Pictorial Guidelines for Secure Spaces

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Abstract

As a result of the recent spread of computer technology and rapid growth of the Internet, we now live in an age when all kinds of information can be exchanged and processed at any time and in any place, including information of a highly confidential nature. We have therefore drawn up pictorial guidelines for designing secure spaces in public work environments where users can handle personal information securely.

1. Background

In recent years, environments have been set up where people can use information technology (IT) equipment such as personal computers (PCs) to carry on with their work while away from the office. These include wireless LAN (local area network) hot spots on city streets and in establishments such as rental offices and Internet cafés. Furthermore, automatic teller machines (ATMs) are being installed not only in banks, but also in convenience stores, allowing people to withdraw and deposit cash close to their homes. It is also becoming commonplace for shops to accept credit cards for payment at the checkout. In other words, all kinds of information can now be exchanged and processed anywhere and at any time, including information of a highly confidential nature. However, these developments are also exposing users to dangers such as leakage or misappropriation of their personal information. Of course, services of this sort are provided with robust security systems such as encryption, digital certification, and authentication technologies such as IC (integrated circuit) cards and biometric authentication, so these services are secure to use 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 the ATM display on a busy sidewalk? In practice, it is difficult to use highly confidential information, such as personal details, securely in public work environments that are open to anybody. Here at NTT Cyber Solutions Laboratories, we are not only researching and developing network architectures where IT equipment can be used in many different places, but have also initiated a study of "secure space design technology" based on a recognition of the fact that it is also essential to investigate physical spaces where people can use these services securely [1].

2. Safety and security

The words "safety" and "security" can generally be used interchangeably, but here we use "safety" to mean "freedom from harm, injury, or damage" and use "security" to mean "freedom from uncertainty or anxiety". Under what sort of conditions do people regard themselves as being safe? There are definitions in common use that are agreed upon at least in this field of study and within organizations. Specifically, these definitions are based on scientific standards and reasoning. On the other hand, although security is strongly related to safety, it includes psychological factors that are not attained simply by being safe (**Fig. 1**). The word security can be thought of as expressing a subjective feeling of security in the sense that somebody feels secure [2]. At NTT Cyber Solutions Laboratories, research into techniques for designing secure spaces is centered around the psychological studies of users, focusing on their feelings

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of security in different situations.

3. Related studies

This section reviews previous studies related to the design of work environments where users can handle information with a feeling of security in terms of physical aspects associated with ergonomics and architecture [3] and psychological aspects associated with environmental psychology and proxemics (explained later).

3.1 Physical aspects
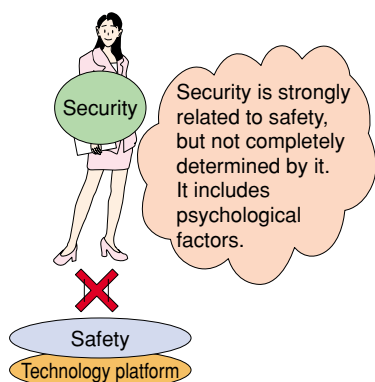**Figure 2(a)** shows a posture suitable for working

Fig. 1.   Safety and security.

on a PC with a display that takes account of the human frame, build, and field of view. This figure shows a desktop PC being used in a setup where the height of the desk and chair, the position of the input equipment, and the display can be independently adjusted to maintain a posture suitable for work.

3.2 Psychological aspects
When we become concerned about other people nearby, it is because we feel they have invaded our space. This "personal space" is an invisible spatial region surrounding a person's body. In general, people feel relaxed when their personal space is guaranteed and uncomfortable when it is invaded by others [4] (**Fig. 2(b)**) As a result of these feelings, people tend to maintain a suitable distance from each other. This concept was described by Edward T. Hall in his theory of proxemics [5] (**Fig. 2(c)**). According to this theory, a person's distance from others indicates the relationship that exists between them and is categorized into four levels: intimate, personal, social, and public. It can also be seen that people move themselves further away from others, particularly ones behind them, when they feel insecure. It can thus be inferred that when people are handling credit card numbers or the like, it is particularly important to consider what is going on behind them. Also, since partitions can be used to block visibility, they are suitable for keeping spaces private, making them indis-

