

Representation of the ipsilateral visual field in early retinotopic cortex

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Introduction

Representation of the ipsilateral visual field

- Early visual areas represent the contralateral visual field
- At higher levels of the visual hierarchy, neurons with receptive fields that cross the midline are found
- Trans-callosal fibers connect extrastriate areas (e.g., V4; Desimone et al., 1993)
- The portion of the visual field that is close to the vertical meridian also has an ipsilateral representation (Tootell et al., 1998)

Ipsilateral recruitment following cortical lesion

- In motor and language modalities, there is evidence for recruitment of the contralesional hemisphere in recovery of function
- Increased visual cortex responses to the ipsilateral visual field have been found in the intact hemisphere following visual cortex lesion (Nelles et al., 2002)
- The "unaffected" visual field has reduced spatial and contrast sensitivity following a cortical lesion (Hess et al., 1989)

PURPOSE: Characterize the extent and organization of representation of the ipsilateral visual field in early visual areas using fMRI

Methods

Retinotopic mapping

- All reflective surfaces within scanner bore and head coil covered with black cloth and matte tape to minimize extraocular scatter $% \left({\left[{{{\rm{A}}} \right]_{\rm{A}}} \right)_{\rm{A}}} \right)$
- Retinotopic mapping stimuli presented to a single hemifield during each scan
- Subjects performed a fixation task at one edge of screen
- Five subjects completed retinotopic mapping studies
- Three of these subjects also completed control experiments

Data analysis

- Scans with visible motion artifact removed
- Amplitude and phase of responses modeled with Fourier components
- BrainVoyager used for cortical inflation and flattening
- Borders of visual areas defined by phase reversals on polar angle map





Results

Stimulation, along with null-trials, provided to each quadrant in a pseudo-random order while subjects maintained central fixation Within each visual area, voxels with a significant

response to the contralateral / contraaltidunial quadrant were identified.

The % signal change in those voxels in response to stimulation in other quadrants was obtained.

The average response across regions, hemispheres and subjects was obtained.

Significant negative responses found for stimulation in the ipsilateral visual field.



Diff hemifield

Diff altitude







		Within 3 deg from the vertical meridiar		Over 3 deg away from the vertical meridian	
Visual Field	Visual Area	% Significant Vertices (SD)	% Signal ∆ (SD)	% Significant Vertices (SD)	% Signal ∆ (SD)
Contralateral	V1	37 (12)	0.8 (0.1)	27 (8)	0.8 (0.1)
	V2V3d	60 (7)	0.8 (0.1)	19 (8)	0.7 (0.1)
	V2V3v	41 (9)	0.8 (0.1)	34 (8)	0.8 (0.2)
	V4	35 (9)	0.7 (0.2)	14 (9)	0.6 (0.2)
Ipsilateral	V1	6 (7)	0.5 (0.1)	5 (3)	0.6 (0.2)
	V2V3d	12 (12)	0.5 (0.1)	2 (3)	0.5 (0.1)
	V2V3v	4 (4)	0.4 (0.1)	1 (1)	0.4 (0.1)
	V4	7 (7)	0.4 (0.1)	0 (1)	0.4 (0.1)



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