Title: Perceptual and fMRI Evidence for Filling-In of the Rod Scotoma Under Scotopic Conditions

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Introduction: The phenomenon of perceptual filling-in, where a region of the retina does not transmit visual information, yet we perceive visual information based on what information is available from nearby retinal locations, has been studied extensively at the blind spot (e.g., Ramachandran, 1992) and after inducing “artificial scotomas” (retina-stabilized adaptation) in the periphery (e.g., Ramachandran, 1991, 1993). However, very little work has been done examining filling-in at the rod scotoma in the central fovea, likely because it has been assumed with cursory examination that it does not happen. Hubel (1997) reported that a simple line passing through the rod scotoma does not complete (as happens in blind spots and artificial scotomas), and Hadjikhani and Tootell (2000) reported no perceptual or functional magnetic resonance imaging (fMRI) evidence of filling-in using standard retinotopic mapping stimuli. However, filling-in and scotopic afterimages of an extended surface have been recently reported (Hubel, Howe, Duffy, & Hernandez, 2009).

Methods: We measured angular and eccentric retinotopic organization across human visual cortex using fMRI under scotopic conditions. Retinotopic stimuli consisted of black and white, drifting radial checkerboards comprising (1) wedges and rings (3°, 7.4°, and 11° in radius) or (2) drifting bars (11° in radius). The data were analyzed using population receptive field (pRF) modeling (Dumoulin & Wandell, 2007).

Results/Discussion: Here, we report new perceptual and fMRI evidence for perceptual filling-in at the rod scotoma under scotopic conditions using drifting bar, rotating wedge, and expanding ring stimuli.