ICT Service Design for Senior Citizens Based on Aging Characteristics

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Abstract

In this article, the main problems that senior citizens encounter when utilizing information and communications technology (ICT) services are analyzed from the viewpoints of behavioral and cognitive processing. We introduce the aging characteristics that cause those problems and show how to tackle them in order to implement ICT services that are friendly to senior citizens and will assist and enrich their lifestyles.

1. Introduction

The population of Japan is aging rapidly. The number of adults over the age of 65 (senior citizens) is currently more than 22% of the total population and this figure is expected to exceed 30% by 2025 [1] (**Fig. 1**). In comparison with younger people, senior citizens include more people with failing health. Most senior citizens are losing their motor, perceptual, and cognitive functions because of aging, so they are becoming unable to do things that they could do in the past or they make more mistakes. The effects of these factors are limiting the range of their activities and hindering their everyday lives.

Support through information and communications technology (ICT) services is considered an attractive way of assisting in the lives and activities of senior citizens. The NTT Group is currently planning services such as community revitalization and shopping assistance, using tablet-style terminals that can make use of optical fiber services in a simple manner. However, ICT service utilization has more barriers for senior citizens than for younger people.

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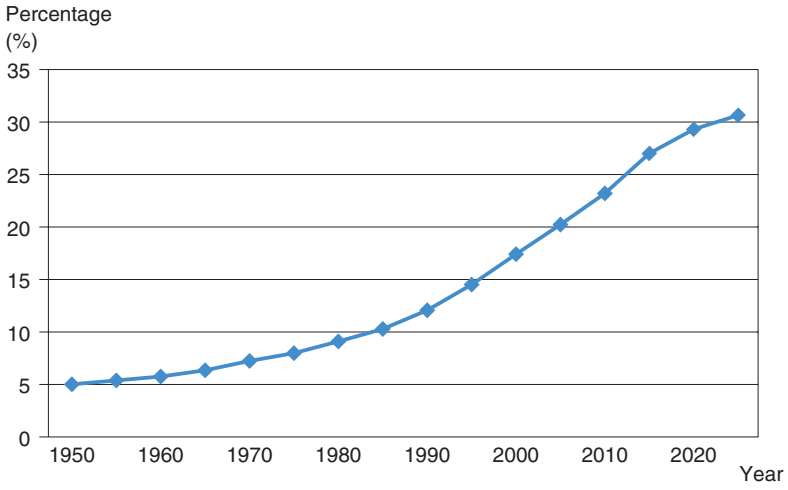
2. The importance of design studies for ICT services intended for senior citizens

ICT services have interactive interfaces that require the user to perform some sort of action in most cases. The user must recognize the status of the system and perform some kind of operation in order to make the system perform the desired function. When senior citizens utilize ICT services, they can find them difficult to use, owing to either their aging or their limited experience and knowledge. Such difficulties also depend on the sort of user interface provided by the service. It is therefore important to provide a sophisticated user interface designed taking account of aging and limited experience and knowledge in order to make the service easy to use by senior citizens.

There are a number of guidelines related to user interface design, such as the Introduction to Apple Human Interface Guidelines and the Windows User Experience Interaction Guidelines. However, not much research has been done on designs that treat problems that are specific to senior citizens.

A number of tips have been proposed to create designs intended for senior citizens. However, it is difficult to create a truly effective design if only incomplete information such as “it would be better if the text were larger” is available. It is sometimes



Source: "White Paper on Aged Society, 2010," Japanese Cabinet Office.

Fig. 1. Population trend for those aged 65 and over.

unclear why small text is unsuitable or what sort of problems would be avoided by making it larger. The visual functions of senior citizens deteriorate with age, making it difficult for them to read small characters, but font size is not the only factor influencing readability: another is font contrast. If the original combination of font and background colors is poor, simply increasing the font size will not solve the problem.

Investigations of user interfaces should not attempt to correct interfaces that are problematical by simply tweaking their appearance; it is critical to determine the true causes of the problems, which involve the user's cognitive-behavioral processing abilities. This recommended approach to design requirements will reduce problems in the most effective manner.

3. Problems faced by senior citizens in web utilization

Below, we present some problems that often occur when senior citizens utilize the web. We also introduce the characteristics of senior citizens that cause such problems.

3.1 Problems caused by lack of experience or knowledge

The experience and knowledge necessary for using ICT equipment includes the terminology and general ideas necessary for using services as well as experience with operating similar equipment. Here, we introduce two problems related to terminology and operable objects.

