Taking the Other Cinderella to the Ball: A Review of *Psychology of Touch and Blindness* by Morton A. Heller and Edouard Gentaz

Reviewed by Jeffrey B. Wagman

THE cognitive psychologist and movement scientist David Rosenbaum [5] pointed out that, despite its fundamental role in behavior, the study of motor control has an undeserved underdog status among psychologists. Accordingly, he cleverly described motor control as the "Cinderella of Psychology." As the readers of this journal surely appreciate, this description may also very well apply to perception by touch. In fact, given the fundamental role of touch in motor control (and vice versa), it may not be surprising that both areas of study are relegated to the shadows of their more famous cousins in psychology and related disciplines.

It may also not be surprising that touch is overlooked for some of the same reasons as motor control. First, the tradition in cognitive psychology is that researchers are more interested in the epistemology of perception, and consequently, perception is typically studied as a disembodied process [6]. Disembodiment, of course, leaves both motor control and touch without dates to the ball. However, as more and more researchers have adopted embodied perspectives on perception-action-cognition (e.g., [1]), both touch and motor control play increasingly important roles in both theory and experiments.

Second, there is no centralized organ of study in motor control or in touch. In fact, functionally, the *entire body* is the organ in both cases, even when only a portion of the body is used to perform a movement or touch an object (see [7]). As Heller and Gentaz (2014) point out on the very first page of *Psychology of Touch and Blindness*:

"The organ of touch is unique in comparison with the other senses. . . The touch organ continually changes its shape and this is radically different from the other sense organs. . .The variability of the touch system is a strength of the haptic perceptual system, *but this also presents a practical challenge to researchers*" (p. 1, emphasis added).

Importantly, the underdog status of touch is at odds with its fundamental and foundational role in evolution, in daily life, and in the history of psychology. Along with the chemical senses, touch provides the backdrop for coordinated movement in a majority of species across the animal kingdom [2]; [3], and systematic investigations of perception by touch precipitated the emergence of scientific psychology from its philosophical roots (see Chapter 1).

Though not necessarily one of the stated goals of the book, the *Psychology of Touch and Blindness* goes a long way toward helping touch to shed its undeserved underdog status. The authors situate perception by touch (perhaps in its rightful place) at the intersection of a number of disciplines including psychophysics, cognitive psychology, neuroscience, low vision and blindness, applied psychology, and engineering. The authors (Heller, in particular) have had long and distinguished careers investigating perception by touch in both visually impaired and sighted individuals and have made important contributions in these areas. To some extent, this book is an overview of this (and related) research, though it is also much more than that.

As the title implies, the book places particular emphasis on the haptic abilities of visually impaired and blind individuals. However, it also focuses on using the haptic abilities of sighted individuals to understand those of blind individuals, and vice versa. This is perhaps its most valuable contribution. In addition, it provides useful historical and theoretical context for research on the haptic abilities of both populations of people. Finally, it not only provides an overview of the ground already covered but also a preview of the ground yet to be covered, especially considering the recent technological advances in haptic interfaces and related technology. Many readers of this journal will appreciate the explicit focus on the cognitive neuroscience of touch (Chapter 2), intermodal relationships (Chapter 5), and on technology, interfaces, and application (Chapters 9 and 11). Moreover, it is written in a folksy style that will appeal to both more and less technically inclined readers.

Personally, I very much appreciated the discussion of the contributions of the ecological approach [3], [4] to haptic perception and to perception-action more generally. However, this is also where I take issue with some of the claims made in the book. The authors write that in the ecological approach, the stimulation obtained by active exploration and manipulation of a hand-held object ". . .yields a constant and lawful relationship between perceiver and object." (p. 12). As a result, the "Gibsonian view is that *we normally perceive the world accurately*, and perceptual errors arise when stimulus information is sparse, viewing conditions are poor, or artificial and degraded stimuli are used in laboratory situations" (p. 12, emphasis added).

