Contextual Influences on Orientation Perception

Reference	BB/E002536/1
Principal Investigator / Supervisor	Professor Peter Dayan
Co-Investigators / Co-Supervisors	Professor Li Zhaoping
Institution	University College London
Department	Gatsby Computational Neuroscience Unit
Funding Type	Research
Value (£)	402,264
Status	Completed
Type	Research Grant
Start Date	01 October 2007
End Date	31 March 2011
Duration	42 months

Abstract

We propose to investigate contextual influences on visual perception, using orientation as a key example. Orientation perception has a long and distinguished experimental history, but most previous investigations of visual context have used either a psychophysical or a computational perspective. Support from the Foresight Project will help forge a link between these two disciplines. When an oriented line segment appears in an array of other oriented line segments, three well-known phenomena typically occur. One is the tilt illusion; an exaggeration of the difference between the orientations of adjacent line segments. The second is acuity loss; it becomes more difficult to identify the orientation of any individual line segment. The third is facilitation; a low-contrast target becomes easier to see when aligned with high-contrast flanks. (NB: Certain viewing conditions produce the opposite effects.) Various mathematical and computational models have been suggested to account for each of these contextual effects, but no model has yet to account for all of them. The initial focus of our research will be to collect experimental results against which the predictions of these models can be tested. Existing models can then be refined or replaced in the light of our results.

Summary

Forty years of neuroscience have cemented the notion that vision depends on a population of brain cells whose individual responses depend both on the contrast and the spatial orientation of visual stimuli. Consequently, our ability to discriminate between different contrasts should be related to our ability to discriminate between different orientations. However, it is only recently that biologically inspired models have had any success in explaining both of these abilities. Naturally, these early successes have focused on simple targets, like line segments, which are thought to optimally stimulate individual neurons. To parallel neuroscience's progress understanding brain connectivity, we propose to extend (or refine) contemporary models in order to explain how our perception of simple targets depends on visual context.

Committee	Closed Committee - Animal Sciences (AS)
Research Topics	Mathematical Biology, Neuroscience and Behaviour (including human psychology), Systems Biology
Research Priority	X – not assigned to a current Research Priority
Research Initiative	X - not in an Initiative
Funding Scheme	X – not Funded via a specific Funding Scheme

Associated Awards

BB/E000444/1 Contextual influences on orientation perception

Copyright © 2011, BBSRC