fMRI with 2-Dimensional and 3-Dimensional Visual Stimuli

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Synopsis

An fMRI with three-dimensional visual stimulation by anaglyph is investigated. Compared to conventional two dimensional visual stimulation, activated regions of the brain with three dimensional stimulations appear larger by more than 18%, which is probably due to more complicated processing involved in three dimensional perception.

Method

Stereoscopic vision is the basis of the three-dimensional human perception. With technology advances in display and computer graphics, various applications of three-dimensional vision have been under investigation, e.g., virtual reality, three-dimensional display, 3-D advertisement, etc. In this paper, we performed a preliminary study of 2-D and 3-D human vision by fMRI. For 3-D stimulation, anaglyph with red and blue colors is used. By using red (left) and blue (right) glasses, slightly different images are seen for the anaglyph, which makes one three dimensional perception. Experiments were performed with three volunteers for two anaglyphs and two conventional 2-D images. Visual stimulation with these images were applied in 6Hz. Gradient-echo based single-shot EPI images were obtained with repetition time of 2.5s. With a paradigm of rest(15)-active(10)-rest(10)-active(10)-rest(10), fMRI data were acquired. The fMRI data were analyzed by SPM. All the experiments were performed at a 3.0 Tesla whole body MRI system. Experimental conditions for 2-D and 3-D experiments were same except stimulation methods.

Results

Results of brain mapping with 2-D and 3-D stimulations are shown in Fig.1. As seen in Fig.1 activated regions by 2-D and 3-D stimuli appear similar, however, the areas of activated regions by 3-D stimulations are larger than those by 2-D stimulations (5 cases out of 6 experiments as seen in Table 1). Average increase of the areas by 3-D stimulation is more than 18%. This is partially due to more complicated processing involved in 3-D perception. Further experiments are needed in precise localization of human 3-D vision.

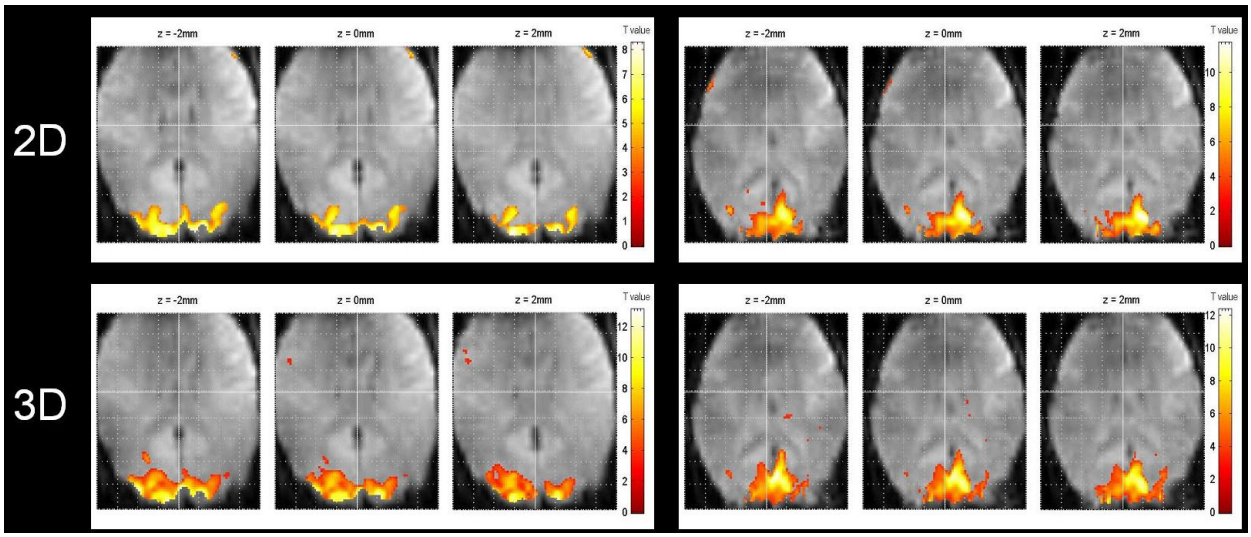

Fig.1 fMRI images with 2-D (top) and 3-D(bottom) visual stimulations.

Table 1 Number of activated pixels by 2-D and 3-D stimulations

Experiments	2-D stimulation	3-D stimulation	3-D/2-D
1	4285	6167	143%
2	3357	3833	114%
3	5074	6073	119%
4	5171	3953	76%
5	1570	2398	152%
6	5037	5372	106%