

Attention and Error Repetitions

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Abstract

Elder users of IT-based equipments often show repetitions of the same erroneous operations in daily lives and also in the usability testing labs. In this study, we have tried to identify important factors of this error repetitions phenomenon with young adults, using a simple Kanji-selection task. Experiment 1 showed that the error repetition did not occur when task complexity needs more attention resources under the reverse condition. However, in Experiment 2, error repetition occurred under task-switching condition, where attention resources were required for goal maintenances. These results implied attentional loads for maintaining multiple goals is one of most important factors for error repetition, even though some other cognitive load like irregularity of spacing design also seemed to be a necessary factor.

Error repetition is a phenomena which is defined that once erroneous operations occur, the same wrong operation is repeatedly executed to the same stimulus-situation which is manifested again because of the error itself. This phenomenon is easily observed in the usability testing of IT-based equipment by elder people (Harada, & Akatsu, 2003), or also reported in observation of daily lives. Investigating this error-repetition phenomenon and its cognitive mechanism is important for making usable and user-friendly design for elder people.

In the previous studies we have tried to construct an experimental paradigm using a simple Kanji-selection task to investigate this phenomena under precise experimental controls (Harada & Suto, 2004), and found that there are some factors relating to occurrence of error repetition regardless of age. One experiment showed that even young adults (university students) showed error repetitions under the dual-task condition, which implied the relation between attention and error repetition. However, elder people with low scores in a simple attention-necessary test, like a visual-search task, did not show any more error repetition than high score participants. We should clear which aspects of attentions in dual task conditions make participants to commit the error repetition. For example, there are at least two kinds of requirements related to attentions in the dual task conditions: for one, it simply requires more attention load, and the other, it requires to maintain two goals in mind and it might need some special attentions.

In this study, we executed two experiments to compare these two possibilities in order to investigate to which kinds

of attention load is affecting the occurrence of error repetitions, either simply attention load or attention load for goal maintenance.

Experiment 1: with the reverse condition

In experiment 1, we examined whether task complexity which demand more attention load caused error repetition or not, using the reverse condition in the Kanji selection task. The reverse condition means that participants should consistently select the 'not-correct' homophone candidates. Because participants decide which candidates is the correct one, and then choose the answer which is not the correct, but the suitable to the sentence pronunciation. If error repetition is observed under this condition, simply demanding attention resources may be the major factor of the error repetition phenomena.

Method

Participants:

Sixteen undergraduate students participated. The range of the participants' mean age was 18-23 years.

Apparatus and Stimuli:

Stimuli were presented on a Tablet-PC (HP TC1100) with a 10.4-in. LCD monitor. Forty-eight sets consisted with two sentences and 4 candidates were used for the Kanji selection task. Target words and lures were homophone pairs which were two-character words. These words were constructed with 2 - 4 moras and had high familiarity (score 4.0 or more in 5 scale rating). Other distracters were homophone pairs with other pronunciations. Contextual sentences consisted of 3-4 phrases and presented semantic clues to distinguish the target word and the lure.

Design:

A 2-levels repeated measure with the task conditions (Reverse / Control) was the main factors of the experiment.

Three levels of the repetition error (Single error / double errors / triple errors) were also included for analysis.

Procedure:

The experiment was done individually. Each trial in the Kanji selection task started with presenting an instruction cue ("correct", " wrong", "*"") at the center of the screen for



Figure 1. Example of selection screen used in the two experiments.

2 seconds. After the cue, a context sentence with a target pronunciation was presented. Finishing to read the sentence, participants pushed the "next" button, and four candidates were presented for the selection (Figure.1): the correct Kanji, a homophone, and two distracters with similar but different pronunciations. No triple buttons were not arrayed in straight, and two of the buttons, one from each pronunciations, were randomly painted orange, for increasing visual complexity. Participants were asked to choose the appropriate candidate according to a presented instruction cue.

When participants made a mistake in a trial, the same trial was repeated until the correct answer was selected or repeated 3 times, even though in the instruction participants were told that these repetitions would happen randomly on both correct answers and wrong answers.

In the experiment, there were 2-blocks, each of which consisted of 24 trials. In the first block, the reverse condition, participants were asked to select the not-correct-but-homophone words, and in the second block they were asked to choose the correct Kanji as a control condition, which was the same procedure as the previous experiments. The experiment lasted about 20 minutes.

Results and Discussion

The percentage of the error occurrence in each condition was calculated as a function of the number of repetition, results of which was shown in Figure 2. A two-way ANOVA 2 (experimental conditions) by 3 (numbers of repetition) showed a significant effect for error repetition [$F(2, 30) = 38.75, p < .01$]. However, neither the main effect of the condition nor these interaction of the two factors did not reach a significant level [$F < 1.0$]. These results showed no evidence that more demanding attention by task complexities with young adults.

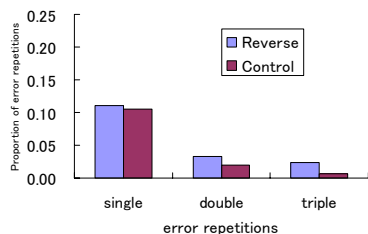


Figure 2. Proportion of error repetition in experiment 1.

Experiment 2: with the Task switch condition

In experiment 2, we examined whether the task switching condition, which requires more attention resources especially for maintaining multiple goals, caused error repetition, or not.

Method

Participants:

Sixteen undergraduate students participated. The range of the participants' age was 18-23 years. All of them had not participated the experiment 1 or similar experiments with kanji-selection task.

Apparatus, Stimuli, and Procedures

Method of the experiment 2 was same as experiment 1 except the first block was changed to the task switching condition from the reverse condition in Experiment 1. In the Task switching conditions, answering the 'correct' or the 'wrong' was interchanged on every 3 trials. This change was instructed with the cues before the context sentence presented, which was changed from trial to trial among 'right', 'wrong' and '*'; the asterisk mark '*' meant "same as the previous one".

Results and Discussion

The percentage of the error repetition (single error, double error, and triple error) in each condition is shown in Figure 3. A two-way ANOVA repeated measure showed a significant effect of the task condition [$F(1, 15) = 13.78, p < .01$], and a significant effect of the error repetition [$F(2, 30) = 57.96, p < .01$]. The interaction between task condition and error repetition marginally reached significance [$F(2, 30) = 2.73, p = .06$], maybe because of floor effects of double/triple errors in the control conditions. The results showed that the error repetition occurred more frequently under the task-switching condition, which implied that demanding attention load for maintaining multiple goals is one of important factors of error repetition phenomena.

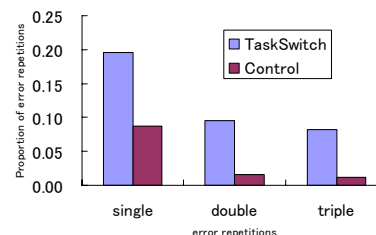


Figure 2. Proportion of error repetition in experiment 2.

General Discussion

The results of two experiments indicated that error repetition is related to a specific function of attention for goal maintenance, which was supported also by experiments with elder participants (Harada & Suto, 2006). These results and implications fit to the hypothetical model of error repetition using the dual process theories (Jacoby, Kelly, and McElree, 1999). The relation between attention and dual-process theories or inhibitory process should be investigated with other tasks and be generalized as models.

References

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