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# Investigating User Generated Presentations of Self in Face-to-Face Interaction between Strangers

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## Abstract

A recent trend in HCI has been the reuse of social media to augment face-to-face interactions amongst strangers. Where Digital presentation of media are displayed during face-to-face encounters. Work has shown that displaying media when co-present with a stranger can help to support conversation. However, existing work considers social media as a raw resource, using algorithmic matching to identify shared topics between individuals, presenting these as text. Therefore, we do not know how users would choose digital media to represent themselves to others or how they would wish it to be displayed. This is important, as existing work fails to take into account the rich practices around how users choose to represent themselves on-line to others, and the implications if unwanted data are disclosed. Through a two-part study 32 participants designed a digital representation of themselves that could be presented to strangers in face-to-face interaction. We then studied how these were employed. Our results found that users prefer more social, rich and ambiguous content to present, the majority of which comes from outside existing social and digital media services. The use of ambiguous content helping to both sustain conversation, and being used as a way to control disclosure of information. By considering two display technologies (HMD and Smartwatch) we are also able to decouple the role of the visualisation from how it is displayed, identifying how showing the visualisation can help in the conversation.

*Keywords:*

Digital Self, Face-to-Face Interaction, HMD, Smartwatch, Conversation

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## 1. Introduction

Social media services, such as Facebook ([www.facebook.com](http://www.facebook.com)) and Instagram ([www.instagram.com](http://www.instagram.com)), allow individuals to represent themselves digitally on-line and socialise irrespective of their geographical location. How users present themselves on-line through digital media has been widely studied (Farnham and Churchill, 2011; Hogan, 2010; Zhao et al., 2008; Nosko et al., 2010). A more recent, and less considered trend has been to connect people with others they do not know who are geographically nearby. Primarily this has been through the development of dating and ‘hook-up’ services such as Tinder ([www.gotinder.com](http://www.gotinder.com)). However, connecting people with others nearby has significantly greater potential than dating apps. Mayer et al. (2015), in an interview study on the potential of social-matching, found individuals were open to meeting nearby strangers in a wide range of contexts and scenarios. Svensson and Sokoler (2008) reports that there is high potential for face-to-face interaction with others in everyday life without a pre-defined *a priori* to those meetings. For example, at the shops, supermarket or on the street. Such work indicates significant potential in the use of technology to connect people to others nearby.

Coupled to this has been renewed interest in the digital augmentation of face-to-face interaction between people. McCarthy et al. (2004) presented names and affiliations of people who stood close to a large display at an academic conference as a way to provide ‘tickets’ (Sacks, 1992) to interaction. However, more recent work has focused on wearable devices, such as Head Mounted displays (HMDs) - e.g. Microsoft HoloLens ([www.microsoft.com/microsoft-hololens/](http://www.microsoft.com/microsoft-hololens/)). Leading to potential ubiquitous availability of digital data to provoke and augment face-to-face interaction between individuals, outwith relatively well understood scenarios (such as at an academic conference). For example, Jarusriboonchai et al. (2015) have used mobile phones worn as badges to present a shared topic from two users’ Facebook profiles as a way to provoke strangers to talk to each other. Nguyen et al. (2015) have evaluated a system that mined shared interests from two strangers’ Linked-In ([www.linkedin.com](http://www.linkedin.com)) accounts and presented them as text via an HMD as shared discussion topics during a face-to-face interaction.

However, existing work treats social media accounts as a raw resource, with data automatically selected or mined to produce shared interests between two people without user involvement. Users have no influence on which media is selected to present, or control that presentation (other than providing access to social media accounts). Existing work has not asked users what media they would want to share, how they would wish to be presented to others, or the role

they would want media to play in face-to-face interaction with strangers. However, such understanding is important. When two strangers meet there is a high degree of uncertainty between them, and it is through progressive disclosure this uncertainty is reduced, creating the possibility to have a more meaningful relationship (Douglas, 1990). Individuals will therefore restrict information that they feel is personal to them, and will vary how they present themselves depending on the situation. What one person feels is personal to them may be something another feels is public. When treating data as a raw resource this is not taken into account, and lack of knowledge on how users would wish to present themselves increases the risk unwarranted data disclosure might occur with algorithmic matching. Just because two users share an interest does not mean that they would want it disclosed.

Existing research into how users present themselves on social media services (Farnham and Churchill, 2011; Lampinen, 2014) has identified rich practices in how users employ social media services to represent themselves on-line to others. This highlights concerns of avoiding inappropriate disclosure, as well as the loss of face that can occur because of it. However, such work does not extend to how users might use media to augment face-to-face interaction.

To investigate how individuals would choose to use social media to represent themselves to others in face-to-face interaction, we carried out a two-part study developing Digital Selves: visualisations curated by users to represent a facet of themselves to strangers in a face-to-face interaction. Through studying both how users create these, how they are presented, as well as how they are employed in interaction between strangers, we better understand how users would wish to employ media to present themselves.

## **2. Key Contributions**

This is the first study to investigate in depth how user crafted visualisations of digital and social media are used during face-to-face interaction with others. As such we make the following key contributions:

- An understanding of how users choose to employ both social and digital media to craft representations of themselves for use in face-to-face interaction with strangers. Our results show that whilst significant use of existing social media accounts is made, most content comes from outside existing social and digital media services. And that users employ more general representations of media with the intention to use conversation to manage disclosure.



- An understanding of how the Digital Selves created by participants are incorporated into face-to-face interaction with strangers. Identifying that Digital Selves are used throughout the conversation. That ambiguous information in the Digital Self leads to richer conversations, and that user curated representations reduce concerns over unwarranted disclosure.
- An understanding of how the technology used to present a Digital Self impacts its use. Through comparison of two delivery mechanisms (a semi-public Smartwatch and private Head Mounted Display (HMD)) we identified that users do not seek to hide accessing a Digital Self. Technologies that allow both individuals to see the Digital Self can help ‘repair’ trouble in the conversation, and how social acceptability and distraction of the technology is reduced, compared to prior work, when individuals are aware of its use.

### **3. Related Work**

To further elaborate the key issues surrounding the use of Digital Media to support face-to-face interaction, we consider three perspectives: How users employ technology to present themselves to others, how face-to-face interaction between strangers occurs and existing work in its digital enhancement, and finally the issues surrounding the use of wearable technologies in face-to-face interaction.

#### *3.1. Digital Presentation of Self*

When users present themselves they are performing a facet of their identity, with the objects, props and other materials they use in that performance either supporting or degrading the impression they wish to convey to others (Goffman, 1959). For example, a lawyer dressed in ripped jeans and a t-shirt is likely to undermine his performance as a lawyer when in the courtroom. Whilst, wearing a suit to a heavy metal concert, would undermine his performance as a heavy metal fan. He tailors his performance to meet that facet of self he wants to portray.

How users present themselves on-line through digital media has been widely studied, such as on web pages (Schau and Gilly, 2003), social media (Farnham and Churchill, 2011; Hogan, 2010; Zhao et al., 2008; Nosko et al., 2010), on-line dating (Ellison et al., 2006) and virtual environments (Kaplan and Haenlein, 2009). Such work largely agrees with the classical research of Goffman (1959). Farnham and Churchill (2011) studied how users managed the faceted aspects of

their identity when using social media services. They found that there was a lack of faceted support within social media networks, with users employing different social media services to express different facets of self and manage its presentation. Who users ‘friended’ and gave access to individual social networks helped control the performance of that facet to only the intended audience.

Early work in digital media sharing has illustrated why this is important. Volda et al. (2006) investigated the sharing feature of personal music libraries in the iTunes desktop application within a large company. The application allowed users to connect and listen to the personal digital music collections of colleagues. Whilst they found users were keen to browse colleagues’ libraries to understand them better, Volda et al. (2006) noted that this could either reinforce a particular impression, or could create surprising and sometimes detrimental impressions solely based on the music shared. Persson et al. (2005) developed the DigiDress system, a mobile application running on feature phones that allowed users to create profiles about themselves that could be broadcast over Bluetooth to other nearby devices. Users would be notified by a sound if a user emitting a profile was nearby. Persson et al. (2005) did not investigate face-to-face interactions, and their study suffered as they did not have a critical mass of active users that made DigiDress a practical tool to discover others. However, they did find that scanning the environment to find others was a core use function. Recently, Kleinman et al. (2015) investigated how an additional outwardly facing display attached to a notebook computer, called Billboard, was used in different settings (e.g., conference, office and university). Billboard enabled users to post texts and images to the second display. Kleinman et al. (2015) found that, in addition to functional purposes, such as leaving a note to others, Billboard was used to make connections to nearby people based on the media they were willing to share. However, they did not analyse if, and in what way, media was used during face-to-face interactions. Other recent work has tended to focus on novel technical prototypes, with only informal evaluation being undertaken (Kan et al., 2015; Kao and Schmandt, 2015; Devendorf et al., 2016). For example, Kao and Schmandt (2015) investigated a coffee mug with an embedded LCD screen that could display images. With images changing if the mug was being used in a private (office) or public (coffee room) place. However, only an informal study was undertaken, and the role of the mug to start face-to-face interactions was not considered.

Existing work indicates that there is both potential in using media to support interaction between strangers, and a desire to discover others who might be interesting in the environment. However, whilst users express facets of them-

selves *on-line* to different audiences, it is unclear how this media can, or should, be incorporated into face-to-face interaction, and what aspects of self individuals would want to disclose. Only our prior work (McGookin and Kytö, 2016), which motivated this work, has considered users views on how social and digital media should be used in algorithmic matching work. This revealed the same issues of faceting, identity and boundary regulation, identified from existing face-to-face interaction and social media use (Lampinen, 2014), and unconsidered in automatic matching work, are also relevant to face-to-face augmentation. However, that work was conceptual and did not study a working system. We do not know what media, or in what form, users would use to represent themselves in face-to-face interaction, or how it would be employed.

### 3.2. *Face-to-Face Interaction*

The meeting between strangers is an example of a situation where persons have restricted rights to talk each other and a ‘ticket’ (an accepted reason known to the parties) is needed to initiate conversation (Sacks, 1992, p. 265). Tickets provide common ground between participants, and support strangers in starting a conversation. Such tickets can either be on the context of interaction (for example visiting a doctor or meeting a client), or can be caused by something in the environment (e.g. being on a broken down bus). But without such tickets conversation will rarely occur. Such conversations usually start with safe, neutral topics, ‘setting talk’ (Maynard and Zimmerman, 1984), such as conversation about the weather or how someone reached a meeting. However, such topics are often limited and quickly exhausted (Svennevig, 2000, p. 222), unless parties can move onto a more meaningfully deeper topic that is of interest to both. Successful conversation around such rich topics (Sacks, 1992) helps to reduce uncertainty between the parties through disclosure of information (Clatterbuck, 1979). Such disclosure is a process of boundary regulation, dynamically determined during interaction (Lampinen, 2014). Successful ‘navigation’ through this process helps to deepen the interpersonal relationship, increasing social attractiveness between individuals (Douglas, 1990), and allowing more meaningful interpersonal relationships to form (Altman and Taylor, 1973).

