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# Patterns of brain rhythms at performing cognitive tasks with gradually changing properties

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## Abstract

This study was designed to investigate the relationships between brain rhythms, mental activity and individual human differences. Our recently obtained results demonstrate that performing mental tasks in mind is accompanied with an establishment of certain rhythmical patterns in subject's EEG. If a task being performed in mind implies using both modes, a mixed rhythmical pattern is observed, which possesses the properties of both. To understand how EEG signs of thinking modes change throughout smooth transformation of one mode into another, a line of tasks with gradual changes in spatial and verbal thinking involvement was designed. Specifically, six task types were elaborated, each containing 60 stereotyped tasks presented to 30 healthy subjects while their EEG was recorded. After that we realized that some tasks required imagination of objects rather than spatial thinking. This mistake led us to an interesting result. We introduced a measure of 'distance' between EEG rhythmical patterns (pertinent to different mental conditions) as a statistically calculated index of difference between appropriate power spectra. We then plotted task types as circles on a plane in a way that approached distances between them as closely as possible to measured 'distances' between rhythmical patterns. On such plots we could see that circles did not lie on a straight line connecting two outmost thinking conditions – purely verbal and purely spatial. Instead, circles formed a two-dimensional structure spanned over two axes: 'verbal-spatial' and 'pictorial-abstract'. Thus, quantitative characteristics of EEG rhythmical patterns form a continuum that reflects a continuum of different types of cognitive activity.

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