Contributions of long-term memory to age-related increases in visuo-spatial working memory performance

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Introduction

Question : Does long-term memory contribute to the development of visuo-spatial working memory?

Assumptions: (1) older children have acquired more knowledge about structural features in their environment than younger children.
(2) visuo-spatial knowledge contributes to the performance on visuo-spatial working memory tasks: 'chunking'.

Prediction: Knowledge about structural features will be used especially by older children in order to remember visuo-spatial stimuli.

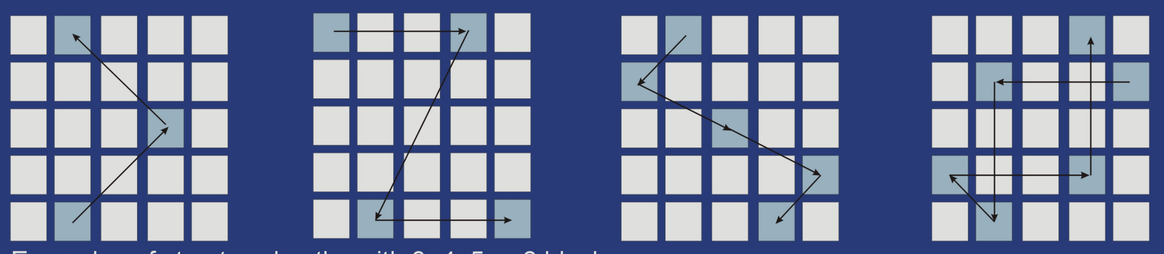
Expectation: The discrepancy in visuo-spatial working memory performance between structured and unstructured stimuli should grow larger with age.

→ **We expect an age x structure interaction.**

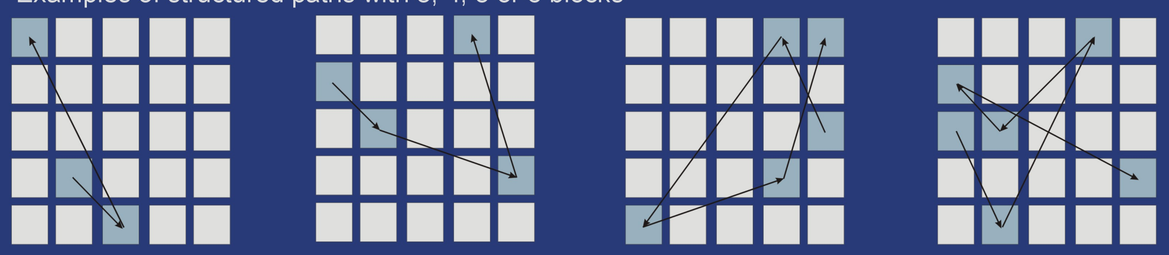
Method

Participants: children, adolescents and adults of 9, 11, 13, 15, 17 and 19 years old (twelve in each age group).

Material: Corsi Blocks Task with structured and unstructured paths (based on Gestalt principles: continuation, repetition, and symmetry; Kemps, 2001).



Examples of structured paths with 3, 4, 5 or 6 blocks



Examples of unstructured paths with 3, 4, 5 or 6 blocks

Results

Analysis on the absolute performance: **Trial-length**

Age (6) x Structure (2) x Trial-length (6) ANOVA

- Main effects of Age, Structure, and Trial-length.
- Interaction **Age x Structure**: the effect of structure augments as a function of age (graph 1).
- Interaction **Structure x Trial-length**: the benefit of structure grows with trial-length.
- Interaction **Age x Structure x Trial-length**: is the age x structure interaction biased by trial-length?

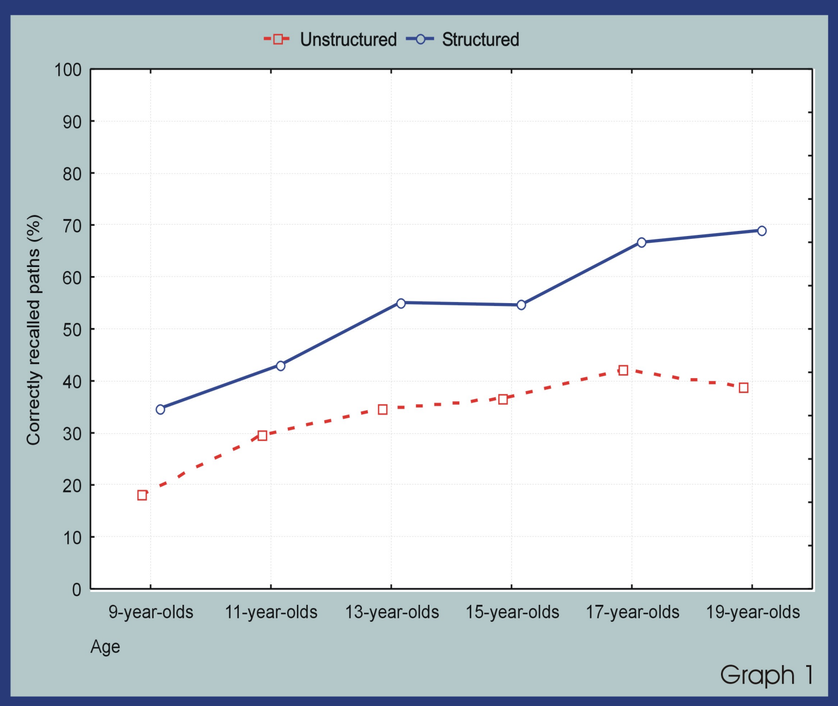
→ Analyses on the relative performance.

