

Usability Enhancement of Smart Phone Application for People with Communication Disorders based on User Experience

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ABSTRACT

Objective: The aim of this study is to investigate an objective approach of enhancing usability of assistive technology for people with communication disorders by adopting software usability testing and user experience. **Background:** People with Cerebral Palsy have communication issues due to its spasticity characteristics. One of alternative communication methods they use is an augmented and alternative communication (AAC) device. But this kind of device is generally expensive and bulky to use in their daily activities. Authors adopt smart phone application approach to overcome these barriers and, in this paper, introduce an objective method to assess the application resolve these issues. **Method:** The handy smart phone application named 'Jinsori' has features of storing Korean words and sentences, retrieving and updating stored words and sentences, and pronouncing the stored words and sentences, which are assisting roles for people with communication disorders, i.e., people with Cerebral Palsy (CP). After a few hours of user experience of 'Jinsori', a subject with CP answers number of questions and performs designed service scenarios in type of face-to-face conversation with a nondisabled people. With these outcome measures, authors analyze the outcome qualitatively and quantitatively. This approach leads findings and recommendations for enhancing usability of the smart phone application. **Results:** A few findings are difficulties in using input keys due to their small size and the subject's limited hand function due to the spasticity. Authors' analysis concludes 'Jinsori' needs to have configurable input keys to provide maximum freedom of limited hand function. **Conclusion:** After meeting with the developers of 'Jinsori', authors find the objective approach adopted form ISO standards and user experience is one of effective methods of finding issues and resolutions to enhance usability of the prototype of 'Jinsori'. **Application:** Authors extend the approach to other assistive devices to prove its feasibility and robustness of the usability method.

Keywords: Usability, Communication disorders, User experience

1. Introduction

Most people with communication disorders experience difficulties in daily conversation. Beukelman (1992), Unverzagt (2001), Chung (2010), and Becker (2005) investigate demographic characteristics of people with

communication disorders, and find the spectrum of people with communication disorders spans from young generation to elder generation. For instance, as the population of elderly continues to grow and age related problems help creating communication barriers; there is an ever-increasing need of an assistive communication system focusing on the elderly needs. As the body weakens

physically with age, it affects the communicative senses like hearing, speaking, vision and memory. In this paper, authors focus on people with Cerebral Palsy (CP) from the perspective of communication disorders to provide them with easy-to-use and handy type of communication assistive technology. The motivation of innovative approach to resolve the current issues of communication assistive devices, i.e., Augmented and Alternative Communication (AAC), is originated from the idea of Chung (2009) and Prologue2Go, which are answers to the current issues of AAC's poor availability and usability in case of daily conversation. Most people with communication disorders regard the AAC devices are expensive to purchase and inadequate, bulky, and unpleasing to use with people with non-disability.

Augmentative and Alternative Communication has made quite some progress in assistive communication. Many such systems like Proloquo2Go. IBM Accessibility and Ma (2009) are teaming with researchers in academic institutions in Japan and India to explore an open, common user interface for mobile devices that is easy for aged or illiterate people to use. However, most of the research till now has been focused on treating children suffering from autism and aphasia, and do not take into account of their usability of user with CP in daily conversation. The extensive features and sometimes uncategorized vocabulary may overwhelm the CP users in day to day communication, which requires understanding complex features of AAC.

The aim of this study is to investigate an objective approach of enhancing usability of assistive technology for people with communication disorders by adopting ISO International standards on software usability testing and user experience. Especially, people with Cerebral Palsy (CP) have specific communication issues comparing to other people with communication disorders due to its spasticity characteristics. For instance, they are unable to pronounce or speak words fluently enough for daily conversation because of their tongues and pronunciation organs get hardened. These characteristics influence their communication performance in its correctness and timeliness. One of alternative communication methods they use is an augmented and alternative communication (AAC) device. But this kind of device is generally

expensive and bulky to use in their daily activities. Banajee (2003) suggested core vocabulary determination for young generations to recommend minimum vocabulary for AAC use is also challenging to the people with CP. In daily conversation, people with CP want their own vocabulary by typing text into tiny computer platform, i.e., smart phone. From the interview results with people with CP, authors select a smart phone application, Jinsori, as one of alternatives of AAC to meet their needs. Authors adopt the smart phone application to overcome these barriers and, in this paper, introduce an objective method to assess the application resolve these issues.

2. Method

The handy smart phone application named 'Jinsori' has features of storing Korean words and sentences, retrieving and updating stored words and sentences, and pronouncing the stored words and sentences, which are assisting roles for people with communication disorders, i.e., people with Cerebral Palsy (CP). Authors design the usability assessment protocol consists of preliminary survey, outcome measure, post survey, and interpretation based on Wason (1997) and Yorkston (1986) work. The survey focuses on user experience of AAC or other communication devices with survey categories of effectiveness, productivity, satisfaction, and safety. The outcome measure consists of set of daily conversions and evaluation categories in quantitative and qualitative perspectives., i.e., how long it takes to enter a sentence, what kind of errors does the subject make, reason of satisfaction and dis-satisfaction. The assessment starts with introducing whole process of usability assessment to the subject, asking whether the subject participates the assessment, and signing by consent of the participation. After the sign by consent, the assessment starts with preliminary survey, outcome measure, and post survey. From the results of three core parts of the assessment, authors interpret the assessment results to find recommendations for usability enhancement of Jinsori.

