Attire: Conveying Information Exposure through Avatar Apparel

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Abstract

Systems of interpersonal interaction typically allow a user
to manage privacy by specifying which accesses to his or
her personal information are permitted. However, users
rarely know whether, when, and by whom information was
actually accessed within the parameters they specified.
We define *actual* accesses to personal information as
"information exposure." Knowing one's exposure can
potentially enhance privacy management. Toward this
end, we present Attire: an app for computers and
smartphones that represents the user with an avatar.
Attire conveys real-time information exposure in a
lightweight and unobtrusive manner via modifications to
the avatar's clothing.

Author Keywords

Location sharing services; privacy; exposure; avatar

ACM Classification Keywords

H5.2. [Information interfaces and presentation (e.g.,
HCI)]: User Interfaces – Graphical user interfaces

General Terms

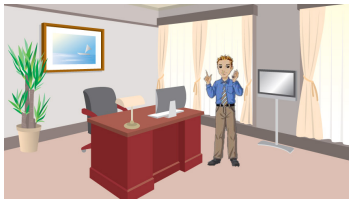Design, Human Factors, Security

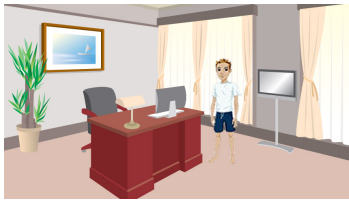**Figure 1:** Contextually appropriate work attire.

Figure 2: Contextually inappropriate work attire.

Figure 3: Contextually appropriate home attire.
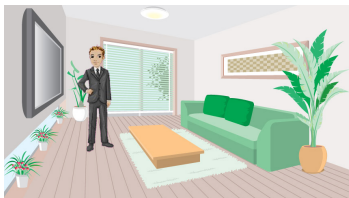

Figure 4: Contextually inappropriate home attire.

Motivation

Systems for interpersonal interaction and coordination are critical for collaborative activities, both professional and social. Since these systems impact personal privacy, they typically allow a user to specify permissions to control access by others to the user's information. However, the user is rarely informed whether, when, and by whom information was *actually* accessed within these specified parameters for permitted access. For example, knowing that information was accessed repeatedly within a short time-frame could be useful for making judgments such as urgency or stalking. We define *actual* accesses to personal information as "information exposure." Knowing one's information exposure can facilitate improved privacy management. For instance, it could highlight when the *actual* audience of information disclosure differs from the *intended* audience defined by access permissions. Our prior work found that audience mismatches were a major contributor toward privacy violations [5].

Attire: System Description

We built an app called Attire to convey real-time information exposure in a lightweight and unobtrusive manner. Attire is based on our initial exploration of using an avatar for conveying exposure [4]. As we have found the background of computer desktops and smartphones to be useful for this purpose [6], Attire presents the avatar as a desktop wallpaper. Presently Attire handles a user's current location as the piece of personal information being accessed by others. Attire detects the user's location and accordingly situates his or her avatar in one of four typical locations: home, work, school, and a place of social interactions such as a restaurant or bar. Each location is associated with contextually appropriate default attire. Figures 1, 3, 6, and 8 show the default avatar for work, home, school, and restaurant, respectively.

As long as the user's information exposure remains within contextually appropriate levels, the avatar sports apparel fitting the context (e.g., a business suit at work). Increases or decreases in exposure beyond contextually permissible levels are reflected by changes in the avatar's clothes. For instance, too many accesses to the user's location by social contacts while he or she is at work result in the avatar appearing progressively less formal (see Figure 2). Similarly, frequent accesses by professional colleagues while the user is at home result in a formal avatar in a domestic context, indicating context-exposure mismatch (see Figure 4). Figures 7 and 9 show mismatched attire at school and restaurant, respectively.
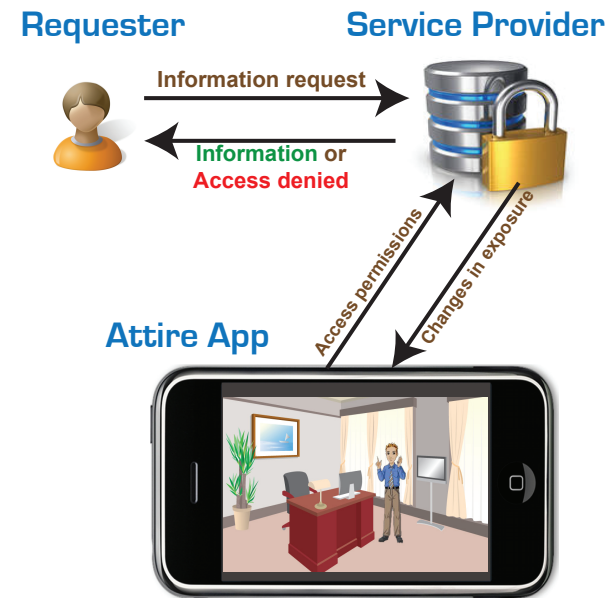

