
Are You Exposed? Conveying Information Exposure

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Abstract

We explore the design space of interfaces for conveying and managing 'exposure' – the *actual* access to information by parties authorized to access it. Our goal is to *convey* the resulting disclosure in a quickly interpretable form and to enable lightweight interactions to *manage* exposure, if needed. Toward this end, we propose mapping levels of exposure to levels of concepts familiar in everyday practice, e.g., the appearance and physiology of an avatar. We hope that our ideas will spur further expansion and exploration of the design space around these issues.

Author Keywords

Exposure; privacy; location sharing

ACM Classification Keywords

H.5.2 [Information interfaces and presentation]: User Interfaces — Graphical user interfaces.

General Terms

Design, Human Factors, Security

Introduction and Motivation

Recent years have seen a meteoric rise in the popularity and use of interpersonal awareness and communication systems, such as social media. The benefits of these

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systems are often at odds with privacy needs. Typically, the systems allow users to manage interpersonal privacy by specifying preferences for various access control settings. These settings ensure that parties can only view information they are authorized to access. However, the settings deal only with *potential* information disclosure. This leaves a disconnect between information disclosure as perceived based on the settings and the *actual* accesses to information by authorized parties and the resulting disclosure that takes place in practice. We denote the actual disclosure with the term “exposure.”

Consider, for instance, that an employee has allowed his boss access to information about his whereabouts during business hours. How would the employee feel about or interpret the boss’s actions if he knew that she had accessed his location 7 times in the past 15 minutes? In this scenario it is certainly permissible for the boss to check the employees location as often as she desires. However, the boss’s behavior within the constraints of permissible access provide additional information, such as an indication of urgency or hint of surveillance. Therefore, we believe that knowledge of exposure could inform appropriate short- or long-term privacy management actions. Yet, current systems lack effective capabilities for users to determine and manage exposure. Our aim is to fill this gap.

A well-known design challenge in this regard is the tradeoff between conveying exposure and overwhelming the user with unimportant minutiae [3]. As a result, it is not only important to select the right information to convey at the right time but also to present the information in a way that takes optimal advantage of human cognitive and sensory abilities. Therefore, we are interested in conveying exposure more effectively than as

a mere textual list of information accesses. Our initial design attempt was a simple visual interface in which each party authorized to access information was represented as a pair of eyes. The eyes were meant to create a sense of being watched and each pair grew in size with increasing exposure toward the respective party. For each requesting party, users could pre-specify the number of permissible accesses per hour. The growth function for the eyes was weighted by the permissible accesses for the corresponding requester. A user study showed that our initial design was more effective in conveying exposure than merely listing information accesses [5]. Encouraged by this initial success, we explore further designs for presenting and adjusting exposure. We seek feedback and discussion from the community to improve and refine the designs. We also hope to inspire other creative designs.

Interfaces to Convey Exposure

The promise of our initial design is derived from the mapping of exposure levels to a familiar metaphor that users could easily relate to. Therefore, we sought additional useful mappings in our exploration of the design space. Below we discuss one illustrative example in detail.

Design Exploration: How Do I Look?

In a prior study, we found that users considered the avatar metaphor intuitive and usable for specifying access control rules for health records of specific body parts [1]. Therefore, our design proposes linking the clothing and physiology of an interactive avatar to levels of exposure (see 1). The avatar would be customizable like avatars in the virtual world Second Life [4]. Users may assign different requester social groups or individuals to each article of the avatar’s clothing, such as hat, sunglasses, shirt, pants, shoes, etc. Initially, each article of clothing is a dark shade of color. Increased exposure toward a social

group or individual turns the corresponding article progressively lighter and vice versa. The design rationale is drawn from darker objects (e.g., tinted windows) allowing less light through, thereby providing less exposure of whats on the other side.

