The 7th Tsukuba International Conference on Memory: Current Directions in Visual Memory, March 20-22, 2008

# Mentally Representing the Shapes of Objects Costs Executive Functions

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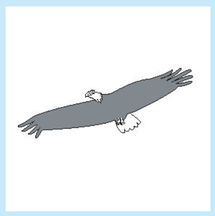
## BACKGROUND

☐ Readers may mentaly represent images implied by the sentences read.
☐ Zwaan and Colleagues examined this idea experimentally (Stanfield & Zwaan, 2001; Zwaan et al., 2002).

The ranger saw the eagle in the sky. or The ranger saw the eagle in its nest. → Read Sentence



or

Was this object mentioned in the prior sentence?

The times to verify the pictures were longer when their images mismatched the shapes depicted by the sentence than when the imeges matched them.
☐ e.g.), ~ in the sky +  > ~ in the nest + 

☐ This finding suggests...
a) Readers constructed representations for the shapes of the objects during reading?
b) Readers interpreted the picture in the view of the sentences at responses?
☐ The central executive would involve creating images from LTM or general knowledge (Baddeley & Andrade, 2000).

## The Present Research

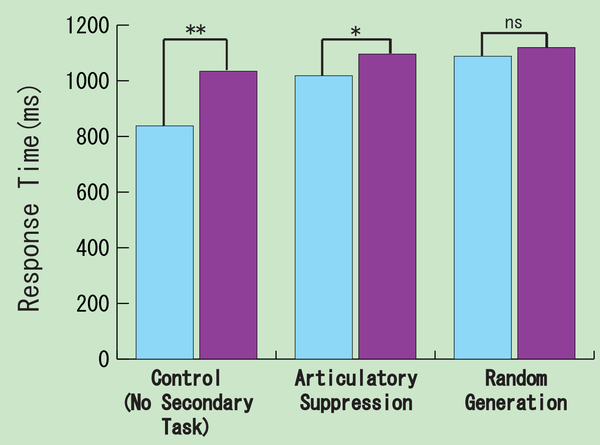
We investigated the mismatch effect in Zwaan et al.'s paradigm using dual task paradigm
●Random genaration: Saying random sequences of the number of 1-10 continuously; This task imposes heavy load on the central executive.
●Articulatory Suppression: Articulating the number 1 to 10 ascending order repeatedly; This task disrupts the operation of the phonological loop.
●Control(No secondary task): Reading only; No additional cognitive load.
☐ If image representations were constructed from LTM during reading, the executive load at reading would decrease or eliminate the mismatch effect.

## METHOD

☐ Participants: Female Japanese undergraduates were assigned to control (*N* = 20), articulatory suppression (*N* = 20), and random generation groups (*N* = 21).
☐ Material: 40 sentence-picture pairs. The two pictures in the given pair depicted different shapes of the same object mentioned in the sentences. There were also 20 filler pairs, in which pictures were unrelated to the sentences.
☐ Design: 3 (secondary tasks: control vs. articulatory suppression vs. random generation) x 2 (condition: match vs. mismatch) mixed design (The secondary tasks was between-participants factor).
☐ Procedure: Participants read a sentence her own pace, and then decide whether the pictured object had been mentioned in the sentence. The participants in articulatory suppression and random genaration groups were instructed to vocalize numbers in the assigned manner.

## RESULTS

### Response Time

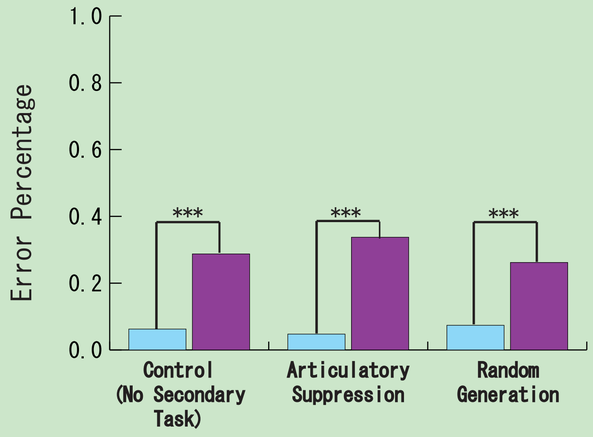



☐ The effect of condition was significant, $F$ (1, 58) = 15.69, $p$ < .001.
☐ The interaction between secondary task and condition was significant, $F$ (2, 58) = 3.65, $p$ = .03.

☐ Mismatch effect (mismatch RT - match RT):
- ● Control (No secondary task): 196.24 ms**
- ● Articulatory suppression: 77.64 ms*
- ● Random generation: 31.42 ms

☐ The executive demands diminished the mismatch effect in the paradigm. The simple repeat of articulation did not eliminate the effect entirely.

### Error Rate




☐ The condition was the only significant effect in error rates, $F$ (1, 58) = 98.09, $p$ < .001.
☐ There was no suggestion for a trade-off between Error rates and RTs.

## DISCUSSION

☐ The present results suggest that the heavy load on the central executive during reading disrupts the construction of the shapes of objects mentioned by the sentence.

☐ If readers had interpreted the pictures according to the sentences at response, they would have done so when they had been required any secondary tasks during reading. However, the results indicated that some tasks impair the strategy based on the interpretation of the sentences.

☐ The accesses to LTM during reading seemes to play a major role in mental representations like visual images.

☐ Readers might create mental images about the situation which is described by the text when they read it.

☐ The above conclusion depens on the assumption that
(a) random generation reflects the functioning of the central executive properly, and
(b) the executive involves the retrieval from LTM.
Although these assumptions were supported by recent findings (see Repovs & Baddeley, 2006, for a review), further research are needed in order to clarify the relationship between working memory components and mental imaging in text comprehension.

We thank Yumi KIKUCHI for generating materials and running the experiment.
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