Within HCI there has been historical work incorporating media in face-to-face interaction. McCarthy et al. (2004) deployed a large screen display at a conference that detected people standing nearby via RFID tags and displayed their name, affiliation and a user selected image. More recently, Jarusriboonchai et al. (2015) investigated presenting automatically matched shared likes or interests between the Facebook profiles of two strangers, displaying these on simple text badges (via a mobile phone worn around the participant’s neck). Chen

and Abouzied (2016) developed an LED bracelet to support networking amongst strangers at a conference. The bracelets of two users, who were algorithmically matched, would flash the same pattern and colour when users came within 20m of each other. Whilst the face-to-face interaction the bracelets provoked was often valuable, it could be difficult for individuals to find their matched partner, with only 15% of identified matches resulting in face-to-face interaction. However, the bracelets only showed that two users were matched, not on why they matched. Therefore the bracelets played only a role in providing a ‘ticket’.

Most closely related to our work is Nguyen et al. (2015). They used data mining techniques to identify potential shared topics of interest between two users based on their profiles on the Linked-In social media service ([www.linkedin.com](http://www.linkedin.com)). Three topic suggestions were displayed every 2.5 minutes as text via a pair of Google Glass smart glasses<sup>1</sup>. Topic suggestions updated every 2.5 minutes. Whilst these were found to be useful, the augmentation only provided the initial topic of conversation. The rapid updating meant participants could find the automatic suggestions invasive, encouraging and pressuring to change topic, and could be hard to incorporate into the existing flow of a conversation. They were largely seen as a ‘backup’ if there were not other things to talk about, rather than enhancing the conversation.

Such previous work assumes that media should be automatically selected (e.g. through algorithmic matching to connect people on shared interests). In this way, individuals who are similar can be connected. Other than users providing initial access to their social media accounts, they have no control over what media is selected and how it is compared to others. Unlike the discussion of existing face-to-face interaction (see Section 3.1), individuals have no control or prior knowledge over what ‘tickets’ will be exposed to others, or the facets of themselves that will be revealed. As previously discussed, this may damage face-to-face interaction by presenting information that undermines the impression an individual wishes to portray, or disclosing information an individual does not wish to share.

Whilst these studies show the potential benefits of incorporating social and digital media into face-to-face interaction, all specifically focus on professional networking events, providing either very simple (McCarthy et al., 2004) information, or taking control from users and automatically determining media to share from social networks (Nguyen et al., 2015; Chen and Abouzied, 2016). In more social and personal situations, given the previous discussion of facets, automatic selection is likely to be a more significant issue.

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<sup>1</sup>Google Glass website: <http://www.google.com/glass/>. Retrieved on 8th April 2016

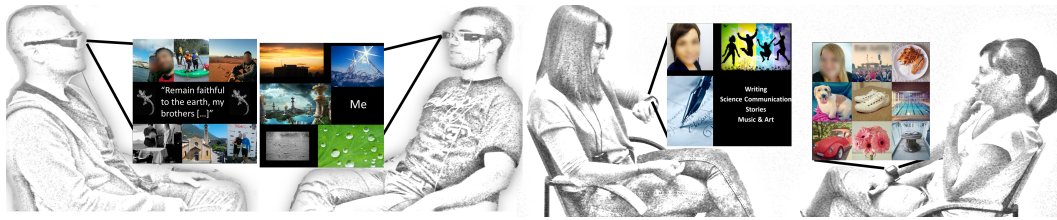


Figure 1: Two strangers having a conversation in our study situation. The image on the left visualises a situation where a Digital Self is shown on a HMD and the image on the right shows a situation where a Digital Self is presented on a smartwatch.

As noted by Svensson and Sokoler (2008), a face-to-face encounter with a stranger, without a pre-defined purpose to the encounter, is one of the most common situations we encounter people in everyday life, and has high potential for face-to-face digital augmentation to be useful. More recent work by Mayer et al. (2015) has considered the situations and contexts where individuals would be open to meeting strangers. Interviews with 58 college students identified that simply matching on things participants have in common is overly simplistic, finding key attributes of social, personal and relational context that influence who, when and where individuals are open to meeting strangers. Individuals may be drawn to people with whom they share only one, very specific common aspect, but are different in other regards. Also, individuals may be drawn to others who are very different from themselves if all other people are largely homogenous (e.g. when at a party). Mayer et al. (2015) also identified that the potential to connect people extended well beyond the professional or dating scenarios that have so far been studied (McCarthy et al., 2004; Chen and Abouzied, 2016) and were applicable in a much wider variety of contexts. However, the focus of Mayer et al. (2015) was on the creation of future ‘Apps’ (e.g. such as Tinder ([www.gotinder.com](http://www.gotinder.com))) to connect people to others nearby, rather than the face-to-face interaction we consider here.

Existing work shows significant potential in the augmentation of face-to-face interaction, but also that automatically selecting shared content or matching users, raises issues over unwarranted disclosure, and may exclude potential cases where individuals who are unrelated wish to connect. A potential solution is to allow users to curate representations that they would wish to share. However, we do not know what the effect of user curated representations would be.

### 3.3. *Delivery Mechanism of Digital Presentation of Self*

A final issue is how the Digital Self should be presented during interaction. Work such as McCarthy et al. (2009) has used public displays, but this limits in-

teraction to a specific place. As Svensson and Sokoler (2008) note the ubiquitous potential of face-to-face augmentation in public places, the ability to quickly and easily access the Digital Self *in-situ* is important. However, the introduction of technology must also not have a detrimental effect on face-to-face interaction. Przybylski and Weinstein (2012) have found that in a face-to-face interaction between two people, even a switched off mobile device can have a detrimental effect on the quality of the conversation between them.

Given the ubiquity and frequency that interactions with strangers occur in day-to-day life, and the many “everyday” encounters that may benefit from digital augmentation (Mayer et al., 2015), a mobile phone may not be the best delivery mechanism. A user would need to explicitly take out the device from a bag or pocket to view a person’s Digital Self. Given the number of people and interactions that might occur, this is impractical and may significantly disrupt face-to-face interaction. Instead, emerging wearable technologies such as head mounted displays (HMDs) and smartwatches, which offer either proactive viewing of a person’s Digital Self (such as when viewed in a HMD), or shorter, glance-able viewing (such as with a smartwatch), become a more practical way of incorporating a Digital Self into conversation (see Figure 1).

Whilst the ubiquity of interaction with wearable devices fits well with our notion of ubiquitous availability of a Digital Self, prior work does raise issues over the impact of wearables in face-to-face interaction. McAtamney and Parker (2006) found that an HMD interfered in a face-to-face conversation, with the HMD being found to be distracting and difficult to ignore during conversation. However, McAtamney and Parker showed email, texts and other notification style content unrelated to the conversation, rather than information related to the other person in the conversation. Today this might be considered the equivalent of someone constantly checking his or her smartphone during a conversation.

More recently, the Google Glass HMD has been argued to invade the privacy of others and cause negative face-to-face interaction in public, with wearers being termed ‘Glassholes’<sup>2</sup>. Although Koelle et al. (2015), who have investigated the social acceptability of HMDs (particularly Google Glass), proposed that social acceptability improves if the intention and current use of the device is communicated to those around. Smartwatches also raise such issues, where checking a watch during a conversation may be seen as a signifier that the wearer wants to end the conversation and leave. However, Pearson et al. (2015) have begun to consider how smartwatches may be appropriated as semi-public displays. For

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<sup>2</sup><http://www.ibtimes.com/what-google-needs-do-fix-glass-end-glasshole-stigma-1790398>, Retrieved on 8th April 2016

example, in a conversation a person's watch might display a notification intended for the other person that he or she should leave for another meeting.

However, even if a user is aware of the role of an HMD or smartwatch, it is unclear how socially acceptable it would be to check a user's Digital Self before and during face-to-face interaction. Are private displays (such as HMDs) that support covert checking better than semi-public displays (such as smartwatches) where there would be some overt signal that a Digital Self is being accessed? Conversely, the use of semi-public displays may confer advantages. For example, Clark and Brennan (1991) note how indicative gestures can be used to establish common ground necessary for conversation, the ability to share the view of a Digital Self may help in this. Whilst wearable technologies offer fast and ubiquitous access to Digital Selves, there are significant questions over the role of private versus semi-public displays.

#### 4. Research Questions

Existing work shows that there is significant potential in incorporating a facet of a user's digital identity into face-to-face interaction. The work of Mayer et al. (2015) illustrates that there are many diverse situations in which individuals might meet and wish to connect with strangers. However, it is unclear how users would choose to represent themselves in such situations. Automatic algorithmic matching approaches can create anxiety over what is disclosed. The faceting of digital social identity is likely to be as important when incorporating digital media into face-to-face interaction as it is in on-line media. Yet we know little of how users would choose to represent themselves, or how such representations should be best presented. To investigate these issues we carried out a two-part study to answer the following research questions:

**RQ1: What content do users select to include in a Digital Self to represent themselves to strangers?** Existing work has considered only automatic matching to identify shared interests, which may disclose unwanted information. Asking users to create their own Digital Selves will help us better understand what, and how, users would choose to represent themselves in face-to-face interaction, and the potential roles they believe it could play.

**RQ2: What visual representation do users choose to employ in a Digital Self?** The same content can be represented visually in multiple different ways. Interests could be presented through text or images. Media could be represented at varying levels of fidelity, or with varying ambiguity levels. McGookin and Kytö (2016) indicates that users may vary these to disclose or reveal information

about themselves, but this has so far not been considered in a working system. RQ2 will allow us to do this.

**RQ3: What is the impact of a Digital Self on face-to-face interaction?**

Given the potentially richer representations of individual facets that users may choose, that representations are crafted by individuals rather than automatically, how is the Digital Self incorporated into the conversation? What is it used for and what is the impact of user choices in RQ1 and RQ2 on this?

**RQ4: How does the delivery mechanism (HMD or a smartwatch) of the Digital Self affect face-to-face interaction?** Based on the discussion of delivery mechanisms it is unclear how the properties of the device used to present a Digital Self will impact on its use. Private displays, such as HMDs, allow discrete access to a digital self. Semi-public displays (such as a smartwatch) may make it more obvious a Digital Self is being accessed. In both cases devices can interfere with the conversation. By studying a semi-public (smartwatch) and private (HMD) display, we will better understand how a Digital Self can be presented in face-to-face conversation. Our goal is not to argue that either is ‘best’, or better than other novel technical (though often unevaluated) systems that prior work proposes (Kan et al., 2015; Kao and Schmandt, 2015; Devendorf et al., 2016). Rather, by investigating two, relatively well understood technologies with varying characteristics, we will gain knowledge of the use a digital presentation of self decoupled from the technology used to present it.

## **5. Study Design**

To answer these questions we developed a two-part study. In the first part, participants created a Digital Self to represent a facet of themselves they would want to present to a stranger (a person they had not previously met) during a face-to-face interaction. In the second part, pairs of participants had a face-to-face conversation, with each viewing the other’s Digital Self either via an HMD or smartwatch. An additional group did not use the Digital Self and acted as a baseline to consider findings from. Having a baseline condition in our study allowed us to understand if the general conversational situation was affected by the addition of a Digital Self, and therefore better understand its impact. It is not yet possible to carry out an *in-the-wild* study of Digital Selfs that investigate their use in ‘everyday’ settings outside of professional networking events. Therefore we must conduct a lab-based study. However, such studies are common in research on initial interactions among strangers (e.g. (Maynard and Zimmerman, 1984; Douglas, 1990; Tidwell and Walther, 2002; Nguyen et al., 2015)).