Analysis on the relative performance: **Span-level**

For each participant, the age-related, individual memory span was calculated, and also the span-1 and span+1.

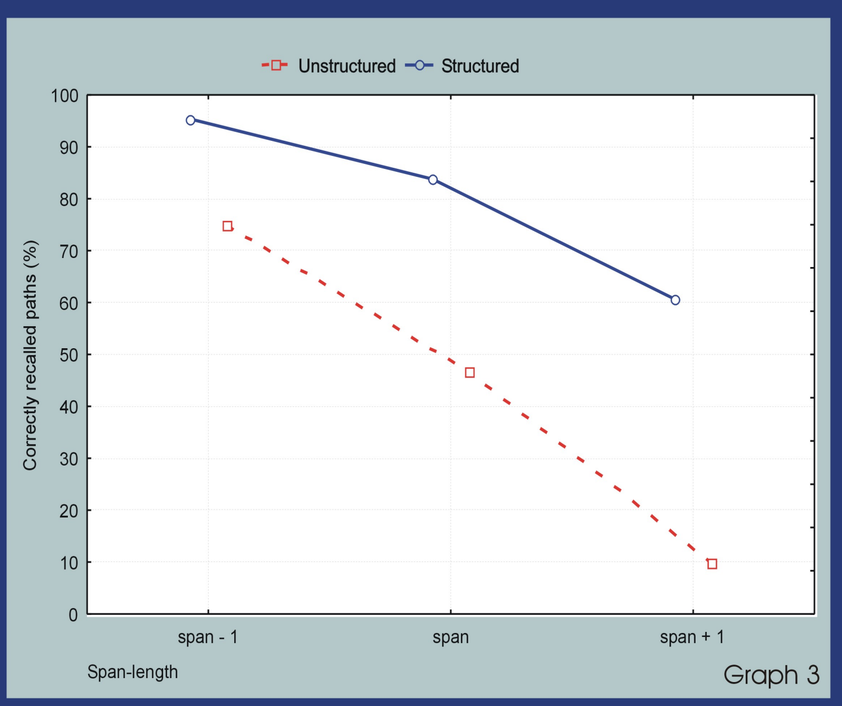
Age (6) x Structure (2) x Span-level (3) ANOVA

- Main effects of Structure and Span-level.
- No main effect of Age: possible confound is excluded.
- Interaction **Age x Structure**: the effect of structure augments as a function of age (graph 2).
- Interaction **Structure x Span-level**: the benefit of structure grows with span-level (graph 3).



Graph 1

Graph 2



Graph 3

Conclusions

Long-term knowledge about visuo-spatial features plays an important role in the development of visuo-spatial working memory. Older children perform better than younger ones, and this difference is most apparent on structured stimuli. Even when the working memory task is within the range of their individual processing capacity, younger children make less use of the presented structure than older children.

References

Kemps, E. (2001). Complexity effects in visuo-spatal working memory: Implications for the role of long-term memory. *Memory, 9, 13-27.*
Gathercole, S.E., & Pickering, S.J. (2000a). Assessment of working memory in six- and seven-year old children. *Journal of Educational Psychology, 92, 377-390.*
Gathercole, S.E., & Pickering, S.J. (2000b). Working memory deficits in children with low achievements in the national curriculum at 7 years of age. *British Journal of Educational Psychology, 70, 177-194.*

Implications

Interaction long-term memory - working memory

Working memory promotes the development of long-term memory (Gathercole & Pickering, 2000a, 2000b); and stored knowledge promotes the development of a well functioning working memory (this study).

Sensitivity to cognitive stimulation

Cognitive stimulation turns out to be very useful in learning situations, and especially when the processing capacity of the child is challenged.