

Multilingual Medical Dialog System Developed as Smartphone/Tablet Application*

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Abstract— Along with the concomitant rise in foreign residents in Japan has come the need to improve understanding at several social levels. The need for clear communication is most immediate in the area of the emergency or health care fields. Several types of apps exist that can be used to assist with communication between Japanese medical staff and foreign patients. However, there are problems with ease of use. This study asked 34 subjects to evaluate three types of touch designs with the “ExLanguage Nurse” to improve the usability of such multilingual apps. Results indicate that touch designs on the apps are related to ease of usability.

I. INTRODUCTION

The number of foreign residents in Japan has increased over the last two decades rising from about 1.2 million in 1981 to 2.3 million in 2008 [1]. Medical staffs are often overwhelmed by the numerous languages, the inability of foreigners to speak Japanese, and the complex phrases needed to express health issues. In addition, important information for medical assistance or disaster prevention should be accurate, immediate and accessible to everyone [2]. A multilingual translation system available through modern communication devices can help both patient and medical staff in immediate situations. We have developed medical communication support systems that have character and voice phrases in multiple languages and can be used at mobile terminals. This research considered the human interface of the mobile type multilingual communication system for medical use.

II. OVERVIEW

Multilingual medical communication systems are presently on the market in various forms and types known as the “ExLanguage” series. “Medical Talk” has also been developed for a certain Japanese hospital reception to make multilingual communication possible.

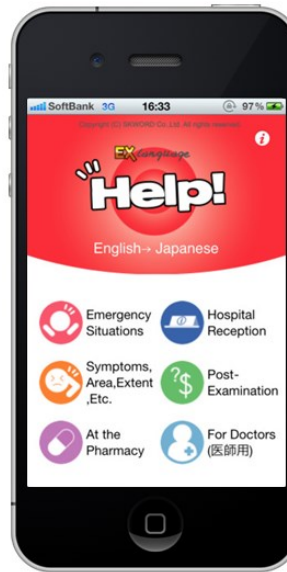
A. ExLanguage Series of “Help!” and “Nurse”

“ExLanguage HELP!” (Figure 1(a)) are phrase helpers that can assist travelers in emergency medical situations while traveling abroad. “Exlanguage Nurse” (Figure 1(b)) is a

communicative support for nurses needing to speak to foreign patients. Both such aids are iPhone/iPod touch apps.

B. Medical Talk

“Medical Talk” (Figure 1(c)) is an iPad app that can help with communication between Japanese medical staff and foreign patients at a hospital reception counter in Japan.



(a) ExLanguage Help!



(b) ExLanguage Nurse



(c) Medical Talk

Figure 1. Initial images of ExLanguage series and Medical Talk.

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(a) Paper sheet with Speaking-Pen for nurse



(b) Prototype A of “ExLanguage Nurse” on iPhone/iPod touch



(c) Paper sheet with Speaking-Pen for hospital reception



(d) Prototype of “Medical Talk” on iPad for hospital reception

Figure 2. Multilingual communication system

III. USER INTERFACE

At present, there are many devices that have applications that interface with real objects such as an e-book, which allows the user to employ an easy page-turning feature while reading a text. This study at first developed two prototype apps (Figure 2 (b) & (d)) of a same design as a multilingual system that uses a speak-pen that touches a paper sheet (Figure 2 (a) & (c)) and then translates the phrase on the sheet. Similar to the speak-pen design shown in Figure 2(a), the buttons on the panel of the ExLanguage Nurse prototype are shown in Figure 2(b) and include a matrix of language variations including Chinese, Korean, English and Portuguese (columns) and phrases in Japanese (rows). Such user interface is superior because all items are on one screen. That superiority is effective for one sheet paper like speak-pen system (Figure 2(a)), however the software graphics in the ExLanguage Nurse (b) can be easily switched. In the case of the Medical Talk, the different languages and phrase that are present on the screen (Figure 2(d)), are also more accessible to tactile manipulation without pen device. The circle buttons on the paper sheet (Figure 2(c)) are appropriate size for the tip of the speak-pen. However, the small circle button (Figure 2(d)) may be insufficient for the size of human finger.

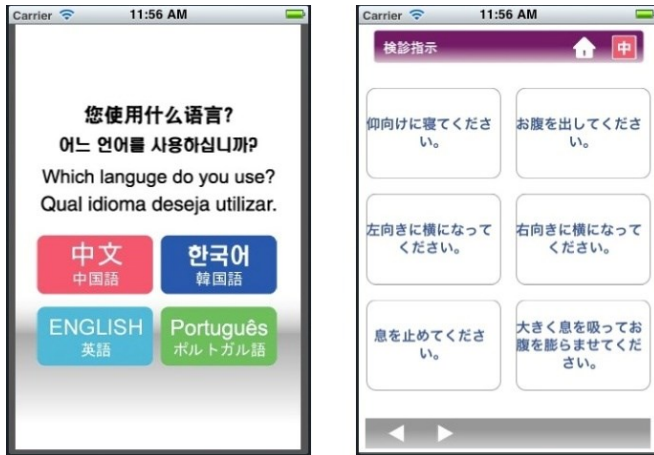
This study had subject evaluate usability for three types of user interface of “ExLanguage Nurse” including the prototype A (Figure 2(b)).

