学 位 論 文 の 要 旨

氏名　福庭　栄治

学　位　論　文　名　Brain Activation During the Spot the Differences Game

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著　　者　　名　Eiji Fukuba, Hajime Kitagaki, Akihiko Wada, Kouji Uchida, Shinji Hara, Takafumi Hayashi, Kazushige Oda, Nobue Uchida

論 文 内 容 の 要 旨

INTRODUCTION

Detection of changes in what we are viewing, so-called change detection, is easy under normal circumstances, but it becomes difficult when transient disruption such as flicker disturbance occurs. This phenomenon is called change blindness by Rensink and colleagues. Supporting evidence that humans are very interested in change detection is provided by a game that has been popular all over the world since long before the discovery of change blindness, which is known as Spot the differences game. In this game, two pictures that are identical except for several features are placed side by side and the aim is to find all the differences between them. Functional activation of the brain while playing this game has not been investigated. We used functional magnetic resonance imaging to investigate the main cortical regions involved in playing this game.

MATERIALS AND METHODS

Eight healthy volunteers (6 men and 2 women aged 23 to 46 years; mean age: 29 years) were recruited for this study. All of the subjects were right-handed and had no history of neurological or psychiatric disorders or substance abuse. Subjects were presented with three sets of visual stimuli: a set of two identical stars located centrally, a set of two similar illustrations, and a set of two identical illustrations. Each individual presentation of these

stimuli was done for a 30 s block of a block-design paradigm. We compared the sites of cortical activation between a session of playing the game and a session of viewing two identical pictures and examined the relation between the sites of cortical activation and the accuracy (the number of detection / the total number of differences) of each subject in detecting differences.

RESULTS AND DISCUSSION

During the session of playing the game, significant activation was detected in the left middle occipital gyrus, the right superior parietal lobule, and the precuneus. Moderate activation was observed in the right middle and medial frontal gyri and the right cerebellar hemisphere.

During the session of viewing two identical pictures, there was significant activation in the bilateral lingual gyri, while moderate activation was observed in the right superior occipital gyrus, the superior parietal lobule, the middle occipital gyrus, the left precuneus, and the bilateral cerebellar hemispheres.

The accuracy of playing the game ranged from 41% to 76% for the eight subjects (mean accuracy: 57%). There was no correlation between age or sex and the accuracy of performance. The right posterior parietal cortex (PPC) showed more activation during a session of playing the game than in viewing two identical pictures and the cortical activation volume was positively correlated with accuracy in playing the game (Spearman's rank correlation coefficient, $r= 0.807$, $p=0.015$).

Generally, a good performer knows a special technique that may be associated with activation in a specific brain region. Because the key brain region for game performance should be significantly correlated with accuracy, we compared the accuracy of each subject in playing the game with the volume of the activated region in the right PPC. We found a significant positive correlation between the activation volume and accuracy. This means that the extent of activation in the right PPC is critical for game performance.

CONCLUSION

The right PPC is the site of brain activation related to visual awareness of changes after detection of the differences between two similar pictures and may play an important role in playing the Spot the differences game.