(a) Visual display unit and work posture

(b) Personal space

(c) Proxemics

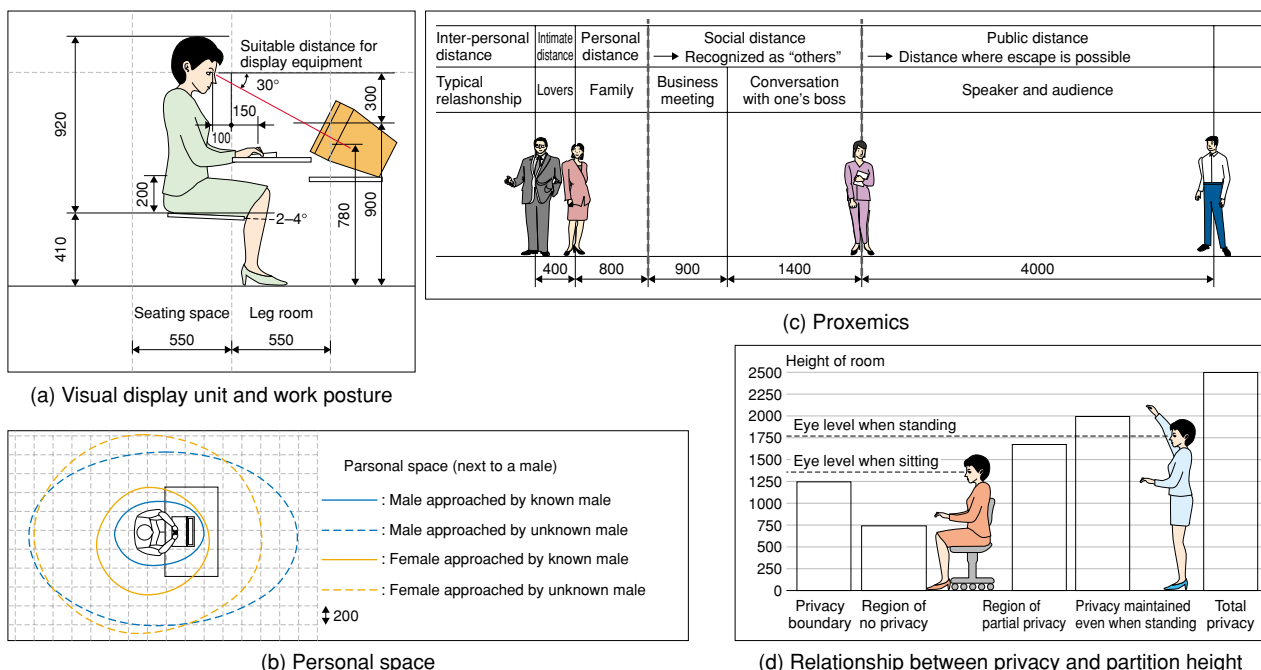(d) Relationship between privacy and partition height

Fig. 2.   Other studies related to the design of work environments (units: mm).

pensable environment elements in the construction of personal PC operating environments in public spaces. Privacy is also influenced by the height of partitions (**Fig. 2(d)**). For someone who is sitting down, for example, a partition height that conceals another seated person from view can afford adequate privacy. The minimum partition height that can provide this lowest level of privacy among seated persons is about 1200 mm.
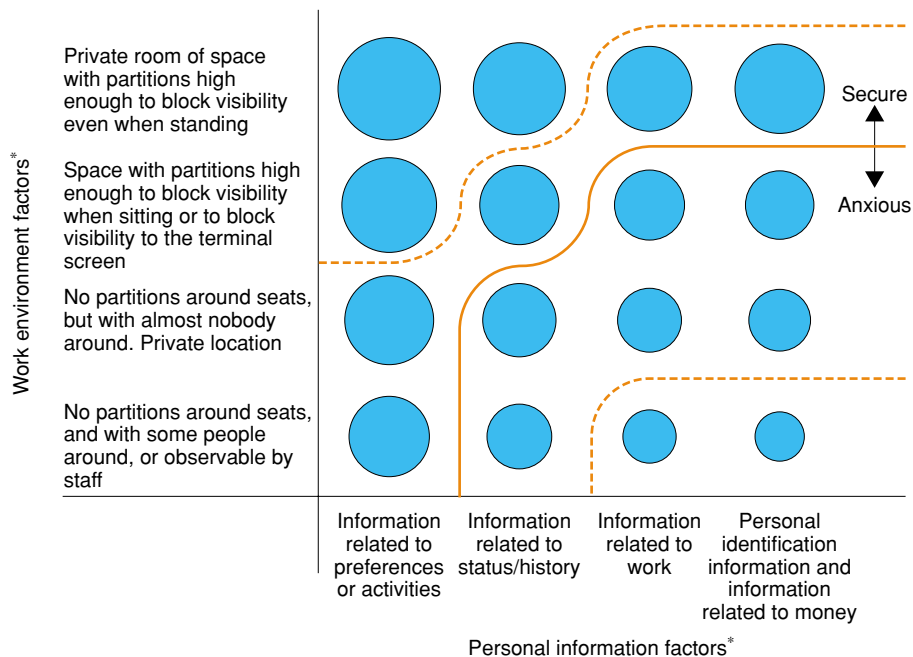
4.   Designing secure environments

In the design of work environments, as in the example shown in section 3.1, guidelines have already been shown from the viewpoint of the human form in the fields of ergonomics and architecture. However, no research has been done from the viewpoint of how secure users feel or what sort of information they are dealing with. Consequently, there is a need for guidelines and methods relating to the design of shared work environments where users can handle personal information securely. At NTT Cyber Solutions Laboratories, we are therefore conducting research with the aim of constructing high-security environments based on the level of security that users feel when handling personal information in public work environments. A feature of this research is that we are

designing work environments where users can feel secure according to the type of personal information they are dealing with. As mentioned above, the concept of security encompasses many psychological factors. Our studies have therefore included psychological assessment of users, and we have conducted various cognitive experiments and analyzed the results. In this way, we have extracted factors that influence feelings of security, and we have calculated various parameters for designing spaces according to people's feelings of security. Based on these results, we have drawn up guidelines for the design of secure environments.

