Designing for Self-Expression: A Personal Visualization Projection of Real-Time Social Data

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Abstract
In this paper, we report on the design, implementation and evaluation of a personal visualization projection, which provides onlookers with a real-time view of the online social identity of the wearer. The wearable system was developed as a novel means of electronic self-expression, and for catalyzing increased social interaction between the wearer and onlookers with similar or complementary personality characteristics. The interactive prototype, driven by a handheld pocket (pico) projector, was evaluated with two groups of four participants each. This paper presents our findings according to a contextual evaluation model, which includes aspects of environment, usability, privacy, ambientness, social interaction, and insight.

Keywords
Personal projection, wearable visualization, ambient display, social identity, Facebook

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design, Human Factors

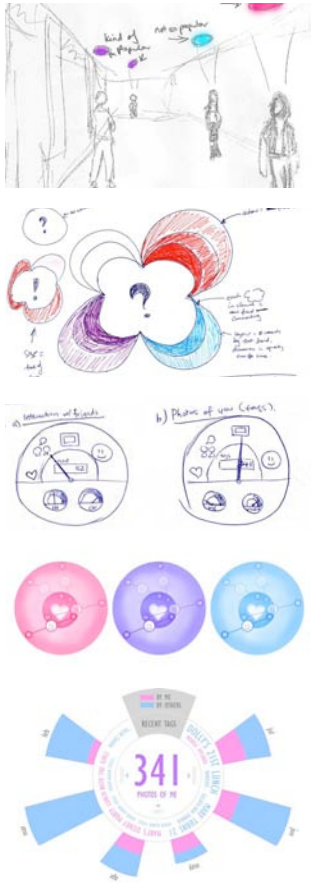

Figure 1. a) Two sketches from the first iteration using the thought bubble metaphor; b) a sketch and mockup from the second iteration exploring forms of user interaction; c) an early sketch from the third iteration.

Introduction

Popular social networking websites such as Facebook allow people to share "virtual" representations of their "real" identities. Particularly teens and young adults seem to prefer online social interaction over face-to-face contact [5], resulting in considerable disparity between one's online and offline presence. Recent advances in pervasive and mobile technology, such as netbooks, smartphones and handheld "pico" projectors, present promising opportunities for leveling out this inequality, for instance by externalizing the information surrounding one's online social identity in physical reality. We claim that explicitly blending one's virtual identity with the real world has the potential to significantly enhance the awareness of this person's "real" or "potential" social capital for any person in the vicinity.

Small projectors have already been shown to enrich various social computing tasks, including photo- and video-sharing among groups [1,2] However, there are still few working examples of using handheld projectors as a personal visualization or feedback medium, for instance to enhance awareness, support opportunistic sharing, catalyze conversation or social interaction, or promote personal expression. In turn, the MIT *SixthSense* project demonstrates the huge potential of personal projection, here to augment the physical world with digital information and gestural framing [2]. Early research has shown the potential for the projection of in-situ information in order to aid people in making better decisions [7]. Here, we follow a similar idea in a social computing context by exploiting a personal projection as a means of self-representation, which also allows passers-by to form judgments about a person's social identity.

Design and Implementation

Following a research through design approach [9], we designed a wearable visualization system that conveys actual social media data of the wearer. Facebook was chosen as the source of the data to be projected, due its popularity and rich data sharing features. After several prototype and testing cycles, we chose to project the visualization on the ceiling, because: 1) the limited projection brightness means the system can only be worn in indoor environments; 2) ceilings generally are still relatively pristine surfaces that do not suffer from continuous distractions or activities; 3) using the floor would lead to shadowing and lack the required projection distance to assure a large size display; 4) ceilings are traditionally used for the communication of information [8]; 5) our visual design rationale resembles the holographic displays known from some role-playing games, such as the Sims; and finally 6), using walls or other vertical surfaces would lack a clear mapping between wearer and display.

Design Process

A crucial step in our design process was matching the social identity data that would be perceived as interesting in everyday life with a suitable, enjoyable and immediately understandable form of visual representation. The design of the visualization involved three iterative stages of sketching and reflection. In the first iteration we explored different forms of metaphors, starting with the "thought bubble" metaphor for informing the visual design (Figure 1a). In the second iteration, we focused on designs that allowed for interaction and privacy control (Figure 1b). The insights from these two iterations formed the basis for the third iteration cycle (Figure 1c), leading to the final visualization, which consists of two modes: The *Likes*

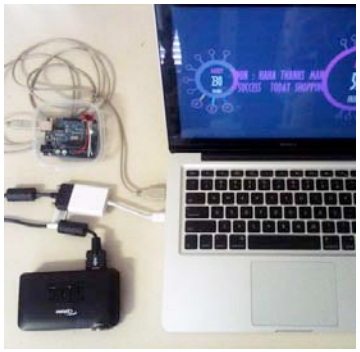

Figure 2. Technical components of the prototype: laptop running the Friends mode visualization, compass module, Arduino microcontroller, and pico projector.