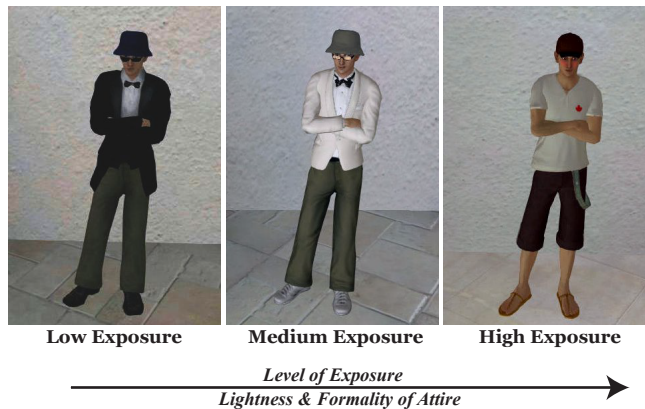


Figure 1: Avatar states at different exposure levels.

Higher exposure levels also trigger changes in formality. For instance, a dress shirt turns to a t-shirt; sandals replace shoes. Literature shows that such cues are often utilized in personal judgments and social perception [2]. Our design links the comfortable and relaxed nature of informality with higher exposure in terms of disclosing ones 'true' self. On the other hand, formality is associated with practices constrained by a set of externally structured and established behavioral norms, thereby limiting exposure of one's own individual expression.

Further, extreme levels of exposure cause physiological changes such as sweating, sunburn, or anxious face. Admittedly, as privacy researchers our orientation toward exposure is focused on *limiting* it, which explains our

association of discomfort with exposure. However, it must be acknowledged that it is conceivable that high levels of exposure are considered desirable (consider, for example, the desire to tweet to a large audience). In such cases, higher levels of exposure could trigger pleasant physiological changes like smiling.

Interaction with the avatar allows quick context-relevant exposure management. In addition to changing clothing color and formality, users can adjust exposure levels by other metaphor-relevant actions, such as putting on sunscreen for a temporary privacy increase (*prevention*), and soothing a sunburn with lotion to decrease exposure (*cure*). The avatar also possesses special exposure management articles, such as a 'Cloak of Invisibility' that temporarily blocks access to all parties.

Discussion and Conclusion

In addition to the avatar concept, we are also considering other mappings with familiar objects such as a desktop wallpaper that looks and behaves like frosted glass; changes in levels of exposure are correlated with changes in transparency. Higher exposure leads to more transparency (leaving one more exposed to observation) and vice versa.

Another possible technique to convey exposure information is to employ various types of notifications – passive as well as active – about changes in exposure levels. The notifications can range from a non-intrusive, ephemeral popup to a call to ones mobile phone. Levels of exposure are mapped onto the intrusiveness of the notification; intrusiveness increases with increasing exposure. The specific levels that trigger changes in notification levels are determined by user-specified privacy and exposure preferences. For instance, the same number

of requests for access to one's location could result in an ephemeral popup or trigger a ringing sound depending on whether the requester was a family member or the boss.

It should be noted that the designs and mappings need not be mutually exclusive and could be combined for an integrated experience customizable by the user. For instance, a user may assign the most critical social groups or individuals to the avatar and handle the rest with exposure notifications. Or the user may utilize the frosted glass metaphor to indicate *combined* exposure to all requesters in addition to the more granular information provided by the other mappings.

Further, the designs are easily adaptable to platforms such as smartphones, tablets, and ubiquitous computing environments with ambient displays. The operation could also be customized in other ways. For instance, instead of requesters, interface elements could be mapped onto information types (e.g., location, calendar, health, status messages, social-networking activities, etc.). Similarly, as discussed above, with minimal operational adjustments, the designs can also accommodate situations in which high levels of exposure are desired (e.g., emergencies). While we currently follow the principle of reciprocity (i.e., in order to receive information, the requester would need to reveal his or her identity), we are interested in exploring how to protect requester privacy appropriately. User evaluation could provide insight into this issue and further inform refinement, customization, and integration across deployment platforms and contexts. It could also shed light on appropriateness, comprehensibility, and applicability of the mappings and metaphors across different cultures.

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