ARE THEORIES OF PERCEPTION NECESSARY?
A REVIEW OF GIBSON'S THE
ECOLOGICAL APPROACH TO VISUAL PERCEPTION

A. P. COSTALL

UNIVERSITY OF SOUTHAMPTON, U.K.

Representational theories of perception postulate an isolated and autonomous "subject" set apart from its real environment, and then go on to invoke processes of mental representation, construction, or hypothesizing to explain how perception can nevertheless take place. Although James Gibson's most conspicuous contribution has been to challenge representational theory, his ultimate concern was the cognitivism which now prevails in psychology. He was convinced that the so-called cognitive revolution merely perpetuates, and even promotes, many of psychology's oldest mistakes. This review article considers Gibson's final statement of his "ecological" alternative to cognitivism (Gibson, 1979). It is intended not as a complete account of Gibson's alternative, however, but primarily as an appreciation of his critical contribution. Gibson's sustained attempt to counter representational theory served not only to reveal the variety of arguments used in support of this theory, but also to expose the questionable metaphysical assumptions upon which they rest. In concentrating upon Gibson's criticisms of representational theory, therefore, this paper aims to emphasize the *point* of his alternative scheme and to explain some of the important concerns shared by Gibson's ecological approach and operant psychology.

My title, "Are theories of perception necessary?" makes an obvious reference to Skinner's paper on theories of learning (Skinner, 1950). But it is also based upon the following passage from James Gibson's (1966) book, *The Senses Considered as Perceptual Systems*:

When the senses are considered as perceptual systems, all theories of perception become at one stroke unnecessary. It is no longer a question of how the mind operates on the deliverances of sense, or how past experience can organize the data, or even how the brain can process the inputs of the nerves, but simply how information is picked up. (p. 319)

The point of this double reference is that not only Skinner but also Gibson rejected the kind of "theory" which is now so enthusiastically promoted within cognitive psychology. The intention of their rejection was not, it should be stressed, a denial of any role for theory in psychology, but an insistence that be-

havior is subject to lawful description in its own right without appeal to "underlying" structures, be they mental, neurological, or quasi-neurological (Gibson, 1966, chapter 13; Skinner, 1938, pp. 3-5; 1969, pp. vii-xii). Gibson's recent book, *The Ecological Approach to Visual Perception*, presents his final views on this matter (Gibson, 1979; see especially chapter 14).

Although cognitive psychologists like to define their approach largely by contrast with what they consider behaviorism, the cognitive approach can nevertheless be characterized by its habitual appeal to internal, "mental" rules and representations, which it treats as exclusive and primitive, explanatory terms. Skinner has presented some valuable criticism of the cognitivist program—for example, in his paper in *Behaviorism* (Skinner, 1977a). But the effectiveness of his challenge has been limited not only by his contentious style, but also by his stereotyped role as the villain in cognitivist melodrama. The problem is compounded by a troublesome ambiguity about much of his criticism. He keeps shifting the grounds of his attack so that sometimes he seems to deny the reality of the mental structure invoked by cognitivism, while at other times he appears merely to question their heuristic value in generating research. Increasingly, his arguments

A version of this paper was presented at the First European Meeting on the Experimental Analysis of Behaviour, Liège, Belgium, July 26-30, 1983. Requests for reprints should be sent to A. P. Costall, Department of Psychology, The University, Southampton SO9 5NH U.K.

are pragmatic, concerned with the effectiveness of particular kinds of analysis for the purposes of control. As a result of this ambiguity, cognitive psychologists have felt free to disregard his metaphysical criticisms and insist that choice of means and ends in science is merely a matter of taste. Indeed, cognitive psychologists have felt free to enter the confines of the experimental analysis of behavior movement itself, and even to own up to their alien allegiances.

Cognitivism is under real threat, however, and from within one of its own strongholds, the theory of perception. James Gibson's challenge to the representational theory of perception has provoked some truly fundamental debate within the Establishment journals in the last couple of years. In this paper I shall try to explain the nature of his challenge and to examine both its origins in the behaviorist tradition and some of the important concerns it shares with operant psychology.