Figure 3. The shoulder bag containing the technical components with the pico projector attached to the side, pointing upwards.

mode conveys the interests of the wearer based on the Facebook Fan Page data. This includes total number of pages liked, page titles, page categories and the number of pages in each category. This data is represented as a circular bar graph, in which the titles of the selected categories are animated to scroll towards their respective bars (see Figure 4). The *Friends* mode represents the wearer's social status and the interactions with her friends by summarizing the total number of friends, number of active friends, and the communication between the wearer and her friends. The identity of the wearer and a selection of her friends are represented as circles that include the wearer's name and her total number of Facebook friends. Active friends, that is those who have recently interacted with the wearer, are represented as nodes surrounding their respective circle. A more detailed summary of social interactions between the selected friend and the wearer reveals keywords of recent posts and comments, as well as the proportion of total communication contributed by each party (indicated by the pink bar surrounding the wearer/friend circles) (see Figure 2, visualization running on laptop screen). Wearers can change the visualization in terms of which data is shown (Likes or Friends) to provide them with an appropriate level of privacy control. For instance, the Likes Mode shows more public information and the Friends Mode more intimate. Furthermore, wearers can control the selection within each mode through physically rotating their body to face the categories they wish to view in more detail. This adds a novel, and intuitive interaction technique to personal projection.

Implementation

We used a PHP implementation of the Facebook Graph API to gather wearers' Facebook data, while the visualization was developed using Processing. The visualization runs on a laptop, placed inside in a shoulder bag. The pico projector is mounted to the shoulder bag, pointed upwards to provide the ceiling projection (Figure 3). A compass module inside the bag (attached to an Arduino microcontroller) measures the wearer's physical rotation for controlling selections within the visualization. A mouse button integrated into the bag allowed the wearer to switch between the two visualization modes.

Figure 4. Close-up of the projected Likes mode visualization.

Evaluation Methodology

The evaluation study was conducted with two groups of participants over two separate sessions. One group consisted of four 'friend' participants who were well acquainted with each other (F1-F4), while the other group consisted of 4 'stranger' participants who were not well acquainted (S1-S4). Each session required the participants to take turns wearing the visualization device for approximately 10 minutes each. The rest of the group interacted with the wearer as onlookers. Each session took place at a common meeting place for students at our university: a cafeteria inside the student union building for the 'strangers' session, and a lounge area in our Faculty building for the 'friends'

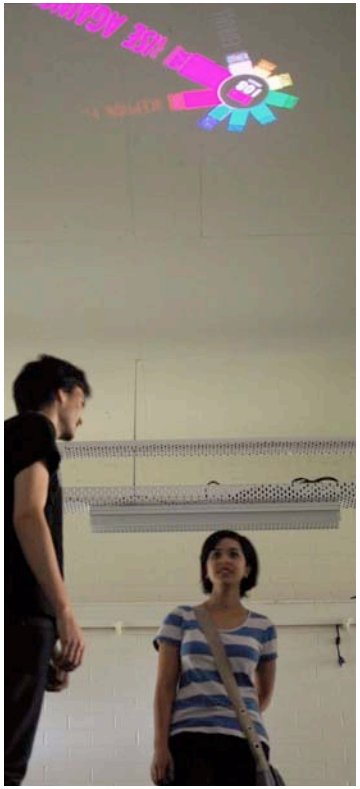

Figure 4. Usage scenario showing the wearer (right) and an onlooker (left).

session. Each session lasted approximately 40 minutes, was recorded on video, and was followed by a focus group discussion. The focus group invited the participants to discuss their thoughts, feelings and experience in wearing the system. These discussions were recorded and transcribed, and categorized by criteria derived from related literature [1,2,3,4,8] described below.

Results and Discussion

Environment

We discovered several problems associated with using the ceiling as projection surface. While the ceiling was typically available as a clean surface, the projection was competing against the light situation. Participants S4, F1, and F2 mentioned difficulties in monitoring the visualization while simultaneously having a conversation with the wearer. *"I find that when you put it on the ceiling it's hard to have a face-to-face conversation because no one is looking at each other."* (S4) While the system was designed to be viewed from further away by occasional passers-by to encourage them to engage into a conversation with the wearer based on the data shown, it proved unsuitable to sustain its effectiveness during the conversation itself. Some participants, in turn, supported the ceiling placement: *"The ceiling definitely worked better […] because the floor, you have to look down, then look back up to talk."* (S1) *"You're still looking at the ceiling, but you can glance down [to talk]"* (S3).

Usability

In terms of wearability, the overwhelming majority (n=7) found the device fairly comfortable to wear with descriptions such as "*very natural*", "*reasonably normal*", and "*didn't mind it too much*". Using the rotation of the wearer's body for changing parameters proved to be a usable way of providing hands-free control. Unfortunately, the prototype hardware suffered some latency associated with the compass sensitivity, and the fact that the sensor was kept inside the bag, offset to the wearer's center.

