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Ecological Psychology: The
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INTRODUCTION: BARRIERS TO REALISM

Science assumes a real world whose existence is not a matter of mental fabrication. Animals, by further assumption, are said to know this reality, at least in part. They know those aspects of the world that bear on their individual existences; and what one (kind of) animal needs to know, another (kind of) animal need not. Though the claim is easy to make—that an animal is perceptually in contact with reality—it is not a claim that can easily be defended. Realism as a philosophical point of view has required constant and sophisticated defense.

Yet it would seem that some form of realism must be captured in any theory that claims to be a theory of perception. To do otherwise would render impossible an explanation of the practical success of perceptually guided activity; and it is this aspect of perception, its role in successful activity, that we take to be the focal problem. For psychologists, a realist stance should seem to be a truism. There should be fairly general endorsement of the view that the causal relations that hold between the physical world and the physiological mechanisms of an organism guarantee that the animal is, indeed, sensitive to its environment. However, belief in a form of perceptual realism and the construction of a theory

that actualizes such a belief are two very different things. Historically, it has proven very difficult to design a theory of perception that is intrinsically realist; that is, a theory that identifies the objects of perception with objects that can be said to be present when no perceiving is going on.

Elsewhere (e.g., Mace, 1977; Shaw & Bransford, 1977; Turvey, 1977) we have discussed the issue of direct realism versus indirect realism as a major issue dividing perceptual theorists on the assumption that most are realists and that virtually all perceptual theories are realist theories. We are no longer so certain of this assumption, particularly with respect to the theories. The issue of whether a perceptual realism is direct or indirect may well be a subordinate issue—one that may eventually take care of itself. The overarching problem, as we see it, is whether or not one can devise a perceptual realism at all. The reason we think a realism in perceptual theory is so hard to come by lies not so much in the complexity of the problem as in the assumptions that we bring to it. These assumptions have created formidable barriers.

What are the major conceptual barriers to a successful realism? They appear to be several, all firmly grounded in traditional thinking that treats the animal and its environment as logically distinct (Turvey & Shaw, 1979). There is, to begin with, the assumption that the distal object and the proximal stimulus—say, the environment and the light reflected from it to the eyes—relate equivocally. Stated more strongly, the assumption is that the mapping of distal object properties onto proximal stimulus properties is destructive; the structuring of the light by the laws of reflection does not preserve the structure of the environment. On this assumed failure of the proximal stimulus to specify the distal object, it is a simple matter to generate skepticism about an animal's knowledge of what is real. Given the nonspecificity assumption, perception must be a matter of making propositions (about what the proximal stimulus stands for) with neither a guarantee of their truth nor any apparent way to determine their truth.

A second related barrier to realism is raised by the mind-body subtheme of animal-environment dualism. It is the promotion of two kinds of objects—that which perception is with reference to, the physical distal object; and that which perception is an experience of, a mental object representing the distal object. They are two kinds of objects because, it is argued, to talk about them, one must use two different and irreducible languages. Given the assumption of these two object kinds, skepticism arises about the animal's ability to perceive what is real, because the perception of reality depends on two object kinds—the physical and the mental—being coordinated. It has seemed in the past a relatively trivial matter to show slippage between the object of reference and the object of experience.

Animal-environment dualism thwarts realism in another, though more subtle, way: It invites a science of psychology largely separate from a science of physics and vice versa, a science of the animal as a perceiving/acting agent indifferent to a science of environments and indifferent to a science of the energy patterns

created by environments. Realism is hamstrung to the extent that the sciences hold distinct the knower and that which is known.

Consider, however, a program of theory and research committed to realism. It would have to advocate a physics in which the descriptors of the environment and the energy as patterned by the environment would be animal-referential; and a biology in which the descriptors of the animal would be environment-referential. It would have to seek a single language in which the object of reference and the object of experience receive the same description, thereby dissolving the distinction between them. With respect to the first barrier, a program committed to realism would have to promote a contrary assumption—namely, that the proximal stimulus necessarily specifies the distal object. On the assumption of a necessary specificity holding between, say, the light as structured and the properties of the environment inducing that structure, a realist program would pursue alternative descriptions of the structured light in search of such specificity. The search would be unfettered by a priori claims as to the proper spatiotemporal grain of analysis.

But closely related to the conceptual barriers already noted are others, made conspicuous by the preceding responses of a program committed to realism. There is, quite noticeably, the issue of describing what is real. If we choose to hypostatize the conventional variables of physics, then it is a simple step to argue that how things appear to an animal and what those things really are, are sometimes—perhaps often—largely distinct. Either the animal's experience is not of reality, or reality for the animal has been incorrectly defined. A program committed to realism would claim the latter. Paraphrasing a point of the preceding paragraph, the program would have to seek a definition of reality that would be animal-relative, but no less real for being so.

There is also, and again quite noticeably, a realization that if the proximal stimulus specifies the distal object, then perception need not be a proposition-making activity. That perception might be nonpropositional would also follow from a conflating of the objects of reference and of experience. But the notion of perception as nonpropositional is more than simply a suggestion on which other parts of a realist program converge. It is, we believe, a necessary response to a major barrier to realism—precisely, the assumption (belief?) that perception can err. Perception as a proposition-making activity can be either true or false and is therefore suspect as a source of knowledge about what is real. But if perception is nonpropositional, then it can be neither true nor false, neither right nor wrong. When conceived as nonpropositional, perception is a state of affairs, a fact of existence—and, therefore, incorrigible.

By and large, these introductory remarks summarize the thrust of the present chapter. The chapter is a *first* pass at dismantling two conceptual barriers to realism already identified—namely, the assumed distinction between the object of reference and the object of experience, and the assumption of perception as propositional and error-prone. In the sections that follow, the conceptual barriers

are fleshed out, and in measured steps we try to delineate the conceptual tools needed for dismantling them. Simultaneously we attempt to develop a case for the realist alternatives.

An overriding theme of the chapter is that a commitment to realism and an ecological approach to psychology go hand in hand, and it is to the character of this ecological point of view that our attention is first directed.

ECOLOGICAL PSYCHOLOGY

The ecological approach to psychology is a functional approach. It construes psychological problems as instances of biological adaptation. The ecological treatment of perception defines perception as awareness of the environment and thereby focuses attention on an animal's veridical experience. (Where veridical means that an animal's experience of the environment is sufficient to allow the animal to live and reproduce, one might say that the experience is ecologically correct. It is not "correct" in any absolute, philosophical sense.) Because the animal's environment constitutes part of this definition of perception, it is not possible to study varieties of meaningful experience as instances of perception unless the environmental component is included as an intrinsic part of the object of study. Awareness of the environment is not composed of two things that can be isolated and separately scrutinized—first, awareness and, second, the environment. For the ecological psychologist, to study perception without the environmental component would be like studying one hand clapping. A full account of clapping must necessarily include a sufficient study of that one hand, but increasingly detailed analysis of the hand does not continually increase knowledge of clapping. Nor will it help to divide the labor among those who study right hands and those who study left hands. Under this scheme of things, the phenomenon of clapping will be conspicuously absent.

Treating perception functionally makes it what philosophers have called an achievement word, not a process word or a word referring to the qualities of experience *qua* experience. Visual experience as a result of a blow on the head is not visual perception. Dreams and hallucinations are not perception. Awareness (including tacit awareness) of a real environment—the one in terms of which effective action must take place—is perception. The functional definition of perception reflects the opinion that experiences such as those found in dreams, hallucinations, and imagination are derivative and not likely to be fully explained until perception of the environment is understood.

Contrasting views of perception in psychology treat it in terms of characteristics that do not necessarily involve achievements. Observe that the common references to *perceived size*, *perceived distance*, *perceived duration*, and so forth not only fail to denote a sense of veridical experience but actually connote a lack of correspondence with reality. Instead of treating perception as something

like hand clapping, the traditional approach treats it like hand anatomy—at least in the sense that the problem allows a division of labor among those who study characteristics of hands and those who study the uses to which hands may be put. Thus they may agree that the study of environments is an important topic for perceptual psychologists to acknowledge but also believe that the labor can be divided between those who study the experience or process of perception and those who study topics about the objects of perception. As we said earlier, the ecological approach does not define its problem in a way that would allow such a division of labor to preserve the essential object of study.

In short, the ecological focus is different from the conventional, and in consequence the ecologically oriented scientist soon discovers that there are many conceptual issues to work out that are not usually discussed in modern psychology. It is not that the issues do not inhere in all psychology but that there has been tacit agreement to keep the issues out of harm's way. Preeminent among these is the issue on which we focused our introductory comments—that of realism. What does it mean to say that an animal perceives its environment? The answer must be that it perceives some of what is actually there in the world. But *what?* Atoms, molecules, quarks? Tables, chairs, oranges, waterfalls? Time, space, motion? Cubes, lines, pyramids? Each of these answers leads to conceptual difficulties that make it impossible to reconcile a theory of the causal processes (physical, physiological) involved in perceiving with the behavioral level of adaptive activity.

For most psychologists the problems that assume preeminence in the ecological perspective belong to philosophy and should not properly cut into the psychologist's work schedule. But it is a simple enough matter to show that the problems *are* inherent in the phenomena psychologists seek to understand. The fact that they have been addressed most often in philosophy rather than psychology, and the fact that they are often problems of clarifying concepts rather than making empirical discoveries, should not mislead one into thinking that as problems, they do not belong to the science of psychology.

BACKGROUND

The framework for our discussion of realism and ecological psychology builds on traditional approaches to the question: "How is knowledge possible?" We sharpen the question by giving it the form: "How is knowledge of the world (environment) possible?" Traditional answers, with successors in modern psychology, have been selected from a general set of characteristics of animals or humans that can be called mental processes. Thus the available pool of candidates includes sensation, perception, memory, reason, association, and various subdivisions of these processes. Theorists who stress the primacy of sensation or perception in knowledge gathering can be crudely lumped together as empiri-

cists. Theorists who stress reasoning processes such as inference or prior knowledge contained in a type of memory can be collectively designated as rationalists. In pursuing realism, we argue for the primacy of perception, thus casting our lot with empiricism. It becomes apparent, however, that an empiricism committed to realism will differ radically from familiar varieties of empiricism, sufficiently so to consider the ecological approach its own new category. Indeed, it is argued that the familiar forms of both rationalism and empiricism share a commitment to two features of dualism that a committed realist must oppose. These features are simple to describe and familiar to all psychologists despite the less familiar descriptive labels we have selected. We touched upon them in the introduction, and in the following discussion we refer to them as the doctrine of intractable nonspecificity and the incommensurability of natural kinds. These are two different ways to designate gaps between the knower and that which is known that must be bridged (or barriers that must be overcome) to have a complete scientific theory of knowing. In this background section, these gaps are discussed together with the recalcitrant problems facing not only the rationalist and conventional empiricist approaches to bridging the gaps but also the representational approach, which shares characteristics with both rationalism and empiricism and is currently a dominant feature of theories in cognitive science.

Intractable Nonspecificity

There is a belief of some antiquity that holds that the inputs to an animal's nervous system are an inadequate basis for knowing the world. This inveterate belief is fundamentally an assertion that energy media cannot convey meaningful information for animals about the world in the sense that the media, as patterned, are not specific to properties of the world taken with reference to animals. We have referred to this belief as the doctrine of intractable nonspecificity (Turvey & Shaw, 1979).

