The role of working memory in text comprehension: Individual differences in storage and retrieval

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The present study addressed the relationship between an individual difference in the reading span test (RST) and the performance in text comprehension with respect to storage and retrieval systems. In Experiment 1 a comparison was made of an effect of the serial recall task on performance in text comprehension on high and low RST score groups. Experiment 2 was an investigation of an effect of the word fluency task on performance in text comprehension of two groups. The results of both experiments showed that the performance in text comprehension of the low RST score group was decreased by the serial recall task. In contrast, the performance of the high RST score group was influenced by the word fluency task. The results suggested that the high RST score group comprehended text not only by using a temporary storage system but also by using a retrieval system.

Key words: working memory, reading span test, text comprehension, storage and retrieval

Individual differences have been reported in working memory, which is measured by the reading span test (RST), in a temporary storage system, which is reflected in the memory span task (e.g., Daneman & Carpenter, 1980), and in a retrieval system represented by a word fluency task (Rosen & Engle, 1997).

This study focused on the individual differences in two aspects of text comprehension: the temporary storage and the retrieval systems. The dual-task method was used and two types (easy and difficult) of secondary task were set.

Experiment 1

Individual differences in the temporary storage system during text comprehension of the high-RST score group (H-group) and the low-RST score group (L-group) were examined.

Methods

Participants The experiment involved two groups, the H-group and L-group, each of 15 participants.

Design A 2×3 factor design, involving the 2 groups of participants (H-group vs. L-group) and 3 conditions (easy vs. difficult vs. control) was used.

Materials

Primary task (the listening comprehension) The participants were required to listen to the text and to answer a comprehension test (three trials (texts) for each condition). The texts were taken from newspapers or textbooks on Japanese for senior high school students (mean number of letters in the texts (M), 356; mean listening time (M), 76.91 seconds). For each trial the comprehension tests scored eight points.

Secondary task (the serial recall task) The difficulty level of the secondary task was manipulated by the number of words which were presented. For the difficult condition seven words were presented and for the easy condition four words were presented visually (e.g., ant, flower, persimmon, sea).

Procedure In the control condition the participants were required only to listen to the text. In the dual-task condition the participants were also required to retain the words which were presented.

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prior to their listening.

Results and Discussion

Results of primary task The performance of participants in the comprehension test is shown in Figure 1(a). The L-group was affected by the difficulty of the serial recall task but the H-group was not. It can be suggested that for the L-group the role of the storage system is important for text comprehension.

Results of secondary task (the serial recall task)

The performance of the H-group was better than that of the L-group irrespective of the task difficulty. The individual differences in storage capacity during text comprehension between the two participant groups are shown.

Experiment 2

The individual differences in the retrieval systems from long term memory (LTM) of the H and L-groups were examined during text comprehension.

Methods

Thirty undergraduate students participated (15 subjects in each of the H-and L-groups). The experimental design and the primary task were the same as those used in Experiment 1.

Secondary task (the word fluency task) The participants were required to generate the names for as many as possible of the items which were presented on a CRT display. All of the items belonged to a specific category. For the easy condition a category had a wide specification (e.g., sports). For the difficult condition each category had a narrow specification with one additional character (e.g., insects that can fly). The difficulty level of the secondary task was manipulated by the period of time for generating the names.

Procedures In the control condition the participants were required to listen to the text and to simultaneously write their name as many times as possible. In the dual-task condition the participants were asked to listen to the text and simultaneously to write the generated words.

Results and Discussion

Results of primary task The performance of the participants in the comprehension test is shown in Figure 1(b). In the difficult condition the performance of the H-group fell to almost the same level as that of the L-group. This result suggested that the word fluency task had a greater influence on the text comprehension of the H-group.

Results of secondary task (the word fluency task)

The H-group performed better than the L-group irrespective of the difficulty of the word fluency task. Moreover, although the primary task performances of the two groups were not significantly different in the difficult condition, the secondary task performance of the H-group was better than that of the L-group. This indicated a difference in the retrieval system of the two groups during text comprehension.

Conclusion

The L-group was influenced by the serial recall task. In contrast, the H-group was influenced by the word fluency task, which needed access to LTM during text comprehension. The text comprehension process of the L-group was found to depend on temporary storage and their retrieval system from LTM did not work as effectively as that of the H-group. The H-group however, could use a retrieval system as well as a temporary system.

References

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