A. Evaluation Method

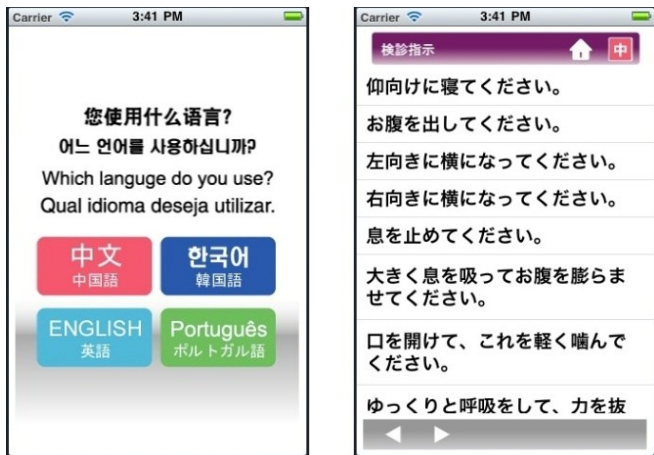
We prepared three types of user interface for the iPhone/iPod touch multilingual system “ExLanguage Nurse” in which phrases and languages can be selected on a touch panel emitting a sound for the listener. Design A (Figure 2(b)) is a digital reproduction of the conventional system that uses a speak-pen (Figure 2(a)). Design B (Figure 3(a)) has larger buttons while design C (Figure 3(b)) simply has a menu list of phrases. In the design B and C, a “language” selection are on the different page on the screens from “phrases” shown as the left images in Figure 3(a) and (b), unlike the design type A (Figure 2(b)).

The subjects for the evaluation included 34 persons between the ages of 22-55 years (mean 28.3 ± 6.9) whose native languages were Chinese (19), English (4), Japanese (5), Korean (1), and Portuguese (5). The ethics committee of the Graduate School of Information Science, Nagoya University approved the informed consent forms ascertained from all subjects. Using a subjective questionnaire, The subjects evaluated the three prototypes (A, B, C) by 6 steps of points of 0:bad-5:good, based on six critical points: 1. ease of search, 2.

size of the buttons, 3. readability of the characters, 4. operability, 5. switching of pages, and 6. intuitiveness of selection. The tasks required the subjects to select designated phrases that would be translated from their respective native languages. Figure 2(b), 3(a) and (b) show only Japanese interface for Japanese subjects, including sentences of “Lay on his back.”, “Hold your breath for a moment.” and so on. Prototypes prepared in 5 languages of the subjects in this experiment.



(a) prototype B

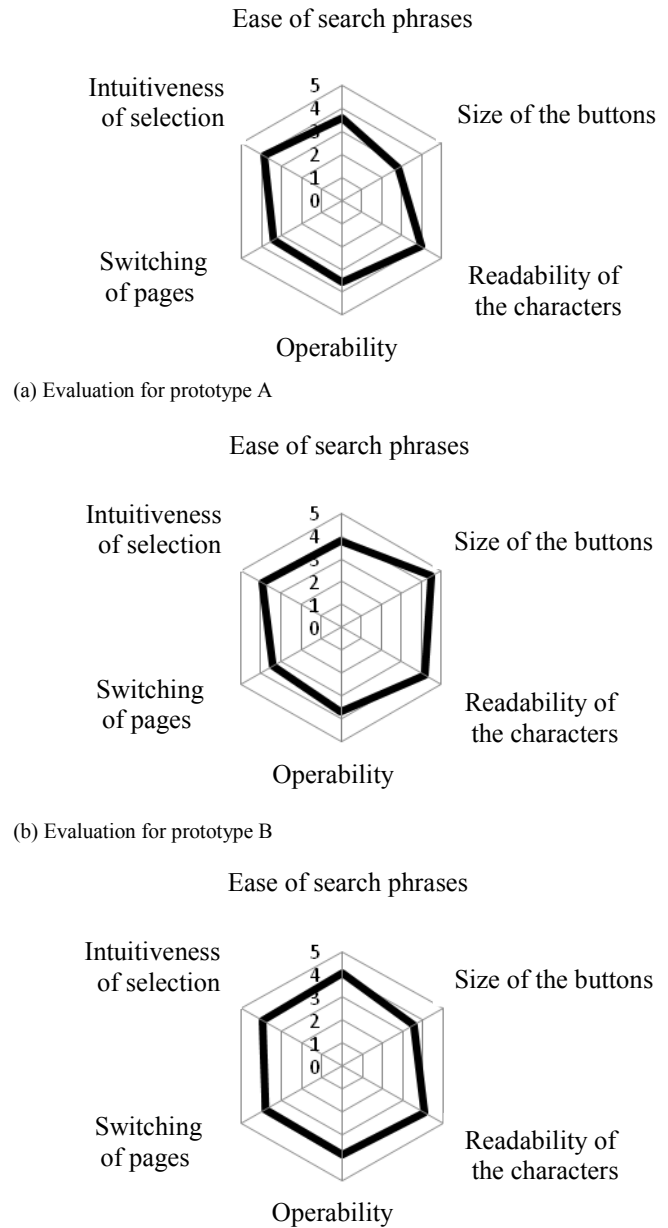


(b) prototype C

Figure 3. User interfaces of prototypes of “ExLanguage Nurse”

