

The Importance of Distinguishing Item and Order Memory for Understanding Short-Term Memory Deficits in Brain-Damaged Patients

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Recent models of STM distinguish processes involved in the retention of item information (i.e., the identity of words) and order information (the order of presentation of words) (e.g., Burgess & Hitch, 2006). In these models, STM for item information is thought to depend upon activation of the language system. By contrast, STM for order information is considered to recruit a specific system, distinct from the language system. Here we provide neuropsychological support for this position, by presenting the first double dissociation between item STM and order STM deficits.

Aim

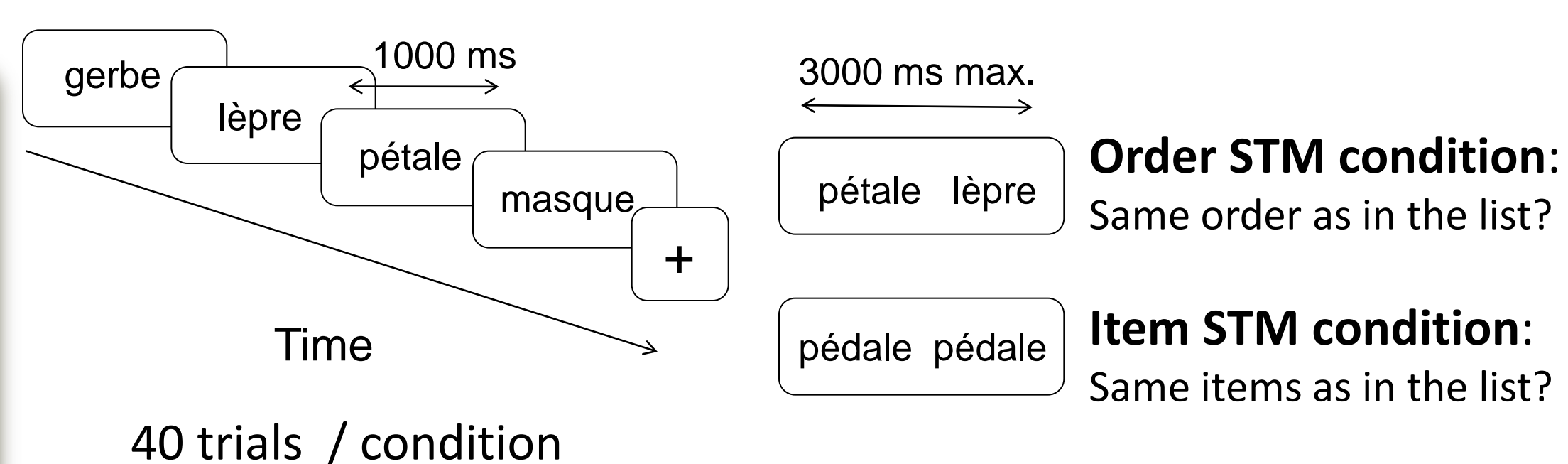
- To explore item STM and order STM capacities in two brain injured patients presenting initially with aphasia.
- To explore the impact of item and order STM deficits on the learning of new verbal sequences.

Participants:

- Patient MB suffered from a CVA. He showed mild receptive phonological impairment and reduced word and digit spans.
- Patient CG suffered from TBI. He was initially anomic; at the time of this study, he showed reduced word and digit spans but no residual language impairment.
- Control group : healthy adults matched for age and profession (N=10 for each of the two groups).

Materials :

Experiment 1: Item and order probe recognition



Experiment 2: Item and order errors in immediate serial recall

- Immediate repetition of word lists of increasing length (2 to 7 words).
- The proportion of item and order errors was determined.

Experiment 3: Serial order reconstruction

- Auditory presentation of digit lists of increasing length (3-8).
- After presentation, cards with the digits printed on them are handed out and have to be arranged as a function of the digits' order of presentation.

Experiment 4: Verbal learning

- Paired associate word-nonword learning task.
- 4 bisyllabic nonwords to be learned.
- 5 learning trials.

Results :

