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Article *in* Journal of Physics Conference Series · November 2014

DOI: 10.1088/1742-6596/546/1/012003

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2014 J. Phys.: Conf. Ser. 546 012003

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Brain activation in response to randomized visual stimulation as obtained from conjunction and differential analysis: an fMRI study

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Abstract. The objective of this multiple-subjects functional magnetic resonance imaging (fMRI) study was to identify the common brain areas that are activated when viewing black-and-white checkerboard pattern stimuli of various shapes, pattern and size and to investigate specific brain areas that are involved in processing static and moving visual stimuli. Sixteen participants viewed the moving (expanding ring, rotating wedge, flipping hour glass and bowtie and arc quadrant) and static (full checkerboard) stimuli during an fMRI scan. All stimuli have black-and-white checkerboard pattern. Statistical parametric mapping (SPM) was used in generating brain activation. Differential analyses were implemented to separately search for areas involved in processing static and moving stimuli. In general, the stimuli of various shapes, pattern and size activated multiple brain areas mostly in the left hemisphere. The activation in the right middle temporal gyrus (MTG) was found to be significantly higher in processing moving visual stimuli as compared to static stimulus. In contrast, the activation in the left calcarine sulcus and left lingual gyrus were significantly higher for static stimulus as compared to moving stimuli. Visual stimulation of various shapes, pattern and size used in this study indicated left lateralization of activation. The involvement of the right MTG in processing moving visual information was evident from differential analysis, while the left calcarine sulcus and left lingual gyrus are the areas that are involved in the processing of static visual stimulus.

1. Introduction

Since the discovery of blood oxygenation level dependent (BOLD) effects [1], fMRI has become a standard experimental technique in accessing brain activity, among others, in response to visual stimuli [2]. This technique allows there presentation of visual field in human occipital cortex to be studied non-invasively [3]. The fMRI technique is also suitable for studying the properties of the visual area of subjects suffering from ocular abnormalities [4].