

Primary Visual Cortex is Active in Response to Stimulation of Phenomenally Blind Areas of the Visual Field in Patients with Cortical Blindness

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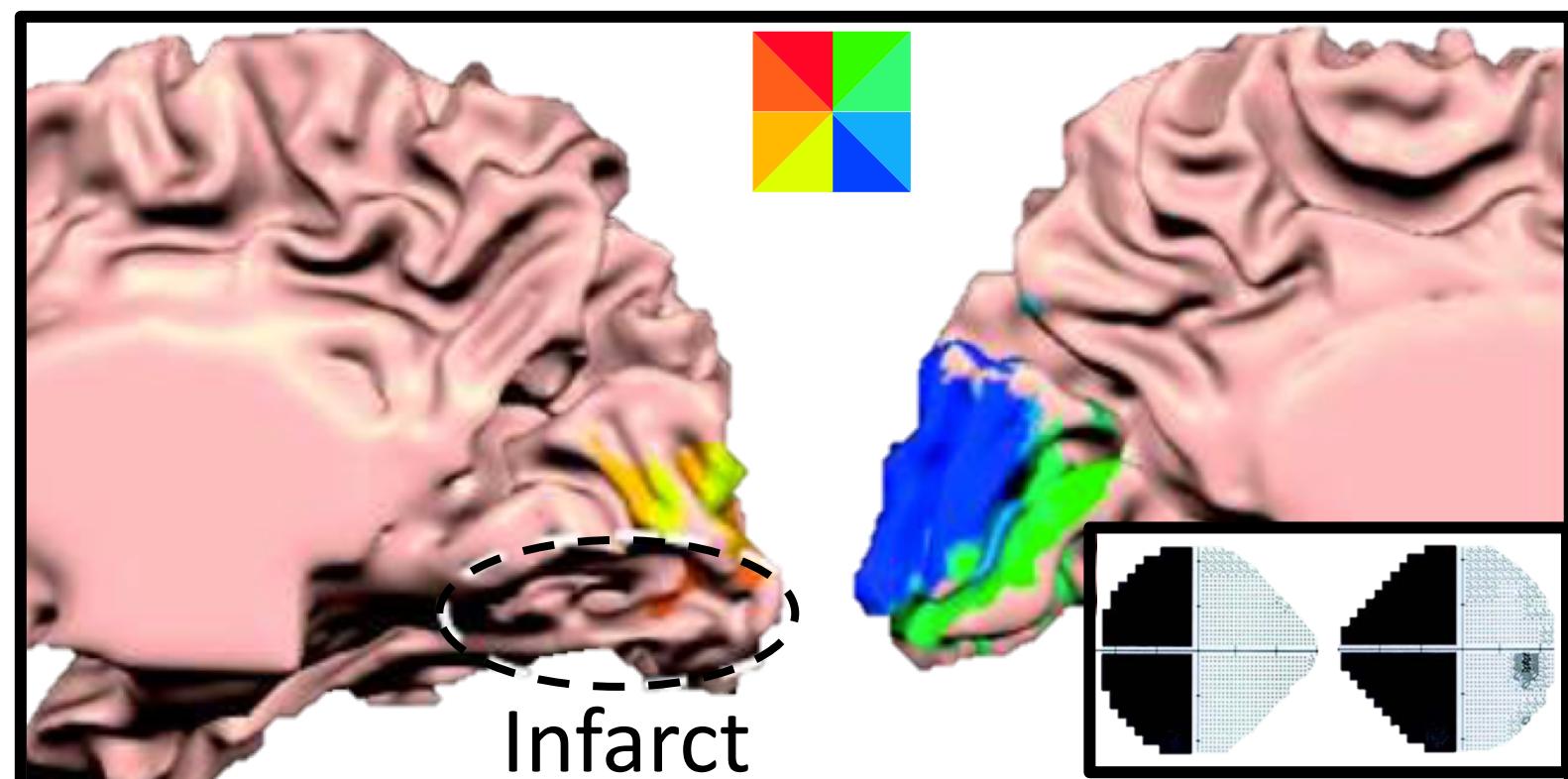
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Background

Geniculostriate pathway lesions disrupt vision in the contralateral visual hemifield. Loss of tissue may not be the only cause of cortical blindness from these lesions. Careful inspection of previous functional MRI (fMRI) studies of patients with visual field defects reveals numerous cases of blind areas of the visual field with a preserved V1 response to stimulation ('blind voxels')¹⁻⁸.

