the neural correlates of the jitter illusion

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Papers and proceedings arising from this research

Refereed Publications

Brooks A, van der Zwan R, & Holden J (2003) An illusion of coherent global motion arising from single brief presentations of a stationary stimulus. *Vision Research*, 43, 2387-2392.

Conference Presentations

Brooks A & van der Zwan R (2001) Integrating first-order and second-order information during form perception. *European Conference on Visual Perception.*

van der Zwan R & Brooks A (2002) Illusory motion from opposite-polarity form cues: It's not a jitter bug. *European Conference on Visual Perception.*

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abstract

The work that follows introduces a new visual illusion. The 'jitter' illusion arises in response to single brief presentations of *stationary* Glass patterns composed of decrement- and increment-defined dot-pairs. Remarkably, the perceptions that arise are of coherent global motion in trajectories that are consistent with the spatial configuration of the Glass patterns; patterns configured according to concentric functions give rise to perceptions of motion in concentric trajectories, those configured according to radial functions give rise to perceptions of motion in radial trajectories, and so on. The aim of the work that follows was to develop a model of the neural correlates of this illusion. An additional aim was to explore the implications of such a model for developing a broader understanding of the means by which coherent visual perceptions arise.

Experiments were conducted under the working hypothesis that the jitter illusion is mediated by activity that arises within the magno-cellular (M-), and not the parvo-cellular (P-) pathway of the visual system. It is argued that a model based entirely on M-pathway activity can effectively account for the illusion if two critical conditions are met. The first is that the model must propose the mechanism by which presentations of *stationary* Glass patterns stimulate activity in the *motion*-sensitive cells of the M-pathway. The second is that it must propose plausible mechanism(s) by which the ensuing M-pathway activity gives rise to perceptions of coherent global motion. Experiments reported in chapters 3 and 4 address the first of these conditions. Data from these experiments suggest that abrupt changes in luminance introduced at the onset and offset of stationary Glass patterns (and *not* eye-movements) mediate the M-pathway activity on which the illusion is based. Experiments reported in chapters 5 through to 8 address the second condition. In chapters 5 and 6, the data suggest that the patterns of Off- and On-channel responses elicited by *individual* Glass pattern dot-pairs somehow stimulates cells that act as 'local' motion detectors. In chapters 7 and 8, models of the means by this occurs were tested. The resulting data rule out the possibility that the stimulation is a product of a processing asynchrony in the M-pathway Off- and On-channels. Instead, they are consistent with a model based on the *diphasic temporal impulse-response functions* attributed to cells that make up the M-pathway. Based on its ability to satisfy each of the stated conditions, the so-called

diphasic TIRF model is presented as a plausible account of some of the neural correlates of the jitter illusion.

The implications of the diphasic TIRF model are discussed in relation to both the jitter illusion and to visual processing more generally. One of the critical (and novel) implications of the model is that under some circumstances, M-pathway mechanisms ‘extract’ structural information from static visual images that P-pathway mechanisms cannot. On this basis, it is argued that both the jitter illusion and the diphasic TIRF model offer valuable insights into some of the means by which light-induced activity within the human visual system gives rise to coherent global perceptions.

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