Design for Confident Communication of Information in Public Spaces

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Abstract. In a ubiquitous society, it is possible to use many kinds of information anytime, anywhere. Increasingly reliant on their mobile phones and PDAs, people often use information in public spaces. However, there are risks to entering highly confidential information such as personal data into a system. People have a strong awareness about the value placed on personal information, and worry about their information being leaked to people they don't want to see it. In public spaces people also worry about real-world leakage (i.e. by non-digital means). In spite of the security provided by law and technology, people cannot handle information with reassurance. Complete security means both communication security and physical security. The purpose of this research is to construct an environment where ubiquitous services can be used with reassurance. In this paper we describe our first experiment in this research area.

Keywords: Personal Space, Reassurance, Public Space.

1 Introduction

The spread of personal computers and the explosive growth of the Internet now make it possible for users to communicate a wide variety of information regardless of location or time of day. This means that even information of a highly confidential nature can be accessed and processed anywhere and anytime. As a result, even highly confidential information can potentially be handled any time, and any place. This situation bears risks, however, as the user's personal information could be leaked or made visible to parties unknown to the user. Of course, services that use confidential information are provided with robust security systems such as encryption, digital certification, and authentication technologies such as IC cards and biometric authentication. Therefore, we can say that these services are secure as far as their functions are concerned, but what about the environments in which these services are used? For example, have you ever found yourself worrying about people catching a glimpse of a display you are using on a busy sidewalk? In practice, it cannot be said that highly confidential information such as personal details can be used securely in public work environments.

Guidelines for designing work environments have previously been presented from a human-physiology perspective in the fields of architecture and human-factors

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engineering (Grandjean, 1989; Maruzen, 2001). Many of these guidelines, however, are based on the physiological characteristics of human beings, and there has been no research that takes account of the types of information handled in such an environment or of user reassurance. In short, these guidelines by themselves cannot clarify what format of work environment is best for providing users with a sense of reassurance. There is a need for guidelines and methods that can be applied to the design of public work environments that enable users to comfortably handle personal information. Therefore, we are researching and developing network architectures where IT equipment can be used in many different places and have initiated a study of secure space design technology because people need physical spaces where they can use these services securely (Iizuka, 2004; Goto, 2004; Iizuka, 2005a).

When taking action, humans feel reassurance based on three factors, reassurance by prior defense, reassurance due to grasp of the situation, and reassurance by subsequent compensation. Applying these factors to feelings of reassurance when a person is communicating information in a public space, it can be said that reassurance by prior defense takes the form of reassurance due to being physically prepared for the environment, reassurance due to grasp of the situation takes the form of reassurance obtained by knowing the surroundings during communication of information, and reassurance by subsequent compensation takes the form of keeping damage from predictable trouble to a minimum. Reassurance by subsequent compensation is considered to be a subject for insurance companies and other similar institutions, and reassurance by prior defense has already been advanced in research on secure space design technology, mentioned above. Actually, when people are communicating information in a public space, since there are many unknown people around them, the surroundings change moment-by-moment. To mitigate the problems this causes, a system that can always recognize the situation clearly, providing reassurance due to grasp of the situation, is needed for people to be able to work comfortably. So, in our research, paying attention to reassurance due to grasp of the situation, we decided to try providing the information to help users feel reassurance while communicating information in a public space. In this paper, we describe our approach to the research, the details of the experiment we conducted as the first trial, its results, and our future plans.

2 Approach

Some people want reassurance by prior defense when communicating information i.e., reassurance by secure space design technology. That is, users don't always want to communicate information relying only on their grasp of the surrounding situation, which depends on available information and judgment of whether the situation is reasonably secure. Prior defense means users want to concentrate on handling information without worrying about their surroundings. However, secure space design technology is still in the research stages. Even if this technology were in the utilization stage, it would still be difficult to apply it to all public spaces. Therefore, users must settle for reassurance due to grasp of the situation provided by presentation of situational information (Figure 1).

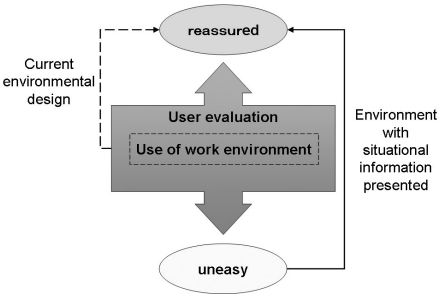

Fig. 1. Research design

The actual work environment is presented in Figure 2. Although the screen on which information is presented naturally faces the user, it also faces a person behind the user (Figure 3).

Fig. 2. Actual work environment

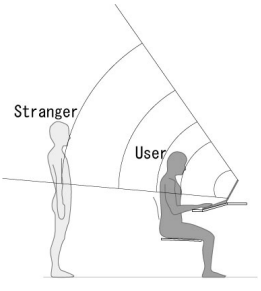

Fig. 3. Direction of screen

However, it is not easy for a user to know if someone is behind him. Therefore, we aim to reassure users about people behind them by presenting situational information.

