

When is Visual Working Memory Needed in Text Comprehension?

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Friedman & Miyake (2000) suggested that visual working memory can affect text comprehension as well. In this paper, we report two experiments that showed that visual working memory is needed in integrating sentences, even though the text is not about visual or spatial objects.

Methods

Forty-four Sungkyunkwan University students, whose reading span was between 25 and 75 percentile and the visual working memory span was either at the bottom (i.e., low span) or at the top 25 percentile (i.e., high span) of 151 students, participated in Experiment 1. In Experiment 1, the participants read six narrative stories and six filler stories. Participants were asked to answer two experimental questions and two control questions after reading each story. The experimental questions were spatial-memory, spatial-relation, or nonspatial-relation questions: The presence of an item was asked in the spatial-memory questions, the spatial relationship between items was asked in the spatial-relation questions, and the relationship between nonspatial objects (e.g., kinship) was asked in the nonspatial-relation questions.

Forty-eight Sungkyunkwan University students, whose verbal and visual working memory span was between 25 and 75 percentile of 151 students, participated in Experiment 2. In Experiment 2, the dual task paradigm (e.g., Robinson & Molina, 2002) was used to test the possible involvement of visual working memory in text comprehension. After the participants finished reading a story, they were asked to perform one of the two memory tests, an auditory memory test and a visual memory test, prior to taking the comprehension test. Each participant had done the six combinations of question types and the intervening memory tests. All experimental procedures were controlled by a PC. The texts and the visual memory test items were presented on the monitor screen. Auditory memory test items were presented through earphones.

Results and discussion

The number of correct answers for the comprehension questions was analyzed. As was shown in Table 1, the low span participants suffered more with spatial relation questions ($F(1,42)=29.46, p<.01$) and nonspatial relation questions ($F(1,42)=30.29, p<.01$) than with spatial memory questions ($F(1,42)=14.63, p<.01$).

The possible involvement of visual working memory on comprehension was tested using dual task in Experiment 2. The spatial relation questions and the nonspatial relation

question suffered more when the visual memory task was added, whereas the spatial memory question suffered more when the auditory memory task was added ($F(2, 94)=4.86, p<.01$). However, the three question types showed the same pattern of performance in the control questions.

The results of two experiments strongly suggested that the visual working memory is involved in comprehending texts, especially when relating items that can be arranged in a spatial way is needed.

Table 1. Average number of correct answers to three types of questions: Experiment 1

Question	High span	Low span
Spatial memory	3.55	2.59
Spatial relation	3.00	1.45
Nonspatial relation	3.41	1.95

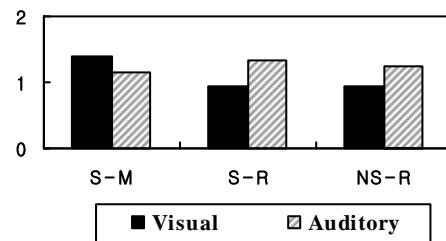


Fig 1. Average number of correct answers to three types of questions in the visual and auditory memory conditions in Experiment 2 (S-M: spatial memory, S-R: spatial relation, NS-R: nonspatial relation).

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References

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