



The Basic Study on the Platform of Language-Communication Assessment Protocol Application for Tablet PC by the Focus Group Interview (FGI) Method

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Abstract: *As for degraded cognitive ability observed in the elderly population, early detection and efficient care are feasible through language-communication assessment protocol in the use of tablet device. Language-communication assessment in the use of tablet device has made objectivity and consistency of the suggestion of test items, convenience of preservation and record of the performance ability, and suggestion of norm on the language ability possible. This study has identified elements, to be considered to suggest the language-communication assessment protocol development platform in the use of service-oriented architecture (SOA) through the group interview with speech pathologists and engineering specialists. The necessity of language-communication assessment protocol development for tablet device has been identified in three domains including the assessment method, mobility, and efficiency & accuracy. However, it was revealed that uniqueness of sub-category of language-communication assessment and environment and expenses of using devices shall be considered at the same time to realize them. Since SOA provides the custom applied programs by considering the role of user, circumstances of wireless communication and remaining electricity of tablet device in connection with previous services, it is expected to make efficient language-communication assessment feasible on the elderly for a long time.*

Keywords: FGI, Language-Communication Assessment, Tablet Device

Introduction

The demand for ubiquitous healthcare (U-health), by which health care services can be provided anywhere and anytime, has risen sharply with time. U-health makes it possible to conduct emergency treatment, to prevent ailments in everyday life and to improve the efficiency of rehabilitation, so it can be actively used in such settings where it is required to carry out early discrimination or intervention in the decline of cognitive functions in the elderly with dementia, mild cognitive impairment or other mental disorders. In addition, it is possible to record regularly user's current conditions such as one's cognitive function and language ability, to conduct a follow-up survey on change patterns in order to generate their profiles, and to create big data from stored

records of each sample to find out a trend or secure normative data so that reliability can be improved especially in the results of a web-based language test for patients with neurogenic communication disorders. The pathway of disease progress and abnormal symptoms also can be detected in an early stage. Cognitive rehabilitation that uses computers was first reported by (E L Glisky et al., 1986), and since then its utility has continued to receive much attention (Engelberts, 2002 and Plohmann et al., 1994). Paper and pencil testing methods, however, have been used so far more commonly in assessing the decline of linguistic and cognitive abilities.

Each of the disciplines, social science, rehabilitation medicine, and computer engineering (or information and communications), although

having made a lot of interdisciplinary efforts, seems to have difficulty adopting techniques from one another. As its characteristic to be applicable to one's real life, services of a life science system should maintain continuity from its previous system and demand specialists of different disciplines to cooperate closely in arranging and applying requests. Effects of such interdisciplinary efforts have been hardly verified in terms of application to actual clinical settings or public services although it is possible to delineate the effects conceptually. Therefore, this study conducted a focus group interview (FGI) with an expert group of three disciplines and organized its results so that it could find out the elements that need to be considered for presenting a platform to develop a language-communication assessment protocol using a service-oriented architecture (SOA).

Methods

Introductions of Computer Assisted Therapy (CAT)

There have been continuous reports (Reitz et al., 2015) on effectiveness of computer assisted therapy (CAT) that checks a patient's current status through information technology effectively as well as economically efficiently, based on the common and traditional concept of language therapy where a patient and a therapist meet one to one. CAT means a product or service designed to help a handicapped or elderly person to live independently and includes both high-tech and low-tech concepts. CAT has a wide range of types, which make it possible to give treatment through mobile devices as well as personal computers with CD-ROMs and applications.

Treatment with mobile devices or software on personal computers has been on the rise. For example, materials used for traditional language therapy like letter cards and flash cards are transferred to an application, and a person can be treated with various materials per category and given immediate feedback

(Reitz et al., 2015). Since the specifications of mobile devices are limited to be applied to older age groups, such treatment, however, has been said to be inadequate to completely replace the traditional way of language therapy.

Language therapy with CAT has proved to be effective in enhancing one's comprehensive communicative competence including speech and language. In a study (Palmer et al., 2013) on word-finding feasibility of CAT for aphasia patients, they were treated three times a week for five months, and as a result, the therapy was reported to have an advantage of motivation through individualized and repeated training. The subjects and guardians said that one's ability for word finding had been improved due to CAT and that a patient's way of life and access to therapeutic support could be guaranteed. A study (Archibald et al., 2009) on sentence comprehension of patients with specific language disorders pointed out that their ability for sentence comprehension had been improved by controlling a speech rate. For a verbal and sentence processing area, Verb Network Strengthening Treatment (VNeST) was applied by which a role related with the verb that had been trained two times a week was presented and a generalization test was carried out weekly. As a result, generalization was proved for the retrieval of a content word from a sentence with a verb not trained (Furnas et al., 2014). In a study (Cherney et al., 2011) on effects of CAT on the discourse capability of aphasia patients, they were directed to read sentences out loud twenty four times, each time for a couple of hours every week. According to the study, CAT is so effective as if they had been treated with a speech pathologist.

