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Human Interface Design at the Fujitsu Design Laboratory – Expansion of Activities and Design Domain –

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In response to the growth of information equipment and systems, the domain of human interface design activities at the Fujitsu Design Laboratory has been expanded and more closely integrated with the various processes of product development. Because of requests from users to make information systems easy to use, comfortable, and efficient, the Design Laboratory has integrated not only the conventional design process for designing shapes and colors but also the upstream processes for designing information exchange and interactivity between humans and a system. The Design Laboratory is studying and promoting processes called "Human-centered design processes." These processes reflect users' opinions, ideas, and characteristics onto the specifications of products and services.

1. Introduction

Over the last two decades, the domain of human interface design activities at the Fujitsu Design Laboratory has expanded as information equipment and information systems have developed. This paper looks at three epochs of information technology and some new fields of human interface design that have come from these epochs. Then, this paper briefly looks at how Fujitsu has expanded the domain of its design activities.

2. Evolution of information technology and expansion of design domain

In the history of information technology, the following three major epochs have expanded the domain of human interface design (**Figure 1**):

1) The increase of users due to the spread of information equipment.
2) The evolution and spread of graphical user interfaces (GUIs).
3) The spread of interactive information and its media.

2.1 Increase of users due to spread of information equipment

In Japan, the number of word processors greatly increased in the first half of the 1980s and the number of personal computers greatly increased in the latter half of the 1980s. These increases were stimulated by the development of new technologies and reductions in costs. The increases happened first in offices and then in the

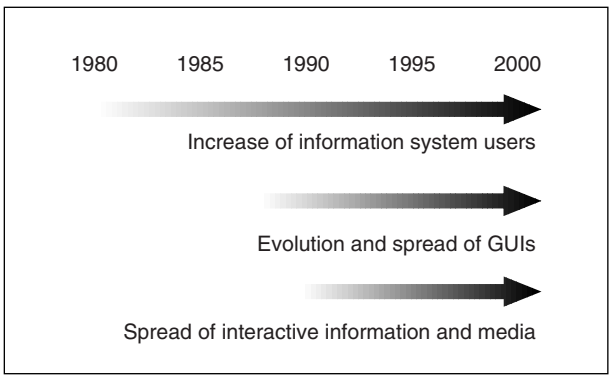

Figure 1
Three epochs that have influenced human interface design.

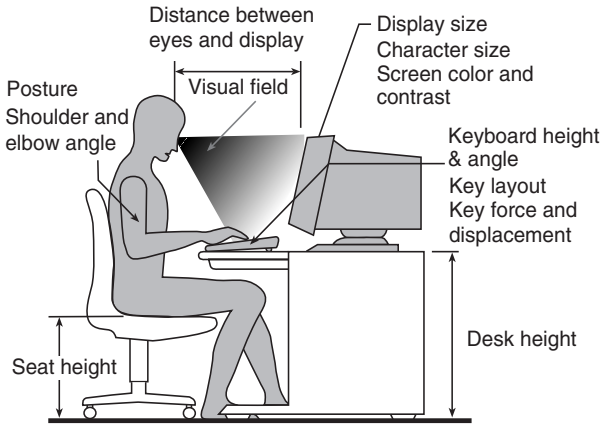

Figure 2
Ergonomic factors that affect VDT workers.