James Gibson engaged in a sustained attack upon cognitivism over many years, from the thirties until his death in 1979, and, like Skinner, his motives were frankly epistemological (Gibson, 1967; Skinner, 1977b, p. 380; see also Costall, 1981; Michaels & Carello, 1981; Reed & Jones, 1982). He credits the behaviorist E. B. Holt as a major influence on his thinking, but after initially attempting to repair the S-R (stimulus-response) formula promoted by Holt, Gibson eventually came to recognize that perception must be viewed as an act rather than as a response. Perceptual information, according to Gibson, is obtained, *not* imposed (Gibson, 1979, pp. 56-57, 149-150). But in his recognition that such behavior does not conform to the classical scheme of reflex psychology, he shared Skinner's conviction that so-called spontaneous behavior is nonetheless related to the environment in a lawful way (cf. Skinner, 1938, p. 20). His encounters with the Gestalt psychologist Kurt Koffka fired his interest in the problems of perception and reinforced Holt's earlier insight (Holt, 1914, e.g., p. 122) that the representational theory of perception presents a primary target for the attack on cognitivism (Gibson, 1967, 1971).

The representational theory of perception is one of those strange doctrines that most psychologists are convinced they just cannot live without. Richard Gregory promotes this doc-

trine with such evident enthusiasm that he not only lets slip its ultimate absurdities, but actually seems to relish them:

Perceptions are constructed, by complex brain processes, from fleeting fragmentary scraps of data signalled by the senses and drawn from the brain's memory banks—themselves snippets from the past. On this view, normal everyday perceptions are not part of—or so directly related to—the world of external objects as we believe by common sense. On this view all perceptions are essentially fictions; fictions based on past experience selected by present sensory data. (Gregory, 1974, p. xviii)

There is something almost disarming about confusion of this magnitude, a theory which denies the possibility of objective knowledge and then goes on to marshal facts in its support. But surely sympathy cannot in itself explain why representational theory has persisted for so long. As has become increasingly evident, this paradoxical theory has much deeper metaphysical ramifications.

While operant psychology takes as unproblematic the fact that organisms can come to detect and discriminate the events occurring within their surroundings, the preoccupation of perceptual theory, especially the theory of vision, has been with how this is possible, given that the organism is in contact not with the events as such but rather with ambient energy, such as light or sound. The classical puzzle of perceptual theory is that there is nothing in the structure of the immediate stimulus which is specific to its source; the same image on the retina, for example, would seem to be consistent with an infinite set of possible circumstances in the world. Internal representations were invoked to restore in some magical fashion the absence of constraint available from stimulation. Gibson's most conspicuous contribution has been to question this, the most explicit function of representational theory, as a *deus ex machina* resolving the supposed ambiguity of the structures available in ambient energy. By urging a molar or higher level description of such structures, and by pointing to the constraints which obtain upon such structures given the actual environment in which the organism lives, Gibson, and his

students, have begun to identify variables in stimulation that are uniquely related to environmental properties and events (see Gibson, 1979, chapters 4-8). Strangely enough, however, many cognitivists have eventually come to concede Gibson's point about specification—that is, the existence of information in Gibson's strict sense—and yet still persist in their ways (e.g., Palmer, 1978). Quite clearly, representational theory is (to borrow James's comment on Wundt's psychology) like a worm: You cut it up and each fragment crawls. It was Gibson's persistence in dissecting the cognitivist system that enabled him to unmask the various enchantments of representational theory, the hidden agenda of the current debates.

As I mentioned earlier, while developing his information-based theory of perception, Gibson came to reject his earlier commitment to S-R theory. He insisted that the organism is active in a very literal sense in its perceptual exploration of the environment. Gibson, therefore, like Skinner (e.g., 1969, pp. 3-13, 175; see also Skinner, 1938), came to abandon the S-R formula—and has suffered the same fate. Critics simply refuse to believe that he can be anything other than a bald proponent of a mechanistic behaviorism if he denies that perception is an active effort after meaning—active, that is, in the peculiar sense that cognitive processes must somehow intervene between the stimulus and the response. It is the very failure of cognitive psychologists even to comprehend, let alone answer, the arguments of the opposition that indicates that more fundamental issues are at stake. So let us delve a little more deeply.