Traditionally, the doctrine is complemented by the claim that an animal has at its disposal the means for processing energy media to make them meaningful. What an animal is said to have, in short, is knowledge about the world; and debate has focused on whether the knowledge comes from stored memories, innate schemata, or reason. The debate has been intensive and oftentimes eloquent, but it has always begged the question that characterizes the traditional explanations of an animal's knowledge: All traditional accounts of how an animal knows what it knows presuppose the very knowledge of the world they seek to explain. What remains fiercely at issue for empiricism and rationalism as alternative perspectives is precisely the origin of the knowledge that the animal is said to have.

We may, if somewhat crudely, compare empiricism and rationalism with respect to three questions: (1) What is the proper vocabulary in which to describe the structured energy in which the animal is immersed? (2) What is the proper vocabulary in which to describe the mental entities corresponding to the struc-

tured energy descriptors? (3) What is the relation between these mental entities and knowledge?

With respect to the first question, empiricism has tended to adopt the stance of nominalism and has assumed that the vocabulary cannot be of abstract relations and the like, but only of simple, concrete particulars. Thus the structured energy might be described—say, in the case of light—as rays of given intensity and wavelength. The answer to the second question follows: The corresponding mental entities are at the same elemental grain-size as the energy descriptors and, similarly, must be simple, concrete particulars. In earlier forms of empiricism, these latter, simple particulars were sensations; in more contemporary perspective, they can be fine-grained features without violating the explicit mental nominalism of classical empiricism. The gist of empiricism's answer to the third question is that the complex, abstract particulars that comprise the animal's knowledge of the world must be induced from the simple, concrete particulars provided by sensory experience. Association has been the commonly promoted mechanism of induction.

Our portrayal of rationalism's response to the three preceding questions can be brief. With respect to Question 1, rationalists would probably be unanimous in their agreement with the answer from empiricism; and with respect to Question 2, empiricism's answer might not be palatable to all rationalists, but it would be tolerable for most. It is with reference to Question 3 that the two points of view diverge. In contrast to empiricism's claim that abstracta are induced from concreta, rationalism argues that concreta are interpreted—given meaning—by abstracta; for rationalism, knowledge of the abstract must be anterior to experience with the concrete.

There are two points to be emphasized. One is that with respect to nominalism, empiricism and rationalism part company only on the last of the three questions raised. The other point is that empiricism promoted "sensing" as the source of knowledge and thereby sought to ground the origin of knowledge in experience, whereas rationalism traditionally denied the primacy of sensory contact in favor of reason. The sensory mechanisms, rationalists often argue, are just sources of phenomena; it is by the instrument of reason, working on the phenomena of the senses, that reality is made known.

But it would seem that to impugn the primacy of sensory contact with the environment is self-defeating, for it leaves no means by which knowledge could originate. If an animal's awareness of what is real (real, that is, for its purposes) is wrought through a process of reasoning from the inadequate data made available by the senses, then we should suppose that the constraints on this reasoning are neither indifferent to the features of the environment, as they relate to the animal's behavior, nor to the laws that relate these features to the patternings of energy that they create.

Now by evolutionary theory, at any point in the evolution of a given animal's species, there must have been an ancestor that knew reality in order that an adaptive relation between this animal and its environment held (to support the

successful production of offspring). That is to say, for any point in evolution that we choose, there must have been an ancestor whose reasoning abilities were tightly constrained by the significant features of its environment and the manner in which those features modulated energy media. What will always remain unexplained is how the constraints arise. Indeed, if the argument sketched here is run to conclusion, we would have to suppose that the requisite environment-specific tailoring of reasoning is extraevolutionary in origin. And that ought to be an unsatisfactory conclusion.

It is of some importance to the point being made that the distinction between nativism and evolutionism be made clear. Nativism has been a classical response to the doctrine of intractable nonspecificity: Concepts available at birth and matured in development define the medium in which inadequate sensory data become meaningful percepts. But nativism did *not* identify, either by design *or by intent*, the mechanism for the origin of said concepts. Whereas nativism regards knowledge as a priori, evolutionism views knowledge as a product of the history of the species, a response to the pressures of natural selection. We see, in short, that nativism and evolutionism distinguish on just this point: Evolutionism is a programmatic orientation to the question of *how knowledge originates*, a question left unasked by nativism. But the point of the immediately preceding paragraphs is that an argument from evolutionism with respect to the origin of knowledge converges on a priorism (and thus nativism) when one of the premises of the argument takes the form of a denial of the primacy of perception—that is, a denial of perceiving as *the* source of knowing.

We should ask, therefore, where empiricism failed in its attempt to found knowledge in experience. The reasons seem to be primarily two, and they are closely related. The first is the doctrine of intractable nonspecificity; given this as the received doctrine, it was necessarily the case that some process other than sensory contact with the environment was needed. Sensory contact per se could realize only equivocal and inadequate dividends. The second is the distinction between sensation and perception, with sensation relating to simple dimensions of physical energy, and perception relating to environmental and animal events; and with perception said to be predicated on sensation. Empiricism in its classical form failed because in order for perceiving to be *the* means by which an animal comes to know what it knows and justifies what it knows, it cannot be the case that perceiving is mediated by *knowledge*, however defined. Classical empiricism was forced by the doctrine of intractable nonspecificity and an entrenched nominalism to appeal to memories and sense data as mediators of perception. Paradoxically, empiricism's platform was undermined by its very assumptions.

But it is clear—at least to us—that *an* empiricism is needed, that the central problem is to unpack successfully the idea of perceiving as *the* means of knowing, whether the focus be the perceptual experience of a present animal or the perceptual experience of its ancestors.

This sought-after empiricism, though consonant with classical empiricism in spirit, would differ substantially from the classical view in detail. A sharp con-

trast on the basic assumptions is to be expected. Thus, for example, a successful empiricism could not be built on the assumption of intractable nonspecificity, but it might be built on the assumption of necessary specificity (Turvey & Shaw, 1979)—that for any given (species of) animal, energy media must necessarily be structured by the world in ways that are specific to properties of surfaces and substances taken with reference to the (species of) animal (Gibson, 1966, 1977; Mace, 1977). The concepts of affordance and effectivity that are discussed in the next main section are expressions of this unconventional doctrine.

Incommensurability of Natural Kinds

We see, in short, that one method of overcoming the nonspecificity dealt with earlier is to change part of the theory to build in more specificity. This is what James Gibson proposed to do in 1950 with his program of perceptual psychophysics. With respect to vision, Gibson (1950) showed examples of structured optical descriptions of an animal's surroundings that were more appropriate than traditional descriptions to the categories of what is perceived. Gibson's suggestion, then and now, is that a concerted effort to discover more such environment-specific structures in the light might reveal enough to support a theory of visual perception based on specificity among; (1) the structure of the animal's surroundings, (2) the light as structured by those surroundings, and (3) the animal's perception of those surroundings. Thus, in the program advocated by Gibson (1950, 1966), both specificity and tractability are assumed. Because we do not know the true structure of the "givens" of perception that support specification, it is taken to be a major task of empirical science to discover this structure. There would be no such scientific task for students of perception committed to nonspecificity as a matter of doctrine (cf. Turvey & Shaw, 1979).

There is a second problem, however—one that tradition might have us believe is a problem that would remain untouched by the demonstration of specification. No matter how much the description of structured energy media is enriched, it might be argued that this enrichment cannot alter the *kinds* of entities involved. Is it not the case that the problem of knowing the environment contains an essential gap between physical and mental entities? This is a *qualitative* gap, one that separates incommensurable entities. It is known more commonly as the mind-body problem.

The metaphysical dualism of traditional psychology and, indeed, of most 20th-century science divides the natural world into two kinds of objects: physical phenomena and psychological phenomena. This division, as noted in the introduction, poses a barrier to realism. A committed realist is justifiably uncomfortable with a kind of realism that is true to dualism, a realism that proposes epistemic entities as mediator between a world that is claimed to be real and experience—a realism that might be dubbed "indirect." Many scholars would argue that the kind of realism that would make a committed realist comfortable, a realism in which there are no epistemic mediators—that is, direct realism—is

nothing more than a form of naive realism, the belief that the perceived world is all that is real. If so, then it must be admitted that a commitment to realism that rejects the dualism-tainted, indirect realism leads nowhere useful. However, it is argued here, as it has been elsewhere (Shaw & Bransford, 1977), that this pessimistic evaluation is by no means warranted: Direct realism and naive realism are not equated; there are a variety of direct realisms, *one* of which is naive realism. What must be demonstrated is that a form of direct realism exists that can satisfy the committed realist who desires a footing for knowledge firmer than mere belief, by allowing perceptual experience to be a direct "contact" with *some portion of what is real in nature*—namely, that which has relevance to the life-style of the perceiver.

Scientists have been justifiably reluctant to take seriously philosophical answers to scientific puzzles. Bertrand Russell most eloquently voiced these shared misgivings among scientists when he observed that metaphysics is to scientific investigation what thievery is to honest toil. Consequently, before launching full throttle into the brambles of the problem of incommensurability of natural kinds (i.e., of physical and psychological phenomena), a few words may be in order to soften the ordeal for the scientist and to allay any fears that the search for an acceptable form of direct realism is in any way an attempt to void Russell's remarks.

The fundamental problem of perceptual epistemology, and hence of psychological approaches to the problem of knowledge, would be solved if it could be shown that the entailed dualism was not necessary. Admitted and unavoidable, however, is the realization that if this dualism is to be dissolved, then the dissolution must take place at a level somewhat deeper than epistemology. It must take place at a level where decisions are made regarding the objects to which perception is with reference and the objects of which perception is an experience—respectively, the so-called physical and mental objects of mind-body dualism.

However, no absolute answers need be sought. All that is needed is a realization that our task is to explain experience both in terms of the reference it makes to the world and the intentional means of doing so. There are apparently two kinds of objects whose ontological status must be elaborated—reference objects and intentional objects. The descriptions of these objects that we seek must satisfy the requirements of scientific explanation, but they need not be philosophically "rock-bottom." That is to say, the deeper problems of constructing an absolute metaphysics can be left to the professional philosopher. As scientists—more precisely, as scientists taking an ecological stance—we need only seek a compromise position that lies somewhere between the absolute concerns of metaphysics, regarding what must exist if anything exists at all, and the relative concerns of epistemology, regarding what must exist if (perceptual) knowledge is to be possible.

Thus, we would argue, the goal of the ecological psychologist is more modest than the goal of the philosopher who pursues ontological analyses: Whereas the

philosopher seeks grounds for inferential knowledge that must be necessarily true in spite of the contingent properties of the world and the experiences of humans, the ecological psychologist seeks only those grounds for experience that make possible a perceiver's evolutionary specialized knowledge of a rather restricted world. Thus grounds for knowledge are sought that possess relative or ecological validity rather than grounds for knowledge that possess absolute metaphysical validity.

This is not to say that the task is any less difficult than that of the philosopher. On the contrary, the logical tools that have been developed over the past 2000 years to aid philosophical inquiries are valuable armaments for the ecological psychologist as well, because the tasks are so methodologically similar. Whatever aids straight thinking in one domain most likely will do so in the other.

