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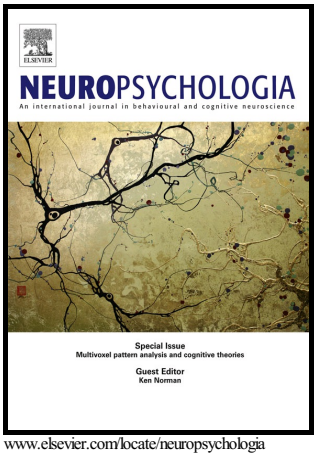

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The role of right frontal brain regions in integration of spatial relation

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Abstract

Previous studies have explored the neural mechanisms of spatial reasoning on a two-dimensional (2D) plane; however, it remains unclear how spatial reasoning is conducted in a three-dimensional (3D) condition. In the present study, we presented 3D geometric objects to 16 adult participants, and asked them to process the spatial relationship between different corners of the geometric objects. In premise-1, the first two corners of a geometric shape (e.g., A vs. B) were displayed. In premise-2, the second and third corners (e.g., B vs. C) were displayed. After integrating the two premises, participants were required to infer the spatial relationship between the first and the third corners (e.g., A and C). Finally, the participants were presented with a conclusion object, and they were required to judge whether the conclusion was true or false based on their inference. The event-related potential evoked by premise-2 revealed that (1) compared with 2D spatial reasoning, 3D reasoning elicited a smaller P3b component, and (2) in the right frontal areas, increased negativities were found in the 3D condition during the N400 and late negative components (LNC). These findings imply that higher brain activity in the right frontal brain regions were related with the integration and maintenance of spatial information in working memory for reasoning.

Keywords: relation integration, spatial reasoning, P3b, N400, LNC