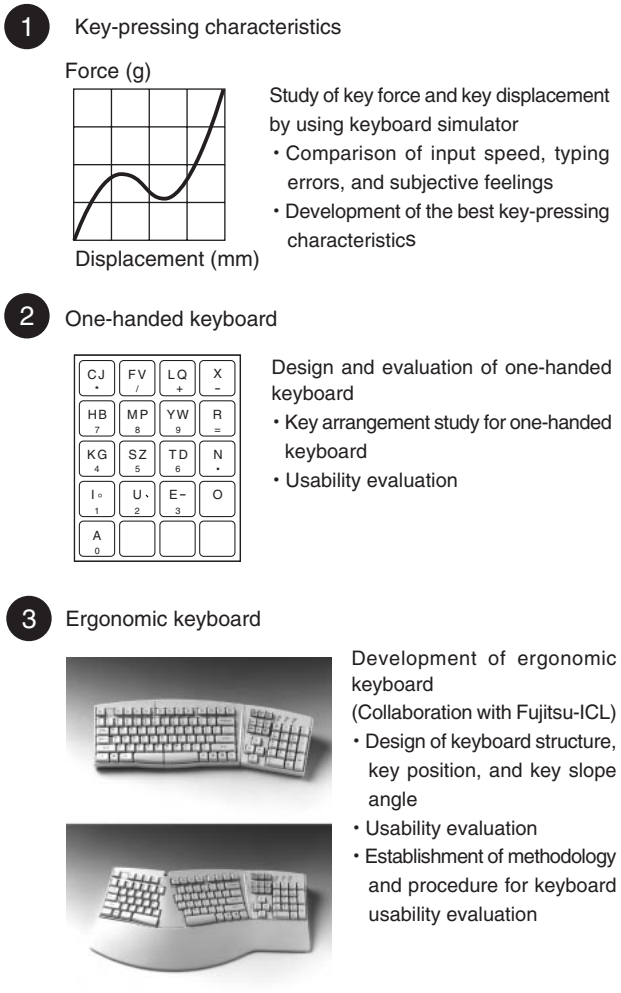

Figure 3
Development and ergonomic evaluation of keyboards.

home. Then, the number of users of information equipment increased rapidly and offices started using visual display terminals (VDTs). However, office workers started to complain of sore eyes, aching arms and shoulders, and other problems. These problems were collectively called the VDT syndrome. Many of the problems were due to poor operational management, for example, insufficient breaks and a poor work environment. Because of the VDT syndrome, there were requests for ergonomic designs to reduce the physical load on the user (**Figure 2**).

An Ergonomics group was created in the Design Laboratory to deal with this problem, and research was done to fit the equipment specifications to human characteristics such as eyesight, the muscle system, and body dimensions. This group is especially concerned with the ergonomic requirements of input-output devices that interface directly with humans. For example, they have researched the legibility of displays and the operability of keyboards and mice (**Figure 3**).

Moreover, the rapid increase of information equipment in offices required big changes in office environments and layouts. Environmental considerations such as lighting that did not reduce screen legibility, cable routing, printer noise, and equipment heat became important.

For example, in banks, the customer movement lines changed because of the spread of automatic teller machines (ATMs), so layouts which maximized the speed of customer movement lines had to be established. Then, the Environment Design group was created in the Design Laboratory and an investigation method for environmental measurements, work analysis, and human movement analysis was established. The investigation results were applied to improve space layouts and equipment arrangements, and an intelligent office that promoted efficient intellectual productivity was built (**Figure 4**).

Today's ATMs can deal not only with deposits and withdrawals, but also transfers and remittances. Now, instead of talking to a teller,

Figure 4
Environment design.

Figure 5
ATM: Example of universal design.

customers spend more and more time operating a machine. Various social systems have been revolutionized by the spread of information systems such as ATMs.

In the public field, designs should be usable by everyone. This has brought the concept of "universal design." Universal design aims for equipment and information systems that can also be used by physically handicapped people such as visually impaired people and wheelchair users (**Figure 5**).

2.2 Evolution and spread of graphical user interfaces

Graphical user interfaces enable commands

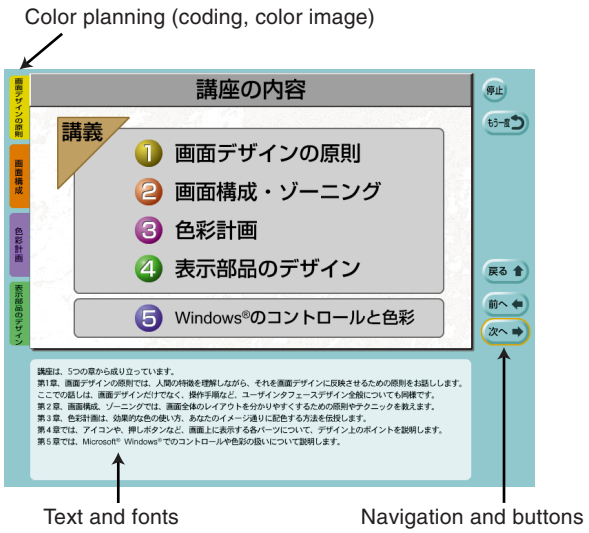

Figure 6
GUI design item.

to be input by selecting icons and menus on a screen with a mouse instead of using a keyboard; they became popular in the early 1990s. Also around this time, technological improvements removed various restrictions affecting displays, for example, the number of colors that could be displayed was greatly increased and the new field of screen design emerged (**Figure 6**).