Consider another curious statement of the representational theory, this time by Fred Attneave:

Naively, it seems to us that the outside world, the world around us, is a given; it is just there. . . . We all feel as if our experiencing of the world around us were quite direct. However, the apparent immediacy of this experience *has* to be more or less illusory because we know that every bit of our information about external things is coming through our sense organs, or has come in through our sense organs at some time in the past. All of it, to the best of our knowledge, is mediated by receptor activity and is relayed to the brain in the

form of Morse code signals, as it were, so that what we experience as the "real world", and locate outside ourselves, cannot possibly be anything other than a *representation* of the external world. (p. 493)

(I first encountered this passage in a valuable critique of representational theory by Noel Smith, 1983.)

Interestingly enough, here there is no appeal to the usual argument for the ambiguity of perception. Here we find the uncritical retention of another aspect of the Cartesian scheme, the notion of a mind lurking within the body, in direct contact only with the body and not with the environment itself. This notion, as Reed has recently argued, derives from the Cartesian hypothesis of corporeal ideas (Reed, 1982). Gibson's own criticisms of this assumption—for example, in his discussion of the visual control of manipulation—echo the important arguments Skinner has voiced over many years concerning the persuasive myth of the "inner man" (e.g., Skinner, 1938, chapter 1):

The movements of the hands do not consist of responses to stimuli. . . . Is the only alternative to think of the hands as instruments of the mind? Piaget, for example, sometimes seems to imply that the hands are tools of a child's intelligence. But this is like saying that the hand is a tool of an inner child in more or less the same way that an object is a tool for a child with hands. This is surely an error. The alternative is not a return to mentalism. We should think of the hands as neither triggered nor commanded but *controlled*. (Gibson, 1979, p. 235)

Unfortunately, the resources of representational theory are not easily exhausted. In its defense, it exposes yet further reliance upon the mechanistic scheme of classical physics. Its next resort is to the argument that only an instantaneous stimulus can be said to have an immediate effect, or can be considered to enter into causal or lawful relations. The influence of past events can enter into an account of behavior, the argument goes, only insofar as we can invoke some mediating representational structure to fill the gap in time. This plea of

cognitivism is familiar enough, of course, though its lineage is not always appreciated. Yet, as Jack Marr (1983) has recently noted:

It is not unlike the old problem in physics of action at a distance. Newton suggested the possibility . . . that an all-pervading "aether" served as the medium for such phenomena as gravitation and light. Psychology has been replete with mental aethers that mediate between stimuli and responses. Indeed, cognitive psychology seems to be paralleling classical physics in the search for an understanding of the structure and mechanics of the mental aether. The mental aether must have the property of mediating action at a temporal distance. (p. 13)

It is evidently not enough to insist, as Skinner does, that appeal to cognitive structures is unnecessary, or a "diversion" (Skinner, 1977a, p. 10), in the sense that we can conduct research and solve problems perfectly well without them. The argument that such structures can be disregarded does not in itself call into question their very existence, and indeed Skinner at times talks as if they might well exist after all. What we require is an alternative scheme that does not merely question the solutions put forward by cognitive psychologists but converts their very problems from implicit to conspicuous nonsense. It is in Gibson's final work towards such an alternative scheme, a new ontology, that his fundamental importance for psychology really lies.

Gibson, like Skinner, viewed science not as some sublime logical structure but as an aspect of human practice, and he showed a similar respect for the reflexive status of psychology which this view entails. Both saw that the theory (and metatheory) of psychology must at the very least be compatible with the fact of the human practice of science. Yet, as a number of critics have remarked, Skinner himself retains, and indeed sometimes recommends, the physicalist ontology which has proved so troublesome for psychology, and, despite the dialectical status of the concept of the operant, tends to treat the environment as though it were an autonomous cause (Kvale & Grenness, 1975; Malone, 1975).

Gibson proved a good deal more alert to the unfortunate sense in which psychology has

been "set up" by the program of classical mechanics. For if, to use Locke's metaphor, philosophers have been keen to serve as underlaborers clearing away the rubbish generated by such master-builders as Galileo and Newton, Gibson was not alone in realizing that psychology had been used as an all too convenient dumping ground. Indeed, Edwin Burt (1954) made this point most clearly in his important text, *The Metaphysical Foundations of Modern Science*:

It does seem like strange perversity in these Newtonian scientists to further their own conquests of external nature by loading on mind everything refractory to exact mathematical handling and thus rendering the latter still more difficult to study scientifically than it had been before. . . . Mind was to them a convenient receptacle for the refuse, the chips and whittlings of science, rather than a possible object of scientific knowledge. (p. 320; see also Koyré, 1965; Mead, 1938; Whitehead, 1926)