The outcome measure initiates after a few hours of user experience of 'Jinsori'. The subject with CP answers number of questions and performs designed service

scenarios in type of face-to-face conversation with a nondisabled people. Authors adopt ISO international standards on software usability testing. With these outcome measures, authors analyze the outcome qualitatively and quantitatively.

This approach leads findings and recommendations for enhancing usability of the smart phone application. In order to specify or measure usability of Jinsori, it is necessary to identify the goals of usability and to decompose effectiveness, productivity, satisfaction, and safety as well as these four sub-components with measurable and verifiable attributes suggested in Technical Report ISO/IEC TR9126-4 (2004).

The external view of the Jinsori is shown in figure 1. The features of Jinsori are conversation panel, file panel which stores saved sentences, and setting panel that configures options of Jinsori.



Figure 1. External View of Jinsori

When the user enters a sentence to start or continue communication dialogues, that sentence will be saved automatically in the file panel for further reference. The play button is located at the right side of text input space.

The design of external view of Jinsori seems easy to use in daily conversation.

3. Results

The usability assessment was performed in one of smart homes at the National Rehabilitation Center located in Seoul, Korea. Authors use two digital video cameras for additional outcome measure of performing the service scenarios, which is one of daily conversations in figure 2.



Figure 2. View of Jinsori Usability Assessment

3.1 Outcome of preliminary survey

The subject does not have severe spasticity but generally experiencing increase of overall muscle tone and its associated reaction in voluntary movement which preventing the subject from fine task and pronounce. However, long-term medication allows him to controlling mild muscle tone and participating activities of daily living (ADL). He answered difficulties in communication due to pronouncing and reading issues as well as typing keyboards due to spasticity, which is one of major issues in his physical health. Even though he does not have any plan to overcome his issue, he is interested in assistive technology for resolving communication disorders.

3.2 Outcome of performing service scenario

The service scenario has number of conversational dialogues and authors measure duration time and type of errors in each dialogue.

Part of the face-to-face dialogue is introduced as follows; (partner) 'how are you? How have you been?', (subject) 'Great. It has been three weeks since we met. Nice to meet you.', (partner) 'We have a nice and warm spring. Did you have time to go out?', (subject) 'Sure. I went out to blossom cherry flowers last week.'

Subject is asked to enter text of each conversational dialogue to have conversation. After 19 conversational dialogues, subject has done the performance of the service scenario.

3.3 Outcome of post survey

The subject expressed good impression of Jinsori with a few limitations he experienced. From these few limitations, authors select noticeable comments which are 'Jinsori may helpful to people with communication disorders.', 'Difficulties in typing keyboard on the smart phone, which is smaller than that of desktop computer, cause him typing errors.', 'My limited hand function raise issues on accessibility of Jinsori installed in the smart phone.', 'Jinsori has distinct pronunciation features that reflect comfort conversational dialogues, but it is difficult to access the Jinsori.' Figure 3 shows part of the service scenario performance reflecting the subject's limited hand function.

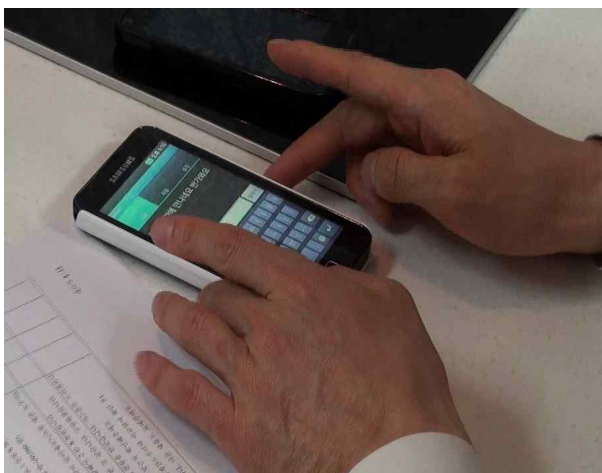


Figure 3. Performing Service Scenario (limited hand function)

4. Discussions

A few findings are difficulties in using input keys due to their small size and the subject's limited hand function due to the spasticity. Authors are interpreting a few finding to create recommendations to enhancing usability of Jinsori. The ultimate recommendations are 'Jinsori' needs to have a configurable input keyboard to provide flexible freedom of limited hand function, and adding a speed option of pronunciation. These recommendations make sure of enhancing the usability Jinsori for people with CP in their daily conversation.

5. Conclusion

After usability assessment with a subject with CP, authors extract a few recommendations for enhancing Jinsori's usability from assessment data. In the meeting with the developers of Jinsori, these recommendations are explained with knowledge of people with CP in terms of their communication barriers. Jinsori developers find the objective approach adopted form ISO standards and user experience is one of effective methods to find issues and resolutions regarding to enhancing usability of the prototype of 'Jinsori'. Authors will extend the usability method to other assistive devices to prove its feasibility and robustness of the usability method.

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