3.1.1 Terminology

We must be cautious about utilizing terminology that is not used much in everyday life, or which is used to refer to a different concept. For example, there have been cases in which "Help" was interpreted as "Rescue me!" and the user did not imagine that it would open a page containing guidance. Moreover, "Home" was interpreted as "one's residence", and the user envisioned that it contained information about the household. In particular, many senior citizens are unfamiliar with many terms written in *katakana* characters. Designers should confirm that *katakana* terms will be well understood before using them.

3.1.2 Operable objects

Most web page contain many links, but many users who are not experienced with web operation do not know which objects can be selected. In addition, there have been many cases in which senior citizens with knowledge of selectable objects failed to apply their knowledge and so failed to access the links that were available. Senior citizens are particularly inexperienced with text links, so they often fail to notice links that are not underlined or ones that differ only slightly in design from ordinary text. In one case, when options were rather far apart, as shown in **Fig. 2**, radio buttons or checkboxes were perceived as just circles or squares and thus overlooked.

An experienced user can recognize selectable

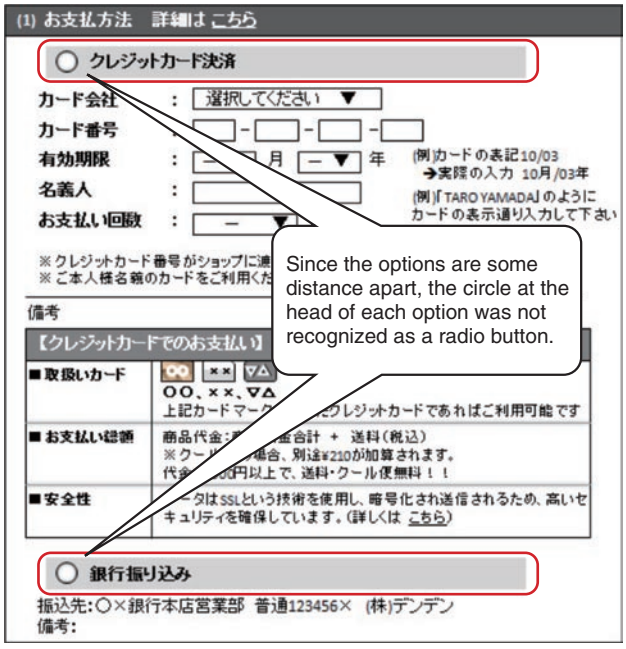


Fig. 2. Example of design in which radio buttons are overlooked.

objects by moving the mouse pointer to hover over different objects in the hope of triggering a change in appearance such as a change in color. Many users who are inexperienced at operating a personal computer (PC), however, have not acquired such identification methods and are uncertain of such input operations. Therefore, it is important to create a design in which selectable locations can be found intuitively, without pointer movement being required.

Moreover, it has been observed that users who have little experience with input operations by keyboard, remote control, or touch panel can experience many problems with key or button inputs. Errors include inaccurate object selection or excessively long pressing. These findings show that the designer must make operations simple and also widen the permissible range of timing and selection areas.

The problems that we have introduced above were taken from current case examples related to senior citizens. Even younger people, who have a lot of experience with PCs and games machines, will become senior citizens in 20–30 years and they can also be expected to suffer aging-related problems with new technologies of that time.

3.2 Problems arising from aging characteristics

Aging refers to the tendency for functions such as perception, cognition, and motility to deteriorate with age. In this section, we introduce *readability* as a problem caused by the deterioration in perceptual functions and also *failure to notice* and *coping with the unexpected* as problems caused by the deterioration in cognitive functions.

3.2.1 Readability

The eyesight of senior citizens deteriorates with age, for various reasons. About 80% of Japanese people in their 60s have cataracts. When eyesight deteriorates, a variety of symptoms occur, such as details becoming difficult to see, colors taking on a yellowish tinge, and the visual field narrowing. For example, a white-and-orange color scheme will be perceived by senior citizens as having an overall yellow tinge and also poor contrast, resulting in it having reduced readability. For that reason, it is necessary to consider readability in detail even in user interface design. Various methods of coping are being considered, such as increasing size and spacing and increasing contrast. It should be noted, however, that increasing the size too much will make the surrounding information difficult to identify.

3.2.2 Failure to notice

Failure to notice desired information even though it has been provided is a problem that is often observed, particularly in senior citizens. It is said that senior citizens have fewer processing resources* [2]. These include the attention function, which directs attention to information needed to achieve an objective without being distracted by unnecessary information, and the working memory, which selects the necessary information and holds it temporarily.

