Department of Psychology
The University of Hong Kong
香港大學心理學系

Departmental Seminar

Brain Correlates of Visual Perception: From Neurophysiology to fMRI

11:30 am – 12:30 p.m. │January 25, 2017 (Wednesday)
Rm 813, 8/F, The Jockey Club Tower │ Centennial Campus │The University of Hong Kong

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Abstract

This talk traces the evolution of the visual receptive field (RF), the most profound concept in neuroscience, from the retina to the extrastriate cortex by summarizing the highlights of histological, neurophysiological, and neuroimaging studies. It starts with the early experiments by Hartline (1938) in the optic nerve of the frog, by Kuffler (1953) and Barlow (1957) in the retina of the cat, and continues with the recordings by Jung & Baumgartner (1952-1962) and Hubel & Wiesel (1959-1965) in the visual cortex of cat and monkey. An attempt is made to correlate neuronal findings to phenomenological and psychophysical observations.

For example, central excitation and lateral inhibition in concentric RFs are discussed in relation to border contrast in human perception. Double-opponent cells in the lateral geniculate nucleus are related to color contrast. Simple cells in elongated RFs are proposed to account for the perception of orientation and stereo-depth, while complex cells are assumed to mediate the perception of motion direction and hypercomplex cells the perception of size. The anatomical pathways of these functions are outlined.

A new era began with the discovery of von der Heydt et al. (1984) of cells in area V2 capable of bridging a gap by an illusory contour. These cells have RFs “beyond the classical RF” and may be responsible for the perception of contextual phenomena such as orientation and motion contrast, perceptual filling-in and completion, contour integration, border ownership, and grouping. Other cells responding to complex stimuli are face cells in the fusiform face area. Cells in areas MT and IT are characterized by increasingly larger RFs, prompting the question of whether retinotopy is partially lost. Massive feedback from higher cortical areas onto lower areas suggests major modulation of bottom-up signals by top-down circuitry (attention?).

Modern neuroimaging techniques have revolutionized the field of vision research by providing a noninvasive technique to study the human cortex, for example, to learn more about brightness enhancement, neon color, and illusory motion. A celebrated field is the study of face blindness in inherited and acquired prosopagnosia. The study of population RFs, visual field maps, and inverse optics finally enables comparisons between microelectrode results in the monkey and fMRI findings in the human observer, thereby closing the circle to the beginning of psychophysics which started 150 years ago.

~All are welcome~

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