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Aspects of complexity in visual–spatial working memory: indication for the application of strategies?

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Abstract Visual-spatial working memory is commonly assumed to consist of two systems: One for spatial-dynamic information and one for visual-static information. Four experiments were carried out to disentangle aspects of complexity in visual-spatial working memory using the Corsi Block Test and the Matrix Task. In Experiment 1 adult subjects were asked to memorize Corsi-sequences and Matrix-patterns of different complexity each consisting of a fixed amount of items. Results show that complexity in the Corsi Test is defined by the absolute length of the sequence-path, the number of path crossings and the number of blocks that were crossed by the imagined path but actually not involved in the sequence. Additionally it was found that sequences which form a path on basis of Gestalt criteria are easier to remember. Complexity in the Matrix Task is defined by the degree of symmetry of the pattern and the possibility to integrate items to an overall structure. Based on these findings a span procedure for both tasks was constructed in Experiment 2. Aspects of complexity were found to be relevant in both tasks, showing that complexity lowers the overall span in visual and spatial working memory. Experiment 3 investigated the role of visual and spatial complexity in children aged from 6 to 10 years by using the span procedures of Experiment 2. Results reveal reliable complexity effects within the Corsi and the Matrix Task across all age groups. Next to clear age effects, different developmental trends were found for the visual-static and the spatial-dynamic task. In Experiment 4 the serial demand within the Corsi Tasks was examined by varying the speed given to encode spatial location: Adult subjects had to memorize sequences consisting of a fixed amount of blocks. Next to the aspects of complexity the presentation time for the sequences was varied. The memorization of easy sequences was not influenced by the reduction of presentation time, whereas memory for complex sequences showed a significant decline. Generally our findings indicate that the processing demand of visual-static and spatial-dynamic information varies with task complexity. Particularly the application of strategies, like spatial rehearsal or chunking, seems to be influenced by different aspects of complexity. The fact that this effect can be found in younger children points towards an early acquisition of visual-spatial strategies. Serial demands within the Corsi Task are not yet clear, but it can be assumed that they play an important role in the processing of spatial-dynamic information.

Keywords Visual-spatial working memory · Complexity · Strategy

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