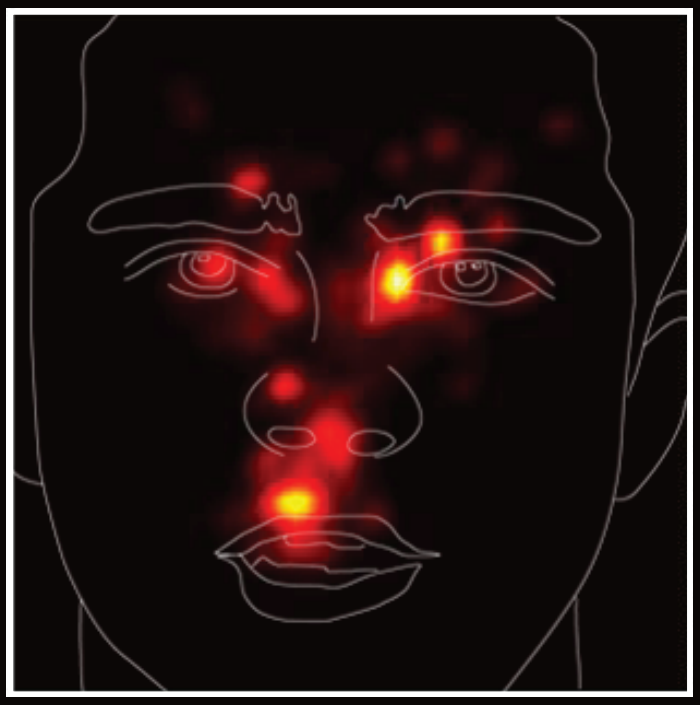
Saccade Target Selection by Synchrony Between and Within Sensory-motor Neuronal Populations



Martin Paré, Ph.D.

Queen's University

Active vision entails alternating periods of saccadic eye movements and fixations, during which perceptual processing can take place. This natural visual behavior has been best investigated in studies using the visual search paradigm—the search of a target among distractors—which have suggested that two distinct processing stages precede saccade initiation: an initial scene analysis that direct visual attention to the target and the subsequent planning of the saccade. This talk will describe how these processes are reflected in the activity of neuronal populations within the lateral bank of the parietal cortex (area LIP) and the intermediate layers of the superior colliculus (SC) when animals are performing a rather unconstrained visual search task that mimics natural visual behavior. Results suggest that the activity of single LIP and SC neurons predicts simultaneously the saccade's goal and latency, suggesting that visual attention is shifted concomitantly with saccade planning during natural visual behavior. Direct evidence for parallel, competitive processing of visual stimuli was gained by recording pairs of SC neurons encoding different portions of visual space: Activity representing target and distractor coexist concurrently during stimulus encoding but become negative correlated as the trial progresses. Concomitantly, neurons encoding identical visual space become positively synchronized and functionally connected neurons signal target selection coincidently. Altogether, these findings indicate that saccade target selection arises from synchrony in multiplexing activity that dynamically engages competition between and cooperation within ensembles of sensory-motor neurons.

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For more information contact Gale Fox at 615-343-7620 or e-mail vvrc@vanderbilt.edu. Sponsored by the Vanderbilt Vision Research Center.