Unlike hardware design, screen design is quite a new field and its methodologies are still being established. The purpose of screen design is to make screens that suit human characteristics. From the viewpoint of the user, therefore, screen design and hardware design have the same purpose.

Software design started with bitmap objects such as icons. However, it is important to achieve not only a good superficial design expression (called the "Look & Feel") but also to achieve a good functional, informative, and interactive interface so the user can easily understand complicated software and work efficiently. To meet these needs, the domain of software design at the Design Laboratory was expanded to the design of entire screens and operational procedures. Finally, it extended even to the investigation of users' char-

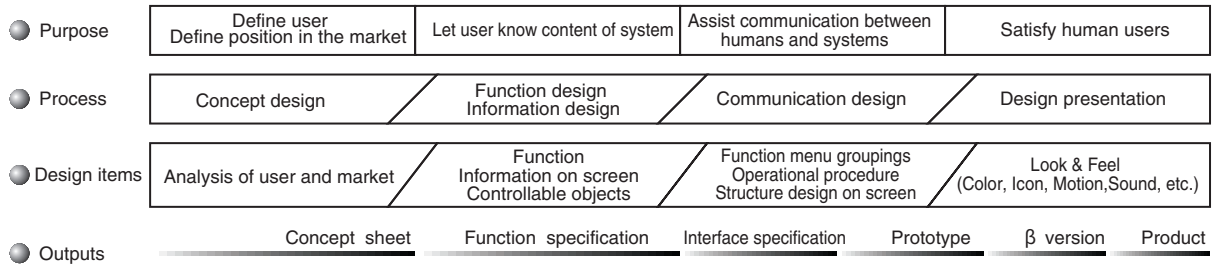

Figure 7
Design processes for human interface of software.

acteristics and opinions, function design, and product concepts (**Figure 7**).

Figure 8 shows an example of a prototype human interface design for software used for managing personal information such as schedules and addresses. This prototype was made with an authoring tool and consists of some typical screens and various functions. During the design of this interface, the designers discussed the necessity of each function and verified the overall operability by operating the prototype with a mouse.

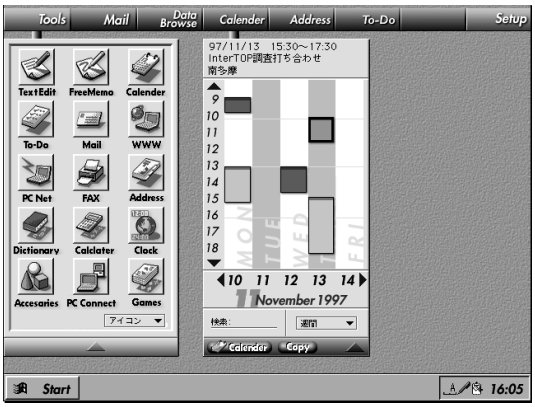

Figure 8
Design prototype for personal information software.

2.3 Spread of interactive information and its media

The rapid increase in Internet use and the storage and distribution of multimedia content on CD-ROM started around 1995. There are three significant points that can be made here.

The first is that interactive information content has become popular. The second is that the number of people who edit and send information is rapidly increasing. The more people there are who produce and send interactive information on the Internet, the more demand there is for people who can design human interfaces and screens. Our Design Laboratory integrated its know-how and compiled two manuals titled the "User Interface Guidelines" and the "Screen Design Guidelines." We also developed educational programs about human interface design, screen design, and usability evaluation for engineers and programmers. The Design Laboratory is trying to promote and improve the practice of human interface design through these and other efforts. In addition, we have developed BesTool, which is an add-on program that makes it easy to create effective electronic presentation screens. This tool is in wide use among Fujitsu employees (**Figure 9**).

The third significant point is that the Internet has rapidly evolved from being just an information media to being a virtual society. The current expansion of Fujitsu's business in the software and service field is remarkable. The interfaces of information systems are being integrated into the Internet and the Web, and more and more services are becoming available over the Internet. In response, a group named Solution Design was created in the Design Laboratory to develop new services in the virtual society of the Internet and to design Web sites (**Figure 10**).

