A Pilot Study of the Intuitiveness
of Smartphone Camera Interface for Elderly Users

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Abstract. We propose a ZUI (zoomable user interface)-based smartphone inter-
face for elderly users. The proposed interface extends the application design
space to provide an overview that allocates space to each function of the appli-
cation according to its importance. According to the feedback of interviewees,
an overview augmented by text-based guidance facilitated their understanding
of the application.

Keywords: Design philosophy of HCI and UX, Zoomable User Interface.

1   Introduction

Figure 1 shows the information structure on a smartphone. A number of applications
are installed, and each application has its own information space. The small smart-
phone screen causes space fragmentation. Users should build their own virtual infor-
mation hierarchy to help them understand the applications available on their device.
In addition, as more functions are added to these applications, the information struc-
ture becomes more complicated and memorizing it becomes harder.

   Another problem related to smartphones is an overabundance of icons. The early
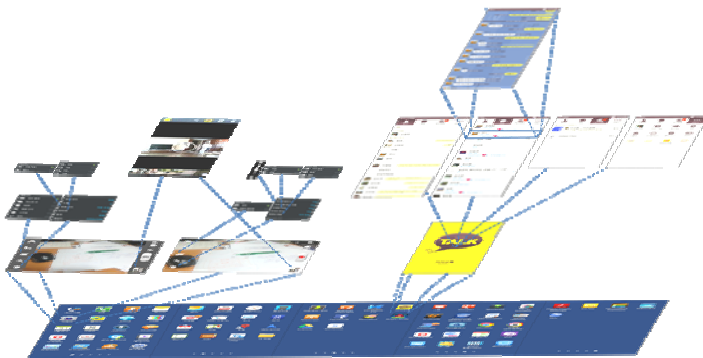smartphone user interface was almost the same as that of a desktop PC. A text-based

Fig. 1. Information structure on smartphone

hierarchical menu was a common interface, and a stylus pen was therefore essential for selecting text commands presented in small fonts. As the finger touch interface became more popular, menu sizes increased, thus making touch-based selections possible. As a result, implicit icons have become a common design paradigm on smartphones. These issues may create further complications and difficulties for users, especially the elderly.

2   Related Work

There are several studies on the usability of handheld computers for elderly users, who generally experience a higher level of disorientation when navigating a menu on a handheld computer. This is one of the most serious problems of handheld computers [1-2]. Zhou et al. [3] discussed two ways to achieve simplicity: **reducing functionality** and **improving the design** of individual functions. Some studies insisted that handheld computers for elderly users should provide only limited functionality [4-5]. However, many studies disagree that limited functionality is beneficial. In Ziefle et al. [6], the tradeoff between readability and orientation demands was investigated experimentally. Two factors, font size and the size of preview, were varied. The results showed that large font and preview sizes contributed to optimal navigation performance. Further, if the two factors were mutually exclusive, preview was more important than font size.

Kurniawan et al. [7] reported that older women wanted menus to be simplified by being presented in list form. Textual menus arranged in a list are preferred to icon-based menus arranged in columns and rows. Ziefle et al. [8] provided contextual information so that users would not forget the position of and route to an item in the menu. The study designed two mobile phone menu navigation aids for elderly users: **category aid** and **tree aid**. **Category aid** showed the name of the current category as well as a list of its contents. The **tree aid** was identical to the former except that it also showed the parents and parent–parents of the current category, and it indented the subcategories to emphasize the hierarchical structure. The results showed that tree aid was more useful than category aid for both younger and older users.

3   Camera Interface Design

In our study on improving the usability while maintaining the functionality of a smartphone interface, we adopted the user interface of Android applications as our reference model.

The more smart features are installed in the camera, the more icons will appear on the smartphone camera interface. Let us consider the sample camera application shown in Fig. 2(a), which has eight top-level commands represented by icons. Some of these commands have second-level commands, which are displayed on a pop-up menu (Fig. 2(b)).

