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Event-related potentials of single-digit addition, subtraction, and multiplication.

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Source

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Abstract

This study compared the event-related potentials elicited by single-digit addition, subtraction, and multiplication problems. With a delayed verification paradigm, 18 Chinese undergraduates were first asked to solve the arithmetic problems that were presented visually for 200 ms and, after 1.5 s, to judge whether a presented solution was correct or not. Results showed that, compared to addition and subtraction, multiplication elicited a greater N300 at the left frontal electrodes peaking around 320 ms (in the interval between 275 and 334 ms after the onset of the arithmetic problem). To control for the confounding effects of task difficulty and solution size, comparisons were further made between "large" addition problems (with sums between 11 and 17) and "small" multiplication problems (with products between 6 and 24). Similar results were obtained (i.e., a significant difference between addition and multiplication in the N300 component between 296 and 444 ms). Source analyses demonstrated that a single dipole in the left anterior brain areas could have contributed to the topographies of the difference waveforms ("multiplication-addition", "multiplication-subtraction", and "'small' multiplication-'large' addition"). These results are interpreted in terms of the greater reliance on phonological processing for the retrieval of multiplication facts than for the retrieval of addition and subtraction facts.

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