Representation as Presupposing a User and as Presupposing Specification

A compelling strategy that has been adopted to sidestep partially, if not to solve, the problems raised by the doctrine of intractable nonspecificity and the incommensurability of natural kinds is to posit representations that contain the essence of knowing. If an animal can be said to know or perceive or remember by virtue of its own representations of its surroundings, the theorist might ease the transition between the physical and mental world. It has become increasingly popular, with the growth of the information-processing perspective, to explain perceiving, remembering, and behavior by *internal* representations. Consequently the call is out for a completely general theory of representation (e.g., Bobrow & Collins, 1975; Dennett, 1977; Fodor, 1975) in order to understand better how one thing can represent another. A representation may be defined, tentatively, as a structure—either abstract or concrete—the features of which purportedly symbolize the features of some other structure (MacKay, 1969). And *to represent* entails the thing represented, the representation, and *the device for which the representation is intended*. The latter aspect of representing has been the cause of much concern.

Long before the information-processing perspective took hold, philosophy and psychology (with a few exceptions, such as behaviorism) claimed that the only kind of psychology with a chance of success was one that posited internal representations. But since a representation entails a user, an interpreter or agent with psychological traits such as comprehension and goals, the claim that a psychology without internal representation cannot succeed is equivalent to the claim that a psychology without internal animal-analogues cannot succeed. In short, to advocate the necessity of internal representations is to advocate the necessity of homunculi; but to advocate homunculi is to doom psychology to an infinite regress. And a psychology with unexplained or uninterpreted, internal animal-analogues is no psychology at all.

Let us distinguish between "representation *for*," which necessarily implies a user, and a "representation *by*," which does not (cf. Cummins, 1977 [appendix]). Suppose that we are talking about a skill of some kind (such as striking a baseball). This relatively complicated activity can, in principle, be decomposed into a number of relatively less complicated activities that, when suitably organized, produce the skilled striking of the ball. Taken collectively, the component activities and the order and manner of their interlacing may be said to identify a "program," and learning to hit a baseball can be described, in part, as memorizing that program. We can speak, therefore, of the program as a kind of knowledge that can be examined and followed by some separate mechanism to execute baseball batting much as a cook might examine and follow a recipe to execute the preparation of a gourmet meal. Herein lies the sense of representation *for*: The internally represented program must relate to the mechanism that executes it in much the same way that a recipe, as a part of a cook's environment, relates to the cook. The analogy underscores the properties that the user of the internal representation must have, and they are the very properties that a science of psychology would seek to explain.

Is there a way in which these properties can be discharged that preserves the notion of internal representation as a source of knowledge? The problem is an old one, and it was tackled unsuccessfully by Hume (Dennett, 1977). Hume, however, did point in the direction of what, to some, appears to be the solution—precisely, the idea of self-understanding representations. It has been suggested (e.g., Dennett, 1977; Fodor, 1975) that the "data structures" fashionable in artificial intelligence research are just such creatures or, at least, that they come very close to being just such creatures: Data structures are said to be (kinds of) representations that understand themselves. The trick to discharging an intelligent device—an animal-analogue that manipulates internal representation—is to devolve that intelligence on *many* fine-grained devices that are marked by their ignorance and myopic outlook. This is not the whole trick, however. For paralleling the devolution of intelligence, there must be a differentiation of any given representation into representations of considerably lesser sophistication, each tailored to the stupidity of its respective user(s). And paralleling this paring down of sophistication in representation and user-ability, there must be an increasing sophistication in organization. Hence it is by such means that, in theory, markedly intelligent activity can be achieved by a collection of markedly unintelligent subsystems.

The thrust of self-understanding representation is to slur intentionally the distinction between representation and user. Additionally, it would seem to slur the distinction between representation *for* and representation *by*. Referring back to the baseball-hitting program, saying that the program is represented *by* a device is to intend something quite different from saying that the program is represented *for* a device, as the following example (after Cummins, 1977) illustrates.

Given a complicated electronic circuit, one could draw a schematic diagram of the circuit as a way of expressing the circuit's style of functioning. And it would be legitimate to say that the circuit is represented by the schematic diagram, and vice versa. Similarly, one could write a computer program to express analytically the circuit's behavior, and in like fashion it would be legitimate to say that the circuit is represented by the program, and vice versa. In both these cases exemplifying representation *by*, representation is used descriptively rather than imperatively. That is to say, in both cases, representation is used as a theoretical tool for analyzing behavior rather than as a cause of behavior (Cummins, 1977). In neither case could we internalize the representation, for although we can say that the schematic diagram or program is represented *by* the circuit, it would be nonsense to say that the program or schematic diagram is a representation *for* the circuit that can be used to direct the circuit's performance.

Clearly, representation in the sense of representation *by* is a userless concept: A representation, in this sense, is not information, not a source of knowledge, to be used by some agentlike device. When representation is interpreted in the sense of representation *by*, we cannot ascribe to the representation of *X* the status of a thing perceived when one is said to perceive an object or event *X*; nor can we ascribe to the representation of *Y* the status of a thing controlling and coordinating behavior when one is said to perform the activity *Y*. A representation of *X* by the nervous system of an animal might be discerned by the neuroscientist or by the information-processing scientist when the animal is perceiving *X* (as might a representation of *Y* when the animal is doing *Y*), but it is not discerned *by the animal or any of its parts*. To be purposely redundant, when we speak of representation in the sense of representation *by*, there may be a representation of an environmental situation *X* by an animal's nervous system when the animal sees *X*, but it is not a representation *for* the animal (or any part of the animal) as perceiver; and there may be a representation of an activity *Y* by an animal's nervous system when the animal does *Y*, but it is not a representation *for* the animal (or any part of the animal) as actor.

Ideally, the concept of self-understanding representation, as intimated already, eliminates the representation/user dichotomy. A question arises, however: On eliminating this dichotomy, do we relinquish the rights to the notion of representation as a source of knowledge (a source for whom?) and to the use of the prefix *internal*? And does it not invite a consideration of the possibility that self-understanding representation is logically equivalent to representation in the sense of representation *by*? In this case, there would be no imperative sense in which representation can be used, only a descriptive sense. That is to say, in short, that representation would refer (simply) to the way in which an animal is structured when, say, the animal is perceiving, acting, or remembering and not to a causal determinant of the animal's perceiving, acting, or remembering.

The conundrum on which the preceding remarks have focused is the time-honored one of representation presupposing a user, and the remarks are intended

to convey the flavor of the debate to which the user presupposition has given rise. There is another conundrum to be considered—one that is far less heralded but no less important—that representation presupposes specification. Following MacKay (1969), we tentatively defined a representation as a structure, the features of which symbolize the features of some other structure. Of any posited internal representation, we could ask: how did it arise? More to the point, however, we could ask: Why did that *particular* representation arise, symbolizing *those* particular features and not some other? Presumably, it must be argued, by those who would posit internal representations as determinants of perceiving (or acting, or remembering), that the internal representations are “made” during the course of phylogeny and/or ontogeny. The underlying puzzle is how the to-be-made internal representations are selected—that is, how they are specified.

We may highlight the specification presupposition through a brief consideration of the mechanics of using representations. A conventional argument, motivated by the doctrine of intractable nonspecificity, is that proximal stimulation is interpreted in terms of the distal object that would most normally give rise to it. The idea is that the perceiver has at his or her disposal internal representations of “normal” situations and brings these representations to bear on the proximal stimulation. Helmholtz (1925) and William James (1907) were early proponents of this idea, which currently receives expression through a number of scholars (e.g., Gregory, 1966; Minsky, 1975). Suppose that normal situations are represented in the form of structural descriptions exemplified by frames or schemata (cf. Bobrow & Collins, 1975). The assimilation by a frame of a preliminary description of the proximal stimulus yields the perception of the distal object. There are, of course, many frames, and how the proper frame for assimilating the proximal data is arrived at presents a problem. We may suppose that several frames are tried before the correct one is hit upon. But how is the first frame chosen? It would be undesirable if the first frame did not approximate the correct frame, for we may suppose that a blind choice of frames would then ensue. Theory at this point seeks succor in “context,” assigning to context a significant role in narrowing the initial choice of frame. Roughly and intuitively, the way in which context may be presumed to work is like *pointing*: Context points to (or specifies) the ball park of relevant representations. Hence selection of a frame presupposes specification by a context. Whether an epistemic entity that is framelike is necessary or not, we take it that in representational theories, there will always be some relation of specification between the structure of stimulation and the putative epistemic entity.

At all events, a little thought suggests that a case can be made for a completely general theory of specification, so that we might better understand how one thing can be said to specify another. Such a theory might be thought of as a natural accompaniment of a completely general theory of representation, but it need not be—at least not with respect to such matters as perceiving, acting, and remembering. We have touched upon the deep-seated difficulties of positing epistemic mediators for perception, and we have identified problems for a concept of

representation interpreted in the sense of representation *for*. It may well be that an adequate theory of specification would obviate the need to postulate internal representations; in short, perhaps it is a theory of specification rather than a theory of representation that is of primary concern.

The Problems of Representational Realism (as the Principal Form of Indirect Realism)

Conventional psychology (largely under the influence of positivism) expresses limited interest in metaphysical issues; this attitude has been generalized to epistemological issues as well—a case of throwing the baby out with the bath water. This attitude is exemplified by the lack of concern for the questions of whether memories are true representations of past experiences and whether perceptions are truly distinguished from appearances (e.g., sense data). In keeping with this studied disinterest in epistemological issues is the contemporary eminence of a theory of representation on which we have just remarked: The central concern of cognitive psychology appears to be how knowledge is represented and organized (e.g., Anderson & Bower, 1973; Bobrow & Collins, 1975).

Not surprising, either, is the fact that little concern is shown for determining how such representation may express valid knowledge about objective occurrences. That is, they do not inquire into the problem of how representations “interface” with the world; and, *a fortiori*, they do not inquire how representations can yield knowledge of the world with which they are interfaced. To a great extent, cognitive representations are left dangling, semantically hinged to nothing more solid than other cognitive representations.

To be fair, contemporary cognitive theory tacitly assumes some form of the correspondence theory of meaning and imputes a degree of resemblance, or isomorphism, between the cognitive structure and the thing it represents. If pressed to explain whether such a resemblance is necessary or only contingent, the most apt response is that since perception can sometimes be in error, as when viewing illusions or mirages, then the correspondence at best is only contingent.

But how valid is the knowledge possible under such a view? The only answer that can be given is to invoke a version of the causal-chain theory of perception, which, in the case of vision, asserts that *somehow* (a somehow that is never quite explained), the image experienced is of a real fact if the causal chain from object-to light wave-to retinal image-to brain-to homunculus remains unbroken and undisturbed—say, by intrusions in the media (e.g., light, eye, nerve tract, or brain) supporting the perceptual process. However, the percipient can never know whether such intrusions are present and to what extent perceptual experiences may be of something other than the reference object for which the representation was intended.

Involved in the de facto structure of the foregoing argument are de jure questions of considerable epistemological importance arising from the assumed incommensurability of natural kinds: To what does a perception refer? To the

cognitive representation? Or to the reference object in the world? If the answer is that it refers to the object in the world, then why the need for a representation at all—why not just let the object of experience be the object of reference? Although such a solution avoids the need for representational stages in perception, a ploy that a committed realist should endorse, it seems to fall down on the issue of error in perception, an issue that the traditional theorist is not likely to ignore given the large body of research devoted to the study of illusions.