In addition, CAT was found to be able to arbitrate in a speech area. A study by Whiteside et al., 2012 included a training session during which AOS patients were trained for six weeks with word sets of contrast pairs through a virtual space and time program and evaluated on their performance. The patients were observed to improve in respects of accuracy and fluency,

and even after the treatment, to continue to show such improvement.

In Korea, there is only one aphasia therapy application based on Android and no any other software and CD-ROM, whereas as shown in Figure 1, various types of applications and computer software have been developed in other countries. The treatment software developed in other countries has contents focusing rather on therapy than on assessment. Most of the programs are to help adult patients who have difficulties in verbal output to have communication or to assist patients with impaired grammatical abilities in speaking and writing.

Interview Procedures

A focus group interview was conducted two times with two professors of speech and language pathology, one physiatrist, and one professor of computer engineering so that those elements that need to be considered for developing a language-communication assessment protocol using tablet devices could be figured out. The interview where all the four experts were present was carried out two times, each for four hours.

The interview was presided over by one professor of speech and language pathology, and the professor presented the categories

of the sub-items included in the language-communication assessment protocol for the elderly and introduced the testing method. After that, the experts discussed several matters: including a way to implement a test in a tablet device; to analyze participant responses, engineering methods and technical approaches; and considerations and limitations in application of assessment and treatment results by the device into the actual daily lives of patients.

Results

The necessities to develop a language-communication assessment protocol for tablet devices were first discussed, followed by technical difficulties in realizing the protocol and their solutions. As shown in Table 1, the necessities for a language-communication assessment protocol for table devices can be divided into three domains: assessment method, mobility, and efficiency and accuracy. A conventional paper and pencil test has test items focusing on either auditory or visual components, whereas the tablet device can

Table 1 Necessities for Developing Language-Communication Assessment Protocol

Domain	Necessities
Assessment Method	- Able to make a multimodal assessment using multimedia components of the tablet device
Mobility	- Secures user's mobility; allows a test to be conducted not only in medical institutions but also in other settings like homes and welfare centers
Efficiency & Accuracy	- Expands a pool of labor forces allowed to conduct an assessment - Decreases human errors likely to occur in the process of a test and/or in interpretation of test results - Obtains big data with ease - Efficiently collects and, if necessary, processes data



Fig. 1 Overseas Treatment Programs Based on Information Technology

display a word (for example, 'dog') along with its picture and sound, thereby enabling a multimodal assessment and having test items similar to actual ones, which provides also a benefit that multi-modality of the cue provided by an expression therapy can be secured. Second, all the information required for a test is contained in the device and can be retrieved so that anyone can conduct a test anywhere. Last, the analogue way of conventional paper and pencil testing has a high risk of human errors depending on tester's direction or variations.

Difficulties Relating to Analysis Methods as Characteristics of Subcategories of a Language Test

i. Language Expression Task: A tablet device tends to show a low rate of voice recognition. In case speaker's speech is cut into linguistic units for analysis, the device does only voice recording, so the tester has to transcribe what has been recorded and analyze that again. To deal with the difficulty, it is necessary to examine in depth and apply the principles of morpheme analysis used in natural language processing.

ii. Language Comprehension Task: The response time can be measured, but the counterbalancing of scores by an error rate is not calculated automatically.

iii. Writing Task: When writing letters, the elderly with neurogenic disorders often show changes in letter obliquity (angle), stroke power, and so forth. But they recognize letters by touching them on the device, so there are limitations in analyzing those variables.

Difficulties Relating to Cost and Environment of Device Use

- i. Areas with accessibility to Wi-Fi should be taken into account.
- ii. If an application is priced too high, the chance is high that the scope of its use becomes more limited. Developing such an application tends

to be costly, and purchasing a tablet device can be a burden to an individual or organization.

Difficulties Relating to Participant's Personal Matters

i. The old have a tendency to feel difficult when using an application without assistant's help, which makes it more difficult to assess their language abilities. That difficulty is more evident particularly in the old with low cognition. In case an application is to be developed, a scenario should be set up in a way that maximizes one's understanding.

ii. The market of software programs for language testing or medical treatment has the problem that if not taking into account the needs of patients with neurogenic language disorders, the programs are rarely used. So it is required to suggest methods to make users feel interested and accomplished by for example, adding elements of a game and targeting the general public rather than simply displaying results of a language test to a patient.

Conclusions

If a program built in a tablet device offers items of language tests in an objective and reliable way, it is able to not only improve the reliability of test results but also display the criteria of communication abilities for the elderly on the spot so that the communication abilities the tested person is showing can be compared in real time. To achieve this, multilateral and interdisciplinary research will be necessary in which experts of speech and language pathology develop content, and specialists of engineering design a natural language processing service in order to measure exactly the degree of one's language comprehension and expression, and make other efforts to build an application program to be built in a device. Therefore, this basic study, which explored the elements considered necessary in suggesting a platform to develop a language-communication assessment protocol, will allow a language

assessment to be conducted anywhere and anytime and, in the long run, will improve the quality of a system to develop a personalized recommendation service.

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