### 5.1. Participants

Thirty-two participants (16 female, aged 20-58 years, Mean age=31.0, SD=7.7) took part in the study. Each was compensated with two movie tickets (approximately 30 Euro value) after completion of both parts. Participants were recruited from flyers placed around the university campus and from mailing lists.

## 6. Part 1: Creating a Digital Self

### 6.1. Procedure

In Part 1, participants first completed a demographic questionnaire and a questionnaire on their use of digital and social media. As sharing and use of social media has been shown to be influenced by how introverted/extroverted a person is (Ryan and Xenos, 2011), we also administered a ‘Big Five’ personality trait questionnaire (John and Srivastava, 1999) to measure personality type. This was used to balance the introversion/extraversion within each group in Part 2 of the study.

Each participant was asked to create a single slide using Microsoft Powerpoint (that would later be converted into an image) that they felt represented them, and that they would be willing to share with a stranger during a face-to-face meeting. Although this limits the Digital Self to a static image, Powerpoint does provide an easy and flexible tool to support free-form creation of the Digital Self in content, layout and form (text, images etc.). We asked only that participants use English for any text they included and they keep the black background to better support display on the HMD. Otherwise they were free to design the Digital Self in any way they chose, using as much or little media as they wished. To aid them, participants were given access to a desktop computer running a browser in *incognito* mode to access media from their social and digital media accounts.

Participants were told that the Digital Self would be used in a face-to-face conversation with a stranger, and it would be up to them to “*get to know each other*”. We left this task deliberately vague, as interaction with a stranger without a clear *a-prior* purpose is one of the most common situations we encounter people in everyday life, and has high potential for a Digital Self to be employed (Mayer et al., 2015; Svensson and Sokoler, 2008). Such undefined tasks are also common in classical work in face-to-face interaction amongst strangers (Douglas, 1990). Participants were also aware that the image would be presented on either a watch or HMD. To aid them in designing a suitable image, Powerpoint was configured to show an outline of the slide to illustrate the size it would appear on the watch and HMD. Participants were not time limited in creating the

Digital Self, and on average took 30 minutes each to create the slide. On completion, an individual, semi-structured interview was carried out, covering the content the participant used and reasons why they chose it.

## 6.2. Results

Interviews were transcribed and thematically grouped using a framework approach (Ritchie and Spencer, 1993), with the choice of content, visual form and sources of content used as initial codes. The visualisations were also analysed according to the type and amount of content, and the visual representation used (images or text).

### 6.2.1. Selection of Content

Participants were asked to create Digital Selfs that they would be happy to show strangers (people they had not previously met). We did not explicitly set a context the interaction would occur in, yet categorisation of the content used in the Digital Self revealed participants largely interpreted that such interactions should be social, or non-work related. Participants largely included information that said something about their interests, with 78% of participants incorporating information about their hobbies or interests. Of these, half, did not include any information about their work or school. Only 6% of participants included information about only work/school, 28% included both hobby/interest and work/school.

47% of participants included a self-portrait. Participants felt that as this was public information on many social media sites, there was no reason to exclude it (P14: *"It's a part of my online self already so I don't see a reason why I should leave it out."*). This extended to other commonly known public information, with many participants considering the Digital Self to be a profile page of all their interests: (P6: *"Keep It Simple, Stupid. So basically, there's just my picture, my name and then some keywords, like where I live, what I study and what my hobbies are."*) .

The presentation to strangers also influenced the content that participants were not willing to share, such as relationship status, information about family and wider social circles. Also political and religious content was excluded. Only one participant included political content in the Digital Self and nobody added religious content. Overall participants wanted to present something of themselves, but not to overly disclose (P31: *"I decided to introduce myself from a point of view that is not very personal, but still gives a lot of insight to what I actually do every day in my life"*).

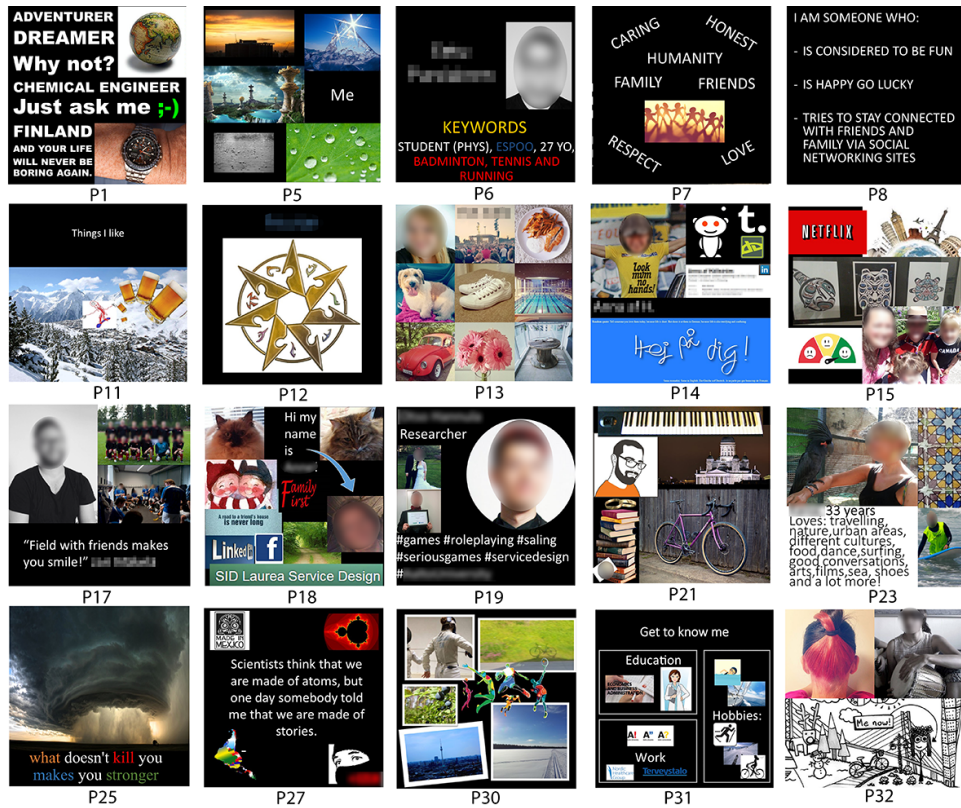


Figure 2: Examples of Digital Selves created by participants. Identifiers are below the images and are referred from the text. The majority included hobby or interest and used both images and text. NB: Identifiable images have been blurred for publication and P16's Digital Self is referred from the text, but is not published as she did not give permission to.

Participants often chose to generalise the content they presented. For example, showing a general interest towards films (for example with a Netflix logo, P15) or books (for example with a pile of books), rather than using favourite movies or books (P21: “*So, I just took a picture of a keyboard to kind of illustrate the music interests.*”). Only one participant added his favourite music band. As space in the Digital Self was relatively limited, there is a risk that providing individual media (e.g. a particular album or book) might skew the impression given, providing too much weight to individual media, that a more general representation would not. We discuss this point further in Section 6.2.2.

Three participants specifically included content that was intended to be used as part of a conversation: (P19: “*Then at the bottom there is a list, topics, that I'd want to talk about or things that I'd be interested in if someone would open a*”).

*discussion around these themes.”, and P16: “It is sort of a conversation starter, so I can just be talking about different things I make that have no relation to my job or such things, just my online persona.”).*

On average, participants used 6.3 instances of content (with instance being an image, name, quote etc.). However there was a wide range between participants, from a minimum of 1 to maximum 17 (SD=3.6). In comparison with the results of the personality trait questionnaire, there was a significantly positive correlation between the amount of content used and the participant’s level of extraversion (Spearman  $r_s(31)=0.457$ ,  $p=0.009$ ). Participants with higher extraversion scores included more content than those who were more introverted.

### 6.2.2. Visual Representation of Content

A related theme to content was how that content was represented in visual form. From analysis of the visualisations created, 25 out of 32 participants used both text and images, five of them included only images, whereas two of them included only text. Over all instances of content in the Digital Selfs, 52% were images and 48% text. Thus the visual forms participants used to create their Digital Self were diverse, and expressive to each individual. Figure 2 shows representative examples of these.

The limited space available to participants was often discussed as a driver for the incorporation of both text and images: (P6: *“I didn’t have images that would describe things that I wanted to say, and then also I wanted to have at least one image of myself so that you could actually recognise me”*, and P1: *“I’m kind of a good writer. But then, they say that the picture tells more than 1000 words, but pictures, if you have an idea in there then it might be misunderstood as something else.”*). Overall, images were preferred due to their expressiveness and glanceability (P20: *“If you have good images they’re worth more than words because they’re visually more immediate and also faster to grasp.”*).

However, participants also incorporated images as they could be ambiguous and open to interpretation. This served several roles. For example, communicating a specific interest that would only be identified by others that shared the same interest, and would appear ambiguous to others. P12 described how he used the logo from a role-playing game as a ‘hidden’ ticket to identify him to other players of the same game: *“it’s a logo from a role-playing game that I play. It’s a game where you meet with new people or strangers. The people who play the game usually recognise the logo of the game, so it might help them to recognise the image. Then if I meet someone on the street or somewhere and they might recognise me, they might come to chat with me.”*. Pictures were also used to communicate emotions or feelings rather than specific information. P17: *“I*

*found it maybe easier to create something that would be better than just telling some little story about myself and my life. Pictures are cryptic but at the same time they are somehow more interesting than the text maybe*". The ambiguity of images also served to support content that could provide only clues to its meaning, and which could only be fully understood during conversation. Participants chose them as a means of encouraging interaction: P5: *"I really didn't want to give a lot of personal information about me, so I think I just put nice pictures that are inspiring, and maybe not so you can see them well, and maybe tell something about me. If you talk about me, maybe I can explain why I have these here."*

The reasons behind the use of text was much less discussed. In part such data cannot often be represented as images (e.g. quotes or names). However, text was used in cases where participants wanted to express feelings or values (P8: *"You know, who can describe me other than my own words describing how I feel"*), or wanted to reduce ambiguity in meaning (P3: *"Well, I just wanted some kind of information part also here, saying clearly that I don't like to share my political views on Facebook and that sort of stuff."*). More practical reasons were that suitable images could not be found by participants, hence they used text instead.

#### 6.2.3. Content Source

Figure 3 illustrates where the image content participants chose was sourced from. Considering the prior discussion of incorporating more ambiguous content to represent more general feelings, the largest proportion of images (49%) was sourced from a Google image search rather than from existing social and digital media accounts. Only around half the participants used any media from social media sources (e.g. Facebook, Instagram, LinkedIn and WhatsApp). In line with the deliberate ambiguity in the Digital Self, it may be media from existing social media services is aimed at those whom the user already has some connection with. Presenting to strangers, the media may be too specific and may create unwanted disclosure. If so, then algorithmic matching with others to determine what media to share with strangers, may not be the best approach.