On the other hand, if it is argued that the perceptual experience refers to the "object in the head," it is still unclear whether this means the cognitive representation *qua* psychological entity or a function of the neural substrate *qua* physical entity. Furthermore, whichever is meant still requires a referential theory to explain how the correspondence with the world referent is achieved so that perceptual knowledge is possible. Such a referential theory must be causal if the representation is deemed to be a physical entity (e.g., a brain state), leaving theoretically vague how the homunculus, as a psychological entity, is to be related to a physical entity. On the other hand, if the representation is deemed to be a cognitive structure, the same problem remains; namely, although a representation might be a content of the homunculus's "perceptual" experience, how is it to be related to the chain of causal support that guarantees the possibility of perceptual knowledge of the world?

As tiresome as this old philosophical chestnut may be to those who have muddled through the mind-body problem in Philosophy 101, it serves to point out exactly why the traditional approach to the problem of perceptual knowledge is fruitless. It is fruitless not simply because it chooses to be vague on the issue of how physical entities may be related to psychological entities but rather because it cannot avoid being vague; it is vague by necessity, not by want of cleverness on the part of its proponents.

The difficulty for representational realism appears to reside chiefly in two assumptions—first, that the object of perception (a representation) corresponds to its reference object by a causal process. This assumption requires that physical entities in the world must somehow be coordinated with psychological entities. (At a more subtle level of analysis, it confuses causal support for an epistemic act with the epistemic act.) For future discussion, we call this the *problem of referentiality*. A second major assumption is that an *internal representation*, as the object of perceptual experience, is an *intentional object* in the quasi-technical sense originally proposed by Brentano (1874/1925). This term, *intentional object*, figures prominently in the ensuing discussion, and we would do well to preface its usage here. It is of no little significance that the idea of intentional object promotes the incommensurability of natural kinds independent of any arguments about the ontological status of mental entities (cf. Dennett, 1969).

By way of a quick (and dirty) explanation of intentional objects, note the argument that statements about intentional objects cannot have the same truth conditions as statements about nonintentional objects. Here are some statements

about intentional objects: I want X; I hope for X; I imagine X. And here are some statements about nonintentional objects: I throw X; I walk through X; I eat X. The point about an intentional object, therefore, is this: It does not or need not exist in the fashion of nonintentional objects such as those thrown, walked through, and eaten; after all, it does not follow from imagining a pint of Guinness stout that there is a pint of Guinness stout that I imagine. In short, intentional objects do not have ordinary existence; rather they have—as Brentano expressed it—"inexistence." On the representational (indirect) realist's view of perception, it is evident from this intuitive explanation that the representation intermediary between the reference object and experience is an intentional object, and the possibility arises that perception does not imply some ordinary (that is, real) thing perceived. We refer to the problem of elaborating on what is meant by an intentional object as the Problem of Intentionality.

Distinguishing Between Direct Realism and Indirect Realism (a Phenomenalism)

It is fair to ask if the direct realism favored by a committed realist fares any better with respect to the epistemological puzzles that infirm indirect realism, which we now appreciate is more aptly termed a phenomenalism. Clearly, the problems the two kinds of realism face cannot be identical since their goals and fundamental epistemological assumptions differ radically. In fact, the main problem of direct realism is complementary to that of a realism mediated by phenomena or representations in the following way: If knowledge of what is real is to be possible, then the content of the perceptual experience of some object *x* must refer to object *x*. For representationalism, a representation stands intermediary between the experience and the reference object *x*. Hence under the representational view, the referential relationship is indirect in that the intentional object of the experience, the representation, is not the same as the referential object *x*. However, under a theory that perception is direct, the intentional object cannot be something other than the referential object, and perception, therefore, is of an object in the world and not of some extraordinary object "in the head." If no representation exists and perception is direct, then there can be no slippage between the experience and that to which the experience refers. Thus, the possibility of knowledge of the world being obtained through perceptual means is logically assured. If this argument is valid, then direct realism is the only reasonable epistemological position—the only reasonable position that a committed realist could endorse.

But notice that if error can be introduced into perception by some means, then no logical assurances can be given to guarantee the possibility of knowledge. If perceptual experience may contain erroneous information about the world, uncertain knowledge is all that is possible. Uncertain, or contingent, knowledge is of course nothing more than beliefs that may be either true or false.

Surely there is undeniable evidence proving that perceptual experiences are sometimes the breeding place of error. Consider the case of so-called misperceptions, as in magic shows where one fails to perceive what really takes place, or in masking experiments where seeing one of two closely presented displays precludes seeing the other. Also, what of illusions where one sees something that, from the standpoint of physics, is not really there? We can see straight lines as spuriously bent (the Hering and Wundt illusions or the stick-in-water illusion), size discrepancies between objects that are truly of equal size (the Ponzo, Müller-Lyer, and Jastrow illusions), or a lack of alignment where alignment is really perfect (the Poggendorf illusion).

Thus the concerned realist who desires a firm perceptual foundation for knowledge seems trapped between the compellingness of erroneous experience, on one hand, and the necessity of valid experience, on the other hand.

It is now possible, in the wake of the preceding discussion, to move to a deeper level of appreciation of the dilemma facing a viable realism, regardless of which of the two views is advocated: Direct realism and indirect realism (phenomenalism) are horns of the same dilemma; to deny one is to affirm the other and, unfortunately, at the same time to inherit all of its attendant epistemological puzzles. A popular tactic for avoiding dilemmas is to deny that they represent the only alternatives—which means, so to speak, to pass safely between the horns without being ensnared by either self-contradictory position. As appealing as this solution might be, it does not seem viable since no third alternative form of realism is possible. Between the two horns of direct and indirect realism, there does not seem to be sufficient room to pass.

If we are essentially correct in our appraisal, then the only strategem left open to the psychologist *qua* committed realist who stubbornly refuses to be cynical about the possibility of knowledge is to demonstrate that a change in the relative acceptability of one of the two positions is possible. Such a change must be wrought at a level of argument deeper than epistemology—namely, at the level of ontology that furnishes common ground for both views. Direct and indirect realism can only be placed at loggerheads at the level of epistemology (i.e., regarding perception-as-knowledge versus perception-as-belief) if they are commensurable at the level of ontological commitment. For instance, both views (as already portrayed) share a common belief with respect to which aspects of perception are physical entities—namely, the reference object in the world—and which aspects are psychological entities—namely, the contents of experience. Since they are essentially in agreement on these ontological matters, we must look elsewhere for an issue that can be used to pry them apart. Metaphorically speaking, this cement of shared ontological framework allows the objectively stronger of the two positions unwittingly to provide support for the other. By logically separating the two positions at their ground of support, it is our belief that the weaker position will topple under its own weight, leaving the logically sounder position upright.

It remains only to ascertain the divisive issue: Recall from the earlier discussion, in addition to the contents of experience and the referential object from which such contents draw their meaning, that there is the intentional object—a cognitive representation for indirect realism—and the object of reference—as captured in a conventional physical description—for the naive form of direct realism. It is here that the required ontological wedge is to be found.

THE REALIST INTERPRETATION OF PSYCHOLOGY AND ITS PROBLEMS

Perceiving as Knowing Rather than Believing

An almost universal opinion about the epistemological status of the information about the world that perception provides asserts: "Seeing is believing." We hold this view to be seriously misleading because it imposes on perceiving the logic of believing rather than the logic of knowing. Only the latter logical analysis is acceptable, since the former makes it impossible to distinguish knowledge of reality from knowledge of appearance. To avoid this epistemological conclusion, the adage should read: "Seeing is knowing." The argument to be made can be schematized as a formal analogy: *Perceiving is to appearing as knowing is to believing*. The most fundamental distinction between direct and indirect (representational) realism inheres in the strong epistemology of direct realism, which endorses perceiving-as-knowing, and the weaker epistemology of indirect realism, which accepts perceiving-as-mere-believing.

The crucial distinction between the two forms of realism is not so much that one believes knowledge of the world through perceptual means is possible whereas the other does not, but that they disagree as to what the constituents of knowledge are—facts or beliefs. Their differing characterizations of knowledge retroact on their respective views of perception, forcing each faction to adopt a theory consistent with its peculiar form of realism and at odds with the other. Furthermore, even theories at this level have inevitable implications for the design and interpretation of experiments. For instance, one does not attempt to measure quarks unless one believes that they exist in a state sufficiently real to be measured. Neither does one attempt to investigate the organization of the imputed cognitive structures presumed to represent knowledge or perceptual experiences unless these, too, are believed to be in a state sufficiently real to be investigated.

The question of the ontological status of the intentional and referential objects of perceptual experience and of the nature of their epistemic accessibility has serious consequences for one's scientific realism and entails constraints that are passed down to the selection of methodology and experimental goals. Therefore, it would be a serious mistake to dismiss the issue of what form of realism is most

plausible, since regardless of what ultimately proves right or wrong, the position chosen has significant practical ramifications.

If one defines knowledge as *true* belief, then the possibility of *false* belief is also implied. Following the foregoing analogy, perception would be defined as true appearance and misperception as false appearance. Something that happens to be true but could just as well have been false is contingent. Thus perception as defined by the analogy would be considered a source of contingent knowledge about the world. In this case, perception would assume the same logical status as occupied by judgment or inference: To perceive that "some x is y " would be tantamount to inferring that some x is y is a fact about the world that may or may not be true; at least, if true, it might have been otherwise. Such a view, as Helmholtz realized, makes perceiving a species of judgment (an unconscious inference, perhaps) as fallible as any other source of belief. It is extremely important to notice that this assumption—that perceiving and believing can be treated as logically equivalent—allows error to creep into perception just as readily as it might creep into judgment. In more technical terms, this traditional characterization proclaims perception to be the assertion of contingent, a posteriori facts about the world.

As we shall see, this traditional characterization of perception is not acceptable, since it permits certain philosophically queer conclusions to be drawn—such conclusions as importing existence to mere fictions—and it gives other vagaries of imagination the same ontological status as real objects: Unicorns and sphinxes become ontologically indistinguishable from horses and lions and hallucinations indistinguishable from perceptual experiences. A stronger commitment to realism than the anemic form endorsed by representational realism is needed in order to avoid such confusions. What is knowable must be more tightly bound to what is real than is admitted by the claim that perceiving is believing. To see what this means, let us consider, in some detail, various issues separating the perception-as-believing and perception-as-knowing positions as held by indirect and direct realism, respectively.

Avoiding Inexistent Objects

The accusative form of sentences involving verbs specifying psychological attitudes has led many philosophers and psychologists to postulate a shadowy realm of entities to be taken as direct objects of these verbs. Such ghostly entities are to be distinguished from those objects needed to define relationships among physical objects. "John *believes* Mary lied"; "Bill *saw* the snake"; "The detective *knew* who the murderer was"; and "The wife *desired* a change" are all sentences that employ verbs referring to psychological attitudes regarding the objects involved. Such objects, however, may or may not exist in the sense intended by the sentence: Mary may not have lied to John, so there is no lying Mary who exists to be the intentional object of John's believing. Yet the accusative form of the statement clearly requires that the verb take an object. Similarly,

the objects intended by each of the other psychological attitudes may not really exist: Bill's snake may have been a stick; the detective's victim may have been a suicide; the wife's desire for a change may forever go unfulfilled. But if the objects of the main verbs may not refer to things in the ordinary world, where are the objects intentionally specified by the corresponding psychological attitudes?