From Ho et al., 2009



Here we describe the characteristics of blind voxels in stroke patients with homonymous visual field defects. We compared visual cortex activity (fMRI) with visual sensitivity (perimetry) in chronic stroke patients with cortical blindness.

References:

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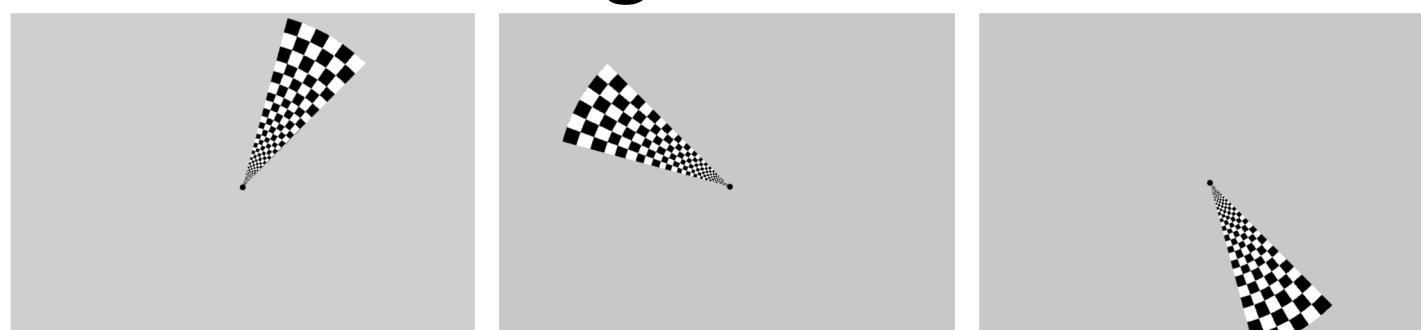
Methods

Subjects: 13 chronic stroke patients with homonymous visual field cuts

Measures:

