

# Information Design for User's Reassurance in Public Space

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**Abstract.** We are developing an intuitive information design that can increase the user's feeling of reassurance and security when handling private information in public space. We conducted an experiment to collect user responses to displays providing awareness of the activity behind them while they handled private information. Two approaches were examined: a simple two-color LED array and a mirror. The former yielded less distraction and faster response speeds while the latter was more intuitive and offered more reassurance.

**Keywords:** Reassurance, Public Space, Information Presentation.

## 1 Introduction

Many kinds of information are handled in public space because of the increased use of mobile terminal devices. However, risk becomes a concern when people enter highly confidential information like personal data; people have a strong awareness about the value of such information and worry about its leakage. Even though new laws and new technologies offer some relief, we still worry about leakage in real public space situations [1]. We are concerned with providing a sense of safety and reassurance to the usage of information systems and networks in public spaces.

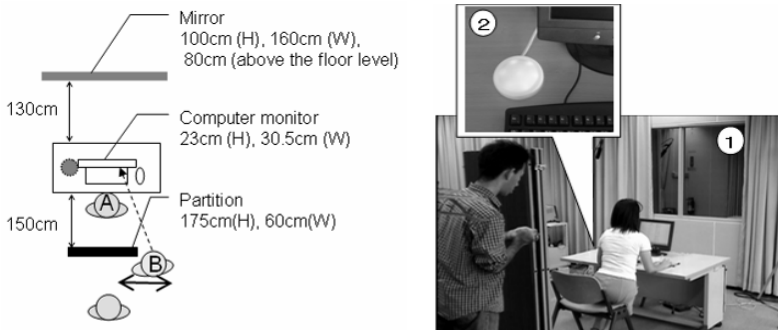
Under the current technology, there is a space design technique that uses partitions in innovative manners to help users feel safe and reassured. If an environment is made using this space design technique, users can handle private information with little concern for what might be occurring around them. But the technique is still rather immature and difficult to apply it to all public spaces. We suggest replacing the partition technique with methods of dynamically presenting information about the user's environment. In public spaces the movement and flow of people is ever-changing thus private information usage situations change too. Providing with dynamic information of the environment a person can have consistent understanding and awareness of their specific situation.

The purpose of our research is to design and evaluate methods to present this awareness information. A user should easily feel reassured that others cannot see or access their private information when they are handling it in public spaces.

## 2 Experiment

To use information with reassurance, a user must pass through processes of perceiving, understanding, and evaluating their surroundings. The most effective way to complete all processes is to present indicators of the current environment state. We considered two different presentation methods: one using a two-color LED array and another using a mirror. The LED array was used to present a rather abstract level of situation understanding. The mirror was used to present the environment exactly as it is. Five trials (Table 1) were conducted using a mixture of these two methods and a setting where no information is provided at all.

A person's reassurance is mostly determined by qualitative factors, but we also had to consider the efficiency of their information use so we collected both subjective and numeric data.



**Fig. 1.** The layout of laboratory (*left*) and the experimental setup (*right*)

### 2.1 Method

We attempted to create a scenario where an information user would be anxious about their data being captured by an observer standing behind the user. The mirror and the LED array were used to provide the user with awareness of the observer. The subjects, five men and fourteen women, were paid to participate in the experiment. One of the five men performed only as the observer in all trials. We used a man as the observer since a man's presence is sensed more heavily in personal space than a woman's [2].

The experimental setup is depicted in Figure 1. *A* is the information user and *B* is the observer. The information user was seated at a common office desk equipped with a keyboard and PC monitor (21 inch). Between the information user and an observer was a partition large enough to completely hide one man. The distance between the information user and the observer was set to 1.5 m as this is the radius around a person which, if a strange comes closer than this distance, he or she will feel uncomfortable [3]. The PC's numeric font was specified at 26 point font so that the observer could read the screen characters without difficulty. For the presentation method using a mirror, the mirror was large enough to provide full coverage of the region behind the information user (Figure 1). For the LED array method, the LED

array (inset 2 in Figure 1) was placed on the desk next to the keyboard. It was 110 mm in diameter and each LED was 11 mm in diameter (inset 1 in Figure 1). The LED array was driven to illuminate either all red or all green LEDs. It is said that red color causes anxiety and green color provides reassurance [4]. LED color was switched by an experimenter according to whether the observer was in a position where he could view the PC screen (red) or not (green).

**Table 1.** Trials in the experiment

Observer	Information presentation
none	none
present	none
present	LED array
present	Mirror
present	LED array and Mirror

To successfully reproduce scenarios of private information usage in public spaces, we had to bring on a user's sense of reassurance and anxiety in the laboratory setting. The best approach would be to use actual personal information but this would be unethical. Our solution was to use randomly generate numbers and create a type of game; the user was told to minimize the number of digits that the observer could capture from the screen while the observer's goal was to record as many digits as possible.

The information user seated at the computer was asked to enter ten sets of randomly generated 8 digit numbers per trial. We chose 8 as this is the memory limit of most people [5]. The observer had to see, memorize, and write the numbers down. The request to enter ten 8 digit numbers per trial was made because we wanted to emphasize the difference in task time among each trial and the information users. The font size and input form size and position could not be changed but we allowed the information user to cover the PC monitor with their hand or body. The observer was instructed to periodically move from behind the partition to a specified side behind the information user. The total standing time in each position was the same for all information users.