Brentano (1874/1925) suggested (but later recanted) that such objects, because they may not exist as physical objects do, must exist in some other way; they have, he argued (and as we noticed earlier), *intentional inexistence*. Intentionally inexistent objects, required to satisfy the accusative form of statements about psychological attitudes, have an immanent—or mental—origin and, therefore, should be distinguished from physical objects, which exist independently of any psychological attitude.

Of course, physical objects also enter into statements having an accusative form, such as "The boy hit the ball" or "The dog bit the mailman"; here the interpretation of the direct object of the verb is quite different: In order for the boy to hit the ball, there must be a ball to hit; and for the dog to bite, there must be something that can be bitten. Hence, physical phenomena, as opposed to psychological phenomena—according to Brentano's thesis—cannot "intentionally contain objects in themselves." Rather, the statements using physical verbs seem to have the form of relational statements. "Diogenes sits in his tub" specifies a relationship between a man and his tub. Such propositions are said to be *extensionally* existent rather than intentionally inexistent.

Many philosophers and psychologists have attempted to treat propositions involving intentional objects like those involving extensional objects, assuming that they, too, specify a relationship between two kinds of real objects—objects of a physical kind and objects of a psychological kind. This leads to difficulties to which phenomenalism or representational realism is particularly susceptible because of the assumption that *knowing* and *perceiving* are psychological attitudes like *believing* and, therefore, must intentionally implicate some kind of immanent (mental) object—a representative cognitive structure.

But this view, to a wary and committed realist, seems too literal a confusion between the accusative grammar of certain statements involving psychological predicates and the intentional logic required to analyze psychological attitudes. Where the verb grammatically requires direct objects, psychological attitudes logically may require no objects at all. Although respect for grammar has run deep in philosophical analysis, it should not be allowed to lead to false conclusions regarding metaphysics.

The nonmediated or direct realism favored by the committed realist avoids this danger by arguing that, to the contrary, perceiving is more like *knowing* than *believing*; whereas *believing* may invite the assumption of intentional objects with immanent existence, or inexistence, *knowing* does not.

To anticipate the committed realist's argument: Our goal is to show that although *knowing* and *perceiving* are indeed intentional, the objects they specify are quite real in an ordinary sense and, therefore, commensurate with the physi-

cal objects required to define extensionally an animal's, or human's, environment. We call this the *ecological thesis*—a thesis that, so far as we know, was first raised for psychologists in a different form by James J. Gibson (1966). As the logician Hintikka (1975) observes:

The conceptual moral [i.e., of Gibson's thesis] is that the perceptions that can surface in our consciousness *must be dealt with in terms of the same concepts as what we perceive*. The appropriate way of speaking of our spontaneous perceptions is to use the same vocabulary and the same syntax as we apply to objects of perception. If there is a general conceptual or philosophical point to Gibson's book, it is surely this [p. 60; italics added].

Fundamental to the ecological thesis put forward by Gibson (and under elaboration here) is the precept that *perceiving* is a form of *knowing* rather than a form of *believing*. Whereas beliefs must be translated from the mind to the world of reason to register a fit, perceptual knowledge does not. It derives its "fit" from the directness of the act of experiencing in part what truly exists. Thus, it is the lack of translation of perceptual experiences by cognitive mediators that allows a description of perceptual experiences and the reference objects perceived to share a common basis in both meaning and syntax, as Hintikka (1975) remarked and as we have made explicit elsewhere (Turvey & Shaw, 1979).

In this way, the significance of the direct realism position for theoretical psychology is that it provides a framework in which the problem of the incommensurability of natural kinds might be resolved. In very large part, the subsections that follow identify necessary steps to that desired conclusion.

Laying the Ground Rules of Argument

Assume that two convicts, Mr. X and Mr. Y, handcuffed together, are lost in the desert and are on the verge of dying from thirst. After peering expectantly in various directions over the hot desert sands, Mr. X gleefully cries that he has spotted a lake off in the distance. Mr. Y, a thirsty but avowed philosophical skeptic, disagrees that what his friend sees is water at all; rather, he insists it is only a mirage—a shimmering optical display caused by waves of hot air rapidly rising off the furnace floor of the desert. But Mr. X, an eternal optimist who trusts his senses, doggedly persists, and the two thirsty felons at last start out in the direction of the watery appearance. To take their minds off their ordeal, we can imagine that a classical argument fills the interim.

They agree that they both detect an optical display of the sort described, but they disagree as to its nature. Is it water or a mirage? Is one perceiving correctly and the other perceiving incorrectly? Or are they each perceiving correctly what is there, say, an optical display at a distance that resembles water—with error arising not from perception but from a willingness—say, on the optimist's

part—to jump to conclusions unwarranted by the evidence at hand? In the former case, error would originate in perception; in the latter case, error would not be intrinsic to perception but would originate from inference, with further perception as the basis for verifying or falsifying the inference made. (We should note that on the view of perception as an inferential process or, similarly, an act of asserting propositions to be tested, the distinction just cited is nonexistent; on this Helmholtzian view, error must be intrinsic to perception.)

At this point, we offer a simple logical hypothesis: Whichever realism, direct or representational, can meet the challenge of the foregoing puzzle will be logically the sounder realism. In order to decide a winner, however, criteria for recognizing a solution must be agreed upon: We declare the winning position to be the one that provides the firmest foundation to the knowledge a perceiver can have. This means that the winning position will have to overcome the problem of how to build a sturdy semantic bridge to span the ontological gap that separates the intentional objects of psychological experiences from the referential objects of the world from whose existence perceptual meanings are drawn. However, such a semantic bridge can be neither "fish nor fowl"—neither wholly intentional nor wholly referential. Neither can it be merely a third kind of object, in violation of Occam's razor, because this would compound the ontological problem by proliferating potentially incommensurate kinds.

Before attacking this serious problem, it will be useful to consider carefully the major arguments for why the realism favored by a committed realist and representational realism (a phenomenism) differ with respect to whether perception is a source of knowledge or only a source of beliefs about the world.

Being True by Force of Existence Rather than by Force of Argument

Although we may ask of a knowledge claim put forward: "How do you know?" or "Why do you believe?" we cannot ask "Why do you know?" or "How do you believe?" (Austin, 1946). The difference in what questions are appropriate suggests that the logic of propositions entailed by *knowing* that something is true is quite different from that entailed by *believing* that something is true. A similar distinction must be made between propositions entailed by perceiving that *x is y* and those entailed by the claim that *x appears to be y*.

We attempt to show that where the proposition purporting to describe a perceptual experience is known to be true by virtue of the existence of the state of affairs in which the percipient perceives, by contrast the proposition purporting to describe the appearance of something can only be known true by virtue of argument. Thus, by this claim, perceptions draw whatever validity they have as knowledge *from the force of existence*, whereas appearances draw whatever validity they have as true beliefs *from the force of argument*. This distinction is of sufficient importance to be considered more carefully.

A noticed resemblance is a prime example of something that draws its validity from the force of existence. If you identify one object with another because they share a resemblance, this fact of resemblance can be usefully cited as evidence for the validity of the belief in the identity only if it is obvious to all parties concerned. For instance, eyewitness testimony in a court of law has no legal merits if it can be contradicted by other eyewitness testimony. Similarly, the claim that one thing is to be identified with another because they share a certain resemblance is impeached if the facts of resemblance are disputed.

The ultimate evidence for the belief that one thing resembles another is the perceptual evidence that the resemblance exists. Such perceptual experiences in which resemblances are noticed are by that fact alone sufficient to guarantee their weight as evidence for beliefs. Although a belief can be impeached by other evidence, the fact that a resemblance is noticed cannot, because it is by the perceptual experience alone that a resemblance can be recognized to exist.

The noticing of resemblances shares with beliefs held, pains felt, and other "noticings," a privileged epistemic position in that unlike the propositions asserted about other things, they cannot be impeached by argument or by any other source of evidence; for to notice them at all is to notice that they exist.

Following Brentano, most theorists have assumed that all such "noticings," since they are intentional, necessarily refer to some immanent object, such as an image, sense datum, or other mental representation. We eventually dispute this claim after considering further why the logical analyses of *perceiving* and *believing* differ in just the same way as do those of *knowing* and *believing*.

Let (1) " x is y " stand for the proposition that is true if and only if x is y is indeed a fact about the world. Now let p be a proposition whose truth value requires that the proposition " x is y " be true; hence p can be true only if (1) is true, and (1) is true only if a certain fact about the world holds—namely, that x is y is the case. In this way, proposition p draws its truth from existence vis-à-vis proposition (1). Proposition (1) can be modified by introducing an intentional qualifier, or modal prefix, as follows: (2) APPEARS (x is y) is a schema representing the claim that " x appears to be y to someone." Similarly, we can modify (1) with another intentional qualifier: (3) PERCEIVES (x is y) is the schema representing the claim that "someone perceives that x is y ." The question we wish to explore is which of the two modal propositions, (2) or (3), may be logically identified with the nonmodal proposition p , the proposition that is true by force of existence (i.e., from the fact that x is y is a fact).

In addition to modal propositions (2) and (3), we introduce two more modal propositions also constructed by prefixing intentional qualifiers to the original proposition (1): (4) BELIEVES (x is y) and (5) KNOWS (x is y). Again we ask if either proposition (4) or (5) may be logically identified with the nonmodal proposition p so that either is true if p is true.

The logical distinction between the species of realism favored by a committed realist and representational realism can be sharpened by using the foregoing

analysis: Representational realism as a form of phenomenalism claims that the logic of (2) APPEARS (x is y), (3) PERCEIVES (x is y), (4) BELIEVES (x is y), and (5) KNOWS (x is y) must be the same. Moreover, realists of any persuasion must agree that the reference object of any of the preceding intentional kinds of modal propositions must be some fact that is true of the world as specified by proposition (1). Consequently, because of their approach to the problem of reference (or meaning, in the extensional sense), indirect realists must argue that all the modal propositions—(2), (3), (4), and (5)—should have exactly the same truth conditions as (1): that is, they must be logically identified with proposition p . This follows, of course, from the twin assumptions of phenomenalism that knowing and perceiving are both species of believing (i.e., true beliefs and contingent beliefs, respectively).

If the identity of these propositions (truth-functionally) with p should, however, turn out not to hold, the program for indirect realism is severely jeopardized, for then there would exist no basis for explaining or adjudicating knowledge claims (i.e., the claim that " x is y " would refer equivocally to both factual contingencies x is y and x is not y .)

Furthermore, if a specific subset of the modal propositions can be shown to be truth-functionally equivalent to p whereas another subset cannot—say, (3) and (5) can, but (2) and (4) cannot—then a case can be made for the viability of the direct realist's program. In order for the direct realist's program to be supported, it must be the case that (3) PERCEIVES (x is y) and (5) KNOWS (x is y) are logically equivalent to p and thereby draw their meaning (truth) from the existence of a fact about the world.

