



Cortical Activation for Shape-in-Depth from Different Depth Cues

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Introduction

- Human observers may perceive depth from two types of cues: **binocular cue** and **monocular cue**.
- We investigated cortical responses to shape-in-depth constructed from **motion parallax**, **perspective cues**, and **disparity** among local elements with fMRI.

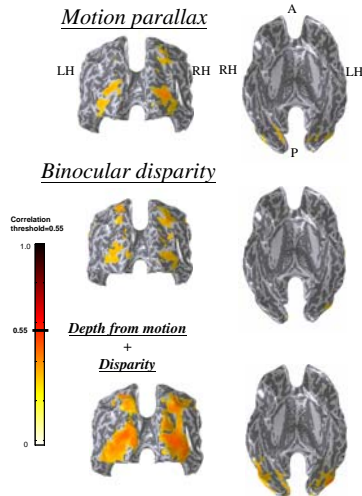
Method

- Block design with six 36s periods of a 18s test epoch alternating with a 18s control epoch.
- Color discrimination of fixation point for attention control.
- EPI sequence
- The BOLD activation were collected on a Bruker 3T magnet (TR=3s, TE=30ms, flip angle=90 degree).
- Eight observers in Exp. 1 and five observers in Exp 2.
- Voxel size: 3.75mm x3.75mm x 3mm

Experiment 1

Condition	Activated areas
Combined cues vs. No depth perception	ventral occipital lobe Middle occipital gyrus (MOG) Intra-occipital sulcus (IOS)
Combined cues vs. Binocular disparity	No significant activation
Combined cues vs. Motion parallax	No significant activation
Motion parallax vs. No depth perception	Left fusiform gyrus Right lingual gyrus Middle occipital gyrus (MOG) Intraparietal sulcus
Disparity vs. No depth perception	Middle occipital gyrus (MOG) Superior occipital gyrus Intra-occipital sulcus Angular gyrus (AG) at right hemisphere Intraparietal sulcus

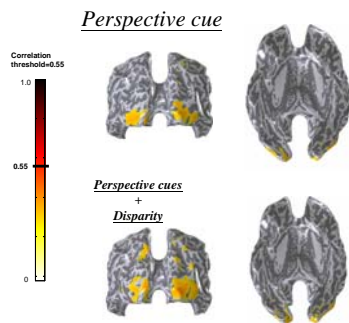
* Combined cues: (Motion parallax) + (Disparity)



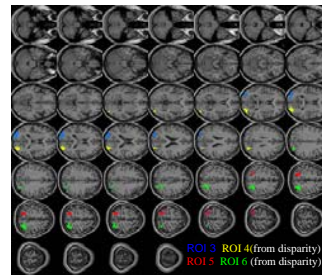
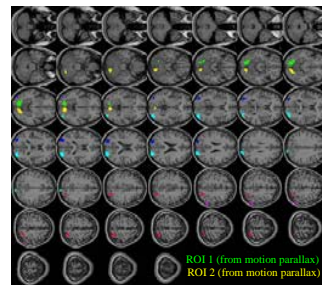
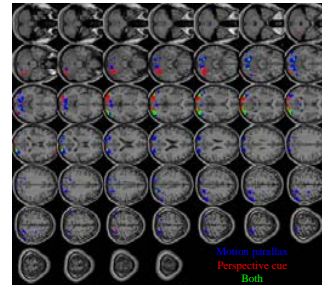
Experiment 2

Condition	Activated areas
Combined cues vs. No depth perception	Middle occipital lobe Middle occipital gyrus (MOG) Intra-occipital sulcus (IOS) Superior occipital gyrus Angular gyrus (AG) Intraparietal sulcus (IPS)
Combined cues vs. Binocular disparity	MOG in the left hemisphere
Combined cues vs. Perspective cue	No significant activation
Perspective cue vs. No depth perception	Left fusiform gyrus Right lingual gyrus Middle occipital gyrus (MOG) Intraparietal sulcus (IPS)

* Combined cues: Perspective cues + Disparity

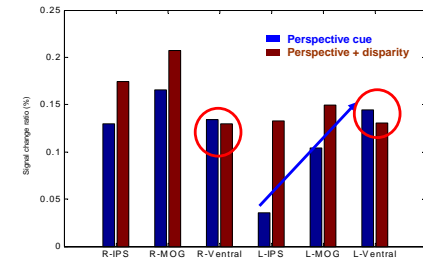
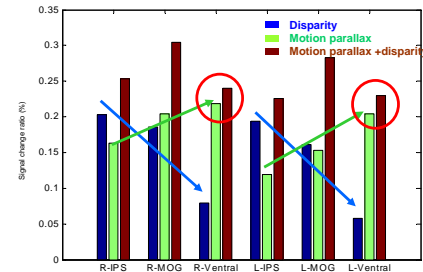


ROI & Signal Change

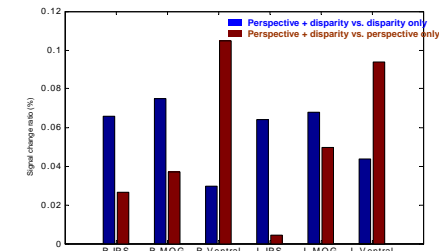
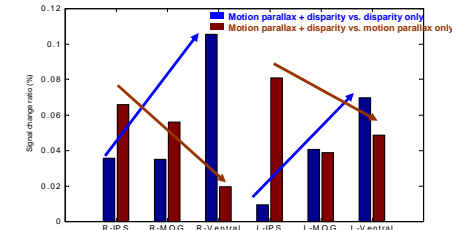


ROI 1	Left lingual gyrus, left fusiform gyrus
ROI 2	Right lingual gyrus, Right fusiform gyrus
ROI 3	Left MOG, IOG
ROI 4	Right MOG, IOG
ROI 5	Left IPS
ROI 6	Right IPS

Individual cue & combined cues



Individual cue under another cue context



Conclusion

- Compared with single depth cues, multiple depth cues increased activation in the MOG and IPS but not in the ventral occipital lobe.
- MOG and IPS responded to both binocular depth cue and monocular depth cue.
- The ventral occipital lobe responded only to monocular depth cues but not binocular cues.



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