Privacy

We discovered some indication how transferring the online social identity information into the real world can have a significant impact on the way people maintain this data. For example, participant F4 stated that she would have 'liked' a different curated Fan Page, if she had known that it would then be visible in the real world, to show others her attitude towards a certain topic (the topic being Architecture students in her case). While this sentiment conveys an issue with the different norms of privacy between online and physical space, it also demonstrates how such an externalized visualization has the potential to serve as a form of self-expression, similar to the way people choose to wear certain clothes or accessories as a public statement. The study confirmed that there exists an inherent difference between making available the same types of information, online versus in the real world. In the real world, wearers experience the visualization as a form of self-validation, and are immediately affected by experiencing how people are paying attention to what they post. *"I actually know when someone is looking at what my interests are, while online I don't know or care who is looking"* (S2). The evaluation study also demonstrated that online data is perceived in a more privacy-sensitive way when projected into the real environment: *"I felt a bit embarrassed with mine. But then I came to realize that it was already on Facebook..."* (S1)

It was also suggested that it appears more socially acceptable for people to take an interest in this sort of data in face-to-face interactions in the real world rather than online. The fact that in the online environment, strangers have to deliberately search for such specific data associated with the person they wish to interact, feels less natural and more "*stalker-like*" (S2)..

The location of the visualization was also a factor in the perception of privacy. Participant F2 expressed how floor placement might provide for a greater sense of security: "*It would be small, but it would be next to you and ... not out in the open. In a strange way, because it's closer to you, you feel more comfortable with it...*"

Ambientness
Some elements of the design did not achieve the characteristics of ambientness as desired. Some participants reported feeling self-conscious and vulnerable, since especially because they were initially unfamiliar with the exact contents of the visualization. The scrolling messages proved not optimal, as the continuous change in textual content meant wearers were curious to check what was showing, for instance in case something potentially embarrassing showed up. Both effects might become reduced with increased usage as participants are getting more familiar with the content:*"[It] made me feel more vulnerable. I kept looking up to see what it was showing... but after a while I got the hang of it"* (F1). With wearers and passers-by becoming more comfortable with the system, some design changes may be implemented. For example, animated features should be invoked to draw attention only when something significantly changes, while the visualization as a whole should appear relatively static.

Social Interaction
Particularly, in the strangers session, we observed that participants tended to use the visualization as a conversation starter. For example, they would look at the visualization to pick up a keyword, such as "Toy Story" and then initiate a conversation with the wearer about this topic. As a result, participants in this session mainly used the Likes Mode, as it helped them to find topics of shared interest. In turn, participants in the friends session were more interested in the Friends Mode, as they wanted to see how they compared to the other present friends in terms of online social interaction. Even more, they often requested the wearer to turn so they could see their own interactions.

Some outside passers-by were observed during the evaluation sessions watching the wearable visualization, but none of them approached the wearer. The low number of passers-by interaction might be due to the fact that the novel technology revealed the experimental setup rather than invoke a real-world situation that is sufficiently trustworthy for strangers to feel encouraged to start a conversation with a stranger. A different evaluation methodology would be required to accurately determine in how revealing one's online social identity value is able to encourage social interaction with outside passers-by in a real world context.

Insights
The visualization enabled onlookers to gain insight about the wearer, supplementing the social interactions within the group. In most cases, the insights were small and specific, such as *"Participant S1 really likes drawing"*, but still significant considering the limited complexity of the data shown. In some instances, the

visualization allowed wearers to gain more profound insights. For example, Participant F1 was able to both reflect on her own online behavior, *"Yeah, I spam people's walls...",* and gain insight through comparison to another participant's, *"Participant F2's 'likes' tripled mine...".* In other cases the visualization triggered remembering things like events that happened in the past: *"That was Friday, remember? When we all met up...?"* (F2).

Conclusion and Future Work

The evaluation study of our personal visualization system revealed that the externalization of personal data from the online realm can 1) trigger social conversations; 2) provide insights into oneself, others, or shared experiences; 3) provide means of self-expression; and 4) has the potential to bring online identities and the real world personality closer together. In our case, the Likes Mode proved to be especially valuable in an environment where people are unfamiliar with each other, whereas friends interacting with each other especially appreciated the Friends Mode. As was also mentioned by previous work in this area, it is important to provide adequate levels of privacy control when exposing personal data [1,2]. We suggested that the choice of projection surface itself has the potential to influence the level of perceived control over privacy. However, further developments in pico projector technology, such as brightness and battery life, are required before a system such as this can be successfully adopted for everyday situations. Integration of projection technology into wearable devices like smart phones might therefore become a future promising avenue, which could also open up better suited display surfaces than ceilings or floors.

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