daily social interactions amongst friends and closer relationships. Friends in close relationships value personal communication [33] and it seems that the current systems augmenting F2F interactions amongst friends (e.g., Snapchat and Octi) rely on supporting playful interaction [60, 65], for example by overlaying humorous augmented reality content, such as filters that modify the visual appearance of a friend when viewed through a mobile device [60, 65]. Here, we found the humorous content to be an important part of some *private* profiles as well, indicating more playful usage of profiles amongst known people. However, longitudinal studies in F2F interactions in everyday life are required to investigate how digital self-presentations are used within friends and closer relationships.

6 CONCLUSION

With the development of social systems for F2F interaction becoming embedded within our everyday lives for various contexts and with the increase in awareness of privacy and information leakage, studies into how we share and with whom we share information have become crucial. This paper presents the first study investigating the creation and use of faceted digital self-presentations in F2F interactions having multiple audiences. We explored the development of digital facets according to closeness of relationship, providing new insight into how individuals create, use and perceive faceted digital self-presentations according to closeness of relationship (strangers, friends, and close friends) with collocated others. Here we underline that the ability to support faceted digital self-presentation according to closeness of relationship is important for F2F interactions drawing together sociological concepts and technological advances. These facets should not be static and categorised into private and public digital self-presentation, but rather easily tailorable depending on closeness of relationship. In order to achieve this, we suggest using a profile, which consists of a 'base' part that is shared with all the persons within the social situation, and a tailorable part, which can be personalised towards individuals to support more nuanced and playful self-presentation.

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