Experiment 1: Item and order probe recognition

- Patient MB: Impaired item recognition
- Patient CG: Slowed order recognition

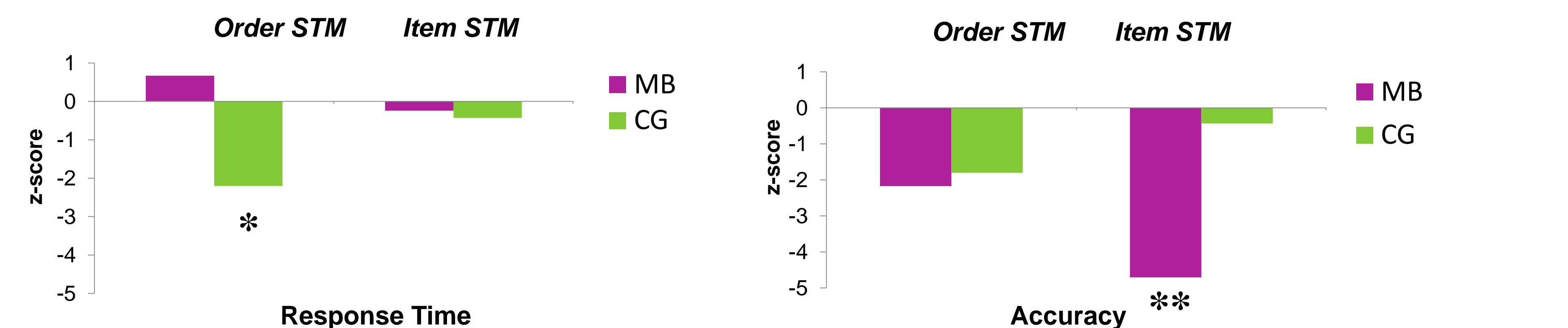


Figure 1. Patient Z-scores for response times and recognition accuracy and in the item and order probe recognition task.

Experiment 2: Item and order errors in immediate serial recall

- Patient MB: Increased rate of item errors; preserved order recall
- Patient CG: Increased rate of order errors; preserved item recall



Figure 2. Patient Z-scores for error proportions in immediate serial recall.

Experiment 3: Serial order reconstruction

- Patient MB: Preserved order recall
- Patient CG: Impaired

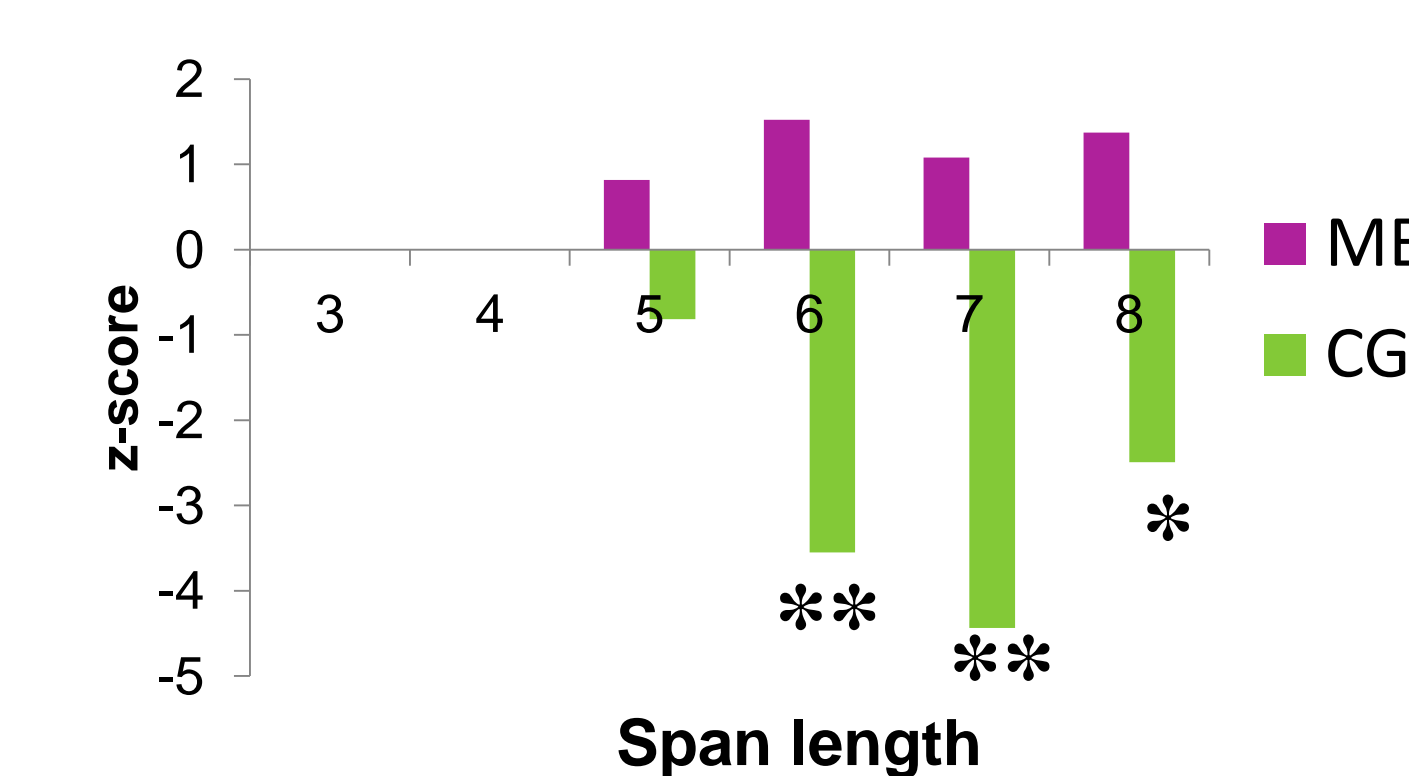


Figure 3. Patient Z-scores for accuracy as a function of list length in the serial order reconstruction task.

