

Introduction

Alteration of structure and function in the blind

- Early blindness is associated with alteration of white matter structure and development of cross-modal responses within occipital cortex
- Disruption of cross-modal cortex interferes with tactile and auditory processing
- In the congenitally deaf, resting metabolism within the “auditory” cortex negatively predicts recovery of function following cochlear implant

Does visual deprivation produce a correlated alteration in the structure and function of occipital cortex?

Participants

	Blind (n=10)	Sighted (n=7)
Mean age (range)	56y (30-65)	45y (29-59)
Gender	3 ♂ 7 ♀	4 ♂ 3 ♀
Age at blindness	0.4y (0-4)	---
Age at NLP	16y (0-30)	---

Methods

Cross-modal activation (BOLD fMRI at 3T)

- Auditory presentation of 1) sentences for plausibility judgment, 2) reversed sentences, 3) white noise
- Sentences blocked by semantic content (auditory/tactile/visual)
- Participants scanned in darkness with eyes closed

	Plausible	Implausible
	The alarm is blaring.	The creek is grunting.
	The snow is powdery.	The wheel is spongy.
	The radio is pink.	The frog is cloudy.

Cerebral Blood Flow (ASL Perfusion)

- Resting, 8 minute ASL perfusion scan, 3.4x3.4x5 mm

Diffusion Tensor Imaging (DTI)

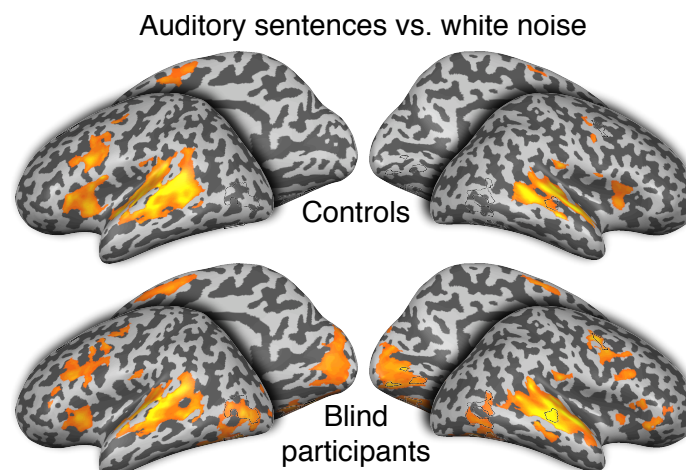
- Two, 3.5 minute scans, 12 directions, 1.7x1.7x2 mm

Voxel Based Morphometry (VBM)

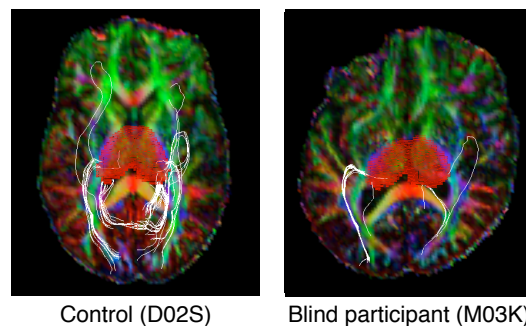
- 5 minute MPRAGE scan, 1x1x1 mm isotropic voxels
- Images warped to common template. Log Jacobian of warp matrix within ROIs indexes the relative degree of atrophy / hypertrophy.

Results - Blind differ from controls

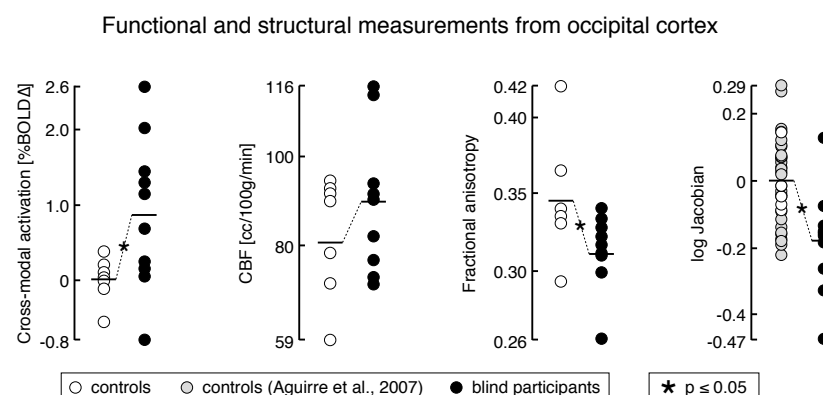
Cross-modal responses



Tractography

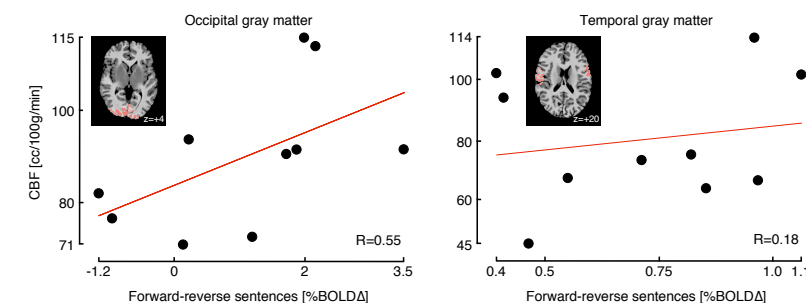


Within the occipital ROI

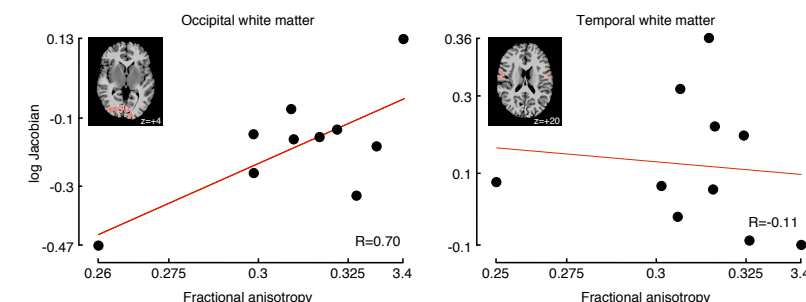


Results - Structure and Function

Function



Structure



Structure vs. Function

	Activation	CBF	FA	Jacobian	
Activation		0.55	0.04	-0.03	NS
CBF			-0.31	-0.28	
FA				0.70	
Jacobian					

Summary

- Congenitally blind participants have cross-modal responses within the occipital cortex. These responses reflect semantic content.
- Blind participants have alterations in white matter structure compared to sighted controls.
- Resting CBF is related to cross-modal responses. Cross-modal activity may be a negative predictor of functional recovery (by extension from cochlear implant results).
- Functional and structural alterations may be driven by different aspects of visual deprivation (e.g., duration vs. quality).

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