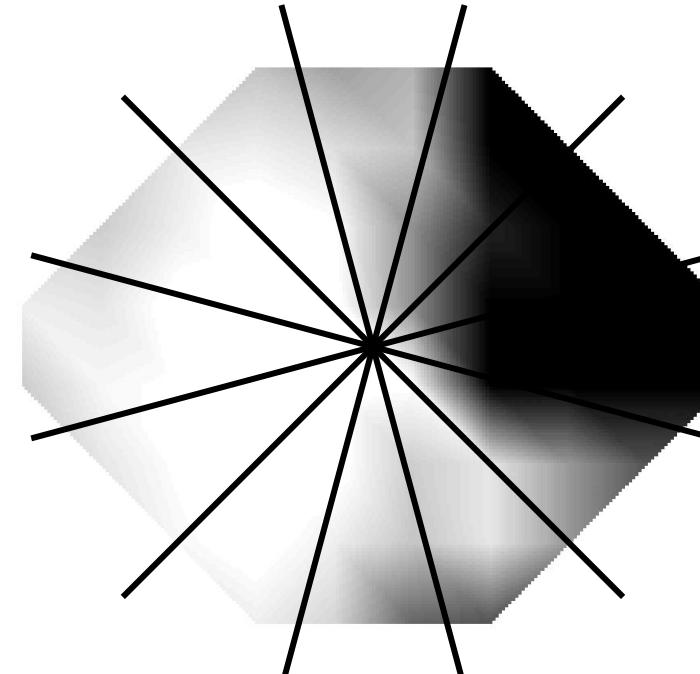
Functional MRI - TR = 2.2s

Polar Angle – 2 runs

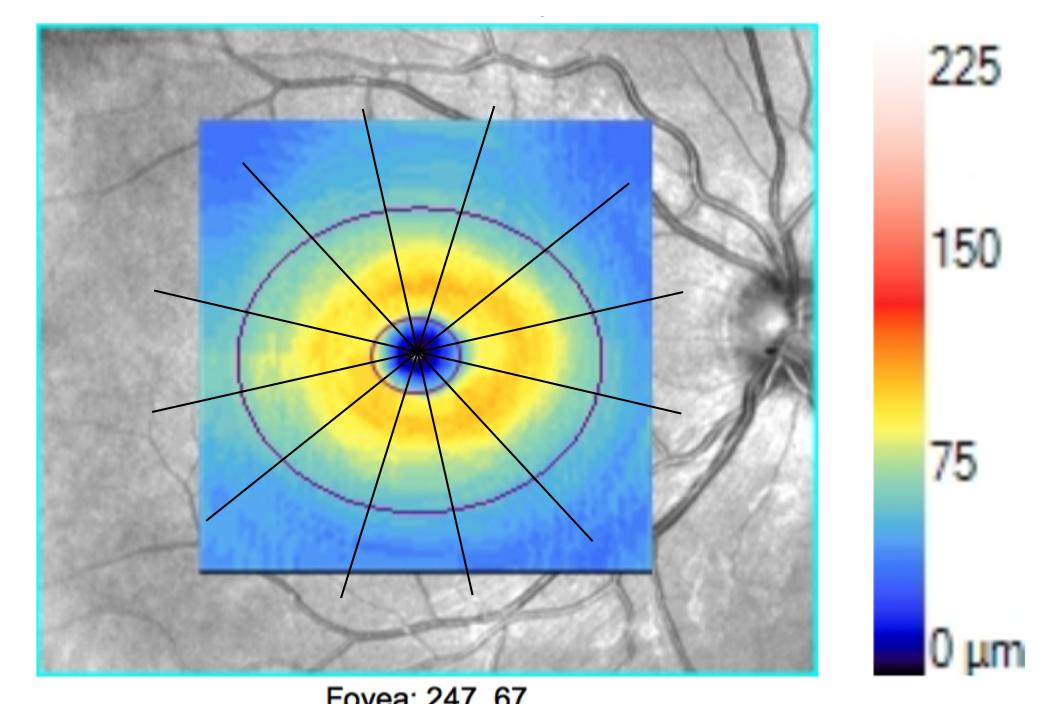