Many case examples involving senior citizens have been gathered. A highly visible area attracts their concentration to the exclusion of other areas [3]. In addition, if a large amount of information is presented all at once, they might be unable to process all of it owing to weak working memory. As countermeasures, there are methods of reducing the amount of information by visually gathering similar pieces of information into a chunk.

If there is a change in only one part of a page containing a lot of information, a senior citizen may be unable to notice the change because a paucity of processing resources. Many case examples have been observed. For example, in the example shown in **Fig. 3**, when a certain category is selected, subcategories appear immediately below it slightly indented.

* Processing resources: The finite amount of mental energy that is shared between information retention and cognitive processing.

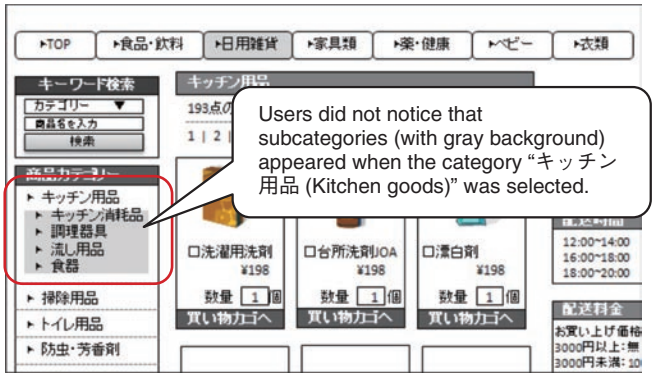


Fig. 3. Example of design in which the existence of lower levels is overlooked.

However, some users did not notice the subcategories [4]. Designers of web pages intended for senior citizens must consider making parts that change more obvious in order to attract attention.

In addition, senior citizens often overlook information that cannot be seen without scrolling, which is thought to be due to insufficient allocation of attention. For senior citizens, information should be accessible without operations such as scrolling as far as possible. And if scrolling is unavoidable, it must be made as intuitive as possible.

3.2.3 Coping with the unexpected

Senior citizens are often observed to be unable to cope with unexpected situations. These problems occur when details that differ from anticipated ones are displayed, unknown terminology is used, or the next operation is not readily apparent. Calmly judging the situation, flexibly changing earlier strategies, and solving problems require advanced cognitive processing abilities such as situational judgment, problem solving, and mental flexibility. However, these abilities are thought to deteriorate with age.

In particular, senior citizens get confused when a motion they made unwittingly is recognized by the system as an input and an unexpected change occurs. We have observed many problems in experiments that examined the use of the iPad. When users touched the touch panel with the palm of the hand or with the hand being used to hold the terminal or when the finger moved while touching the panel, the action was misrecognized as a flick. Such errors are due to weakened control of the fingertips due to deterioration of the motor functions or due to inadvertent contact caused by a poor sense of touch—something that is difficult for a senior citizen to notice. These problems have been observed to be particularly common among senior citizens.

4. ICT service design taking into account aging characteristics

In the previous sections, we examined problems observed in senior citizens when utilizing the web and introduced relevant characteristics of senior citizens. Besides understanding the characteristics of senior citizens, user interface designers should also know what problems that these characteristics will cause.

Solutions can be found for most of the problems caused by perceptional characteristics such as experience, knowledge, or readability, by understanding their relationships with design requirements and considering individual design elements. In some cases, however, a direct solution might lead to a different problem. The design needs to proceed with an integrated viewpoint.

5. Conclusion

Senior citizens have various characteristics and needs, so it is not possible to simply lump them all together by age. Various other factors are thought to be involved, such as health, lifestyle, experience, and knowledge. In the service design, it is difficult to accommodate all senior citizens with a single approach: one must target characteristics and needs under specific conditions. It will be necessary to study whether senior citizens can be classified.

In addition, low service acceptability may result from a reluctance to allow senior citizens a preview of ICT services before they are launched. Acceptability is related to factors such as prejudice against using

ICT equipment or the degree of concordance between the service and the needs. In the future, we will also investigate ICT service acceptability to senior citizens in order to promote the introduction and continued usage of ICT services.

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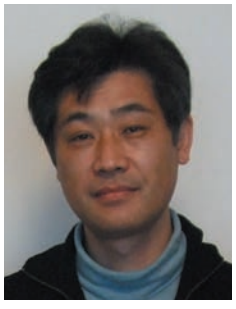

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