B. Results

Results of the questionnaire are shown in Figure 4. The average score for the six critical points of evaluation was for design A, 3.5; design B, 3.9; and design C, 3.9. In addition, the results showed that in terms of overall user satisfaction with interface usability 14 persons favored design C (41.2%), 11 subjects chose design B (32.4%), and 9 individuals preferred design A (26.5%) The subjects evaluated the design prototypes B and C superior to design A, especially with regard to the “Size of the buttons”. While the subjects scored design B higher on average for the “Size of the buttons,” they scored C higher on “Ease of search phrases” and “Switching of the pages” (Figure 4 (b), (c)). A larger selection button reduces the number of phrases displayed and thus could represent a trade-off to these other two points.



(c) Evaluation for prototype C

Figure 4. Results of the subjective evaluation

IV. PRODUCTS

A. ExLanguage Series: Help! and Nurse

The ExLanguage HELP! apps (Figure 1(a)) found in iPhone/iPod touch screens can assist travelers in emergency medical situations abroad. The “ExLanguage HELP!” is actually a series of apps that allow a person to translate from their native-tongue to another language. Such a resource is available on-line through the app store (Apple Inc.) for each respective country, but may be named differently as in English it is called “phrase helper”.

“ExLanguage Nurse” (Figure 1(b)) is available through the Japanese app store. This application allows Japanese nurses to communicate with foreign patients in a hospital. Phrases included in this app were selected based on the researched needs of medical staff in Japan. In this system, the

nurse first selects the language of the patient (Figure 1(b)). Then, the nurse can easily select the needed phases (Figure 5(b)) categorized as Basic Conversation, Reception, Interview, Examination, Medical Tests”, and Consultation also shown in Japanese in Figure 5(a). The category Medical Tests has a sub-list that includes “Blood sampling”, “Electrocardiogram” and “CT”.



Figure 5. Examples of the menus of “ExLanguage Nurse”

B. Medical Talk

“Medical Talk” is an iPad native app developed for specific medical facilities. In this system, the Japanese staff in the hospital reception can select from several items such as General reception, Departmental reception, Payment / drug, Medical test entry, Inquiry guidance and Facility information in the main menu (Figure 1(c)). Figs in Figure 6 are not upside down. The patients standing on the other side select languages from Japanese, English, Chinese, Korean, and Portuguese by using the touch panel (Figure 6(a)). The iPad is set flat on the reception counter, and patients use it from the other side of the iPad across the staff. In the case shown in Figure 6, patients selected English in the menu shown in (a). An English phrase is communicated to the patient from what the Japanese staff originally selected from the phrases (Figure 6(b)). The patient can also use their native language to go through the system and communicate with the staff (Figure 6(c)).

V. FURTHER STUDY

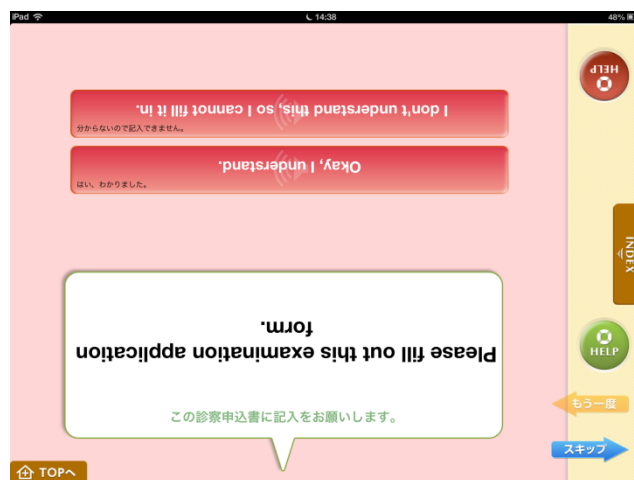
Multilingual systems enable communication beyond language barriers. However, user interface should be studied for usability. Communication using multiple devices including iPad mini or other mobile devices should also be studied.

ACKNOWLEDGMENT

Research for the user interface evaluation in this study was designed by Mr. Shunta Sano in Dr./Prof. Masaru Miyao’s Laboratory in Nagoya University. Products in this study were partly the result of the joint research with KARIYA TOYOTA General Hospital, Aichi, Japan. Thanks to all involved in this study.



(a) Buttons for patients to select language at hospital reception



(b) Phrases from staff and answer buttons for patients



(c) Question from patients
Figure 6. Examples of dialogs in “Medical Talk”

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