

Examination of Memory Retention Evaluation System Easy to Use for Elderly Using Touch Panel People

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ABSTRACT

It is very important to evaluate the memory retention of elderly people in daily life. OSPAN is effective as method for early detection of deterioration in memory ability, but has problems in usability. In this research, we improve the usability of OSPAN and propose new evaluation system for elderly people.

1 Introduction

Currently, the total population of Japan is 126.93 million (October 1, 2016). Among the total population of Japan, the elderly population aged 65 and over is 3459,000 (27.3% of the total population) [1]. First, it is important that familiar people, such as family members, notice cognitive decline in the elderly. Next, it is important for elderly people to undergo an examination at a hospital etc. early. At present, the detection of significant cognitive decline is often late. There is a need for testing methods for the elderly to find early signs of cognitive decline. In addition, a system that allows the elderly to operate easily is also indispensable. In this study, we have prototyped a system that enables the elderly to measure and evaluate the decline in memory. The purpose of this study is to prevent the elderly from becoming mild cognitive impairment (MCI) and dementia by early detection of functional decline.

In this report, among various evaluation methods of memory ability, we focused on a method (Operation Span Test) to detect early memory deterioration of healthy elderly people. The conventional operation span test is difficult for elderly people to understand and use. This report describes the improvement plan and its evaluation results on the usability of the elderly.

2 Memory retention evaluation method

2.1 Operation Span Test

We extracted five subjects of the conventional operation span test [2] (hereinafter referred to as OSPAN) in the previous research [3]. We explain the memory retention evaluation method considering the problem and the improvement plan.

The first problem is that the number of problems is unknown. We have improved this task by displaying the number of remaining issues. Fig. 1 shows the actual display screen.

The second problem is that the number of remembered characters is large. Fig. 2 shows the percentage of correct answers for each letters in the elderly. The correct answer

rate for 3 letters is 42.4%, and the correct answer rate for 8 letters is 12.5%. For the elderly, the 3-letter task is easy and the 8-letter task is too difficult. An effective and easy evaluation for the elderly is a method of performing two sets of 4 to 7 letters tasks.

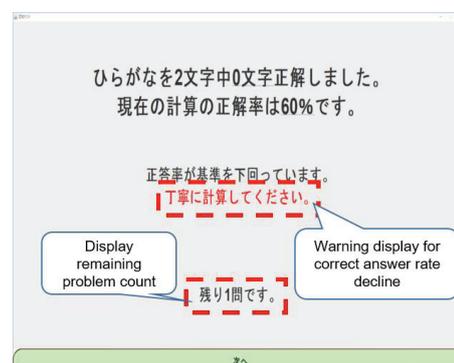


Fig. 1 Display screen after improvement

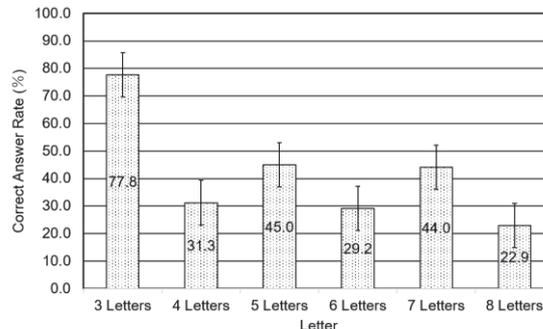


Fig. 2 Correct answer rate for each letters

The third problem is that the display time of feedback of correct answer rate is short and the display (red letter) that warns of decrease in correct answer rate is difficult to understand. We solved the problem of display time by switching the display with the "次へ" button. Also, we changed the conventional display to a warning display saying "丁寧に計算してください。"

The fourth problem is that it is difficult to understand the order of practice. Subjects receive this test in the order of teaching, practice, and production. In this order, it is difficult for subjects to understand the content of the test. We changed to teaching and practicing at the same time.

The fifth task is the point where the answer method "?" Button is difficult to understand. Fig. 3 shows the answer method after improvement. We deleted the "?" Button and set the answer frame for character input.



Fig. 3 The answer method after improvement

2.2 Automated assessment system

Fig. 4 shows the configuration of the automated assessment system. We improved four points ((1) to (4) below) as a system for elderly people.

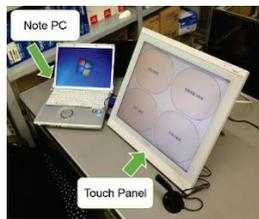


Fig. 4 The automated assessment system

- (1) The subject can use only the touch pen for input without using a keyboard or mouse.
- (2) The subject can see and understand the teaching immediately before the test. Fig. 5 shows an example of teaching).