#### 6.2.4. Constraints on the Digital Self

As the Digital Selfs created were to be used in the paired conversation of Part 2, there were practical constraints that we placed on their creation. The limited size of the templates we used, and meant some participants could not include all the content they wanted, and in part contributes to the generalisation of content (as described in Section 6.2.1). Issues were raised by nine participants. Five would have liked to add more pictures and four more text, but were not able due

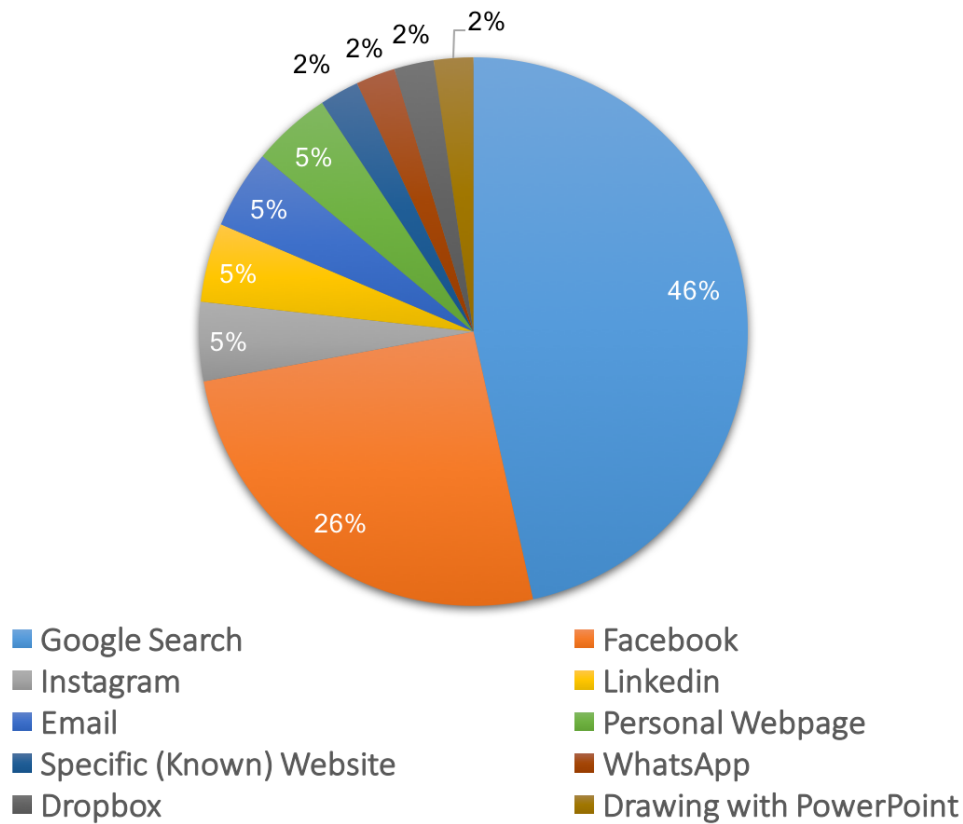


Figure 3: Chart showing the sources where images in the Digital Self were taken from. The largest proportion of images was sourced from Google Search, outwith existing Social and Digital Media accounts.

to lack of space. Two participants wished to be able to add moving images (such as videos or animations).

### 6.3. Discussion

Part 1 of our study showed that participants created visually rich and complex representations of facets of their self. These self-crafted representations go far beyond the simple data mining approaches to identify topics of common interest of prior work, such as Nguyen et al. (2015). Most of the Digital Selves were very different from simple public profiles of social networking sites (Nosko et al., 2010), as participants included information that was ambiguous in its meaning, which would require conversation to fully understand, and encoded information (such as the role-playing game symbol used by P12) that whilst public, would only be meaningful to those who shared that interest. In addition, and in compar-

ison to topic mining, participants avoided providing precise and detailed representations of their interests (such as favourite artists or movies) due to concerns it may provide a too limited representation of their interests. Much of the content participants chose came from outwith existing social and digital media accounts. Such media would not be incorporated into existing social matching approaches, and illustrates that although aspects an individual may wish to present to others are in social media, not all aspects may be represented there.

## **7. Part 2: The Digital Self in Conversation**

In the second part of the study participants were paired with another participant that they did not know and had a face-to-face conversation. We based our approach on prior work in studying face-to-face interaction amongst strangers (Douglas, 1990), and the study of Nguyen et al. (2015). Part 2 took place about a week after Part 1. Each pair was allocated to one of the 3 groups (5 pairs in each group) that dictated how the Digital Self was presented. We explicitly chose a between groups approach to ensure that in all cases participants were strangers to each other at the start. The three groups were: 1) Digital Self presented via a smartwatch (Watch), Digital Self presented via head-mounted display (HMD), and the baseline group where no Digital Selfs were presented (Baseline). Since we must currently study the use of Digital Selfs in the lab, this may affect how comfortable and natural the conversation setting is. Although we used broadly the same procedure as Nguyen et al. (2015), having a baseline without a Digital Self allows us to assess the naturalness of the conversational situation, the quality of face-to-face interaction, and determine what impact the Digital Selfs and devices have, if any, on this. As the extraversion-introversion personality trait had shown influence in the amount of media used in the visualisations of Part 1, we tried to balance introversion-extraversion scores across groups, but did not within pairs. 13 pairs were of the same gender. Of the other two pairs, one were in the watch group and another in the baseline group. Based on a 1..5 scale, calculated according to John and Srivastava (1999), the mean extroversion score for each group was: 3.03 (Watch), 3.49 (HMD) and 3.38 (Baseline).

### *7.1. Devices and Stimuli*

The Digital Self created by each participant was transferred to either the smartwatch of his/her partner (a Sony Smartwatch 3), or the HMD of his/her partner (EPSON Moverio BT-200) (See Figure 4). In the Baseline group no Digital Selfs were used. The smartwatch was configured to show the Digital Self at the highest brightness and to keep the screen on. On the HMD, the Digital Self



Figure 4: The Digital Self as it appeared on the smartwatch (left) and how it appeared to a user through the HMD (right).

was shown in the lower right of the display, at a fixed location at a size of 9 degrees of visual angle. By using this arrangement, the Digital Self was displayed in the periphery, so as not to block eye contact between participants (see Figure 4 (right)).

## 7.2. Procedure

Each participant in a pair reported to separate rooms and was given an HMD or smartwatch (depending on the group) showing their paired partner's Digital Self. We avoided providing a specific purpose or 'task' to the interaction, and participants were not given a specific topic. Each participant was instructed that they were to 'get to know the other person'. This is similar to Nguyen et al. (2015), and has also been used in classical studies of initial interactions amongst strangers (Douglas, 1990). Participants were told they could use the Digital Self as much or little as they wanted. Participants were also told they could stop the conversation at any time they wanted, but that it would be limited to a maximum of 20 minutes.

Participants were then brought into the same room. Before starting the conversation, the experimenter confirmed that each pair had never previously met and did not know each other. One pair stated they did, and were replaced in the study. Participants were seated opposite each other. Conversations were video and audio recorded.

After the conclusion of the conversation, participants took part in a semi-structured interview. Interviews were conducted individually. Participants also completed a questionnaire comprised of Likert questions on a 7-point scale (1



Strongly Agree to 7 Strongly Disagree), covering the issues of face-to-face interaction and the use of the Digital Self. We incorporated the questions of Nguyen et al. (2015) (to measure conversation quality) and McAtamney and Parker (2006) (to measure the impact of the technology on face-to-face interaction).

### 7.3. Results

Interviews were transcribed and coded using a framework approach (Ritchie and Spencer, 1993), with the use of the Digital Self, the impact of its presentation technology (smartwatch or the HMD), and the introduction of new topics into the conversation as initial codes. For each video we recorded the instances where the Digital Self was verbally referred to. In the following sections we discuss Digital Self to mean both the HMD and smartwatch versions unless explicitly mentioned. We discuss differences in Section 7.3.5. Questionnaire results between conditions were statistically compared using Wilcoxon signed rank tests and Kruskal-Wallis tests using the R statistics software package (<https://www.r-project.org>), whilst effect sizes (Cohen's  $d$ , (Cohen, 1969)) and statistical power ( $\rho$ ) were calculated using the G\*power software package (Faul et al., 2007).

#### 7.3.1. *Quality of the Conversation and Naturalness of its Situation*

The situation we used in the study is similar to that used previously in classical work (Maynard and Zimmerman, 1984; Douglas, 1990), and by the automatic topic suggestion study of Nguyen et al. (2015). However it is by necessity somewhat artificial. In addition, given the discussion of Section 3.3, the introduction of technology can damage the naturalness and quality of the situation. We therefore used a baseline group where participants had the same task but without a Digital Self being present. The Baseline group evaluated the naturalness of the conversation situation to be high, agreeing with the statement “I felt that the conversation situation was natural.” with a mean score of 2.50 (SD=1.80). A one-sample Wilcoxon signed rank test ( $p=0.034$ ,  $d=0.83$ ,  $\rho=0.76$ ) showed this to be significantly more natural than the neutral score of 4. Participants in the HMD group ( $M=2.20$ ,  $SD=1.10$ ) also rated the naturalness of conversation situation as significantly higher than the neutral score (One-sample Wilcoxon signed rank test,  $p=0.010$ ,  $d=1.64$ ,  $\rho=0.99$ ). Participants in the Smartwatch group were neutral ( $M=3.50$ ,  $SD=1.43$ ), which was not significantly different than the neutral score ( $p=0.361$ ,  $d=0.35$ ,  $\rho=0.26$ ). However, the statistical power ( $\rho$ ) for the Smartwatch group was low, and significance may have been reached with a greater number of participants. A Kruskal-Wallis test to compare the differences

between groups in terms of naturalness of conversation situation found no significant difference between the groups ( $\chi^2(2)=4.829$ ,  $p=0.089$ ,  $d=0.39$ ,  $\rho=0.37$ ). We therefore argue that the conversational situation itself is not unnatural. Comments from participants reflected the quantitative results that the conversation setting did not have detrimental effects on perceived naturalness of the situation: P31: *“I think it was actually, surprisingly, natural if you think about the situation where we were. We had never seen each other and there was a video camera on you there and stuff.”*.

The questions on the quality of the face-to-face interaction derived from (Nguyen et al., 2015) showed high reliability (Cronbach’s  $\alpha=0.84$ ). We therefore carried out a Kruskal-Wallis test on the mean scores of those questions across the three groups: Baseline 1.79 (SD=0.62), HMD 1.86 (SD=0.49) and Watch 2.03 (SD=0.46). This found no significant differences between the groups ( $\chi^2(2)=2.262$ ,  $p=0.323$ ,  $d=0.19$ ,  $\rho=0.12$ ). As the power ( $\rho$ ) of the test was low, this may mask some significant effect, yet the quality of all groups is high, so we argue the addition of the HMD and Smartwatch did not, given the discussion of distraction with mobile devices in Section 3.3, significantly reduce face-to-face interaction quality. We discuss potential reasons for this in Section 7.3.7. More importantly, we can also consider that there is little negative impact using technology in face-to-face conversation if that technology is related to the conversation. This provides evidence to the hypothesis of Koelle et al. (2015), that awareness of another person’s actions with private and semi-public displays increases their social acceptability.

