

Exploring Shared Mechanisms of Feature Binding and Visuoconstructional Ability

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This study explored whether visuoconstructional abilities are associated with visual short-term memory (VSTM) binding processes in adolescents. Findings demonstrated significant relationships between VSTM binding accuracy and performance on visuoconstructional tasks, suggesting that visual feature integration may represent a shared neurocognitive mechanism relevant across both developmental and neurodegenerative contexts.

INTRODUCTION		METHODS	KEY FINDINGS
• Visuoconstructional ability involves integrating multiple visual features into coherent spatial representations. • Contemporary models of working memory suggest overlap between visuoconstruction and visual short-term memory (VSTM) binding processes. • VSTM binding refers to the temporary integration of object features (e.g., colour, shape, location). • Binding impairments appear to be sensitive markers of early cognitive decline in Alzheimer’s disease. • However, the relationship between VSTM binding and visuoconstructional performance during typical development remains poorly understood.	Figure 1: Example of a visual array similar to that used in the VSTMBT, showing multiple coloured shapes presented simultaneously for encoding.	Participants • N = 43 adolescents • Mean age: 14.2 years (range = 11 to 18 years) • 44% female (n = 19) Measures Participants completed: • <i>Visual Short-Term Memory Binding Test (VSTMBT)</i>. Binding accuracy (% correct recognition) was used as an outcome. • <i>Wechsler Intelligence Scale for Children – Fifth Edition (WISC-V)</i>. <i>The Block Design, Visual Puzzles, and Full Scale IQ</i> were used as outcomes. Analyses Correlation analyses examined associations between VSTMBT binding accuracy and performance on the WISC-V subtests measuring visuospatial construction.	• Significant positive associations were identified between VSTM binding accuracy and visuoconstructional performance on both Block Design ($r = 0.41, p = 0.004$) and Visual Puzzles ($r = 0.39, p = 0.038$). • These relationships remained significant after controlling for Full Scale IQ, suggesting that associations were not solely attributable to general intellectual ability. • Findings support the view that visuoconstructional tasks engage cognitive processes related to visual feature integration and visual short-term memory (VSTM) binding. • VSTM binding may develop along a trajectory similar to other visuospatial abilities and may help explain why visuoconstructional deficits are among the earliest cognitive changes observed in Alzheimer’s disease. • These results may contribute to theoretical models linking working memory binding and visuospatial construction, while highlighting the need for further research across neurotypical, neurodivergent, and neurodegenerative populations to inform the development of sensitive early cognitive markers for dementia.

Figure 2: The WISC-V assessment battery