Target detection through a visual oddball task: a combined ERP-fMRI study

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Abstract

Detection of infrequent target stimuli evokes a widespread neural activity reflected in both electrophysiological and hemodynamic measures. In the classical "oddball task", participants have to identify infrequent target stimuli within a monotonous series of rapidly presented, similar stimuli. The popularity of this task is a direct result of its success in evoking robust and reliable responses that are deemed markers of various cognitive functions. On the one hand, rare visual targets elicit in ERP studies a posterior N2 component, related to the orientation of attention, which precedes a parietal P3 component, referring to cognitive contextual integration. On the other hand, despite the oddball task's simplicity, fMRI data have shown that processing of even simple cognitive tasks is associated with widespread activation in all brain areas potentially involved in the rapid evaluation and processing of the stimuli. However, due to poor spatial resolution, localizing generators of ERP components is still uncertain, and fMRI alone do not present the temporal resolution needed to segregate the neural sources underlying an N2 versus a P3 component in the oddball task. To solve this discrepancy, we scanned 16 participants using a combined ERP-fMRI recording during a visual oddball task in which they had to detect 3 types of deviant faces (representing a change in emotion -fear or happiness- or in identity) within a series of frequent neutral faces. Results show that constraining fMRI analyses by ERP data (N2 versus P3) provides novel evidence for specific neural networks underlying specific cognitive-related electrophysiological responses to deviant stimulations

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