Experiment 4: New verbal sequence learning

- Patient MB: Impaired
- Patient CG: Impaired

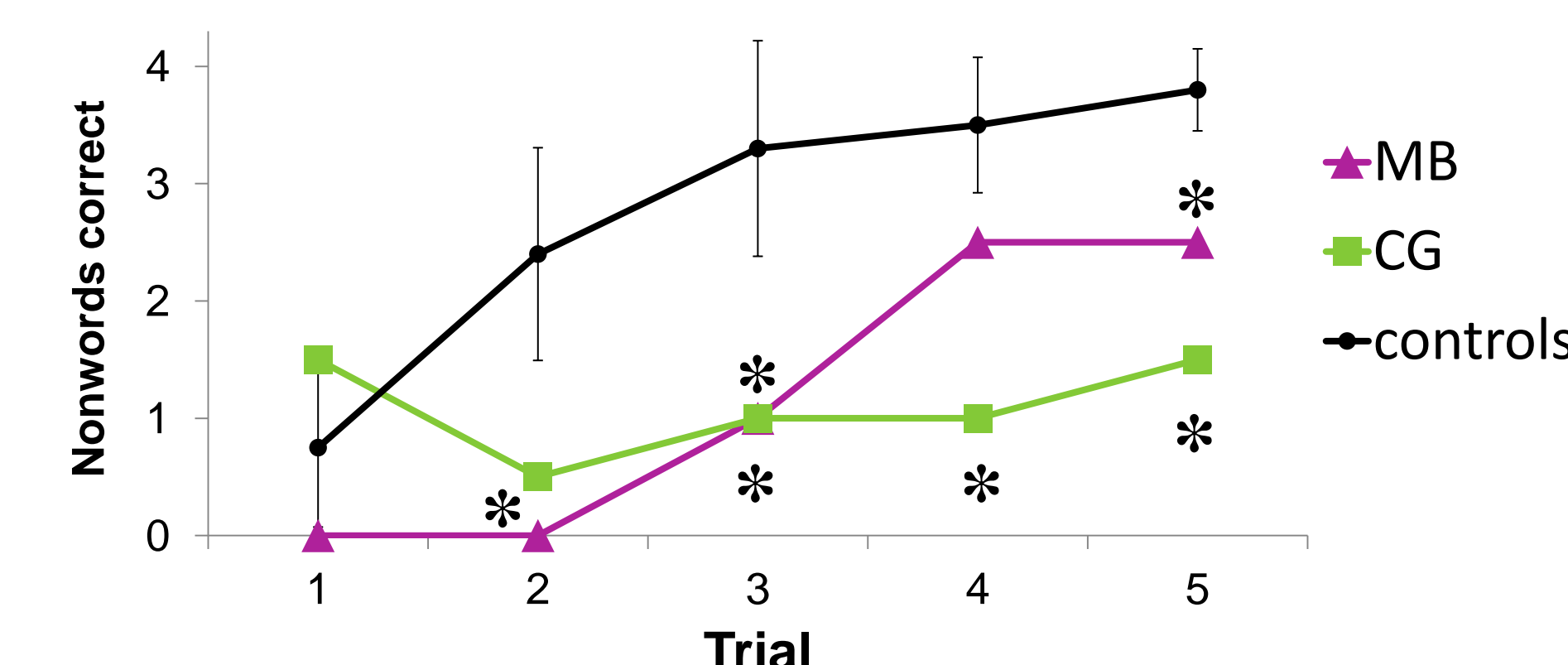


Figure 4. Learning curves for the word-nonword paired associate learning task.

Discussion

- This case study demonstrates the first double dissociation between item and order retention capacities in STM.
- In MB, a specific item STM impairment is associated with residual language impairment. This is in line with current STM models that treat language processing as a major determining factor of item STM performance (e.g., N. Martin & Saffran, 1992; Majerus & D'Argembeau, 2011).
- CG shows selective impairment of STM for order, associated with new word learning difficulties, as supported by recent models considering that order STM capacity is a fundamental building block of new word learning (Gupta, 2003; Majerus & D'Argembeau, 2011).

→ Selective verbal STM deficits reflect distinct types of impairment.

References

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