Let us return to the example of the two thirsty convicts marooned on the hot desert: Merely for the optimistic convict to believe that a shimmering optical display seen in the distance is water in no way entails that it is water, since it may be—as his pessimistic friend declares—a mirage. Thus beliefs no more entail facts than wishes entail their fulfillment. Clearly, to believe that x (a shimmering optical display) is y (water) in no way entails that " x is y " is necessarily true. This means, of course, that the representational realist's claim that proposition (4) can be identified with proposition p must be false, since (4) BELIEVES (x is y), unlike p , entails the disjunct that proposition (1) asserting " x is y " is either true or false.

A similar analysis holds for proposition (2) APPEARS (x is y): Just because the optical display appears to be water in no way entails that it is water; it might, as already argued, be a mirage. The similarity of these conclusions should in no way be surprising given that beliefs are naturally founded on appearances; if they were founded upon reality, then they should never lead us astray as they sometimes do.

As a consequence of the preceding analysis, it is clear that neither proposition (2) APPEARS (x is y) nor (4) BELIEVES (x is y) can be identified with proposition p . Therefore such propositions cannot be said to refer directly to

what exists but at best can refer only indirectly, by argument, to what may or may not exist. Thus, the epistemic thrust of *appearing* and *believing* is propositionally that of contingent, a posteriori facts.

The viability of the realism sought by the committed realist, here termed *direct*, rests upon showing that modal propositions involving *perceiving*, like those involving *knowing*, are necessarily true "by force of existence" because they intentionally specify nonmodal (extensional) propositions like *p*, whose truth value (and meaning) necessarily entails existence (i.e., facts about the world). To see that this is so, we need only observe under what conditions we should be willing to admit that something is known rather than merely believed. The argument is not difficult, but it is subtle and deserving of careful consideration.

We are willing to say that one *knows* some proposition is true—say, that *x* (the optical display) is *y* (water)—if and only if certain conditions are satisfied: (a) One must understand what the proposition means; (b) one must affirm (accept) the proposition; (c) one can offer adequate evidence for it; and finally (d) the proposition is indeed factually true.

This definition contrasts with what must be satisfied simply to say that someone believes in the truth of a proposition. To believe *p* requires only that conditions (a) and (b) be satisfied and that (c) be modified. As already shown, (d) need not be satisfied, since the proposition does not have to be true to be believed. Condition (c) has to be modified, since what is important to believing a proposition is not whether one can adequately defend it, but that one accepts some form of evidence (cogent or otherwise) in its favor.

The optimistic convict presumably demonstrated his belief that the shimmering optical display specified water by satisfying these three conditions in just the way prescribed: He tacitly demonstrated all three conditions by recognizing that water is a significant substance with which to quench one's thirst (condition a); by setting out in dogged pursuit of it (condition b); and by arguing against and opposing the belief of his pessimistic friend (condition c).

But what would have been required of him to illustrate that he had knowledge rather than mere belief that what he and his friend saw was water rather than a mirage? Let us assume that conditions (a) and (b) could tacitly be satisfied in exactly the same way as before. We must now consider what would constitute adequate evidence that he *knows* that there *is* water. The committed realist has no option but to recognize the following as the key to the argument: Whatever evidence is sufficient to satisfy the strong version of condition (c), it must derive its cogency from "the force of existence"—condition (d)—rather than from argument.

This means that the fact that water exists must be recognized by all parties concerned, just as a resemblance purported to exist between two objects must be so recognized if the fact is to have any weight as evidence. As argued earlier, such weight that resemblances have must arise *directly* from the noticing by all

concerned rather than *indirectly* by arguments. This follows because arguments may have contingent outcomes whereas "noticings" carry a necessary force because of the existence of the property to which they intentionally refer (i.e., the resemblance). In other words, to know a proposition *p* is simply to notice that the conditions that make *p* true necessarily obtain. For the form of realism favored by a committed realist, perceiving is a kind of noticing; it is, as we describe later, a primary fact of experience.

Thus, it follows from this discussion of the logical difference separating *believing* from *knowing* that *perceiving* is a necessary condition for *knowing*, although it is not necessary for *true* believing. It is the failure to recognize that *knowing* may entail *true believing* without being in any sense a species of *believing* that has led so many theorists with presumably realist sympathies to endorse a phenomenalism—precisely, representational realism.

If valid, then the preceding analysis demonstrates that modal propositions (3) KNOWS (*x* is *y*) and (5) PERCEIVES (*x* is *y*) are logically equivalent to propositions like *p*, whose truth depends upon existence, whereas propositions (2) BELIEVES (*x* is *y*) and (4) APPEARS (*x* is *y*) are not. Herein lie the ontological roots of the logical separation from which the schism between the warring forms of realism grows. It is sufficiently deep and pervasive that no verbal sleight of hand can conjure it away.

In arriving at this conclusion, we have exploited several ideas and notions of some considerable significance with little discussion of them individually. It is the task of the remaining parts of this main section to provide that discussion and, ideally, clarification. In addition, the remaining parts underscore the evolving claim for the incorrigibility of perception: Perception is a fact of existence; it is necessarily what it is and not something that can be either right or wrong.

In preview, the remaining parts contrast the following: true by force of existence with true by force of argument; necessary a posteriori facts with contingent a priori facts; and the nonpropositional and propositional uses of the term *perception*.

The Futility of Skepticism Regarding Realism (or Perception as the Court of Last Appeal)

Recall the story of the two thirsty convicts: They were left, engaged in philosophical debate, walking toward what may or may not be an oasis. For the sake of argument, let us assume that they are indeed approaching water, which becomes increasingly more apparent to them with every step. The rather nondescript, shimmering optical display takes on the wavy texture of a semitransparent, liquid blue surface. The optimistic convict proclaims that he was correct all along; it is water.

However, let us assume that his skeptical friend refuses to yield this point and stubbornly denies that he is yet convinced. Soon they are at the water's edge and

can hear its rippling sound and feel the coolness of the desert breeze as it wafts across the pond's surface. Still the skeptic stands his ground. Finally, the two find themselves standing knee-deep in water, splashing and drinking; but still the skeptic refuses to recant. Besieged by ill humor and a singular lack of objectivity, the optimist thrusts the skeptic's head under the watery surface, intent upon drowning him unless he gives some tacit sign of agreement. The skeptic, unre-sisting to the last and refusing to acknowledge the water by word or deed, alas, drowns.

The moral of this vignette is that often what cannot be settled by force of argument is settled by force of existence—in this case, by the existence of the water. We would scarcely endorse the optimist's method for curtailing the skeptic's regressive argument—namely, the argument that no number of empirical tests are ever logically sufficient to prove the certainty of perceptual knowledge—although we must admit that the optimist has cogently demonstrated a point: The only possible stopping-rule for the skeptic's regress issues, not from reason, but from the existential power of well-chosen acts to impress the relevant primary facts of experience on all concerned. This is the last court of appeal in arguments where no rational criteria for settling the debate can be agreed upon.

Similarly, given the problematic nature of using deductive or inductive criteria to verify or falsify evidential claims, scientists invariably fall back on observational experience as the final arbiter of theoretic disagreement. Corroborated (i.e., replicable) eyewitness testimony of experimental outcomes carries immense weight scientifically, just as it does legally. (This is by no means to imply that noncompeting theories are necessarily accepted on the weight of empirical evidence alone, nor that these are the only grounds for their acceptance, but to emphasize that in most cases of competing theories, such observational evidence plays a primary, even necessary, role in their scientific adjudication. Nor is it meant to suggest that theoretical attitudes may not color data interpretation; on the contrary, they most assuredly do.)

The perception-as-direct theorist and the perception-as-indirect theorist are equally susceptible to the Socratic skeptic because they share a commitment to perceptual realism; the skeptic's attack cannot be tolerated by either position, for to question the veridicality of perceptual experience is to cast doubt on the last stronghold of realism. Any attempt to appeal to extraperceptual evidence is to worsen one's case, since it is a move from things that are known by acquaintance and are, therefore, true by force of existence to things that are known by description and are, therefore, believable only by force of argument. It is instructive to see how poorly each type of realist fares against a truly unrelenting skeptic.

Assume the debate is over whether in principle one can have sufficient grounds to say with certitude that one perceives a particular object—say, a kitchen table. The perception-as-indirect theorist is forced to agree with the skeptic that if the table is experienced at all, then it must be accomplished by virtue of some intervening process—an epistemic mediator, some image, or

other representational surrogate of the table. This assumption allows the skeptic to ask: "But by what evidence can you be certain that the experience of the epistemic mediator reveals the true properties of the table [say, its solidity and hardness]; moreover, if it does not, then perhaps what you are really experiencing is something else—say, a soft cushion."

The theorist most likely will reply by taking the skeptic very carefully through some form of the causal-chain argument, dramatically gesturing in a knowing manner at the final step where the brain state somehow gives rise to the perceptual experience. However, to this explanation, the skeptic merely repeats the thrust of the original question: "But by what evidence can you be certain that the causal chain projects into awareness the true properties of the table? For even if we accept the assumption, although you have not truly justified it, that the causal process is isomorphic with the table at every stage from the eye to the brain, it does not follow that the representation created spontaneously in awareness necessarily has the properties of the table such as its size, shape, solidity, texture, color, and so forth. To argue that it must is to commit an egregious error of semantics—namely, confusing the properties of a symbol with that which is symbolized." In this way, the skeptic legitimately dismisses the *raison d'être* of the causal-chain argument.

Furthermore, with the causal-chain argument removed from contention on grounds of not being materially relevant, the theorist arguing with the skeptic might just as well be a direct realist rather than an indirect realist. It matters not at all whether the weak link in the realist's argument is the last link in a lengthy mediational chain or the first and only link binding the object perceived to the state of awareness; the skeptic's criticism is equally devastating.

Neither does it help for theorists to appeal to extraperceptual evidence—say, by arguing that they know that the representation, or contents of experience, capture the significant properties of the table because they can match the current experience against remembered experiences of tables and thus verify it. Clearly, this is also a mistake, for it permits the skeptic, in gadfly fashion, to enter a regressive line of Socratic interrogation: "But by what evidence can you justify the claim that your memory is correct? Does not memory knowledge originate in perceptual experience? If so, then it must be heir to two possible sources of error: the potential lack of fit of the original perceptual experience with the object upon which it is based, as well as the potential lack of fit of the memory to the original perceptual experience. Thus it seems your appeal to memory (or to inference, for that matter) worsens your position, for surely memory (or inference) can be just as faulty as perception.

Must the debate end here, with the skeptic smug and triumphant? Not necessarily, because the perceptual realist (of either persuasion) has one last reply that, if used at the opening of the debate, could have stymied and frustrated the skeptic. Where it is futile to argue for the veridicality of perceptual experience from indirect evidence, it is not futile to argue from direct evidence. Indeed, the

only stopping-rule for this kind of debate is the following reply: "What justifies me in believing that I experience a table when I perceive a table is simply the fact that the meaning of such experiences is self-evident and neither requires nor allows appeal to any higher authority. Such experiences are no more capable of being falsified than they are capable of being verified." As surprising as it may seem, perceptual experiences, like the awareness of one's pains and beliefs, are self-presenting facts—that is, facts that neither require nor allow any justification by argument since they draw their validity from the force of existence itself. I know I perceive a table whenever I notice the existence of the object in front of me, while at the same time noticing that it possesses properties of a certain sort that by convention we call a "table." For someone not to grasp this argument is not to understand the difference between appearance and reality. Not to understand this difference is to be thoroughly ignorant of the topic of the debate.