(a)   (b)

Fig. 2. An example of smartphone camera interface

To reduce the number of icons, we design the user interface based on an expanded space. The size of the area allocated to each function differs depending on its importance.
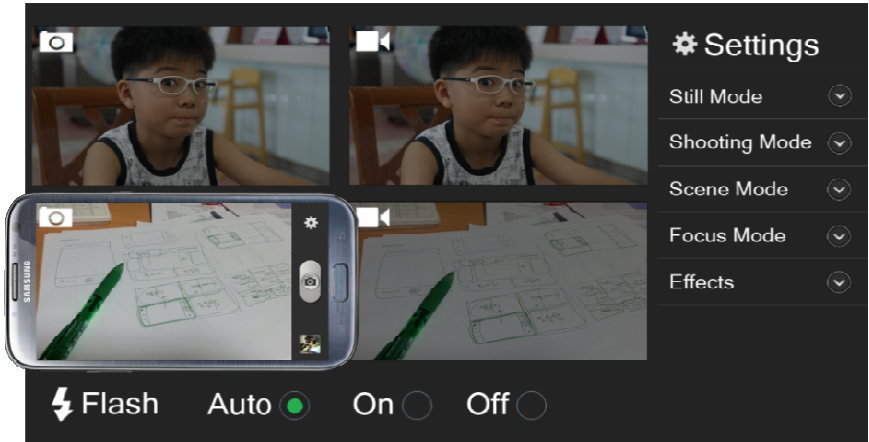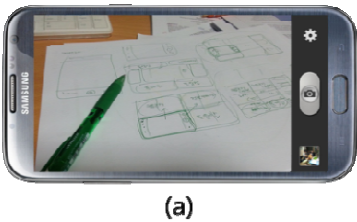

(a)

Fig. 3. Expanded screen space. (a) Default view; (b) Overview screen of an expanded space

Figure 3 shows the redesigned interface implementing the zoomable concept. The default view (Fig. 3(a)) is very simple. It uses only three icons for the "Shutter button," "Gallery preview," and "Settings" commands, which are essential camera features. Figure 3(b) shows the expanded space of the camera interface. At any time, users can zoom out to maneuver to the overview screen (Fig. 3 (a)). Every visual element on the overview screen can be recognized.

If users want to use supplementary functions, they need to return to the overview screen (Fig. 4(a)). To provide interactive manuals, the proposed interface uses semantic zooming. The green circle in Fig. 4(a)) indicates that the user has selected "Shooting mode" from the "Settings" menu. Figure 4(b) shows an animated transition effect. Figure 4(c) shows an expanded space providing interactive manuals for each shooting mode. When we return to the overview screen, the manuals collapse. Using an expand-and-collapse method, we can maintain the context (outline) of the camera interface. Just as desktop applications have a "Help (F1)" menu on their toolbar, the "Settings view" (Fig. 4(c)) provides a manual for each command.

Fig. 4. Space navigation from the overview screen to detailed views. (a) Overview screen; (b) Animated transition; (c) Settings view

4   Pilot User Study

The main hypotheses we sought to test in this study are as follows:

- Elderly users may have difficulty using an icon-based interface.
- Elderly users may prefer a zoomable interface to an icon-based interface.
- Younger and older users have different preferences.
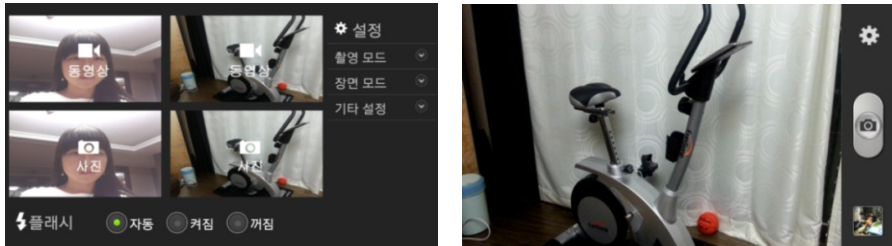

Fig. 5. Icon-based camera interface

Fig. 6. ZUI-based camera interface: (a) Overview screen (zoom-out mode); (b) Shooting view (zoom-in mode)

The hardware platform used in the experiment was Samsung Galaxy S3. Figure 5 shows a screenshot of our reference camera interface for the default camera application on a Galaxy S3. The reference interface uses eight icons to represent eight top-level menus. We call this an icon-based interface. The proposed ZUI-based camera interface (Fig. 6) contains exactly the same amount of information (eight top-level menus) as the reference interface, but the menus are not displayed at the same time.