### 7.3.2. Referring to the Digital Self During Conversation

Figure 5 shows the frequency of verbal referrals to the Digital Self across all participants in each minute of the conversation. As might be expected, the Digital Self was referred to more at the beginning of the conversation. Given the frequency of referrals throughout the conversation, participants found the glanceability of both the HMD and smartwatch to be important, allowing rapid access that did not interfere with the conversation. P27: *“I like that you don’t have to use a cellphone or you don’t have to use a computer; you can only raise your hand and see.”*. Participants used the Digital Self as a ‘ticket’ (Sacks, 1992, p.265), to identify a topic to discuss, in the first minute of conversation in 9 out of 10 cases. However, Figure 5 also shows participants made references to the Digital Self throughout the conversation. Each pair used the Digital Self 7.7 times on average (SD=5.0, min=2, max=17).

Participants also rated it as important that the Digital Self was always visible during interaction. To the statement: ‘It was good that the Digital self was

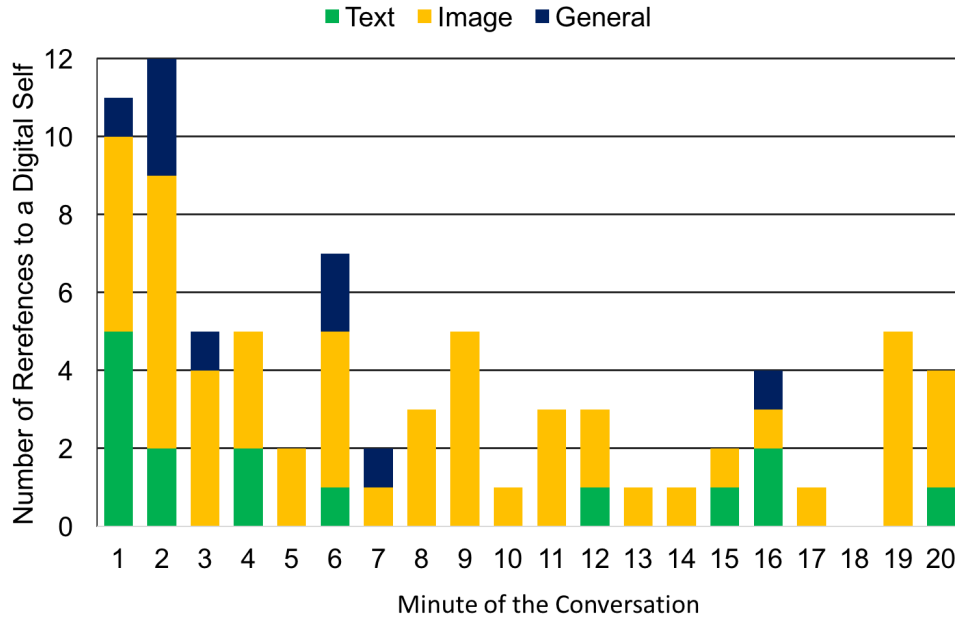


Figure 5: Chart showing the number of verbal references to a Digital Self for each minute of the conversation across all participants. The ‘General’ category means a reference to the Digital Self in general, which could not be classed as either image or text from the video.

visible all the time’, participants’ mean score was 2.85 (S.D.=1.30), and was significantly more in agreement than the neutral score (One-sample Wilcoxon signed rank,  $p=0.002$ ,  $d=0.88$ ,  $\rho=0.80$ ). Participants described how the Digital Self acted as an external memory aid, and could be referred to at any point in the conversation: (P15: “*I found that it gave me something to refer back to, while participating verbally and mentally, I could still visually refer back to something that I could then queue up for the next thing to talk about. It was helpful in that way.*”). In this way participants used it to go beyond setting talk, and discuss topics in more depth. One participant also noted how the Digital Self might be useful in the future as a way of reconnecting with someone and supporting the return to previously discussed topics if the participant later met his or her partner again (P18: “*If you don’t remember faces and names easily you could check.*”). In this way the content from the Digital Self could also be woven into the conversation.

When introducing content into the conversation, participants always did so explicitly. For the HMD group this was generally done by verbally cueing where the data came from in some way. For example, using a phrase that the Digital Self was being used (e.g. P26: “*I can see that....*”), or referring to it in the same

way one might refer to a printed document (see Figure 6). In addition to verbal cueing, three participants used gestures by pointing to or tapping their HMD to indicate that content came from the Digital Self (see Figure 7).

For the Smartwatch group the participant would explicitly look at, or gesture with, the watch when introducing content (see transcription for one pair in Figure 8 and Figure 9 for two other pairs.). From the questionnaire, participants in both groups found it socially acceptable to look at the other person's Digital Self (HMD mean=1.9 SD=1.1, Smartwatch mean=1.6 SD=0.7). As such participants responded that they did not try to conceal looking at the Digital Self from their partner. Participants disagreed with the statement: 'I tried to hide looking at the other person's Digital Self': Smartwatch group (M=6.4, SD=1.0) and HMD group (M=5.1, SD=2.2). Responses in the Smartwatch group differed significantly from the neutral score (One-sample Wilcoxon Signed Rank test:  $p=0.003$ ,  $d=2.41$ ,  $\rho=0.99$ ), but did not in the HMD group ( $p=0.079$ ,  $d=0.50$ ,  $\rho=0.41$ ). The difference between groups was not statistically significant (Mann-Whitney test,  $U=36.5$ ,  $p=0.28$ ,  $d=0.76$ ,  $\rho=0.48$ ).

Participants reported that they felt comfortable when their Digital Self was viewed by their partner, agreeing with the statement 'I found it comfortable when the other person was looking at my Digital Self' (HMD Mean=2.6, SD=1.7, Smartwatch Mean=2.3, SD=1.3). The mean responses differ significantly from the neutral score (respective One-sample Wilcoxon Signed Rank tests:  $p=0.023$ ,  $d=0.82$ ,  $\rho=0.76$  and  $p=0.007$ ,  $d=1.31$ ,  $\rho=0.98$ ), but the groups do not differ from each other (Mann-Whitney U-test,  $U=53$ ,  $p=0.81$ ,  $d=0.29$ ,  $\rho=0.15$ ). However, participants in the Smartwatch group were more aware of when their partner was looking at their Digital Self, than those in the HMD group. The Smartwatch group (M=1.7, SD=1.6) were significantly more in agreement (Mann-Whitney U-test,  $U=22.0$ ,  $p=0.029$ ,  $d=1.19$ ,  $\rho=0.80$ ) with the statement 'I was aware when the other person was looking at my Digital Self.' than the HMD group, who were neutral (M=4.2 SD=2.5).

### 7.3.3. Role of the Digital Self

Reflecting the Digital Self being referenced throughout the conversation (see Figure 5), participants found it useful in a number of ways. Primarily this was to support getting a conversation started, with content acting as 'tickets' (Sacks, 1992, p. 265). From the Likert questionnaire, participants found the Digital Self helped to initiate a conversation (see Figure 10). Based on the interviews, participants described how the Digital Self was used to both start the conversation (P23: "*It makes starting a conversation much, much easier since you have some background information on the person.*"), but also sustain it, helping to move to

A: And how about you? I can see here that you like writing, and communication and stories and this kind of obviously together linked things.

B: Yeah, I write a lot. At this time I write novels and actually I am a journalist and reporter, so that's why writing is very important for me.

A: And what is the medium you usually use?

Figure 6: An example transcript illustrating how HMD group participants incorporated references to the Digital Self in conversation.



Figure 7: Participants either verbally cued when they introduced content from the HMD (see Figure 6) or physically gestured by pointing at their partner's HMD or their own.

new topics (P30: *"We used it to find new topics and to get to know each other because I think at least I put some pictures that are important or about things that are important to me, so it's easy to ask something about the picture, like, 'Why do you have this here?' It's also easier so you don't have these silent moments that much."*). The Digital Self made it easy to identify something of interest and start discussing it (P5: *"I think it helped a lot. Without them it might have been the usual questions; what do you do, where are you from? It's nice to have some kind of direction, this leads to a topic more easily."*).

Participants also found that the Digital Self helped to accelerate the conversation to get to interesting topics faster (P12: *"A good thing is that I think it brings the conversation in a bit faster because there is some small psychological difference in saying, 'So, what do you do?' That is very boring and kind of makes you feel that there is some embarrassment. Whereas, 'Oh, what's this thing I read?' Probably the other person is kind of excited about what the other person is seeing."* And P19: *"I think it really served to break the ice. I think the conversation was fascinating. Having this, that I had beforehand given permission to talk about these subjects, I think that really contributed to the fact that we got talking so fast about this very passionate area."*). This also extended to identifying serendipitous conversation topics that might never have been reached without the Digital Self (P16: *"it's probably the case that I would never have*

A: (Looks at the smartwatch). Yea, what is this picture? Is it about blueberries? (Points the smartwatch with the other hand, leans forward and shows the image to the person B)

B: (Leans forward to look at the image). Oh, yeah. They are blueberries. It's just nature (laugh).

(Both, A and B, lean backwards while A is looking at the smartwatch.)

B: I went picking up blueberries, and I don't know, couple of weeks ago and I saw a lot of blueberries, and...

A: (Looks at the image, then looks at the person B) And this is a picture you took? (Looks again at the smartwatch.)

B: Yeah, I took it there.

A: Cool.

B: And, I don't know, I really like nature. (laugh) Or being in nature, like it's calm and silent and like if you are normally during the week you are in the city so a lot people are like a bit stressful so I like to balance like going into nature sometimes.

A: So where are your summer cottage?

Figure 8: An example transcript illustrating how Smartwatch group participants incorporated references to the Digital Self in conversation.

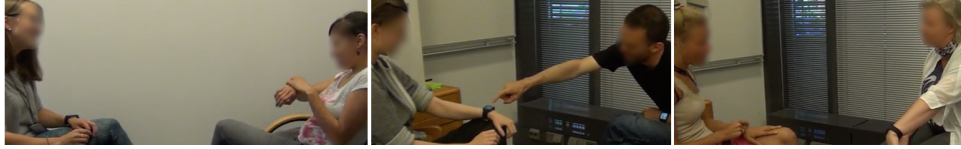


Figure 9: When referring to a Digital Self, smartwatch users were often explicit in their access, and did not try to conceal that access. As with the HMD, participants often gestured at their smartwatch when introducing Digital Self content (Left). The Semi-Public nature of the watch also allowed it to be shared and act as a common ground between participants (Middle and Right)

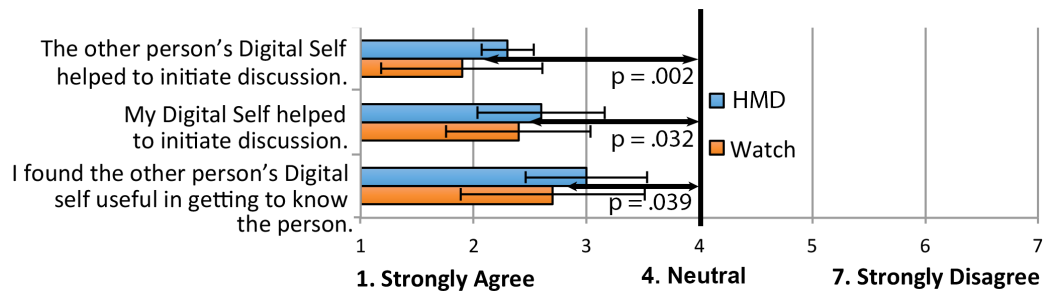


Figure 10: Mean opinion scores to statements concerning the usefulness of Digital Selves. The mean opinion scores differed significantly on a one-sample Wilcoxon signed rank from the neutral score (4) ( $p < 0.05$ ). The corresponding p-values for the statements were  $p=0.002$ ,  $p=0.03$  and  $p=0.039$  when the HMD and Smartwatch groups were combined. The error bars represent standard error of mean.