ROI: visually-active ($p < 0.05$ from full field) medial occipital lobe

24-2 Automated Humphrey Perimetry

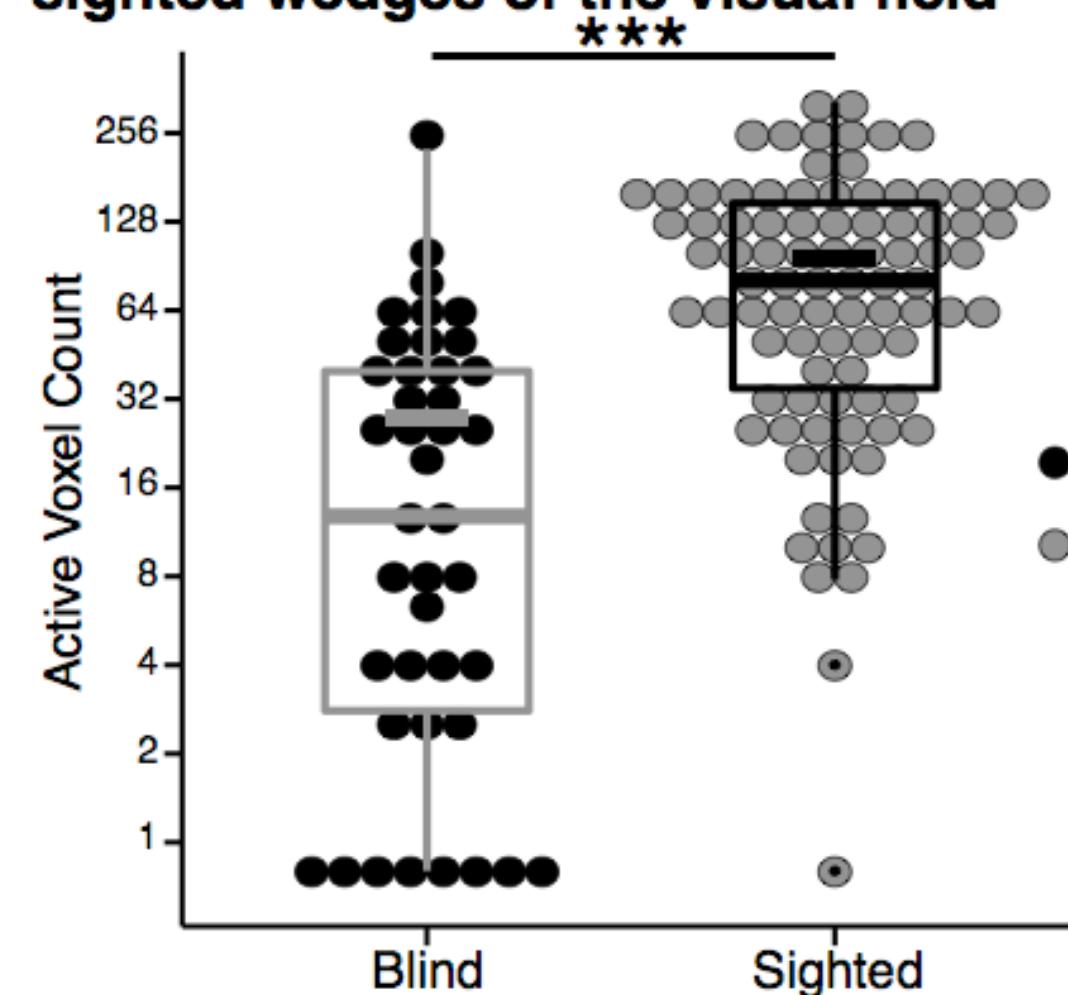


Optical Coherence Tomography of the macula

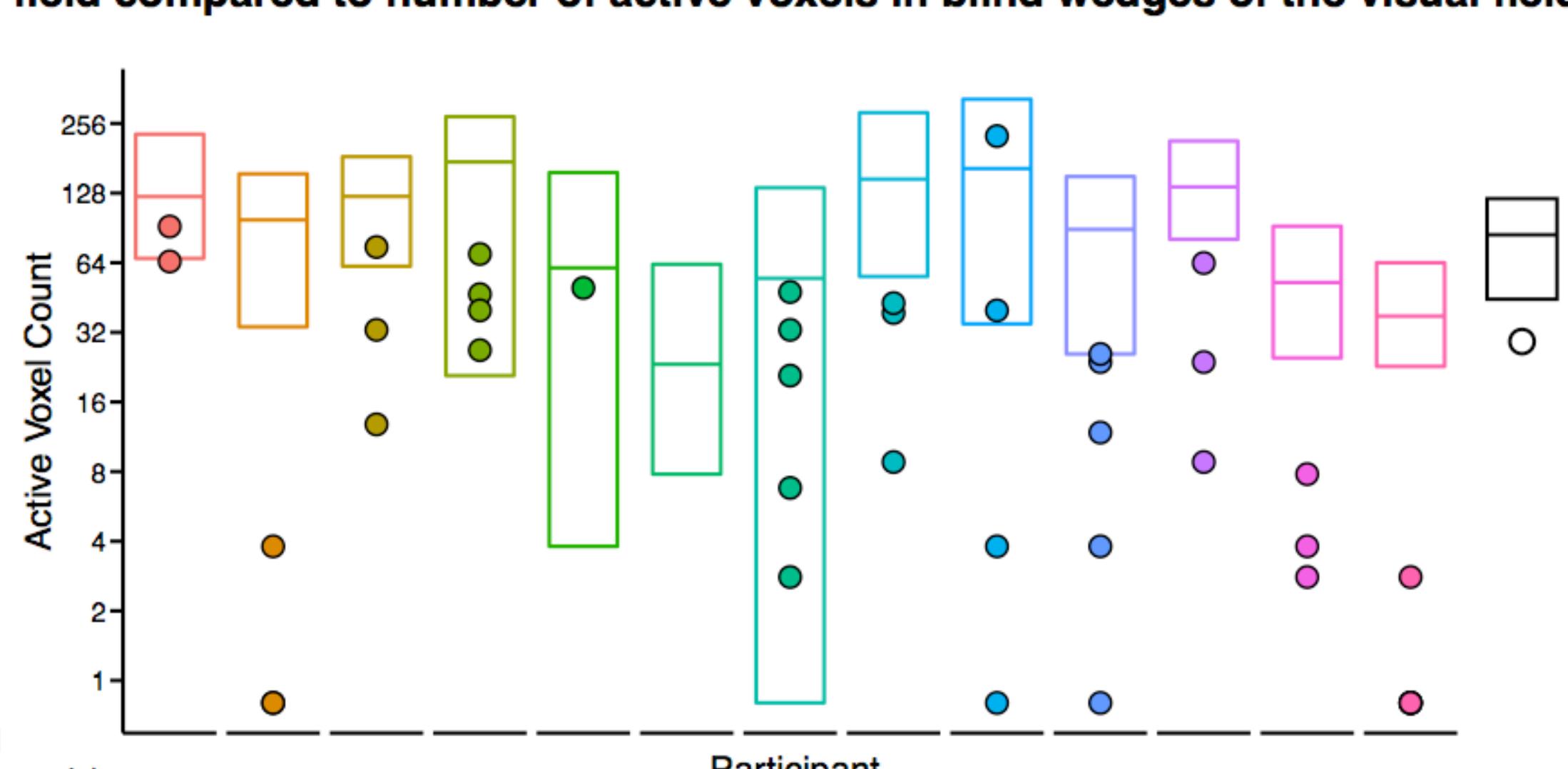


Results