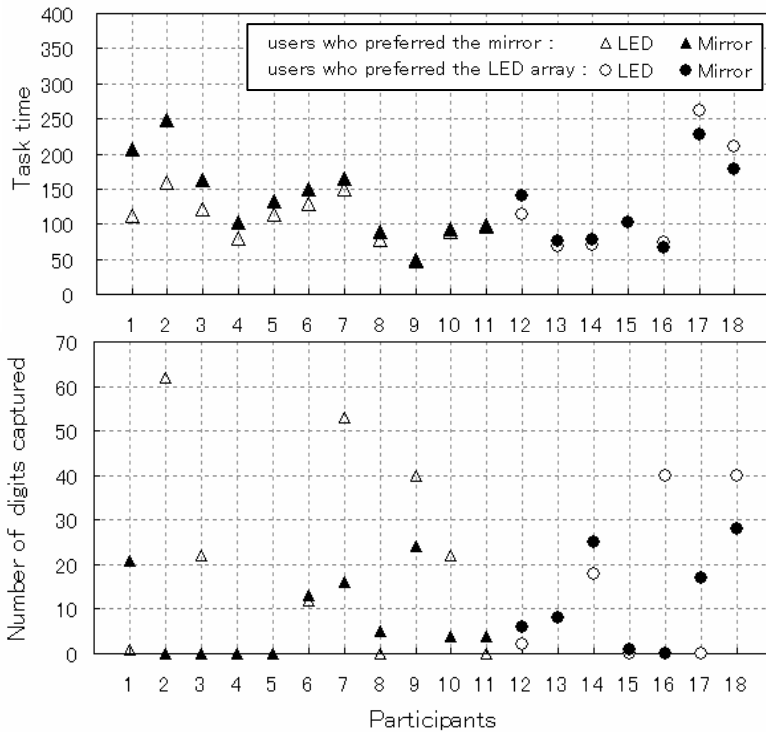
In each trial, the information user was presented with a printed list containing the randomly generated ten sets of 8 digit numbers. The list could not be seen from any position of the observer. After each trial, the information user answered, in writing, a few questions about their impressions of the situation just experienced. Trial order was randomly set.

## 2.2 Results

After all 5 trials were completed the information users answered a final questionnaire asking which information presentation methods provided a stronger feeling of reassurance. For example, they were asked 'which arrangement, the LED array or mirror, provided a stronger feeling of reassurance?' Seven information users (participant IDs 12-18) felt more reassurance using the LED array, while the eleven other users (participants IDs 1-11) preferred the mirror. The following section

classifies the information users according to their answer and discusses the time taken to finish each trial and the amount of data captured by the observer.

First, we discuss the eleven participants who preferred the mirror (data points marked by triangles in Figure 2). All of them had longer task times using the mirror method. A subgroup of five subjects (participant IDs 1, 2, 3, 4, 5) had the greatest number of digits captured by the observer when using the LED array. From the questionnaire results, a subgroup of eight subjects (participant IDs 1-6, 8, 11) did not care how long the task took. These subjects also said that the mirror was credible and steady. Overall, the mirror was preferred because it allowed a user to watch the observer and to have a good overall view of the observer's movement and other things in the environment. It was more important for them to enter the data slowly so that they may pay attention that the observer does not capture any of it.



**Fig. 2.** Number of digits captured by behind people (*top*) and task time (*bottom*)

Next we turn to the seven participants who preferred the LED array. When using the LED array, more data was captured by the observer than when using the mirror. The task also took less time than when using the mirror. From the questionnaire, three users (participant IDs 14, 15, 18) felt that they accomplished their task more quickly given the LED array than when they used the mirror. Their opinion was that the fastest technique was correct and they commented that more data was captured by the

observer when it took a long time to complete a trial. Six users said that the LED array was usable and it allowed them to concentrate on the task. The LED array was preferred because it eliminated the need to watch the observer.

To summarize, the two types of participants, classified according to their preferred information presentation method, had the following characteristics: those whose opinions as to which information presentation method enabled them to complete the task more quickly were wrong (those who preferred the mirror) and those whose opinions were correct (those who preferred the LED array). The former type felt that using the LED took less time than it actually did.

A negative image of a presentation method may impact the user's reassurance and resulting desired information presentation method to be used. In interviews after the trials we determined that:

- Mirrors are considered to be trivial and a bother (one user that preferred the LED).
- The LED array was annoying (two users that preferred the mirror).
- The LED array was untrustworthy (two users that preferred the mirror).
- The LED was trivial and a bother (two users that preferred the mirror).

These users noted that they were unlikely to use a system that had a negative image and/or that did not provide a sense of reassurance. Furthermore, they stressed the importance that an information presentation method should not affect a user's work.

### 2.3 Discussion

An analysis of the data in Figure 2 suggests that the 18 subjects could be split into two groups. The first group (those who preferred the mirror) felt that it was important, with regard to the feeling of reassurance, to enter data slowly and carefully. The mirror clearly indicates when the observer is watching and it is better to enter data when the observer is not present than to attempt to cover the screen when he is present. The second group (those who preferred the LED) felt that it was better to complete the job as quickly as possible and that the LED array was less distracting. We believe that the time taken to enter data affected a user's reassurance. Our next step will be to study the best presentation method given this belief and to identify other factors that affect reassurance.

Meanwhile, it is not easy to create an experimental setup in the laboratory that is truly representative of private information-use environments in public spaces. We intend to improve our experimental methodology and design new presentation methods utilizing the factors discovered in this experiment. We hope to use our data to form guidelines for methods of dynamically presenting environment awareness information for people handling private data.

## 3 Conclusion

This study is a first step towards information design that enables people to easily feel reassurance in public space; we focused on the reassurance possible when a situation can be assessed in an intuitive manner through the presentation of dynamic awareness information. We compared two approaches: the more abstract approach was an LED array while the more concrete approach was a mirror. Differences between the two

presentation methods were categorized by trials using 18 subjects. Experiment results indicate that for some people reassurance is achieved by entering the data slowly and deliberately. Others preferred to work more rapidly. Regardless of the approach taken, the method used to present the information must be seen as reliable and non-intrusive.

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