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Neural networks involved in mathematical thinking: evidence from linear and non-linear analysis of electroencephalographic activity.

Micheloyannis S, Sakkalis V, Vourkas M, Stam CJ, Simos PG.

Source

Medical Division (Laboratory L.Widén), University of Crete, 71409 Iraklion/Crete, Greece. mixelogj@med.uoc.gr

Abstract

Using linear and non-linear methods, electroencephalographic (EEG) signals were measured at various brain regions to provide information regarding patterns of local and coordinated activity during performance of three arithmetic tasks (number comparison, single-digit multiplication, and two-digit multiplication) and two control tasks that did not require arithmetic operations. It was hypothesized that these measures would reveal the engagement of local and increasingly complex cortical networks as a function of task specificity and complexity. Results indicated regionally increased neuronal signalling as a function of task complexity at frontal, temporal and parietal brain regions, although more robust task-related changes in EEG-indices of activation were derived over the left hemisphere. Both linear and non-linear indices of synchronization among EEG signals recorded from over different brain regions were consistent with the notion of more "local" processing for the number comparison task. Conversely, multiplication tasks were associated with a widespread pattern of distant signal synchronizations, which could potentially indicate increased demands for neural networks cooperation during performance of tasks that involve a greater number of cognitive operations.

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