While it is the case that the Gibsonian view is concerned about the limitations imposed by experimental

• *The author is with the Department of Psychology, Campus Box 4620, Illinois State University, Normal, IL 61790. E-mail: jeffreywagman@illinoisstate.edu.*

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conditions, this concern is mostly a consequence of the larger concern that researchers have, by and large, mischaracterized both the stimulation variables of relevance to perception and the experiences of perceivers. Typically, researchers assume that the stimulation variables of relevance to perception are static, lower-order, and animal-independent variables (e.g., mass, volume, and shape). These variables are ultimately processed or interpreted into experiences of properties (e.g., weight) that can easily be measured by human-made measuring devices.

In the ecological view, such mental gymnastics are only necessary if the stimulation variables of relevance have been mischaracterized. In this view, the stimulation variables of relevance to perception are not static, lower-order, and animal independent. Rather, they are *dynamic*, *higher-order*, and *animal-dependent* patterns (e.g., resistance to rotational acceleration in different directions about a joint). Such patterns are lawfully related to (potential) relationships between perceiver and environment (e.g., how easily that object can be controlled by muscular effort). It is these (potential) relationships that are experienced by perceivers (in lieu of isolated object properties). Importantly, such (complex) relationships cannot (easily) be measured by human-made measuring devices.

Thus, the lawful relationships exist not between *object* and *perceiver* (as per Heller and Gentanz) but rather between *informative stimulation patterns* and a *relationship between perceiver and environment*. This might seem like a minor and subtle difference, but it is not. Moreover, it is one that has ramifications for the understanding of both perception by touch and perception of so-called "illusions." As a result, I read the chapter on illusions (Chapter 4) with particular interest.

In traditional approaches, perception is the result of a computational or interpretive process. Perception is correct to the degree that the outcome of this process matches the output of a human-made measuring device (e.g., a scale, a ruler, or a protractor). Conversely, perception is illusory to the degree that there is a mismatch. In the ecological approach, however, perception is a lawful relationship between perceiver and environment. Such relationships are neither correct nor incorrect. Therefore, perception is never in error, and illusions are not examples of such mistakes. Perhaps more importantly, why should we expect the content of perceptual experiences to be anything like the output of a scale, a ruler, or protractor?

The authors write "One might wonder whether perception is normally accurate as it is assumed by the ecological view. . . " (p. 61). Strictly speaking, in the ecological view, the "accuracy" of perception cannot be evaluated. Therefore, illusions do not so much pose a challenge to the ecological view as they do to researchers to discover lawful relationships between stimulation patterns and relationships between perceiver and environment. One so-called touch illusion for which substantial progress has been made along these lines is the size-weight illusion (pp. 72-73). In this illusion, two objects of equal weight can feel unequally heavy, with the more compact object typically feeling heavier. Although there are a number of explanations for this phenomenon, the one favored by ecological psychologists draws an explicit link between touch and movement. In such an explanation, the (higher-order and animal dependent) stimulation variable of relevance is the resistance to rotational acceleration in different directions about a joint (instead of mass or volume) and the experience on the part of the perceiver is "ease or difficulty to move" (instead of heaviness, see [8]). The more diverse the muscular forces required to control an object, the more difficult that object is to control, and the heavier it feels. Reconfigured this way, perception is not in error. Rather, it reflects a lawful relationship between an informative stimulation pattern and a (potential) relationship between perceiver and environment.

Despite my criticism of the description of the ecological approach and the treatment of illusions, to their credit, the authors focus on the considerable everyday successes of perception by touch rather than on the isolated and unusual "failures". This is another strength of the book. Perhaps a more practical criticism is that the focus seems to be on how the touch system brings about experiences rather than on how it helps to guide behaviors. For example, it would have been useful for the authors to expand the chapter on tactile interfaces to include work on perception by means of a hand-held object such as a long cane. Such research is not only theoretically important but also quite relevant to the mobility needs of blind and visually impaired individuals.

Given that *Psychology of Touch and Blindness* provides a comprehensive overview of perception by touch in both sighted and blind individuals, it is perhaps most useful in undergraduate psychology courses in sensation and perception, in special education courses on low vision and blindness, or in a graduate seminar course on perception by touch. In addition, given that it situates perception by touch at the intersection of psychophysics, cognitive psychology, neuroscience, blindness and low vision, applied psychology, and engineering, it provides a useful resource to researchers in all of these disciplines—especially those who are interested in helping perception by touch to shed its underdog status.

References

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