PERCEPTION

Book Review

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Linton, P. *The Perception and Cognition of Visual Space*. Cham, Switzerland: Palgrave Macmillan, 2017; 162 pp.: ISBN 978-3-319-66292-3, £49.99 Hardcover.

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The visual perception of space, and depth in particular, is a long-standing problem in vision research. In the beginning, when experimental data were sparse, theories were very diverse. Depending on the background of the theoreticians, being philosophy, physics, psychology, or neurophysiology, they borrowed ideas from areas as remote as relativistic mechanics. Most theories claimed validity for visual space by generalizing of specific spatial judgments. For instance, the concept of a curved visual space was inspired by the curvature of space–time in relativistic mechanics. The mathematically interesting concept of a curved space described the dissociation between parallelism and equidistance in the judgments of observers. With the arrival of other and better experimental techniques, theories were falsified and replaced by new ones that could describe more experimental results. Some theories are just descriptive, others mechanistic, although possibilities and limitations of underlying neural architectures are not always considered in the proposed mechanisms. Theoreticians with a background in philosophy have an inclination to propose grand theories that can overarch the theories of isolated phenomena. Paul Linton (2017), a vision scientist with a background in philosophy, presents an overarching theory for visual space perception in his book *The Perception and Cognition of Visual Space*. The book is not an easy read. However, it provides much food for thought for students of visual perception and particularly for those interested in space perception. Each chapter contains sufficient substance to chew on.

Linton's theory hinges on the idea that perception and cognition are two sequential stages in the evaluation of visual space, where visual cognition is subdivided in unconscious judgment and conscious deliberation. In the perceptual stage, optical and physiological information provides us with a stereoscopic impression of depth. In the cognitive stage, judgments about what we see are made by the involuntary and voluntary attribution of meaning. Linton presents and defends his theory against other theories and interpretations of experimental results in four chapters. In the first chapter, he discusses two conceptions of stereopsis. In the second and third chapters, he confronts his theory with the existing literature on binocular and monocular stereopsis. Lastly, in the fourth chapter, he argues how monocular stereopsis may result from optical and physiological mechanisms. Earlier versions of the book have been sent out to a few experts of the field. Elaborate responses to their comments have caused some imbalance between treatments of the various issues discussed in Chapters 2 and 3. Linton's theory is a considerable re-vision of the current conceptions on monocular stereopsis, picture perception, and cue integration. Other theories

are refuted with logical arguments or, if these fall short, personal observations are called to the rescue. The division made by Linton between depth perception and depth judgments is intriguing, although I personally have the conviction that the division concerns different spaces. In my view, perceived depth relates to visual space and judged depth to physical space as we know it from interaction with the environment.

A shortcoming of the book is that, apart from a short discussion on a possible implication for the function of V2, it does not discuss the new theory in relation to the neurophysiology of the visual system. At various places, Linton demonstrates having rather exceptional conceptions about the processing of neurophysiological signals. He asserts: ". . . according to cue integration 'top-down' processing is the *only* way of attributing depth meaning to sensory data, without which the sensory data would have no content" (p. 23). Qualifying sensory data without content ignores the fact that knowledge of the physical world is also built into the "bottom-up" machinery of the visual system. The one-sided attribution of meaning to" top-down" processing introduces a new version of the homunculus in vision. Now cognition looks down on perception and makes qualified judgments about what is seen there. The absence of content in sensory data also seems in contradiction with Linton's own view that optical and physiological signals underlie the perception of a three-dimensional visual space. Some lack of knowledge of neurophysiology is noticeable in Linton's use of the word "absence." For instance, in Chapter 3, Linton claims the absence of binocular disparity in two conditions: (a) monocular vision and (b) binocular vision at far distances. The first claim is correct because binocular disparity does not exist in monocular vision, and thus, the binocular disparity signal is indeterminate. The second claim is incorrect because binocular disparity exists in binocular vision, and thus, the binocular disparity signal is well defined. Binocular disparity may be small or even zero at far distances but not absent (and detectors of small and zero disparities generate signals that are as strong as those of large disparity detectors).

My general conclusion about Linton's book is that, despite a few shortcomings, it is a valuable contribution to the scientific literature on visual perception. It contains sufficient controversial material that may be the inspiration for new experiments on visual space perception.