to data and to devise tests that permit disconfirmation rather than acceptance of processing assumptions.

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The Reciprocity of Perceiver and Environment: The Evolution of James J. Gibson's Ecological Psychology

By Thomas J. Lombardo. Hillsdale, NJ: Erlbaum, 1987. xx + 396 pp. Cloth, $49.95. Paper, $24.95.

James J. Gibson's work occupies an interesting place, at once central and anomalous, in the recent history of psychology. His ideas have played an important part in the so-called cognitive revolution; but neither his direct realism in perceptual theory nor the ecological approach of his later years have become mainstream doctrine in cognitive science. The volume under review began life in 1973 as a dissertation on the development of Gibson's perceptual theory; it now begins as a history both of perceptual theory and of foundational concepts in psychology through Gibsonian eyes. In 9 of 18 chapters, or approximately 40% of the book's total pages, Lombardo discusses the theories of writers other than Gibson, beginning with the Pre-Socratics. His aim appears to be to situate Gibson's thought in the history of psychology, and at the same time to elevate its stature by inserting it into the historical canon as a grand dissent.

Briefly put, Lombardo argues that certain very old assumptions, all opposed by Gibson, have been characteristic of both perceptual theory and of scientific thought in general since the seventeenth century. These include (a) the twin dualisms of form and matter, and of mind and body; (b) the elementaristic conception of matter, with its correlative doctrine that order is imposed on matter by mind; (c) the notion, logically derived from the latter doctrine, that perception must work with or upon images or other mediating representatives of the external world, along with its correlative, the homunculus hypothesis; and (d) the parallel claim, which Lombardo calls the "simulative assumption," that these representations are composed of elementary sensations, which in turn correspond in some direct way to the order of the physical world. Lombardo recognizes that not all theorists have accepted each of these dualisms without question or scruple. But he asserts that the last two assumptions have been common to both the rationalist and empiricist accounts of mind. In Lombardo's view, Gibson ultimately rejected these assumptions and tried instead to account for the presence of order in change after the manner of a modern Aristotle. Thus, according to Lom-

bardo, Gibson offered more than an important alternative to mainstream perceptual theories; he proposed to reconstruct scientific thinking in psychology.

Sadly, that claim is not as well supported by this book as it could be. The first nine chapters are potted history, too often drawn from a mix of secondary sources and questionably referenced primary sources (are we really to believe that Lombardo has read Andreas Vesalius's *De Humani Corporis Fabrica* in its original 1543 Basel edition, or William of Ockham's *De Sententiarum* in a 1495 Lyon edition?). Gibson's thought is tied in only with suggestive paragraphs or sentences tacked onto each segment explaining how his ideas differed from those just expounded. Rarely is any evidence presented that Gibson himself read the works discussed. Exceptions to this procedure are the sections on Johannes Kepler's optics, Bishop Berkeley's theory of perception, and Johannes Müller's doctrine of specific sense energies, which are carefully expounded and appear to be well researched in primary sources. The conceptions of these theorists were in fact the central targets of Gibson's critique. By taking only these authors, or the issues they addressed, as nodal points, it should have been possible to cover the necessary background material more comprehensibly and less derivatively in far less space.

On page 154, Lombardo finally goes beyond listing antecedents of Gibson's thinking as descried by the retrospective historian and names some more contemporary writers who had a provable impact on the development of Gibson's thought: William James, Edward Holt, Kurt Koffka, Fritz Heider, Edwin Boring, Leonard Troland, Egon Brunswik, Ernst Cassirer, automotive engineer Laurence Crooks, physiologist Gordon Walls, and finally Gibson's wife, Eleanor Jack Gibson, an outstanding psychologist in her own right. He later adds the name of Harvey Carr. This is an extensive list, to be sure, but it is shorter and less impressive than the cast of characters covered in the book up to that point. Lombardo is justified in calling Gibson an important figure in the twentieth-century revolt against dualism in philosophy and against empiricism and behaviorism in psychology. He would have provided more appropriate and meaningful historical support for that perspective by at least mentioning parallel currents in recent European thought, including, for example, Maurice Merleau-Ponty's phenomenology of perception and behavior, or Albert Michotte's anti-empiricist work in psychology, rather than searching for precursors and antecedents in the more distant past.

Even though this book is a history of ideas, it would not have been out of place to include a word or two more on Gibson's biography and the social and cultural setting in which he worked beyond casual mention of the empiricist philosophical "establishment" he encountered as an undergraduate at Princeton University (p. 96). Gibson's encounter with Fritz Heider and Kurt Koffka at Smith College in the 1930s, for example, is a notable case of intercultural cross-fertilization in psychological theory. Lombardo mentions that Koffka and Gibson were colleagues for 10 years at Smith, and that the impact of Gestalt psychology on Gibson was mediated largely through

Koffka's *Principles of Gestalt Psychology* (1935), which was written during that time. But he fails to note that Heider also taught at Smith while Gibson was there, or that Kurt Lewin was a frequent visitor. Such information, too, would have helped to situate Gibson more effectively in his own time and circumstances.