3 Observation

We observed the effect (users' actions) that presentation of situational information (information about whether someone is behind the user) has on an information user. In this section, we describe the purpose and method and discuss the results.

3.1 Purpose

The first step in this research was investigation of the effect that presentation of situational information has on an information user. We assumed that uneasiness affects how accurately information is input so we decided to use the number of input mistakes as a metric of that effect.

Humans have five senses: hearing, tactility, vision, smell, and taste. Of these, it is thought that it is easiest to perceive visual and auditory information (Oyama, 2003). However, it is thought that surrounding sound in public space drowns out auditory information. Therefore, in this experiment, we decided to use visual information to provide situational information.

3.2 Method

The investigation is explained in detail below.

(1) Equipment

To present visual information, one can use text, pictures, or light. Since this was our first trial and we were concerned about cognitive speed, we decided to use light of two different colors. We wanted to observe whether information can be comfortably communicated and what effect it has on users by assigning one kind of information to each of these colors. We observed the effect this information had on users by assigning one color to safe and one color to unsafe situations. Since green is said to induce reassurance, and red to induce an uneasy feeling (Takahashi, 2002), in this investigation, we used green to signal situations where the user could communicate information with reassurance and red to signal situations where the user could not communicate information with reassurance. Specifically, we fabricated a display that shows circles of green and red light with a diameter of 11 mm on an LED (Figure 4). Considering it a place well within a user's field of view, we installed the display between the monitor and the keyboard of a normal PC set-up. We used the direction of a stranger's face, distance between a user and a stranger, and type of information being communicated by a user to determine what color to display. With this combination of factors, we made judgments about whether the situation was safe, and displayed either a red or a green light. We controlled the display from another room where we could see into the laboratory through a one-way mirror. We explained the meaning of the two colors to participants in advance.

Fig. 4. Experimental set-up

(2) Participants

We conducted the experiment with seven participants, all of whom were women who

- had experience communicating personal information (information that a user would not want others to see) on a PC,
- had experience operating PCs, and
- had used PCs to send email and shop on the Internet.

(3) Environment

In each trial there was a "user", someone inputting personal information and a "stranger", someone unknown to the user, in the room. The users input information on a PC equipped with one of our displays. Intentionally, in order that a stranger could see the PC monitor, and to make users aware that the stranger could see it, we used a 28-inch PC monitor. Moreover, in order that an experimenter might easily determine the distance between a stranger and a user, and to judge whether the stranger was in a position to see a display, the stranger was directed to stand in specified spots. Furthermore, to determine whether the pedestrian was looking at the screen (information), we asked the stranger to orient his body in one of two directions, one where he could see the information and the other where he could not.

(4) Procedure

In each trial there was one user and one stranger. The user inputted all information including person-specific and money-related information, preference- and behavior-related information, and present circumstances and history-related information into a form prepared beforehand. The stranger walked around at random, standing in different spots as directed. The user input information after a practice period. Trials were run with and without our display, each trial consisting of one information input. Then, the role of the user and stranger were changed and a trial was run using the same method. After the experiment, we asked participants to fill out a questionnaire and interviewed them all.

3.3 Results

We counted the number of typos for the color shown during each trial. We counted the number of typos per trial and compared the values for total number of typos for

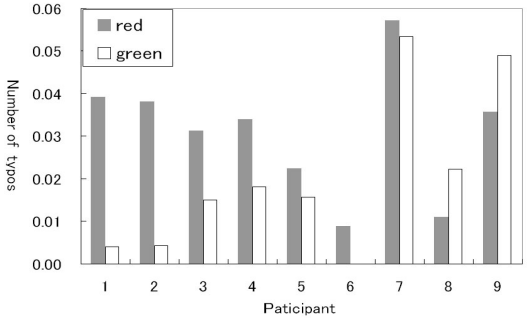

Fig. 5. Number of typos per trial for each participant

each time a color was presented. Figure 5 shows the number of typos per trial for each participant. As can be seen in the figure, there were two groups of participants: one with higher numbers of typos when the red light was presented and one with a higher number of typos when the green light was presented. With this in mind, we discuss the results of the questionnaires and interviews, as shown in Figure 6 below.

