Abstract

The spatial representation of a visual scene in the early visual system is well known. The optics of the eye map the three-dimensional environment onto two-dimensional images on the retina so that the neighboring points in the environment fall on neighboring cells on the retina. These retinotopic representations are preserved in the early visual system. Retinotopic representations and processing are among the most prevalent concepts in visual neuroscience. Considering the fact that the spatial contiguity is a common property of objects in environment, using retinotopic representations to make sense of the world around us seems justified. However, it has long been known that a retinotopic representation of the stimulus is neither sufficient nor necessary for perception. A fundamental problem in vision science is to understand *non-retinotopic* representations that can overcome the limitations of retinotopic representations. Saccadic Stimulus Presentation Paradigm and the Ternus-Pikler displays have been used for this purpose. However, neither of these paradigms eliminates the retinotopic representation of the spatial layout of the stimulus.

Here, we investigated how stimulus features are processed in the absence of a retinotopic layout and in the presence of retinotopic conflict. We used anorthoscopic viewing (slit viewing) with a variant of a Ternus-Pikler display and pitted a retinotopic feature-processing hypothesis against a non-retinotopic feature-processing hypothesis by probing whether attribution of features follows perceptual organizations or retinotopic layouts. The experiments consisted of “Connected Lines”, “Basic Display”, and the “Flash” conditions. In each trial, an offset was inserted randomly to one of the three elements in the display (probe Vernier). In the “Flash” condition, each element was flashed through a narrow slit (7.1° x 17’) whereas in the other conditions, the three-element display was moved behind the slit. Direction of motion was randomized across trials and in all conditions the smallest element always appeared first. Subjects were asked to attend a predetermined element in a given block and report the perceived direction of the vernier offset (left or right w.r.t. upper half). Our results support the predictions of the non-retinotopic feature-processing hypothesis and demonstrate the ability of the visual system to operate non-retinotopically at a fine feature processing level in the absence of a retinotopic spatial layout. Moreover, our results suggest that perceptual space is actively constructed from the perceptual dimension of motion.

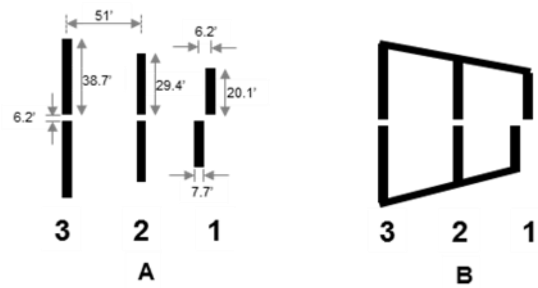

Figure 1. *Stimulus configurations presented behind the slit.* **(A)** *“Basic Display” and* **(B)** *“Connected Lines” conditions.*

Acknowledgments

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