Nonetheless, once he gets to it, Lombardo provides a sensitive, nuanced, and detailed account of the development of Gibson's thought. Gibson, on this showing, began as an empiricist influenced by Holt's motor theory of consciousness, working within the mainstream, Berkleian tradition in perceptual theory. Specifically, Gibson "initially believed that visual perception of form, distance, and so on depends on visual signs being associated with muscular responses" (p. 171). He was "shocked out" of that conventional view by the results of his own research at Smith in the 1930s on visual adaptation and figural aftereffects. In that work he found, contrary to Berkleian assumptions, that subjects adapted quite well to seeing with reversing lenses even without moving, and also that curved lines on the retina were not necessary for phenomenal curvature, which suggested that the retinal image had to be richer than empiricists generally thought it to be.

Gibson nonetheless remained a Berkleian until after his aviation studies, which appeared in 1947. Though Lombardo does not say so, this is eloquent testimony to the power of Gibson's academic socialization. For him as for others, especially in the United States, being a laboratory scientist meant being an elementaristic empiricist. The impetus to rethinking came only from work in a nonlaboratory setting. With automotive engineer Laurence Crooks, Gibson had begun in 1938 to study the role of perception in practical problems, such as driving a car. This work and his aviation studies during World War II impressed on Gibson the centrality of veridical perception, and led eventually to his including the environment and its structures in perceptual theory.

First, however, came *The Perception of the Visual World* (1950), Gibson's first major contribution to perceptual theory. As Lombardo shows, the book outlined a reform, not an overthrow, of the Berkleian viewpoint. In essence, Gibson enriched the stimulus concept to realize Leonard Troland's ambition of accounting for the results of vision in strictly visual terms, without additional contributions from cognitive psychology or physiology. Stimulation in Gibson's view is not impoverished, because it includes not only elementary geometrical points but also surfaces, edges, motion, distance, depth, density, and gradients of texture, as well as functional features such as destinations, obstacles, and paths. Vision alone, thus enriched, is sufficient to account for veridical perception. However, as Lombardo notes, Gibson retains the "simulative assumption" in another guise, by broadening the range of available proximal stimulation to map environmental structures and relations. Moreover, he also follows traditional views by retaining the retinal image, albeit in modified form, and by continuing to regard the optical basis of vision as a stimulus (i.e., as a cause) of perception. Only later does he substitute the ambient optical array for the retinal image and drop the latter assumption.

The impact of Gestalt theory on Gibson's thinking at this stage was more

extensive than Lombardo acknowledges. He notes that Gestalt theory effectively challenged empiricism by demonstrating that certain phenomena, such as phenomenal identity and invariance in motion perception, cannot be explained by retaining the "simulative assumption." But he argues, with Gibson, that the Gestalt theorists remained focused on the issue posed by Kurt Koffka, "How do things look as they do?" rather than the question Gibson later formulated, "Why do things look as they are?" (p. 147). Hence, they slighted the primacy of veridical perception. In addition, Lombardo claims, they retained the concept of visual stimulation on the retina as a collection of points, and were therefore driven to invoke hypothetical physiological processes to account for the immediacy of higher order relations in perception. Lombardo fails to note that in his earlier work, Koffka (1915, pp. 33–34) explicitly defined the stimulus as a real object that is functional for an organism; indeed, Koffka distinguished between distal and proximal stimuli in 1935 in order to retain that definition. Gibson (1971) generously acknowledged Koffka's impact on his thinking, but Lombardo unfairly demotes that impact to the level of phenomenology. In fact, Gibson integrated important concepts from Gestalt theory into his own theorizing, such as the "spatial framework" (in Gestalt terminology, the anisotropy of visual space), frame of reference, invariance and transformations (Gestalt: transpositions) across an ordered ground. Lombardo writes that Gibson got the invariance and transformation concepts from Ernst Cassirer, but Cassirer, like the Gestalt theorists, took them from relativity theory.

Interesting are Lombardo's remarks on the role—or lack of it—of empirical research in Gibson's subsequent turn away from a traditional psychophysical perspective and toward an ecological approach. Gibson's Ganzfeld work in the early 1950s (also influenced by a Gestalt theorist, Wolfgang Metzger) convinced him that a retinal image incorporating "transitions" in the ambient light array, rather than a literal picture, was needed for vision. But his increasing use of terms like "information" and "redundancy" to characterize optical inputs clearly came from the emerging cognitive science vocabulary, rather than his own research. Moreover, as Lombardo notes, the psychophysical theory "did have its problems." The main one is that it cannot be refuted, because there is no necessity that all organized environmental features be perceived, even if some are. Thus, Lombardo writes, though the theory was "altered and deemphasized" in the 1950s "in conjunction with various 'tests'. . . it is clear that it was not dropped because of some crucial experimental falsification" (p. 240).