The dependence of representational theorists upon the ontology of classical science is most explicit in their ultimate resort to the distinction between primary and secondary qualities of experience. Many aspects of perceptual experience, they argue, *must* be purely subjective, mere mental constructions, in that they have no counterpart in the "real" world—the world, that is, described by physics. Gibson's misgivings about this distinction (Gibson, 1979, p. 31) began in some early work of his in the 1930s when he found that perceptual aftereffects held to be distinctive of such secondary qualities as color and warmth also occurred for so-called primary qualities such as line and curvature (Gibson, 1933). By the 1940s, he came to reject the classical, essentially Euclidean, notion of space as a vast, structureless container—as an abstraction irrelevant to the psychology of perception—in favor of a conception of the visual world as a set of overlapping surfaces (e.g., Gibson, 1950; cf. Carr, 1935, p. 1). Later still, he came to insist that the physicalist dimension of time was not perceived; rather we perceive ongoing events (Gibson, 1975; 1979, pp. 253-254). In his last book, in his theory of affordances, he went on to argue that we can properly be said

to immediately perceive the functions that objects serve for our activities (1979, chapter 8). The crucial claim of Gibsonian theory is that many of the so-called secondary qualities are indeed real properties of our environment, and, furthermore, the structures available in ambient energy are related to such environmental properties and events in a *lawful* way—they uniquely specify them. All the organism needs to do is detect these informative structures, and all that perceptual theory has to do, in turn, is explain *what* these structures are and *how* they are “picked-up”:

The theory of psychophysical parallelism that assumes that the dimensions of consciousness are in correspondence with the dimensions of physics and that the equations of such correspondence can be established is an expression of Cartesian dualism. Perceivers are not aware of the dimensions of physics. . . . They are aware of the dimensions of the information in the flowing array of stimulation that are relevant to their lives. (Gibson, 1979, p. 306)

Gibson's effort to deny the metaphysical basis of the distinction between primary and secondary qualities, far from being an obstinate attempt to deny the very existence and successes of science, was a considered effort towards determining its proper empirical basis, a task anticipated in some detail, in fact, in the writings of Whitehead (e.g., Whitehead, 1926, 1930, p. 48).

Two points should be added about the ecological ontology which Gibson developed to displace Cartesian dualism. The first concerns the fact that the ecological laws referred to by Gibson are certainly circumscribed; as he takes care to stress, they hold within the normal ecology of the organism. Such restriction, however, is not a peculiarity of ecological laws. A crucial insight of modern physics has been that laws specifying invariant relations need to be defined relative to an appropriate “domain of validity” (Bohm, 1965, chapter 25). Nevertheless, many psychologists still happily pit one theory against another, or uncritically invoke Popper's canon of falsification, without any regard for the different sets of circumstances to which the theories might apply.

The second point concerns a more profound

implication of the ecological perspective. Gibson denied perhaps the most central Cartesian assumption underlying cognitivism, that the relation between organism and environment is an essentially *external* one, the idea that the organism can be construed as if it could exist outside of any kind of coordination with an environment. In contrast, both ecological and operant psychology draw upon the important insight of early functionalist psychology (e.g., Dewey, 1896, 1898/1976) that it is the very *coordination* of organism and environment that must constitute the basic unit of analysis for psychology. Both operant and ecological psychology are committed to the view that the relation between organism and environment is internal; *neither* term in this relation can be defined independently of the relation itself. But in taking this view we should be clear about its implication, for it follows that the environment can no longer be considered, as it is in the Cartesian scheme, as an autonomous cause (cf. Hocutt, 1967). I cannot say that either Gibson or Skinner is altogether clear on this point, but a most lucid statement can be found in the writings of the evolutionary biologist Richard Lewontin (1982):

This view of environment as causally prior to, and ontologically independent of, organisms is the surfacing in evolutionary theory of the underlying Cartesian structure of our world view. The world is divided into causes and effects, the external and the internal, environments and the organisms they ‘contain’. While this structure is fine for clocks, since main-springs move the hands and not vice versa, it creates indissoluble contradictions when taken as the meta-model of the living world. (p. 159)

(Lewontin moves towards overstatement, however, when he continues that “organisms within their individual lifetimes and in the course of their evolution as a species do not *adapt* to environments; they *construct* them” [p. 163; cf. Dewey, 1898/1976, pp. 279-284].)

