Spatiotemporal dipole models for brain electrical potentials evoked by different spatial frequencies

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Grating onsets generate electrical brain responses with spatial distributions that indicate activation of the striate and extrastriate cortex for high and low spatial frequencies respectively (instantaneous electrical source analysis; Kenemans et al., 2000). To decrease overlap between electrical potentials originating from one or more ipsilateral and contralateral sources we studied the effect of hemifield stimulus presentation, next to full-field. Checkerboard stimuli with spatial frequencies of 0.53 (low), 1.06 (middle) and 4.25 (high) cycles per degree were presented to 10 participants. Furthermore, in stead of analyzing the largest early ERP peak (SFD80) instantaneously, we fitted spatiotemporal source models. That is, a small number of equivalent dipole sources with time-varying moments was used to describe the recorded data. Spatiotemporal source analysis of checkerboard evoked responses indicated that regardless of spatial frequency first the contralateral extrastriate cortex was activated, next the contralateral striate and finally the ipsilateral striate cortex. With full-field stimulation bilateral extrastriate activity was followed by bilateral striate activity. Furthermore, we extended the latency-of-best-fit test procedure (Kenemans et al., 2002) from instantaneous to spatiotemporal dipole models. This procedure involves the estimation of individual spatial and temporal source parameters, starting from the grand average dipole solution. In a next step these parameters are statistically analyzed by MANOVA. Results of such analysis confirm the above observations. They furthermore revealed that contralateral striate cortex was activated more by high than by low spatial frequencies. We will discuss the relationship between the present spatiotemporal and previous instantaneous source models.
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