Also valuable is Lombardo's account of the formation of Gibson's ecological perspective. In contrast to his rather dismissive treatment of Egon Brunswik earlier in the book, he shows that the foundations were laid during Gibson's stay at Berkeley with Brunswik and physiologist Gordon Walls in the academic year 1954–1955. Though Gibson had earlier rejected Brunswik's probabilistic account of perception, he was evidently impressed by Brunswik's insistence on representative design, including evolved natural contexts viewed from the animal's perspective. Fundamental as well was Walls's finding that the retinal image was "not biologically universal," whereas

the optic array and the environment were "ubiquitous and necessary facts" that remained relatively invariant across species and throughout evolutionary history (p. 246). From 1957 on, Gibson's papers always "began by considering the relevant environmental facts and their projective transformations in the optic array." The phrase "ecological optics" appeared in 1960; after that, "the older hypothesis of the ordinal retinal image vanished" (p. 255).

In Gibson's mature thought, he presented the ecological array as carrying information that functions only potentially as stimulation, and substituted the feedback loop concept for linear causation. Thus, animals must engage in activity—sampling, proprioception—to achieve percepts; indeed, Gibson characterized perception itself as activity. It would appear that Gibson had returned to his functionalist-Berkleian roots, but Lombardo insists that this is not so. By activity, he claims, Gibson meant not cognitive or physiological operations on neutral physical inputs, but the optic or ecological array "becoming effective" for the animal (p. 261).

After reading this book, one wonders what Lombardo could have meant by using the word "evolution" in the title. In the final nine chapters, Lombardo shows a fine feeling for the way that the roots of Gibson's later theory were already germinating in earlier stages of his development, even when his thinking appeared to be governed by differing concerns and assumptions. It is not at all clear, however, how the word "evolution" can apply to the book as a whole, unless Lombardo supports the discontinuous view of evolutionary theory advocated recently by Stephen J. Gould and others. Seen in the narrower timeframe of developments since the turn of the century, Gibson's thinking appears to have evolved or emerged from then-dominant versions of mainstream perceptual and psychological theory, even though he ultimately opposed them. Set in the broader context of psychological theory since ancient times, the Gibsonian perspective appears jarringly discontinuous. Thus, Lombardo undercuts his own evolutionary viewpoint in favor of a Kuhnian "revolutionary" stance, at least implicitly. He appears to want to portray Gibson as a triumphant dissenter from the canonical tradition, and at the same time to insert him into that tradition as its greatest product. Clearly, he cannot have it both ways. More reflection on his own conception of history of science, or on the implications of his own argument, might have spared him such unnecessary awkwardness.

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Jealousy

By Peter van Sommers. London: Penquin, 1988. 214 pp. Paper, $6.95.

Van Sommers's *Jealousy* is another addition to the ever-increasing accumulation of books on sexual jealousy for the general audience. It is a notch above the others by virtue of van Sommers's selection of topics. He went beyond the custom of just presenting verbatim material from interviews of victims in jealousy predicaments. Nevertheless, his discussion of jealousy is selective. Van Sommers omitted the entire area of modern quantitative studies of sexual jealousy "for reasons of [its] length" (p. viii). However, much of that research is directly relevant to his speculations and opinions.

Van Sommers presents his personal view of sexual jealousy rather than a scholarly review of the literature. *Jealousy* is written in the style reminiscent of turn-of-the-century armchair philosophizing. Van Sommers gives his opinions on myriad topics with selective citations of the literature. Many of the topics, especially in the first two chapters, are likely to be of marginal interest to nonprofessionals (and, for that matter, also to professionals, because he provides no new insights to old issues). For instance, he spends two pages discussing his disagreement with the Schachter and Singer model of emotion activation which assumes emotions are the result of the interaction of cognitive factors and diffuse physiological arousal.

Jealousy begins with a hodgepodge of topics that are difficult to capture with a title. Perhaps this fact explains the novel first chapter heading, "My Lover's Lover Is My Enemy." It includes opinions that individuals have of jealousy, a critique of limiting the cause of jealousy to single motives (e.g., possessiveness), brief discussions of the issues involved in jealousy during infancy, and the characterization of jealousy as an atavistic drive, as loss of control, and as a zero-sum situation.

One of the major goals of van Sommers is to debunk the popular notion that jealousy is simply due to personality flaws, such as selfishness, possessiveness, and insecurity. In agreement with that goal, he discredits the opinion that jealousy is elicited only in relationships governed by immature love. But it takes him 8 pages of discussing issues related to love and then 10 pages on jealousy to argue the point. It is easy to lose track of where the author is going in those 18 pages. This is a problem particularly in the first two chapters, but it occurs at times throughout the book.

If jealousy is not tied to immature love, and its presence is felt even in healthy relationships, how is it that some individuals appear to have escaped jealousy? Van Sommers inspects open relationships to determine whether they indeed are successful in abolishing jealousy. He transacts this with titillating descriptions of the relationships of well-known individuals (Jean-Paul Sartre with Simone de Beauvoir; the Russian novelist Lou Andreas-Salomé and her liaisons with Nietzsche and the poet Rilke; and Tolstoy's