*asked about the Mexican group, so one good thing could be that it introduced some unexpected elements in a stranger's conversation.”). In this way the Digital Self supported users to reduce ‘setting talk’, allowing them to reach richer topics of conversation, that encourage interaction.*

#### 7.3.4. The Impact of Content Type and Media

As discussed in Part 1 (see Section 6.2.2), participants made explicit decisions on how detailed or vague they wanted the meaning of their Digital Self to be. These decisions also had an impact in the use of the Digital Self during conversation. Digital Selves that provided only basic information, or only very specific information, were often quickly exhausted during the conversation (P21: *“I think I started the conversation by commenting on the football stuff, but after that, I didn’t use it that much, because there wasn’t that much else on it.”*). Digital Selves that reflected personality more than detailed information, for example quotes or images reflecting thoughts and feelings, provided more open-ended

topics for discussion. In such cases images were often referred to as questions (P32: *“Okay, so can you tell me about this picture?” That was mostly how they were used.*”), and were referred to more often than text during the conversation. Images accounted for 68% of references to the Digital Self, compared to 26% for text (see Figure 5).

Although the use of ambiguous images provided more and richer conversations, they also opened the possibility for misinterpretations. Some participants noted they were more cautious in using and referring to them. Five participants also raised concern that images in their own Digital Selfs may be misinterpreted and provide an incorrect impression of themselves. In fact, misinterpretations occurred during the conversation (P27: *“I asked about if she had children, because there are two pictures of her two brothers with children, so I supposed that probably she had, but she hasn’t. I think that at least in particular her profile is not so informative, and I had some troubles.”*). Whilst rich representations open conversation possibilities, they also raise the risk of misinterpretation.

#### 7.3.5. *Impact of Delivery Mechanism*

In addition to the differences already discussed between the HMD and Smartwatch groups in how the Digital Self was referenced in the conversation, other differences and affordances emerged in how they were used. Although Section 7.3.2 discussed the commonalities of how the Digital Self was incorporated either verbally or through gesture between the HMD and smartwatch, a key difference was that the Smartwatch could be shown to the other user (see Figure 9 (right)). In this way a person could see their own Digital Self displayed on their partner’s watch. This served an important role if there was a breakdown or ‘trouble’ in the conversation, for example misinterpreting something about an image a participant shared (see Section 7.3.4). The HMD group participants could not easily show their (partner’s) Digital Self to their partner, and although both were aware what content was being shown, participants may not remember what was in their own Digital Self. The Digital Self could not be referred to by both and could thus not support overcoming such issues (P15: *“One thing I would have liked is, if you could have yours and theirs. Because when she’s asking questions about mine and I don’t quite remember the whole context of one photo or something, and she can’t decide what that is. Then it was difficult to remember exactly the composition.”*).

Given the previously discussed work of McAtamney and Parker (2006) who found that wearing an HMD (that presented unrelated content, such as email) could distract from face-to-face interaction, we incorporated the same questions they used in our questionnaire. However in line with the rest of our question-



naire, participants responded on a 7-point Likert scale instead of the 5 point used by McAtamney and Parker (2006). HMD participants somewhat agreed with the statement ‘The wearable computer did not distract me from the conversation.’ (mean=2.8, SD=1.9), whereas in McAtamney and Parker’s study the participants disagreed (mean of 4.0 on a 5-point scale). The flow of the conversation contributed towards participants stopping noticing the HMDs (P23: *“Because when the conversation flew I didn’t even notice the glasses. I wasn’t aware of the glasses.”*). This fits with recent work by Koelle et al. (2015), who argues from a scenario based design exercise to understand user perspectives on data glasses (such as HMDs), that users are more accepting of someone wearing such glasses around them if they know their purpose, as was the case in our study. However, participants still raised practical issues in use of the HMDs. Whilst we can conclude that knowing what the HMD was being used for reduced its distractiveness, we should note a minority of participants found it to interfere with eye-contact (e.g. P11: *“You could see the eyes, you knew there were eyes behind that, that is kind of to be expected, but you couldn’t really see the eye. That was a bit strange.”*). Although the devices we used were see-through, they did have displays over both eyes. There are few consumer HMDs on the market, but in face-to-face interaction, it may be best to use devices where the display does not cover or obscure the eye. Three participants also raised issues with the placement of the Digital Self in the HMD. We explicitly fixed it be close to the centre of view, but avoid blocking the view of the participant’s partner. For some participants this was too close (P15: *“What I found is I kept trying to put it in this space, over your shoulder, beside your head. Because if it would go down, then it would interfere with the visual. I found myself continually trying to position it an open air space. Other than that, it wasn’t so distracting.”*). For other participants this was too far (P19: *“It was really visible where the screen is so I was maybe trying like, ‘What if I try to set the screen here so I can look direct at him?’ That made me sit at an angle. ‘Okay, can I sneak a view of the profile by placing the profile on top of his face so I don’t break eye contact?’ So I did.”*). Whilst none of the participants found these to be serious issues, the location of the Digital Self in the HMD was clearly a matter of personal preference.

### 7.3.6. Privacy and Disclosure Concerns

Participants created their own Digital Selves, and had complete freedom and control of what content they included and excluded. Even so, participants still discussed their concerns if Digital Selves were more widely deployed as part of everyday life (P11: *“Didn’t apply to this thing but according to how you may put it down, you might be sharing potentially more private things. You could*

*easily, very quickly go into topics that you might not be too comfortable.”* and P32: *“Well, maybe this is not particular to this case, but just then in general, I have still these doubts about, okay, who is going to be seeing these and what would be the privacy settings and sharing settings of these.”*). The ability of individuals to control content that is displayed to others is in contrast to work that uses social media as a raw resource to mine commonalities between user profiles (Nguyen et al., 2015). Allowing participants to create their own expressions of self, choosing their own media and its representation, provided for digital representations that supported richer conversations, and may reduce anxiety that something unwanted might be disclosed.

Of course, it is highly probable that participants would wish different Digital Selves to tailor to different audiences and contexts. We chose an encounter with a stranger without a specific purpose as the most common and potentially most useful case for digital augmentation (Svensson and Sokoler, 2008). The findings we have discovered here may change in different contexts. Understanding how participants would change the content in their Digital Selves is important future work. There is likely a practical limit on the number of Digital Selves an individual would want to create and maintain, as well as how they can be generated. In practice a solution that combines the best of automatic matching techniques such as (Jarusraboonthai et al., 2015) with manual user curation as used here, may be a viable solution.

#### 7.3.7. *Issues with the Digital Self*

Whilst the majority of participants were positive on the Digital Self, there were a number of negative impacts that arose. Four of the participants commented that they felt a need to go through all the topics in the other person’s Digital Self, and rushed through them to do so, cutting potentially interesting topics short to move onto something else. In this way they perceived the Digital Self as an agenda (P16: *“It felt a bit like you’re a host on a talk show and we need to be like, I’ve done a tiny little bit of TV, so the director will tell the host, ‘Now it’s time to wrap up and move on. You will need to take it to the next topic.”*). For five pairs this led to exhaustion of the content in each Digital Self (P27: *“At some point when we had exhausted all the pictures, there were at least two or three times that at least I had to find, and I think she was the same, we were trying to find a new thing for conversation”*). This limited discussions and meant that an interesting conversation in a rich topic area might be cut short to move onto something else. However, all except one pair of participants (in the HMD group) used the maximum conversation time (20 minutes). This pair stopped early, as they had exhausted the Digital Selves, and no topic had helped

sustain conversation. Whilst not a negative impact of the Digital Self itself, it is worth reiterating that the Digital Self can help connect people, but cannot make them friends. For some participants the conversations remained superficial.

### 7.3.8. Reflections on the Digital Self

Participants generally felt that the impression they got from the Digital Self of their partner fitted with their impressions from the conversation (P13: *“She was the same as I thought when I glanced at her Digital Self. I think she was all the things she mentioned there. I think I got a good image before the conversation.”*). Where the view of participants had changed, this occurred quickly and at the beginning of the conversation (P27: *“probably I think that initially I guessed and it was wrong, but it changed at the beginning, but after some point I got more or less a clear idea about her, and this idea remained along the conversation.”*). From the Likert questionnaire participants were neutral when asked if the conversation changed their first impression of their partner (mean=3.60, SD=2.04).

We also asked participants what, if anything, they wanted to change about their own Digital Self. Nine out of twenty participants stated they were happy with their Digital Self and would make no changes. Reasons for wishing to change content highlighted the observations of Part 1 that participants were conscious of the danger of using overly specific content that might provide an inaccurate impression to others (P23: *“It’s always when you try to describe yourself in a very short way, or just to make one slide and tell who you are in one slide, it might give some wrong impression.”*). But more widely, participants wanted to make small changes, adding either more ambiguous content open to interpretation, or more content: (P16: *“I would make it to support the conversation more so I might just leave one piece of art and maybe think of a quote.”*).

In addition to asking participants to reflect on their own Digital Self, we also wanted participants to reflect on where they might see a Digital Self being useful in everyday life. Suggestions strongly related to the same categories that Mayer et al. (2015) identified. In addition to professional networking events, where the use of digital augmentations have been investigated (e.g., (McCarthy et al., 2004; Chen and Abouzied, 2016)), a wider range of use scenarios were discussed. These reflect the potential of a Digital Self to act as ubiquitous conversation starters (P14: *“I would use it if I’m out somewhere then it would be a good conversation starter, anywhere.”*, and P27: *“And then you could choose, ‘I will go and talk to that person.’”*). In addition to starting a one-to-one conversation, Digital Selves were discussed to have potential to support joining a new or existing group, helping to quickly establish common ground (P39: *“If I had to*

*introduce myself to some group of people, like in exchange year it would have been easy to, if everyone had some kind of Digital Self and they would present it to the others”). Beyond the individual matching focused on in most work, the representation of self was also seen as a way to ‘browse’ nearby people in the environment and gain an overview of them, e.g. when arriving at a party or large business meeting (P31: “When, like you know meetings where there a lot of new people who you don’t know. Then you can just watch and then you get this information.”). Such suggestions highlight how it is often valuable and important to make connections with people irrespective of how similar they are. E.g. creating a relationship with a business associate who is different to oneself. As such there are many potential contexts where Digital Selfs can support face-to-face interaction between individuals. Our future work will begin to investigate some of these.*

We can therefore consider that participants created Digital Selfs that fitted the facets of their personality they wished to expose to others, and that others formed an impression of participants that fitted with the Digital Selfs they exposed. Further, participants identified similar scenarios for the use of Digital Selfs that have been identified as opportunities for social matching apps. It is clear therefore that further study of Digital Selfs, beyond the one-on-one scenario we have targeted here, is warranted.

