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WORKING MEMORY PROCESSING OF VISUAL LOCATION AND COLOR

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Cognition & Attention

Abstract

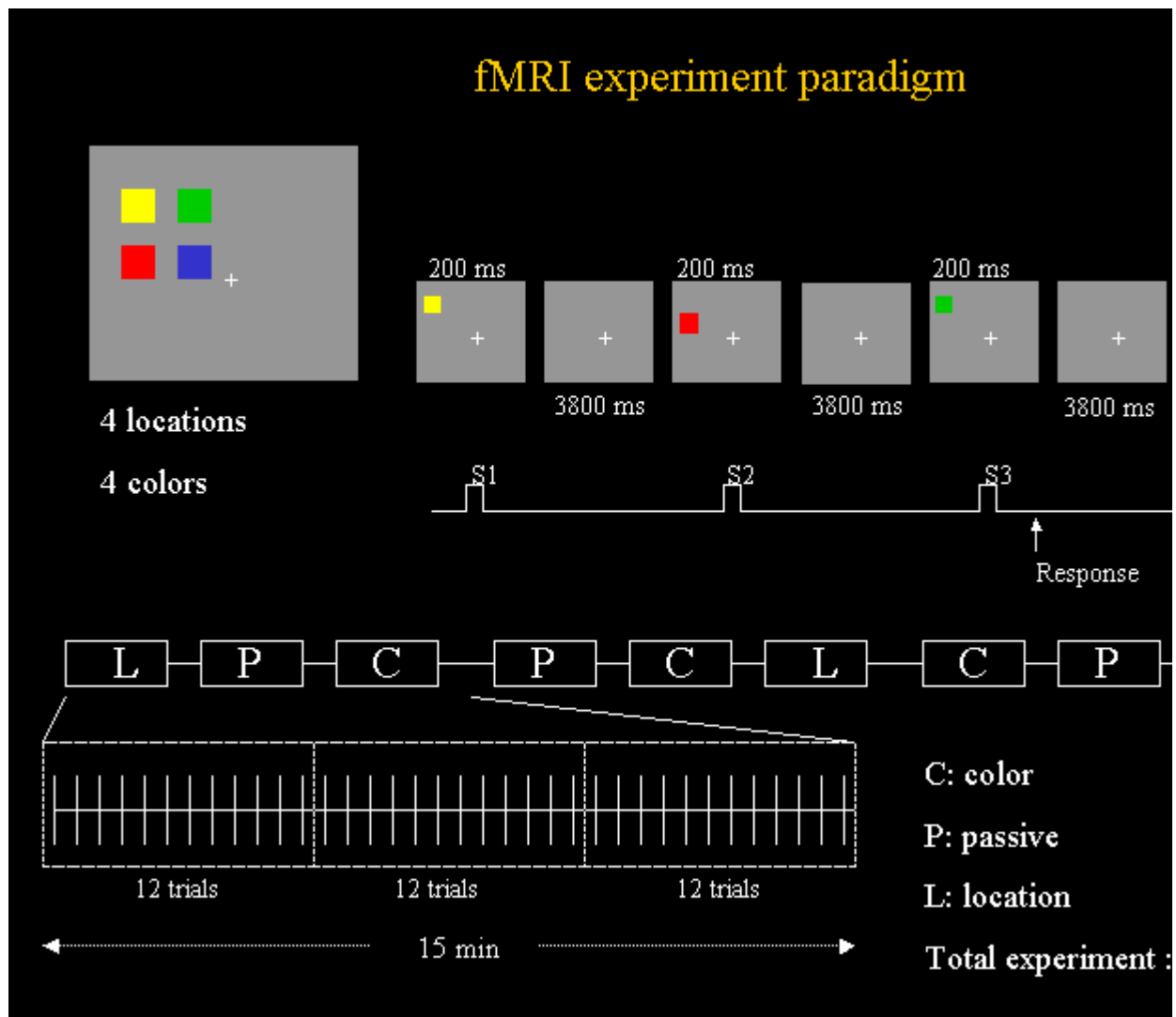
Introduction

Two parallel corticocortical pathways have been identified in visual information processing: the ventral object recognition stream conducting analysis of visuospatial and motion information [1]. However, the extent to which working memory processing of visual object and spatial information is carried out in a similarly segregated fashion remains unsettled [2, 3, 4]. We investigated the organization of visual working memory processing using colored stimuli in which either the color or location served as the working memory task performance.

Methods

Eleven healthy right-handed subjects participated in the fMRI study. The subjects performed color and location visual tasks. The visual stimuli were small colored squares (red, green, yellow or blue) presented in one of four possible locations: top-left, top-right, bottom-left, or bottom-right visual quadrant on a screen with a fixation cross in the middle. Color and location of the stimuli were randomly assigned. In the color task, subjects memorized either the color (color task) or location (location task) of the first two stimuli and, after the third stimulus, pressed the right button if the color (location in the location task) of the third stimulus matched the color (location in the location task) of the first stimulus. If they did not match the subject pressed the right button. In a passive viewing condition (control), the subject pressed the right button after the third stimulus regardless of the attributes of the stimuli (Fig. 1). Functional MRI was acquired in a 3T MRI system (SIEMENS, Erlangen, Germany) using an EPI gradient echo sequence.

The BOLD fMRI images from individual subjects were corrected for motion artifact and image intensity drifting followed by normalization onto a standardized coordinate system [5]. Images were spatially smoothed using an isotropic 3D Gaussian kernel with a FWHM of 3.125 mm. Hemodynamic responses (HDRs) were estimated using a General Linear Model [6] with the canonical hemodynamic response function constructed by convolving a 26-sec canonical HDR [7] temporally locked to stimulus onsets. We used a univariate t-test to generate statistical maps.



Results

Working memory processing of visual location and color activated a network of distributed cortical areas. Comparison location and control conditions revealed activation bilaterally in the superior frontal gyrus, left precuneus, right supran middle and inferior temporal gyri. Comparison between color and control conditions resulted in activation in the super gyri, right superior and left middle temporal gyri, left precuneus and posterior cingulate gyrus. Activation was also det inferior occipital gyrus. Comparisons between location and color conditions (location vs. color and color vs. location) r cortical areas of color and location processing. Location activated areas (more than color) in the right superior and mi right posterior parietal areas. Color activated areas (more than location) in the left precentral gyrus, right cuneus, left right superior temporal gyrus, and right lingual gyrus.

Conclusions

The present results suggest segregation between working memory processing of visual location and color information manual response was decided only on the presentation of the third stimulus, the task-related signal changes describe attention and working memory processing and are not biased by motor preparation or performance.

References

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