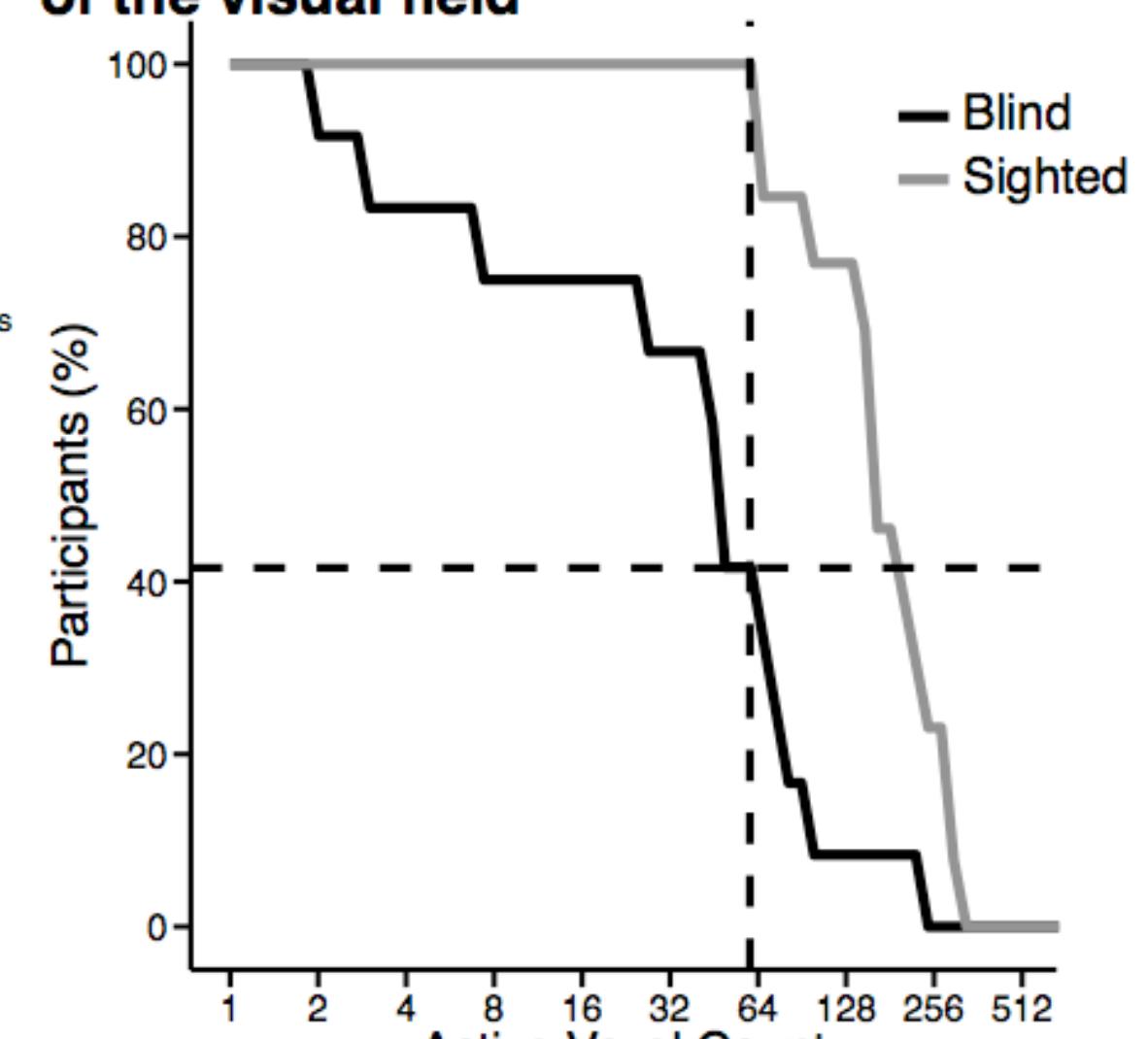
Number of active voxels in blind versus sighted wedges of the visual field ***