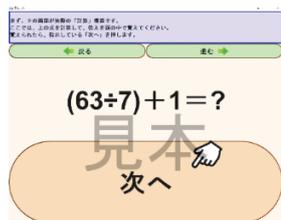


Fig. 5 Teaching calculation scenes

- (3) The subject can easily understand the test contents by watching the teaching in animation. Fig. 6 shows the animation of the teaching.



Fig. 6 The animation of the teaching

- (4) The subject can experience the practice of getting used to the touch panel before taking the test. Fig. 7 shows the practice of touch panel (button press).



Fig. 7 Button press scene

3 Evaluation experiment

3.1 Method

First, we implemented OSPAN before improvement (conventional system) and after improvement (this system) in an automated assessment system. Next, we evaluated OSPAN's understanding and burden using an automatic evaluation system. The evaluation method of understanding level is NEM [4], and the evaluation method of burden level is NASA-TLX [5]. Finally, we conducted a comprehensive questionnaire on usability. The subjects were 16 elderly people aged 65 and over.

3.2 Result

Fig. 8 shows the experimental results of the NEM teaching scene. The NE ratio of the conventional system is 3.6, and the NE ratio of this system is 3.1. We believe that this system is easier for older people to understand the teaching method than the conventional system.

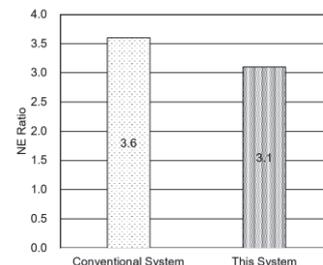


Fig. 8 Results of teaching scene

Fig. 9 shows the experimental results of the NEM practice scene. The NE ratio of the conventional system is 3.1, and the NE ratio of this system is 1.9. We believe that this system is easier for older people to understand how to practice than conventional systems.

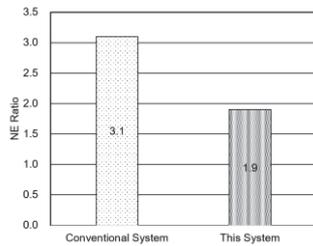


Fig. 9 Results of practice scene

Fig. 10 shows the experimental results of the NEM recall scene. We think that there is not much difference between the conventional system and this system for recall.

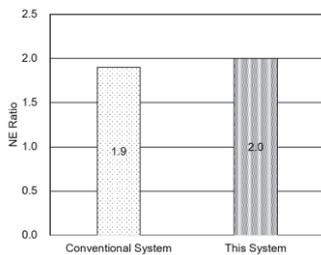


Fig. 10 Results of recall scene

Fig. 11 shows the result of NASA-TLX. From the results of NASA-TLX, we think that there is almost no difference in burden level.

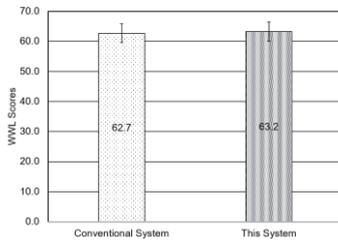


Fig. 11 Results of NASA-TLX

Fig. 12 shows the result of questionnaire about senior understanding. The result of questionnaire shows the percentage of understandable system in a pie chart. From this result, we think that this system is easier to understand than the conventional system.

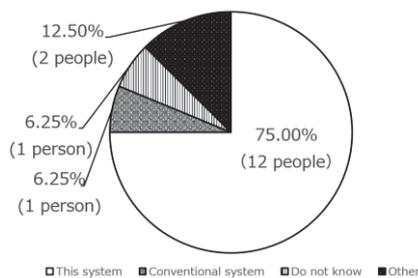


Fig. 12 Result of questionnaire about senior understanding

Fig. 13 shows the result of the questionnaire on burden. The result of questionnaire shows the percentage of mentally overloaded system in a pie chart. From this result, we confirmed that this system has less burden than the conventional system.

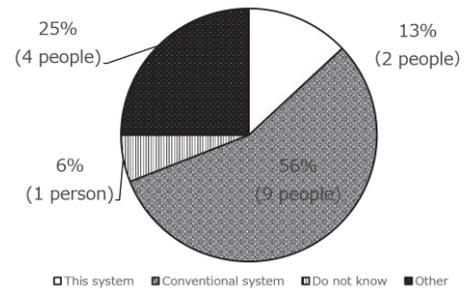


Fig. 13 Result of the questionnaire on burden

4 Conclusion

This report describes an automated assessment system for OSPAN for the elderly. We performed evaluation experiments on the conventional OSPAN and the proposed OSPAN. As a result, we think that this system is easier to understand than the conventional system about the teaching scene and the practice scene of NEM. In NEM (recall task) and NASA-TLX, we have confirmed that there is little to choose between our proposed system and conventional system. From the result of the comprehensive usability questionnaire, we think that this system is easier to understand and less burden. In the future, we plan to improve the reliability of this system through experiments of more subjects.

References

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