Figure 5: Attire: System architecture.

Figure 6: Contextually inappropriate school attire.

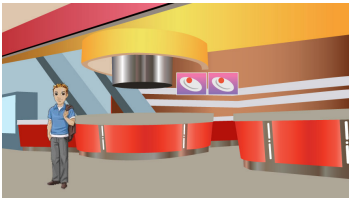**Figure 7:** Contextually inappropriate school attire.

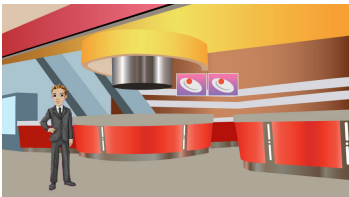**Figure 8:** Contextually appropriate social attire.

Figure 9: Contextually inappropriate social attire.

Figure 5 shows the system architecture of Attire. A user's access permissions along with his or her custom preferences for Attire are stored on the servers of the service provider. When a third party requests the user's information, the service provider verifies whether the access is permissible and, if so, releases the information to the requester. Further, the provider stores information regarding each successful access and examines whether the access leads to changes in information exposure that cross the user's Attire thresholds. When an access is deemed to have changed exposure beyond these thresholds, the service informs Attire. Attire, in turn, triggers avatar clothing changes based on the user's current context and the exposure change information received from the service provider.

Discussion

Attire is principally intended to spur thinking on how meaningful information about a user's exposure can be conveyed seamlessly, intuitively, and non-intrusively. The research challenges lie primarily in finding a way to convey exposure in a way that is easily interpreted without burdening the user with excessive information. Research has explored the use of visualizations and metaphors coupled with ambient and peripheral information displays for tackling this challenge. However, the typical focus of such research in the CSCW domain has been to convey to a user information about the activities of *others* in order to foster awareness [1, 2] and/or intimacy [3, 7]. In contrast, Attire is meant to convey when others access information about the activities of the user.

Attire serves as a seed for further investigation into exposure feedback using avatar-based mechanisms. For instance, additional exposure information could be conveyed via the pose or expression of the avatar,

interaction of the avatar with other entities (animate or inanimate), and actions performed by the avatar (such as, talking on the phone, dancing, etc.).

Attire could also be extended to handle other types of information besides location, e.g., views of photographs, 'mentions' and 'retweets' of tweets, comments on status messages, etc. Moreover, users can be empowered with functionalities that allow: (a) personalizing the levels of exposure at which attire switches occur, and (b) specifying the looks and clothing of the avatar in its various contexts.

Exposure could also be conveyed via further manipulating the background context in which the avatar is situated. For instance, pictures appearing/disappearing on the wall could be tied to accesses to the user's photographs. A chattering crowd gathering in a corner could indicate conversation activity on the user's social media feed.

Conclusion

It can be important and useful to know about accesses to one's information by other parties. Knowing when, how, and by whom, one's information is accessed *in practice* can facilitate better informed and more effective personal privacy management. A challenge, however, is conveying information about accesses in ways that are concise and unobtrusive yet easily interpretable and noticeable. Toward this end, we built an app called Attire that uses the avatar metaphor to convey information access via changes in the avatar's attire and context. We offered suggestions for further exploration of the design space that include manipulating other aspects of the avatar besides clothing. User evaluation and field trials can shed light on the utility and effectiveness of these approaches and may also contribute further design enhancements.

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