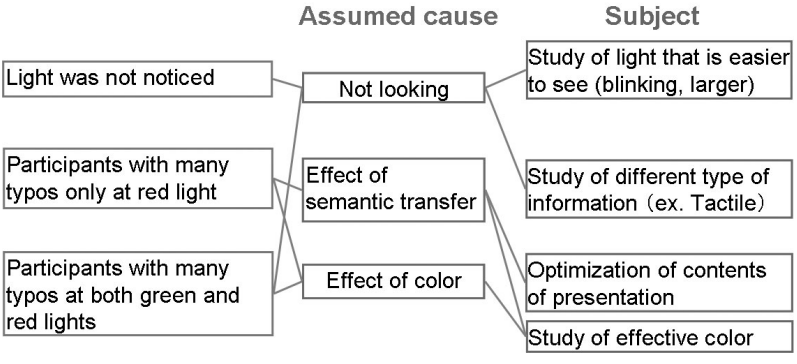

Fig. 6. Questionnaire and interview results

In the questionnaires and interviews the participants who made more typos when the red light was shown said that they were able to judge whether they could input information with reassurance (whether or not they personally felt a stranger's presence) based on the light that was shown. That is, the signals displayed enabled users to judge whether it was appropriate to communicate information based both on their own judgment and on objective information. As for the participants whose number of typos also increased when the green light was shown, we speculate that they became impatient because they were conscious of information about the inputting opportunity signaled by the green light, causing them to make typos. This suggests that the green light, which we thought would induce feelings of reassurance, does not always have a positive influence and may cause users to be impatient. Generally, the red and green lights were strongly associated with the corresponding message of a traffic light: red means "stop", and green means "go". Therefore, the supposition described above (green induces reassurance, and red an uneasy feeling) is not unalloyed semantic information that something can be done with reassurance. That is, the effect of the semantic transfer is not unambiguous. Red's common image induced users to be cautious, affecting the number of typos. Further study is needed about whether a color's external association or the meaning the color was intended to have in the experiment more strongly affects users.

We also noted that the participants sometimes did not notice the light. We think this is because the LED was too small. We also think that users may become myopically focused on a PC monitor while inputting information. It may also be that users sometimes did not notice the light because the LED was outside the user's immediate field of view. Although we installed the LED between the monitor and the

keyboard thinking that it would be easily noticed, we now think that the effect was too small. To make the light more noticeable, we need to study ideas, such as changing the display location, using a blinking light, and changing the color of the light being shown.

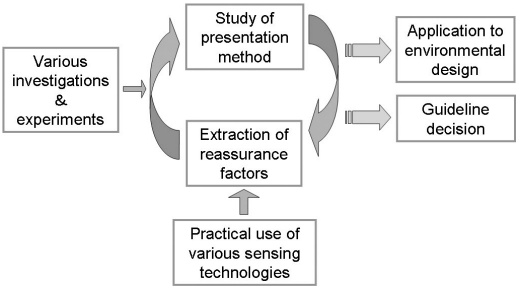

Fig. 7. Overall design of this research

4 Conclusion

We described our approach to designing provision of information intended to create feelings of reassurance when a user is inputting information in public spaces. The investigation was carried out as a first experiment on the effect of presenting two colors of light. We found that using or combining past research results about what affects people's reassurance won't necessarily create feelings of reassurance about communicating information in a public space. For example, different colors of light were found to have conflicting associations for users and to affect their feelings of reassurance in different ways. More research in this area is necessary. Therefore, we think it is necessary to investigate whether presenting a different kind of information (tactile for example) might work better. By compiling current and future results, we aim the type of information that best creates feelings of reassurance in a user communicating information in a public space. In the process, it may be necessary to identify the factors which give the user feelings of reassurance while communicating information in a public space. Using a varied approach that reflects knowledge and guidelines (Iizuka, 2005b) for secure space design technology based on research, (Figure 7) we aim to help create a public space in which users can communicate information with reassurance.

References

1. Goto, Y., Iizuka, S., Ogawa, K.: Research on Designing Environments with a High Degree of Reassurance, Architectural Institute of Japan, Summary of Technical Papers of Annual Meeting, Book E-1, Construction Planning, pp. 935–936 (2004)
2. Grandjean, E.: Ergonomics in Computerized Offices. Keigaku Shuppan, Tokyo (1989)

3. Iizuka, S., Nakajima, S., Ogawa, K., Goto, Y., Watanabe, A.: Reassurance When Using Public Terminals in Public Spaces. In: Proceedings of the 66th National Convention of Information Processing Society of Japan (IPSJ), 4-451-4-452 (2004)
4. Iizuka, S., Ogawa, K., Nakajima, S.: A study to develop public work environment design guidelines for handling personal information. In: Proceedings of HCI International 2005, incl. in CD-ROM (2005a)
5. Iizuka, S.: Pictorial secure space guidelines. NTT Technical Review 17(8), 46–49 (2005b)
6. Maruzen.: Architectural Institute of Japan, Handbook of Environmental Design, Comprehensive Edition. Maruzen, Tokyo (2001)
7. Oyama, T., Imai, S., Wake, T.: Handbook of Perception psychology. Seishin Shobo, Tokyo (2003)
8. Takahashi, K., Nakatani, M., Nishida, S.: Information Presentation from the standpoint of a sense of security. Proceedings of the Human Interface Symposium 2002, (2243) (2004)