The Solution Design group designs Web pages from the user's viewpoint by applying its

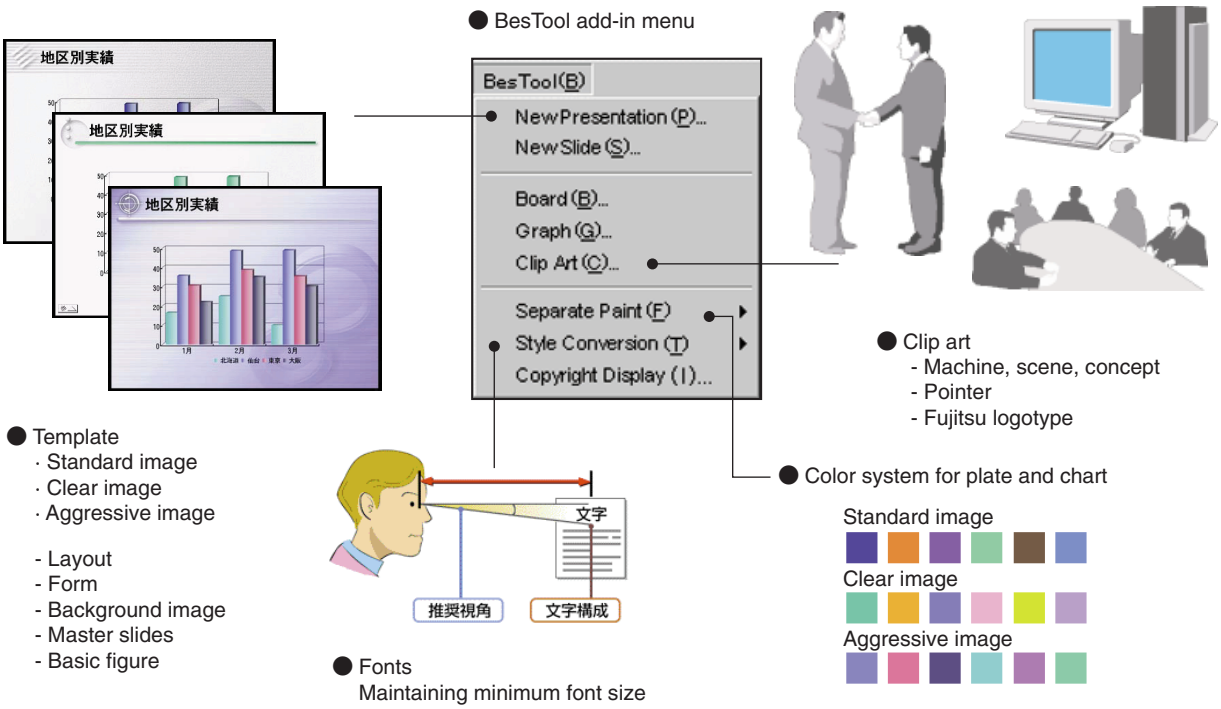

Figure 9
BesTool: Tool for making presentation screens.

Figure 10
Solution design (Internet services and Web site design).

knowledge of graphical user interfaces. Also, the group designs virtual scenes using its know-how of office environment design.

3. Expansion of design domain at Fujitsu

In all fields, design activities generally start from visual design expressions such as shapes and colors. Although visual design is a process of the last stage, problems with function design often become apparent in the first stage. The reason for this is that visual design is concerned with the contact between the user and the system. There-

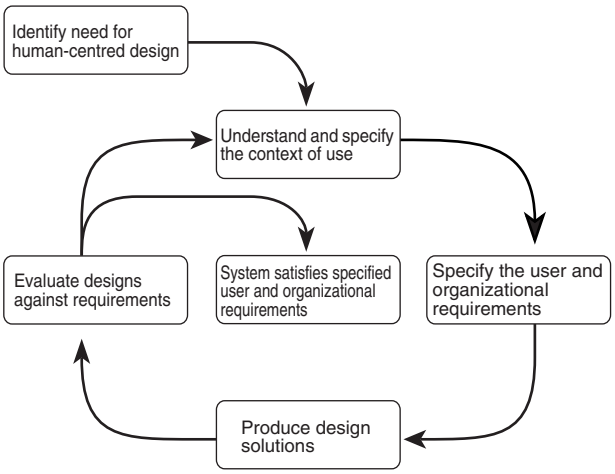

Figure 11
ISO13407: Interdependence of human-centred design activities.