## **8. Discussion**

Our goal in the study of Digital Selfs - visualisations curated by users to represent a facet of themselves to strangers in a face-to-face interaction - was to understand how users would both choose to represent themselves to others in face-to-face interaction through digital and social media, and what the impact of that would be. Our novel two part study has significantly contributed towards this goal. In considering our research questions, we have provided significant answers in the following ways.

### **RQ1: What media do users select to include in a Digital Self to represent themselves to strangers?**

We asked users to create a Digital Self to represent themselves to people they did not know (‘strangers’). However, we did not provide participants with a specific context in which that interaction would occur. The majority of participants focused on presenting information that supported more social uses (such as hobbies or interests) and expressions of personality. This is in contrast with the strong focus of prior work on professional or business scenarios (e.g. (Nguyen et al., 2015; McCarthy et al., 2004)). We don’t argue that such scenarios are

unimportant, 6% of our participants created a solely professional Digital Self whilst 28% included some professional elements, but rather a focus on social face-to-face interaction was a user determined purpose for the Digital Selves. The split in the primary focus of the Digital Selves, largely between social and professional also raises a point over the term ‘stranger’. It is clear the interpreted context of interaction with ‘strangers’ affected what content participants chose to include. In considering other contexts where ‘strangers’ might be encountered, that media would change. As with real self (Goffman, 1959) there is not one true Digital Self, and the content used to represent oneself will vary on context. Yet there are many contexts which are less defined, and where interactions may occur for a variety of purposes or may initially have no clear purpose. Our study indicates that when there is not a clear, specific purpose to the meeting of two strangers (e.g. at a grocery shop, or bus stop for example), the majority of participants will default towards a more personable social facet of themselves. Further study, investigating the use of Digital Selves in the more specific scenarios where individuals are open to meeting others (such as identified by Mayer et al. (2015)), will allow us to understand how users change their Digital Selves based on the specificity of context and purpose of meeting a person.

Digital Selves that were rich and expressive, often incorporating ambiguous or more cryptic information that expressed feelings, emotions or general interests, tended to work better than those with more specific information. These supported the presentation of less tangible aspects of individuals and contrast with approaches that algorithmically mine user accounts to identify specific topic suggestions or shared interests. In many cases participants considered that as the Digital Self would be viewed during conversation, a more general presentation of interests (e.g. an image of a pile of books, instead of a specific book cover) supported some dynamic control of the details of an interest a participant wished to disclose, and a more open topic to stimulate conversation. Algorithmic matching approaches have so far not considered these issues. They often focus on providing concrete interests via text presentation. These can lead to over disclosure on topics individuals may not want to disclose. Self curated representation that can incorporate ambiguity in representations, helped in boundary regulation (Lampinen, 2014), with the individual conversation supporting the detail and depth an individual was willing to discuss a topic in. As the boundary between disclosure and not can vary, even if the relationship and context of interaction are the same (e.g. depending on an individual’s mood), the ambiguity of content helped individuals manage the disclosure they wished. Digital Selves that were more open to interpretation often provided more value in the face-to-face interac-

tions than those which included only specific content. Participants who included specific content often wished to revise their Digital Self to increase its ambiguity. How rich and expressive the Digital Self a participant created was linked to their levels of extroversion. We found that extroverted participants included more content in Digital Selfs, being more willing to share more information.

**RQ2: What visual representation of media do participants choose to employ in a Digital Self?** Although participants used a similar amount of text and image content in Digital Selfs, images were more often referred to when the Digital Self was used (2:1 images vs text content). More interestingly, and related to ambiguity of content participants wanted to incorporate, was the source of media. Our initial assumption was that as users already had facets of their identity in existing social media services (e.g. Facebook) they would reuse this media in their Digital Self. However, whilst there was a significant amount of Digital Self content derived from existing Social and Digital Media services, the majority (over half) came from outside of existing social media accounts, through Google Image searching. This is surprising, and again raises questions over approaches that attempt to automatically identify and present shared interests between users based on their social media likes. Similarly, the algorithms that algorithmic matching solutions use, are often based on textual information retrieval. It can be difficult to algorithmically identify an image that represents the shared interests of two individuals, particularly given the ambiguity participants desire (see RQ1). Media users feel best represents how they wish to be presented to strangers may not exist within the Social Media services such as algorithmic approaches assume is a raw data resource. Whilst public profiles or other content in *on-line* social media services must be interpreted in isolation, Digital Selfs are interpreted in conjunction with the individual the media refers to. Therefore Digital Selfs can support, and benefit from, a much greater degree of ambiguity in content.

**RQ3: What is the impact of a Digital Self on face-to-face interaction?** The introduction of Digital Selfs had an overall positive impact on face-to-face interaction. Whilst the Digital Self acted as a ‘ticket’ (Sacks, 1992, p. 265), providing opportunities to open conversation on, it was also referred to throughout the conversation, helping to sustain and enrich it. Participants found the Digital Self both supported reaching interesting (rich) topics (Svennevig, 2000) faster, allowing exploration and discussion around the interests of others, and discussion of interesting topics that would otherwise not have come up in conversation. Participants were able to use it as a shared discussion artefact, and return to it later in the conversation.

Whilst there are many benefits of the Digital Self, there are also potential negative issues that we found. Most notably some participants felt under pressure to treat it as an ‘agenda’, and felt they had to get through all of the topics. This may lead to pressure to focus on the topics found in the Digital Self and unnecessarily constrain the depth of the conversation on an interesting topic, or limit it to only topics generated in the Digital Self. It is important to note that whilst a Digital Self might help connect people who are compatible but might otherwise have not met, it cannot make two strangers friends. However, to understand this better will require more than a one-to-one conversation. For example, studying the use of Digital Selfs at a party where existing social norms to pause and resume interactions amongst different people are available. We discuss this further in future work.

These benefits of a Digital Self however, strongly depended on how participants created their Digital Selfs, with the ambiguity users designed in (discussed under RQ1) acting to open richer discussion, even at the risk of possible misinterpretation. Something that specific and detailed information did not. How participants create their Digital Self seems to have the greatest impact on its use in face-to-face interaction.

Whilst, as measured by the metrics of Nguyen et al. (2015) and McAtamney and Parker (2006), the addition of Digital Selfs did not significantly reduce the naturalness of the conversation or its quality when compared to the same conversation without the Digital Self, it also did not increase the quality of the conversation. We argue that this may be due to variations in how the Digital Selfs were designed. Participants had no prior understanding of what a Digital Self would work like when they created their own. Those that had simple explicit profiles worked less well. After discussion five participants wanted to add more images, which would support more topics of conversation. We propose that individuals should be encouraged to create richer Digital Selfs. Rather than providing only basic, unambiguous information, that doesn’t help sustain a conversation. Whilst basic information (like names) were useful, more ambiguous text and images provided implicit hints, encouraging others to ask questions about them. As such these contributed more to the conversation and interaction between individuals.

**RQ4: How does the delivery mechanism (HMD or a smartwatch) of the Digital Self affect face-to-face interaction?** Both the smartwatch and HMD were found to be effective and socially acceptable to participants in accessing their partner’s Digital Self. Based on the work of McAtamney and Parker (2006), who studied how distracting HMDs were in face-to-face interaction, we had ex-

pected the HMD to perform worse than it did. However, using the same metrics as McAtamney and Parker (2006), we found the HMD to be much less distracting than their study. The key difference between the studies is that in ours participants knew what their partner was looking at in the HMD and that content related to the conversation. In McAtamney and Parker's work participants did not. As Koelle et al. (2015) have recently hypothesised, HMDs become more acceptable if other users know what they are being used for. Our work provides the first validation of this.

Although no issues on the social acceptability of the smartwatch were raised, we also consider a similar effect may have occurred. The smartwatch had similar scores for social acceptability on the McAtamney and Parker (2006) questions as the HMD. Because participants knew what their partner's smartwatch showed, they also knew their partner was not checking the time or providing a signal that he or she wished to end the conversation. However, outwith our study, where the devices used to access a Digital Self may also be used for other applications, this result may no longer hold. In practical scenarios, the ability of a device to communicate that a Digital Self is being accessed will become important. For example, similar approaches to the 'twisted' designs proposed by Jarusriboonchai et al. (2016), where a public display attached to a device (e.g. back of a smartphone) communicates something of what the user is interacting with to others nearby, could be used. A small external display on the HMD could display a generic Digital Self icon to show a Digital Self is being viewed. However, further study is needed to determine the value of this approach.

Participants could conceal accessing their partner's Digital Self via the HMD, something that was less possible with the watch. However, as participants found it socially acceptable to look at the Digital Self and always explicitly referred to it when bringing the Digital Self into conversation, the discreetness of access was not a significant issue. That the Digital Self can be shown to other participants explicitly, as with the smartwatch, may be more important in overcoming the potential 'troubles' in conversation that the ambiguous media participants preferred sometimes caused. This was not the case with the HMD, where participants sometimes forgot what was in their own Digital Self. Allowing each participant to also see his or her own Digital Self would help to overcome many of these 'troubles', helping to establish common ground.

## **9. Implications for Design**

Based on the results of the four research questions, we recommend future researchers considering the following when considering augmenting face-to-face



interaction with Digital Media.

**Encourage richer Digital Selfs.** Digital Selfs that had basic, obvious or had few content items (e.g. a textual list of hobbies) supported less discussion than those with more content items that were often ambiguous, or whose meaning was less obvious. Participants should be at least discouraged to create very basic Digital Selfs as these are less useful in face-to-face interaction.

**Media users choose to represent themselves with is not easily automatically determined.** Most of the media users chose to represent themselves came from Google image search, and outwith existing social and digital media services that automatic matching approaches use for data. It is outwith the scope of this work to suggest how automatic approaches should consider this finding, but it is important to consider that media users feel represents how they would wish to be seen by others, may not exist in the social and digital media services such approaches use.

**Digital Selfs should be continuously available.** Content in Digital Selfs was used throughout the conversation. It was both directly referred to, and referred back to after being introduced. E.g. unlike Nguyen et al. (2015), where the augmentation only provided initial topics which were regularly changed. The Digital Self should be viewable throughout the conversation.

**Make others aware a Digital self is being viewed.** We did not find the HMD or Smartwatch distracted from conversation. Based on Koelle et al. (2015) we argue this is because participants knew what their partner was using the HMD or Smartwatch for. In real situations, making users aware that the person they are talking to is accessing their Digital Self is likely important to ensure the display technology does not detract from face-to-face interaction.

**Allow users to see their own Digital Self.** Related to the use of Digital Selfs throughout the conversation, it is also important that a user can see his or her own Digital Self. Users may not remember what was in their Digital Self, and this can lead to breakdown. Smartwatch participants could show the Digital Self to their partner, but this was not possible with the HMD.

## 10. Limitations and Future Work

Our work has shown that Digital Selfs bring benefits to face-to-face interaction. However, we have focused on interaction between people who are ‘strangers’. We do not know what the impact of a Digital Self would be in face-to-face interaction beyond this group. As stated by some participants, although they were happy to show their Digital Self to strangers, they would not want to show it to friends or family as it is ‘too general’. How both the content and usefulness

of the Digital Self varies depending on context and relationship is a clear future direction for our work.