So far I have tried to set out the ways in which Gibson's attack upon representational theory has served to expose and challenge the deeper metaphysical assumptions of cognitive psychology. Cognitivism is hardly about to give up the ghost of Cartesian dualism, and

perhaps it will only succumb to death by a thousand qualifications. But there can be no doubt that its complacency has been disturbed, and so I must finally examine its usual retreat from the field of theoretical wrangling to the apparently clearer ground of empirical data.

The first appeal, to laboratory experiments, seems incontrovertible enough until we realize that the psychological laboratory is the very microcosm of the Cartesian scheme. After all, our major experimental paradigms are designed explicitly to prevent the organism from transforming the experimental situation, as would be possible to some degree in real life (Gadlin & Rubin, 1979). The subjects are free only in the sense that they can react to, rather than change, the conditions which are imposed upon them. Furthermore, when critics, such as Fodor and Pylyshyn (1981), for example, dismiss Gibson's claims for the existence of ecological laws on the grounds that "it has been repeatedly shown in psychological laboratories that percepts can be caused by samples of the ambient medium which demonstrably underdetermine the corresponding layout" (p. 172), they not only choose to ignore Gibson's requirement that our experiments should model the normal ecology of the organism, but they also disregard the carefully defined limits Gibson has set to his theory. Gibson's is a theory of direct perception, *not* a direct theory of perception. How people cope with the bizarre situations dreamt up in most psychological laboratories is quite explicitly outside the scope of ecological theory.

The last resort of cognitive theory is to the fact that people do indeed follow rules and represent things—though, of course, they do much else besides. Cognitive psychologists are quite wrong, however, to suppose that these facts about human beings can alone support their entire edifice of cognitive structures, and they are just dishonest when they pretend that Skinner or Gibson ever wished to deny these facts. Gibson (1979, pp. 258-263) was quite clear that the obtaining of "secondhand information" through words, pictures, and writings must be considered as truly mediated perception, and Skinner has gone even further in elaborating an account of how the verbal community comes to mediate much of our behavior (Burton, 1982; Skinner, 1945, 1957; see also Tikhimorov, 1959). In fact, Skinner and Gibson were working towards what they saw as

a proper psychology of cognition, a psychology which treats the relevant phenomena as necessarily grounded in social practices rather than upon the essentially private and individual mental structures invoked by cognitive psychology. Much more needs to be said about their contributions in this direction, but in this paper I can only take the opportunity to set the record straight.

My primary concern in this review article has been to introduce Gibson's critique of representational theory and to explain the way that it has served to expose so many vestiges of Cartesian metaphysics within contemporary cognitivism. I hope I have made clear some of the common ground which exists between ecological and operant psychology. The ecological approach and operant psychology share a good deal more than mere disenchantment with the status quo. Both insist that behavior presents a primary datum for psychology which is not to be treated as a mere symptom of underlying structures of either the cognitive or physiological kind. They recognize that the description of behavior is nevertheless difficult, and they promote a molar and functional classification of behavior rather than muscle-twitch psychology or classical reflexology. In rejecting the S-R scheme, however, they insist that behavior is nonetheless subject to lawful description and that these laws refer to an irreducible organism-environment relationship. Finally, they each have special contributions to make towards a proper psychology of cognition—a psychology, that is, concerned with truly mediated modes of behavior.

In 1915, Gibson's mentor, Edwin Holt, attempted to survey the many groups seeking an alternative to the traditional cognitivist scheme, and came to the following conclusion:

It should be obvious that a fundamental unity of purpose animates the investigators of these several groups, although they approach the question of cognition from very different directions. Will it not be a source of strength for all if they can manage to keep a sympathetic eye on the methods and discoveries of one another? (Holt, 1915, p. 208)

Some seventy years after Holt's suggestion, this alliance is surely overdue. Operant psychologists and ecological psychologists are not,

of course, the sole opponents of the cognitivism that still prevails. But, as I have tried to explain, *they*, at least, should keep "a sympathetic eye" on one another's progress.

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