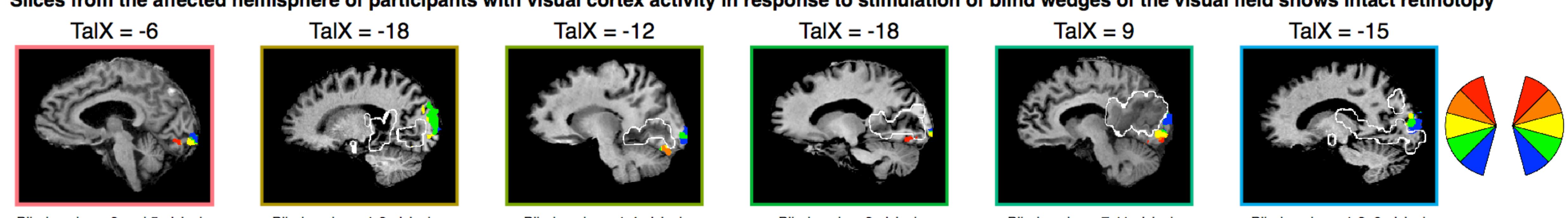
Subject-level range of number of active voxels in sighted wedges of the visual field compared to number of active voxels in blind wedges of the visual field



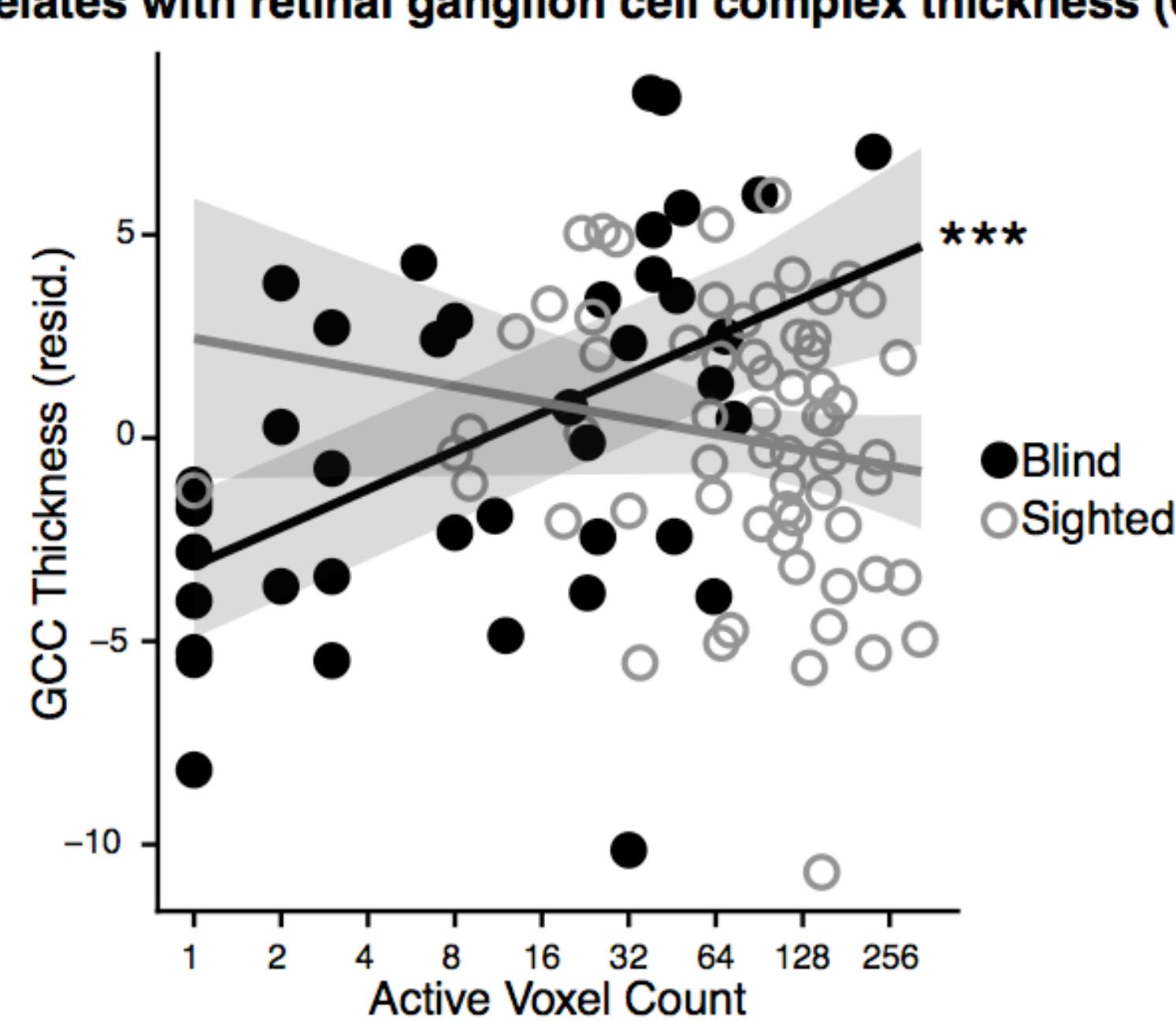
Survival curve of number of active voxels in blind versus sighted wedges of the visual field



Slices from the affected hemisphere of participants with visual cortex activity in response to stimulation of blind wedges of the visual field shows intact retinotopy



Number of active voxels in blind wedges of the visual field correlates with retinal ganglion cell complex thickness (GCC)



Conclusions and Future Directions

- Dissociation between visual perception and early visual cortex activity may be due to disordered information content in peri-lesional voxels or disconnection from higher-order visual areas
 - Is it possible that patients could recover some of their lost vision by learning a new read-out strategy?
- Activity in blind voxels shows functional relevance for survival of retinal ganglion cells. Is it functionally relevant for other phenomenon such as blindsight?
- Tractography and functional connectivity analysis to test whether the dissociation between early visual cortex activity and visual perception is due to disconnection of early visual cortex with downstream targets
- This dataset is part of a longitudinal fMRI study on visual cortex plasticity in stroke patients.

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