4.1   Design and Procedure

Seventeen subjects participated in the study. Eleven subjects are older users (over the age of 50), about half of whom had experience using a smartphone.

The first task given to the subjects was to explain or guess the meaning of each menu item of an icon-based interface without executing any functions. We then explained how to use the two camera interfaces, and the subjects tried to use them for

about 10 to 20 minutes. The amount of time required to complete the task differed according to the user's smartphone experience.

The second task was to execute the proposed command (menu) list.

- Turn on the flash;
- Set shooting mode to "Smile";
- Take a picture using the rear camera;
- Record video using front side camera.

The completion times for the two interfaces were recorded. The list below is a subset of the tasks that the participants were asked to complete. When the experiments were completed, the subjects were asked about their preference for each camera interface.

4.2   Experimental Results

While younger users understood more than three of the six icons, most elderly users could not explain or guess the meaning of even one icon. Younger users also could not understand the meaning of certain icons. However, all the younger users answered that they still tried to use unfamiliar icons, whereas most elderly users said that they did not. We speculated that the reasons why elderly users do not try to use unfamiliar features are that they have no interest in new features or they cannot recall how to use such features even after having used them previously. However, the interview results are significantly different from our speculations. The most dominant response was fear. Although they may want to use many useful functions, they are unwilling to press an unfamiliar icon for fear of breaking the device or being charged a fee. This means that it is difficult for elderly users to learn how to use new applications or features by themselves.
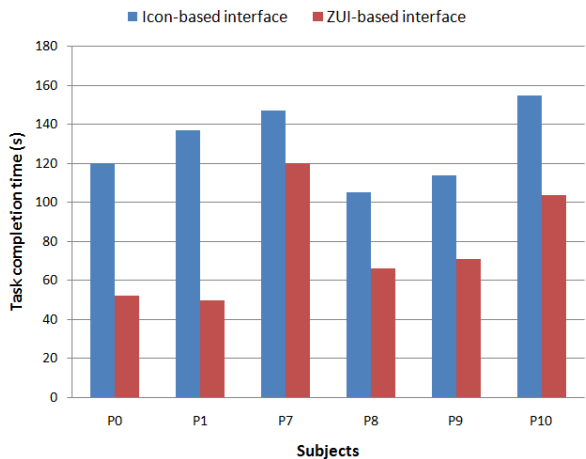

Fig. 7. Configuration and photo-taking completion times of elderly users

Figure 7 shows a comparison of the completion times of the tasks on the icon-based interface and the zoomable interface of elderly users. While the completion times for the two camera interfaces of younger users did not show a significant difference, all the elderly users spent more time completing the tasks on the icon-based camera interface than on the zoomable interface. Many spent a long time finding the presented configuration menu when using the icon-based interface because they were unable to remember the meaning of the icons. The younger participants most often cited that fact that they were already familiar with the icon-based interface as the reason why they found the ZUI-based was not an improvement on the icon-based interface. Moreover, the icons can function as shortcuts for younger users. However, the icon-based interface did not outperform the ZUI-based interface.

5   Conclusion and Future Work

We designed a ZUI-based camera interface for elderly users. The zoomable overview screen emphasizes the main functionality and provides a text-based menu instead of supplementary icons. As a result, the number of icons on the interface is small enough to allow them to be memorized. To verify the usability of the proposed interface, we conducted an interview with eleven elderly users. Most preferred the zoomable camera interface to an icon-based interface. The results of our experiment using six elderly users with smartphone experience and the younger users as our subjects also showed that their task completion time was reduced when the proposed zoomable interface was used. The dominant reason for this reduction is that icons cannot provide elderly users with a shortcut, and their unfamiliarity simply made the elderly users afraid of using them.

The proposed interface can simplify an application information structure using a continuous space, and provides intuitive guidance to its use. According to the feedback from the subjects of our experiment, the overview screen and a text-based manual facilitated their understanding of the application. However, more research is required on standardized navigation mechanisms.

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