On the other hand, if the skeptic is not ignorant and truly understands the distinction between appearance (as knowledge by description) and reality (as knowledge by acquaintance)—as must all who live with some degree of sanity and success—then he or she is either unreasonably obstinate (as was the skeptic who drowned in the oasis) or a liar. This being the case, further argument would be pointless.

However, if the foregoing ploy should fail to silence the skeptic, then you may resort to striking the individual sharply about the head and shoulders with the table, denying all the while that you are doing so. If the skeptic should protest, you may then turn the tables, so to speak, and ask in the name of heavens what evidence led him or her to conclude such a thing. The individual cannot, of course, take exception to your argument except on pain of tacitly renouncing the original skeptical position.

Such pragmatic solutions to epistemological puzzles have never been popular with professional philosophers, not because they lack the stomach for *argumentum ad mayhem*, but because such arguments lack logical cogency. Nevertheless, we may observe that for all living creatures, neither evolution, learning, nor other forms of adaptive change progress by the rules of philosophical debate; rather, they progress by more pragmatic means. Whatever success such epistemic functions of ecosystems achieve, they must do so in an eminently practical way. The decision rule for adaptive choices made must satisfy existential rather than logical criteria.

The Primary Facts of Experience

If it can be shown that perception provides self-presenting (directly evident) truths—that what is perceived *is* necessarily what *is*—then the stopping-rule invoked to curtail the skeptic's attack discussed earlier would be justified and a legitimate basis for knowledge found. But what is the nature of such self-

presenting truths about the world upon which no skeptical doubt can legitimately be cast? Leibniz (1949) characterized the directly evident as follows:

Our direct awareness of our own existence and of our own thoughts provides us with the primary truths *a posteriori*, the primary truths of fact, or in other words, our primary experiences; just as identical propositions constitute the primary truths *a priori*, the primary truths of reason, in other words, our primary insights. Neither the one nor the other is capable of being demonstrated and both can be called immediate [direct]—the former, because there is no mediation between the understanding and its objects, and the latter because there is no mediation between the subject and predicate [Vol. 4, Section 9, p. 2].

Although a committed realist might wish to claim that perception in general satisfies Leibniz's notion of direct awareness, it is not at all obvious that it does. Nevertheless, we argue that perception provides us not only with primary truths *a posteriori*, or "primary facts," about ourselves but also about the environment with which we have evolved strong mutual compatibilities (Shaw & McIntyre, 1974; Turvey & Shaw, 1979). Moreover, such primary facts, although not propositions in themselves, provide the stuff about which propositions might be asserted and on the basis of which propositions might be evaluated. Neither empiricists nor rationalists truly avoid the assumption of direct evidence in their respective versions of phenomenalism. The empiricist appeals to a direct awareness of sense data, retinal images, or brain states, whereas the rationalist similarly appeals to a direct awareness of self-evident truths about logical inference. Thus, the major difference in this regard between the realism favored by a committed realist and the realism that is a variant of phenomenalism does not depend on the assumption that direct evidence for the truths of experience is available, but on the evaluation of the import such directly evident truths may have for our knowledge of the world. An evaluation of the degree of objectivity such direct evidence may or may not have takes us into a very subtle but terribly important argument regarding the relationship of necessary and contingent truths to *a priori* and *a posteriori* facts. We follow Kripke (1972) in distinguishing these concepts. Our drawing of the distinction is less than complete, but ideally, it is sufficient to clarify the nature of direct perceptual evidence. Tentatively, we accept the idea that perceptual facts are both necessary and *a posteriori*.

Truths about which there might be knowledge—direct or otherwise—traditionally include such categories as "analytic," "necessary," "contingent," "a priori," and "a posteriori"—categories that have been referred to frequently in this chapter without explicit interpretation. The distinctions among these categories are often very difficult to define; consequently, some philosophers defend the distinctions vociferously, whereas others work just as hard to dissolve them. For present purposes, however, we need only consider the notions of necessary truths or facts and *a priori* truths or facts. Quite often these are said to be synonymous, or at least they are used interchangeably.

By calling a truth *necessary*, we simply mean that there is a state of affairs that is described truly and could not have been otherwise. Conversely, a *contingent* truth refers to a description of some state of affairs that is true but could nevertheless have been otherwise. This category distinction belongs to metaphysics, the branch of philosophy that attempts to assay what must be necessarily the case.

By contrast, the notion of an a priori fact refers to something that can be known to be true independent of experience. Or, conversely, the notion of an a posteriori fact refers to something that can only be known to be true through experience. This category distinction—if we care to assign it—belongs, not to metaphysics, but to epistemology—that branch of philosophy that studies how we can know certain things to be, in fact, true.

As Kripke (1972) points out with respect to the category distinction between the a priori and the necessary: It may, by some philosophical argument, follow from our knowing, independently of experience, that something is true of the actual world, that it has to be known to be true also of all possible worlds. But if this is to be established, it requires some philosophical argument to establish it. Similarly, one might argue the converse: That anything that is necessary is something that can be known a priori. Since the identification of these two concepts would obviously require considerable philosophical argument, on prima facie grounds we are justified to assume, at least until proven otherwise, that a priori facts and necessary truths are not the same.

To avoid belaboring the distinction, we give but one example to show why the two concepts are not logically coextensive. Goldbach's conjecture asserts that every even number is the sum of two primes. This is clearly a mathematical statement that, if true, must be necessarily true. However, since the conjecture has not been proven, no one at this time knows a priori or a posteriori whether it describes a fact about mathematics or not. On the other hand, no one doubts that if it is true, it must be a necessary truth of mathematics.

Now someone might quibble over the fact that the definition of an a priori fact says that if such a fact is true, we *could* know it independent of experience although we need not. But it is difficult, as Kripke (1972) points out, to know exactly what this reservation means. Does it mean that all a priori facts must be provable? If so, then we know from Gödel's famous theorem that not all necessary truths of mathematics are provable theorems. Hence by the provability criterion, not all necessary truths can be known a priori. On the other hand, the claim that a priori truths may be known by intuition rather than proof is essentially a nonargument until some cogent theory of intuition is given.

Thus there is good reason for believing that the conceptual categories of necessary truths and a priori facts are based on logically distinct notions. At least it is not at all clear that the difference is just a trivial matter of definition; their apparent distinction seems sufficiently real to require that anyone be taken to task who callously ignores it.

The importance of the foregoing discussion for present purposes is to provide just cause for tentatively accepting the claim that some a posteriori facts may indeed be necessary truths. At least this possibility cannot be rejected out of hand for the following reason: Presumably we have shown that it may be a mistake to identify a priori facts with necessary truths; therefore, this suggests that it may be equally mistaken to identify a posteriori facts with contingent truths. Furthermore, although perceptions reveal by definition a posteriori facts, there is no reason to assume that what they reveal must be contingent truths rather than necessary truths.

To return to our main topic: On purely logical or philosophical grounds, there is no reason to accept the skeptic's primary premise that what is known through perceiving must be considered, at best, contingent knowledge about the world. If not contingent, then no evidence is required to establish the "truths" of an animal's environment as revealed by perception; they could be true, as argued earlier, by force of existence (i.e., self-evident truths) rather than by force of argument. In other words, perceiving may be considered to reveal, in Leibniz's words: "the primary truths *a posteriori*, the primary truths of fact"—requiring—"no mediation between the understanding and its objects."

The Propositional and Nonpropositional Uses of the Term *Perception*

We have been pursuing a realism that would be agreeable to a committed realist. This section collects the arguments developed thus far and contrasts the propositional and nonpropositional uses of the term *perception*.

A careful distinction must be drawn between "seeing *that* a shimmering optical display over the hot desert sands *is* water" and "seeing water in the desert"; the former is the so-called propositional use of the term "seeing" and connotes the weighing of evidence, the drawing through inference of a conclusion, and the insight that the evidence is probable or conclusive support for the inferential claim. Thus this usage of the term "seeing *that*" (or, more generally, "perceiving *that*") is the *propositional* use of the term—a usage that connotes judgment and logically permits error to arise. The second sense of "seeing" involves no propositionizing at all; that is, it is in no sense judgmental or inferential and neither requires nor allows for probabilistic surmise from evidential support. Rather, "seeing water" (or, more generally, "perceiving *x*"), like water itself (or *x*), is a state of affairs or an existential fact about the world (including the "percipient" as part of that world).

Notice carefully, however, that the claim is that "seeing *x*" is a state of affairs that either *is* or *is not*, rather than a proposition that *may* or *may not* be affirmed by evidence. Let us call this latter locution, "seeing water" (or "perceiving *x*"), the nonpropositional use of the term. We can now formulate the contrast, separating the positions of indirect and direct realism with respect to the nature of perception in terms of the foregoing distinction: The indirect view

for Quine
is there a
distinction
between
(looking
at)
water
and
seeing
water?

assumes that perception necessarily takes the locutory form "sees that x is y " (e.g., sees that the shimmering display is water), which entails the identification of the act of perceiving with that of inferring, the propositional use of the term.

In sharp contrast to this indirect or phenomenalist view is the direct view, which assumes that perception necessarily takes the locutory form "sees x " as it is (e.g., sees water rather than seeing that x is water is a possibility, a resemblance). Thus the direct view, unlike the indirect view, identifies perceiving with an existential fact about the world (i.e., the percipient and its environment) rather than with an inferential conclusion. Under the direct view, the object perceived cannot be other than what it is, since to perceive it is to relate existentially to it; whereas under the indirect view, the object judged could conceivably be other than what it is taken to be. The former is an *experience* of what is, whereas the latter is a *surmise* of what is from an experience of what is.

Thus we must conclude that the indirect view of perceiving draws whatever truth and meaning it might have ultimately from the experience of what is and deviates into error, illusion, falsehood, or maladaptiveness whenever the judgmental act of surmise deviates in an unwarranted, invalid way from the experience of what is. In short, "perceiving that x resembles y " is true and meaningful whenever it correctly draws on "perceiving x " and is false whenever it abridges that direct experience by unwarranted inference. That is, the propositional use of the term *perception* is dependent upon the nonpropositional use of the term for its semantics. The problem that must now be resolved is twofold: First, can we be certain that the nonpropositional sense of perceiving ever occurs; and second, if it does occur, can we be assured that it must be a direct experience of what exists rather than an indirect experience of what is surmised from evidence about whatever exists? Let us consider the last question first.

If our judgments are to be based on what exists, then there must exist an experience of what does in fact exist; otherwise there would be no way even in principle to gather evidence in support of the judgment. We submit that judgments about which no evidence even in principle can be forthcoming are both meaningless and irrelevant to the percipient's ongoing relationship to its world (e.g., its actions). Such a view trivializes the role of reason. If one's judgment that x is water does not necessarily entail circumstances under which x as water constrains one's ongoing experiences in a way specific to x being distinctively water (e.g., I can quench my thirst or drown in it), then x might just as well be said to be a powder puff, a scorpion, or nothing at all. Hence, if there is to be the possibility of knowledge (propositional or otherwise), there must exist experiences that provide evidential bridges between *knowing* and *doing* or between *knowing* and *being done to*. Knowing or believing must be efficacious; it cannot be vacuous. By definition, assertions that pertain to null experiences are not more than empty wishes or imaginings. A theory of knowledge based entirely on such effete concepts or judgments would be a denial of realism and a degenerate solipsism.