4.1   Extracting factors that influence security

To extract the factors that influence the feeling of security when working with information in public environments, we investigated how resistant ordinary users feel about handling personal information in actual public work environments. As a result, we found there are four personal information factors and four work environment factors associated with users' feelings of security in public work environments. We also produced a security level map (**Fig. 3**) that represents the level of security that people feel with each combination of these factors. In this figure, the size of each blue circle represents the level of security felt by

* Grouped into four categories based on similarities in the security feelings of different users (cluster analysis)

Fig. 3.   Map of security feelings in public work environments.

the user. For example, users feel very secure when dealing with information relating to preferences or activities in a separate room or in a space surrounded by partitions that cannot be overlooked even by someone standing. On the other hand, they feel very insecure (i.e., very anxious) when dealing with personal or financial details when sitting in an open area where there are other people or staff nearby.

4.2 Drawing up guidelines

By conducting further studies, we identified four personal information and work environment factors that influence people's feelings of security: (i) partition height, (ii) partition thickness, (iii) type of information, and (iv) presence of others nearby. We also clarified how tall and thick partitions should be and how much distance should be provided behind users for them to be able to handle different types of information with a feeling of security. By using these results together with the abovementioned findings of our related research, we drew up pictorial guidelines for secure spaces (**Fig. 4**).

In these guidelines, personal information is divided into four categories based on how secure users feel when using personal information in public work environments. Guidelines are then shown for the design of optimal work environments for each category. Since these guidelines relate to the design of spaces, they are depicted in the form of diagrams so that people can easily understand them visually. Specifically, with regard to terminals installed in public spaces, these guidelines stipulate the optimal partition sizes and distances to be maintained from other people to the rear for different information usage applications (i.e., for the handling of different types of information). They will lead to the creation of work spaces where users can handle personal information securely. These guidelines are applicable to the design of offices as well as public work environments.

5. Future prospects

In the future, it is expected that many more types of information will be handled in a wider variety of
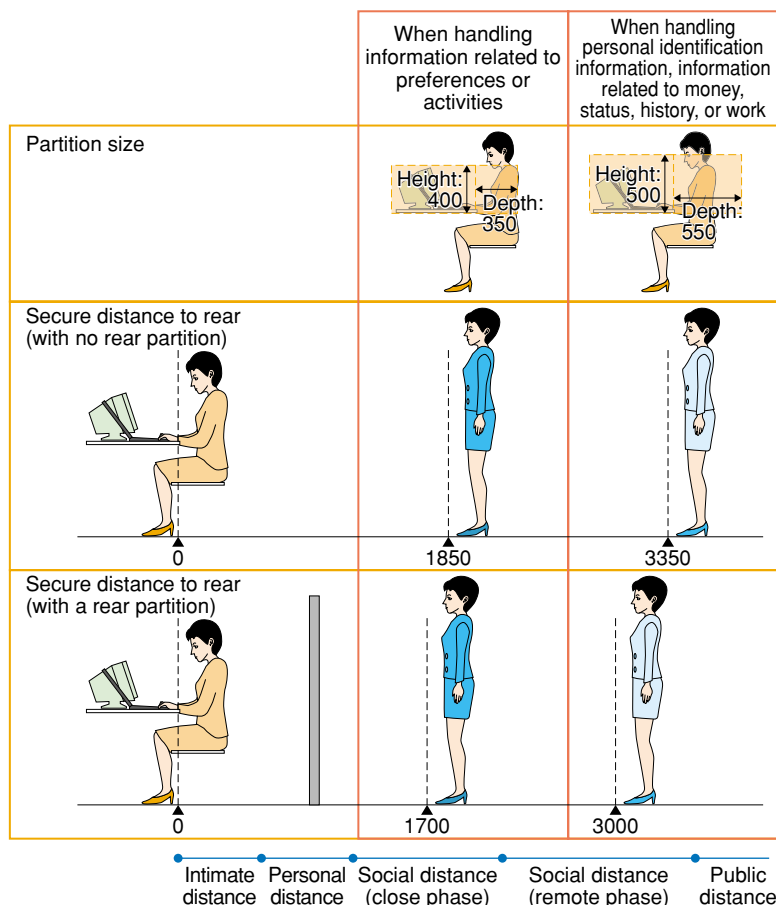

Fig. 4. Examples of pictorial guidelines for secure spaces (units: mm).

places. To handle these changes, we must continue with further studies of environmental factors and other factors that influence people's feelings of security. We will continue in our efforts to clarify people's feelings of security (psychological characteristics) and make use of this knowledge in the design of secure spaces. We will also apply the results of this research to many more spaces to construct environments where ubiquitous services can be used securely. We hope to introduce these secure space guidelines to business companies and expand the importance and significance of secure space design.

References

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