Studying the use of Digital Selves in different contexts is important due to individuals' faceted identity, and that the possibility of valuable encounters depends on social (number of friends in close proximity), personal (e.g. activity) and relational contexts (e.g. rarity) (Mayer et al., 2015). It is outside the scope of our work here to consider all possible interaction scenarios. We chose an encounter with a stranger without a specific *a-prior* purpose to fit with many of the scenarios described by (Svensson and Sokoler, 2008) on how strangers may socially meet, and our study procedure parallels existing work in automatic matching (Nguyen et al., 2015) to provide comparison. But there are many other contexts where the content of a Digital Self may vary. Understanding the differences between both audiences and in more specific contexts of interaction is clearly important future work, as is providing practical tools to manage disclosure across and between these.

In addition we have focused on one-to-one interaction. Yet many of the practical applications of Digital Selves are likely to be in situations where multiple parties interact simultaneously. For example, some participants discussed how Digital Selves would be useful at a party or when talking to a group. This raises significant new research questions. In particular, if such gatherings contain a group of people with differing relationships to one another (e.g. a mix of strangers and friends). Should they all access the same Digital Self? What is the impact on a group conversation if a person presents two different Digital Selves to two different people (based on their relationship), but at the same time? Given the small displays of devices, how should users switch and move between different Digital Selves in multi-party settings? Should an automatic approach be used, or should users manually switch?

In studying these issues we need to move beyond the more controlled study situation based on Douglas (1990) and Nguyen et al. (2015) that we used here. Asking two friends to “get to know each other”, as we did in this study of strangers, is unlikely to be useful. Through future studies we will investigate these issues, building off of our work here to provide a strong understanding of how digital augmentation of face-to-face interaction can be more widely supported and the benefits and drawbacks it can bring.

## 11. Conclusions

Our approach of allowing users to both determine and create their own digital representations has yielded significant new knowledge in how we can digitally

augment face-to-face interactions. Existing approaches have tried to determine similarity between individuals automatically, or mine social media for shared topics of conversation. Our study has raised significant questions of such approaches. Users preferred rich, complex media, that was open to interpretation and required interaction to understand, and largely obtained that media outwith the digital and social media services that other approaches would mine. In face-to-face discussion, it was the use of this richer media that supported interaction, with simple profiles quickly being exhausted. As such, we consider there is significant benefit in pursuing our approach of Digital Selfs amongst a wider and more diverse set of relationships and contexts to understand more deeply how the digital presentation of self can be successfully incorporated into face-to-face interaction with others, and the benefits and drawbacks it brings. By doing so we can employ digital media to support new connections in face-to-face interaction.

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- Altman, I., Taylor, D. A., 1973. Social penetration: The development of interpersonal relationships. Holt, Rinehart & Winston.
- Chen, J., Abouzied, A., 2016. One LED is enough: Catalyzing face-to-face interactions at conferences with a gentle nudge. In: Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing. CSCW '16. ACM, New York, NY, USA, pp. 172–183.
- Clark, H. H., Brennan, S. E., 1991. Grounding in communication. Perspectives on socially shared cognition 13 (1991), 127–149.
- Clatterbuck, G. W., 1979. Attributional Confidence and Uncertainty in Initial Interaction. Human Communication Research 5 (2), 147–157.
- Cohen, J., 1969. Statistical power analysis for behavioural sciences. Academic press, San Diego, CA.
- Devendorf, L., Lo, J., Howell, N., Lee, J. L., Gong, N.-W., Karagozler, M. E., Fukuhara, S., Poupyrev, I., Paulos, E., Ryokai, K., 2016. 'I Don't Want to Wear a Screen': Probing Perceptions of and Possibilities for Dynamic Displays on Clothing. In: Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems. CHI '16. ACM, New York, NY, USA, pp. 6028–6039.
- Douglas, W., 1990. Uncertainty, information seeking, and liking during initial interaction. Western Journal of Speech Communication 54 (1), 66–81.
- Ellison, N., Heino, R., Gibbs, J., 2006. Managing Impressions Online: Self-Presentation Processes in the Online Dating Environment. Journal of Computer-Mediated Communication 11, 415–441.
- Farnham, S. D., Churchill, E. F., 2011. Faceted Identity, Faceted Lives: Social and Technical Issues with Being Yourself Online. In: Proceedings of the ACM 2011 Conference on Computer Supported Cooperative Work. CSCW '11. ACM, New York, NY, USA, pp. 359–368.

- Faul, F., Erdfelder, E., Lang, A.-G., Buchner, A., 2007. G\*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods* 39, 175–191.
- Goffman, E., 1959. *The Presentation of Self in Everyday Life*. Penguin Books.
- Hogan, B., 2010. The presentation of self in the age of social media: Distinguishing performances and exhibitions online. *Bulletin of Science, Technology & Society* 30 (6), 377–386.
- Jarusriboonchai, P., Malapaschas, A., Olsson, T., Väänänen, K., 2016. Increasing Collocated People's Awareness of the Mobile User's Activities: a Field Trial of Social Displays. In: *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing - CSCW '16*. pp. 1689–1700.
- Jarusriboonchai, P., Olsson, T., Prabhu, V., Väänänen-Vainio-Mattila, K., 2015. CueSense: A Wearable Proximity-Aware Display Enhancing Encounters. In: *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems. CHI EA '15*. ACM, New York, NY, USA, pp. 2127–2132.
- John, O. P., Srivastava, S., 1999. The Big Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives. In: *Handbook of personality: Theory and research*, 2nd Edition. Guilford.
- Kan, V., Fujii, K., Amores, J., Zhu Jin, C. L., Maes, P., Ishii, H., 2015. Social textiles: Social affordances and icebreaking interactions through wearable social messaging. In: *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction. TEI '15*. ACM, New York, NY, USA, pp. 619–624.
- Kao, H.-L. C., Schmandt, C., 2015. MugShots: A Mug Display for Front and Back Stage Social Interaction in the Workplace. In: *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction. TEI '15*. ACM, New York, NY, USA, pp. 57–60.
- Kaplan, A. M., Haenlein, M., Nov. 2009. The fairyland of Second Life: Virtual social worlds and how to use them. *Business Horizons* 52 (6), 563–572.
- Kleinman, L., Hirsch, T., Yurdana, M., 2015. Exploring mobile devices as personal public displays. In: *Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services. MobileHCI '15*. ACM, New York, NY, USA, pp. 233–243.
- Koelle, M., Kranz, M., Möller, A., 2015. Don't Look at Me That Way! - Understanding User Attitudes Towards Data Glasses Usage. In: *Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services. MobileHCI '15*. ACM, New York, NY, USA, pp. 362–372.
- Lampinen, A., 2014. *Interpersonal Boundary Regulation in the Context of Social Network Services*. Ph.D. thesis, University of Helsinki.
- Mayer, J. M., Hiltz, S. R., Jones, Q., 2015. Making Social Matching Context-Aware: Design Concepts and Open Challenges. In: *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems. CHI '15*. ACM, New York, NY, USA, pp. 545–554.
- Maynard, D. W., Zimmerman, D. H., 1984. Topical Talk, Ritual and the Social Organization of Relationships. *Social Psychology Quarterly* 47 (4), 301.
- McAtamney, G., Parker, C., 2006. An examination of the effects of a wearable display on informal face-to-face communication. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. CHI '06*. ACM, New York, NY, USA, pp. 45–54.
- URL <http://doi.acm.org/10.1145/1124772.1124780>
- McCarthy, J. F., Farnham, S. D., Patel, Y., Ahuja, S., Norman, D., Hazlewood, W. R., Lind, J.,

2009. Supporting Community in Third Places with Situated Social Software. In: Proceedings of the Fourth International Conference on Communities and Technologies. C&T '09. ACM, New York, NY, USA, pp. 225–234.
- McCarthy, J. F., McDonald, D. W., Soroczak, S., Nguyen, D. H., Rashid, A. M., 2004. Augmenting the Social Space of an Academic Conference. *Proc. Conf. on Computer-Supported Collaborative Work (CSCW)* 6 (3), 39–48.
- McGookin, D., Kytö, M., 2016. Understanding User Attitudes to Augmenting Face-to-face Interactions with Digital and Social Media. In: Proceedings of the 15th International Conference on Mobile and Ubiquitous Multimedia. MUM '16. ACM, New York, NY, USA, pp. 285–296.
- Nguyen, T. T., Nguyen, D. T., Iqbal, S. T., Ofek, E., 2015. The known stranger: Supporting conversations between strangers with personalized topic suggestions. In: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems. ACM, New York, NY, USA, pp. 555–564.
- Nosko, A., Wood, E., Molema, S., 2010. All about me: Disclosure in online social networking profiles: The case of FACEBOOK. *Computers in Human Behavior* 26 (3), 406–418.
- Pearson, J., Robinson, S., Jones, M., 2015. It's About Time: Smartwatches As Public Displays. In: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems. CHI '15. ACM, New York, NY, USA, pp. 1257–1266.
- Persson, P., Blom, J., Jung, Y., 2005. Digidress: A field trial of an expressive social proximity application. In: Proceedings of the 7th International Conference on Ubiquitous Computing. UbiComp'05. Springer-Verlag, Berlin, Heidelberg, pp. 195–212.
- Przybylski, A. K., Weinstein, N., 2012. Can you connect with me now? How the presence of mobile communication technology influences face-to-face conversation quality. *Journal of Social and Personal Relationships* 30 (3), 237 – 246.
- Ritchie, J., Spencer, L., 1993. Qualitative Data Analysis for Applied Policy Research. In: Bryman, A., Burgess, R. (Eds.), *Analysing Qualitative Data*. Routledge, London, pp. 173–194.
- Ryan, T., Xenos, S., 2011. Who uses Facebook? An investigation into the relationship between the Big Five, shyness, narcissism, loneliness, and Facebook usage. *Computers in Human Behavior* 27 (5), 1658–1664.
- Sacks, H., 1992. *Lectures on Conversation*, vols I and II. Blackwell Publishing Ltd.
- Schau, J. H., Gilly, M. C., 2003. We Are What We Post ? Self-Presentation in Personal Web Space. *Journal of consumer research* 30 (3), 385–404.
- Svennevig, J., 2000. *Getting Acquainted in Conversation : A Study of Initial Interactions*. John Benjamins Publishing Company.
- Svensson, M. S., Sokoler, T., 2008. Ticket-to-talk-television: Designing for the circumstantial nature of everyday social interaction. In: Proceedings of the 5th Nordic Conference on Human-computer Interaction: Building Bridges. NordiCHI '08. ACM, New York, NY, USA, pp. 334–343.
- Tidwell, L. C., Walther, J. B., 2002. Computer-Mediated Communication Effects on Disclosure, Impressions, and Interpersonal Evaluations Getting to Know One Another a Bit at a Time. *Human Communication Research* 28 (3), 317–348.
- Voida, A., Grinter, R. E., Ducheneaut, N., 2006. Social practices around iTunes. In: O'Hara, K., Brown, B. (Eds.), *Consuming Music Together: Social and Collaborative Aspects of Music Consumption Technologies*. Springer, Ch. 4, pp. 57–83.
- Zhao, S., Grasmuck, S., Martin, J., 2008. Identity construction on Facebook: Digital empowerment in anchored relationships. *Computers in Human Behavior* 24 (5), 1816–1836.