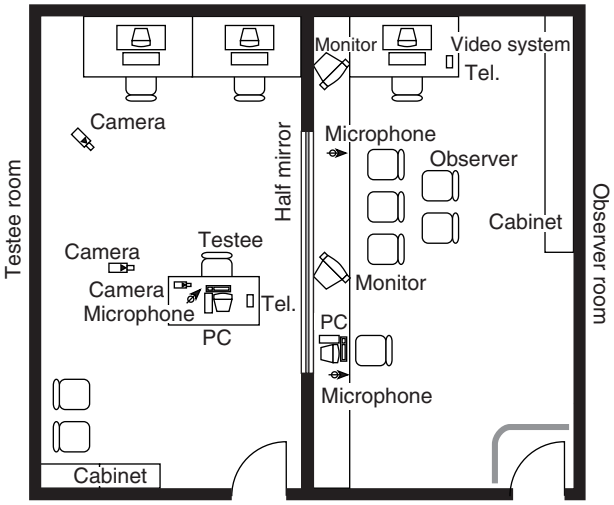

Figure 12
Usability test center.

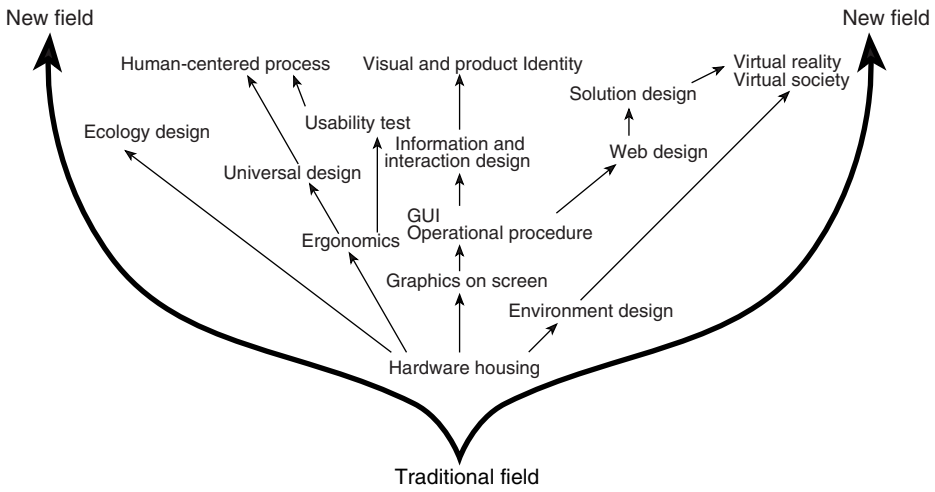

Figure 13
Design field at Fujitsu Design Laboratory.

fore, the domain of design encompasses earlier stages in the development process, in fact its domain goes all the way back to the basic-concept stage.

The domain of design is well defined in the various design fields and development processes. However, the Design Laboratory has come up with the new idea of constructing the design process from a user-centered framework.

International standard ISO13407[1)] was issued in June this year (1999). In this standard, the ISO has laid down guidelines for "Human-centred design," which is a design method that emphasizes the user's viewpoint (**Figure 11**). This method involves user-participation; for example, the designers need to listen to users' opinions and their evaluations of usability (ISO13407 also requires the recording of the processes and the creation of documents).

The Design Laboratory is promoting the development of a framework for effective and efficient implementation of this new standard at

Fujitsu. To advance this development, not only the Design division but many other divisions such as the Quality Assurance division, Engineering division, Management division, and SE division need to cooperate with each other in an interdisciplinary manner.

The Design Laboratory has constructed a usability evaluation center. The center has half mirrors and a VTR system and is used to perform various usability tests (**Figure 12**). The Design Laboratory is also researching evaluation methods and constructing a testee network. Usability evaluation is conducted at the center to find problems. And to solve those problems, the know-how accumulated by the Design Laboratory (e.g., about ergonomics, universal design, graphical user interface design, and solution design) is an important requirement (**Figure 13**).

4. Conclusion

Fujitsu's Design Laboratory has established an expanded design domain which includes the processes of human-centered design.

The function of human interface design is to describe the processes required to make information equipment and systems compatible with the physiology, psychology, and sensibility of humans. In short, human interface design requires an understanding of humans.

Until now, humans were required to adapt to information systems and technologies. But, we are now entering an era in which technology must meet the wants and needs of humans. To make this possible, the new science of human interface design will become an increasingly important part of the overall design process.

Reference

1) ISO13407: 1999, Human-centred design processes for interactive systems.

Keita Matsumoto received the B.E. degree in Industrial Design from Chiba University, Japan in 1985. He joined Fujitsu Limited, Kawasaki, Japan in 1985 and has been engaged in research of ergonomics, development of I/O devices, user interface design, and usability evaluation.