Given that experiences of what is the case must to *some extent* be possible if knowledge is to be possible, it only remains to show that these must be perceptions rather than judgments; that is, they must be perception in the nonpropositional sense rather than perception in the propositional sense. But this conclusion is necessarily entailed by the assumption of realism required to preserve the efficacy of judging as already argued. If *judgment* is to be possible (as opposed to merely wishing or imagining), then experience of the states of affairs of the world must necessarily exist. Anything that necessarily exists is a state of affairs of the world rather than merely a judgment *about* those states of affairs. Hence perception, unlike judgment, by being a direct experience of some state of affairs, is itself a state of affairs and must be counted among the existential facts that necessarily constitute the world. On the other hand, a judgment is merely an experience *about* but not *of* the world. In other words, judgments may be true or false and, therefore, refer to contingent facts of the world rather than necessary facts.

A different but related point: We may assume that knowledge of the world (i.e., realism) is possible without entailing that judgments exist, but we may not do so without assuming that (direct) perceptions exist. For instance, we can imagine situations in which we experience what *is* but do so without (consciously or unconsciously) judging it to be true—that is, without inferring that our experience *corresponds* somehow to what exists. Moreover, we can also assume that lower species of life are sensitive to or irritated by aspects of the world without being able to venture judgments or draw inferences at all. Therefore we must conclude that direct experiences may exist even though judgments or *indirect* experiences do not.

But now we come to the main point of the argument: Judgments do *in fact* exist, for we know of cases where we judge or believe it proper to say others judge. But if judgments contingently exist, then perceptions must necessarily exist. This follows from two things: first, the assumption that realism is possible; and second, from the argument given earlier showing that for realism to be meaningful and judgments nonvacuous, non-(epistemically) mediated perception of the world must exist. To deny the directness of experiences of the world, what we called the "nonpropositional" use of the term *perception*, leads to a hopeless regress where judgments feed parasitically off other judgments, which ultimately feed off nothing. For knowledge to be "living," judgments must ultimately draw sustenance directly from the world. That is, whether judgments are true or false, meaningful or meaningless, depends upon the existence of perceptual experiences that directly draw upon the "facts" of the world.

Thus, since direct perceptual evidence is required to adjudicate judgments, perception cannot be in any sense judgment (propositional). That which is nonpropositional is not *about* anything, but *of* something. Perception, then, is *of* the world—an existential fact of it; but although judgments are *about* the world, they either do or do not correspond to such facts. This means that perception is of

necessary a posteriori facts whereas judgments, insofar as they relate to the world at all, are about *contingent a posteriori* facts.

In summary, we see from the foregoing argument that nonpropositional perception, as a direct experience of existential facts, is a necessary consequence of the possibility of realism. The argument has brought together three distinct lines of thought in the present chapter:

1. The claim that the truth or meaning of perception necessarily derives from the force of existence rather than the force of argument.
2. The claim that perception is a source of necessary a posteriori knowledge about the world.
3. The claim that perception, unlike judgment, is *of* the actual (necessarily true) world rather than *about* possible (only contingently true) worlds.

To deny any of these claims is, we believe, tantamount to undercutting the foundations to a realistic theory of knowledge and thereby flies in the face of the claim that animals live adaptively because they experience their worlds truly.

ECOLOGICAL PSYCHOLOGY AS A POSSIBLE-WORLDS SEMANTIC

This final section considers the logical and semantic grounds for the ecological thesis already identified—a thesis that asserts that the objects of reference and of experience may be described in the same theoretical vocabulary, thereby making commensurate two concepts traditionally treated as dualistic. However, no attempt is made to resolve the issue of metaphysical dualism by proposing either a reduction of one category to the other, as in the case of physical reductionism, or by proposing that the two dichotomous categories be subsumed under a third neutral category, as in the case of neutral monism. Instead, our tactic is to show that rather than psychology and physics being incommensurate parts of a dualism, they are distinct but complementary, and hence quite commensurate, poles of a *duality* (Shaw & Turvey, 1981; Turvey & Shaw, 1979).

The crucial distinction to be emphasized is that the parts in a dualism are not only distinct but logically independent; although the poles of a duality may be distinct, they are reciprocally dependent—with one pole drawing on the other for its meaning and identity. Thus, the view that psychology and physics are logically independent is consistent with the notion of an animal-environment dualism; as contrasted with the ecological approach, which—in the attempt to treat psychology and physics as two different but mutually dependent perspectives of the same object, the ecosystem—is consistent with the notion of an animal-environment synergy (Turvey & Shaw, 1979).

A chief difficulty that the ecological approach must overcome is the semantic prejudice that there is only one possible grain of analysis to be applied to physical

reality and that such analysis is necessarily provided by physics. There is a strong propensity to believe that the description of things at the atomic and molecular scale is metaphysically more real and scientifically more natural than their description at a level of ordinary perceptual experience. This bias holds sway in spite of the obvious fact that the furniture we sit upon, the ground we walk upon, the food we eat, the people we embrace, and the tools we handle provide a greater feeling of substance, solidity, and support than can be adequately reflected in the popularized physicist's image of them as probabilistic clouds of swirling particles.

Clearly, here, the grain of theory is at odds with the grain of experience; yet there exists a strong and pervasive prejudice in favor of the theoretical physicist's picture of reality, which emerges whenever most people are forced to choose the scientifically most accurate description of an animal's environment. Theoretical biology was once solely concerned with macrophenomena (e.g., flora and fauna). But with the advent of electron microscopy, it has rapidly descended to microlevels of analysis, leaving the coarser-grained phenomena by default to ethologists, agriculturalists, and animal psychologists.

Furthermore, coarser-grained analyses are typically considered superficial, inaccurate, and, perhaps, at best practical or heuristic; whereas finer-grained analyses, by contrast, are considered deeper, more accurate, and, hence, more scientific. The ecological orientation disagrees with this assessment and proposes instead that "most scientific" should be considered synonymous with "most appropriate" rather than with "most fine grained." Indeed, detail and degree of precision are relative terms, being attributes of analysis whose grain is most revealing. A coarser-grained analysis that captures the coherence of a phenomenon (e.g., as in the parable of clapping hands in the introduction) is to be scientifically preferred over a finer-grained analysis that dips so far beneath the surface as to destroy the integrity of the phenomenon studied (see Fowler & Turvey, Chap. 1, this volume).

Thus a basic tenet of ecological psychology is the suggestion that we trade in the microstructuralism of these sciences (recognizing while doing so, however, that they may provide quite valid analyses of the causal support of psychological processes) in favor of a more pragmatic, macrofunctionalism that preserves the integrity of the animal-environment synergy (see Fitch & Turvey, 1978; Fowler & Turvey, 1978; Turvey & Shaw, 1979).

Affordances and Effectivities

In order to avoid the dualism reflected in the assumptions of intractable nonspecificity and the incommensurability of natural kinds, appropriate new categories must be fashioned. A first step is to describe the "physical" dimensions of the world within which the animal has evolved relative to the animal's capacity for activity. These dimensions are what Gibson (1977) calls *affordances*. Thus, places that *afford* locomotion or objects that *afford* grasping are

regarded as being values on perceptually relevant dimensions, in contrast to the more usual use of color and bidimensional form as basic dimensions underlying perception. The concept of an affordance relation is a treatment of meaning; it is intended as a way of describing the surrounding surfaces and substances in animal-relevant dimensions, so that an individual animal does not subjectively have to add meaning or value to that which is "merely" physical.

Gibson's notion of an affordance may be schematized as follows (see Turvey & Shaw, 1979): *A situation or event X affords action Y for animal Z on occasion O if certain relevant mutual compatibility relations between X and Z obtain.* With Gibson we would like to maintain that animals perceive affordances rather than animal-neutral dimensions. What we hope to emphasize in this schematic sharpening of Gibson's idea is that an affordance is not merely a mapping of surface and substance states onto animal states—that is, a two-term or binary relation. Rather, an irreducible minimum of three logical terms is required to define an *affordance*—a term that references surfaces and substances, an animal activity term, and a term indicating relevant dimensions of compatibility. A major task is to understand how the set of affordances—the affordance structure—of an ecosystem might be specified; the spirit of such an inquiry is essentially geometric and would result in a theory of *what* there is to be perceived by a particular animal.

An ecological definition of an environment as a set of affordances is very similar to a functional definition; namely, it makes no attempt to answer the ontological question of what the environment *is* in any absolute sense (i.e., metaphysics), but rather attempts to answer the pragmatic question of what an environment means to an animal. The answer given is that it means what an animal can in principle do or is in practice constrained from doing in that environmental context. It is insufficient, however, to focus on the question of what the environment is as construed with reference to the animal (i.e., affordances); there remains the question of what an animal might be when construed with reference to an environment. Both these questions must be considered, because the bidirectionality of the mutual (reciprocal) compatibility relation imputed to hold between animals and their environments demands it (Turvey & Shaw, 1979).

Gibson (1977) asserts: "Subject to revision, I suggest that *the affordance of anything is a specific combination of the properties of its substance and its surfaces taken with reference to an animal* [p. 67]." When generalized, this is to say that the environment from an ecological viewpoint (but not from a physical, biological, psychological, or metaphysical one) is a complex set of relationships among various affordances—what was called an *affordance structure* earlier.

Correspondingly, a similar ecological definition is required of an animal as the complementary component to an environment in the ecosystem. Therefore, it is suggested that an animal consists of a complex set of relationships among effectivities, or what might be called an *effectivity structure*. What is meant by

the concept of an effectivity? The following definition is proposed; it complements the definition of affordance that Gibson provides. We suggest that subject to revision, an effectivity of an animal (or human) is *a specific combination of the functions of its tissues and organs taken with reference to an environment.* The notion of effectivity may be schematized as follows: *An animal Z can effect action Y on an environmental situation or event X on occasion O if certain relevant mutual compatibility relations between X and Z obtain* (See Turvey & Shaw, 1979).

It seems to us that the laws of learning and memory, as they emerge, will have to be written in complementary terms not unlike affordance and effectivity. Consider the contemporary scene in animal learning theory. The belief that guided the earlier and well-known attempts to establish a theory of learning was that there were certain to-be-discovered principles of learning that could be applied uniformly and universally across all kinds of learning and all kinds of species. We might say that these principles were thought of as context-indifferent, activity-indifferent, and species-indifferent. Thus learning might be due to contiguity or to reinforcement.

It was this article of faith that justified attempts to build a general theory of learning by studying only one response system in one animal. That article of faith has been rudely shaken. The current impression (Bolles, 1975; Hinde & Stevenson-Hinde, 1973; Seligman & Hager, 1972) is that learning depends in very important ways upon the kind of animal that is being considered, the kind of behavior that is required of it, and the kind of situation in which the behavior occurs. On the current view, it is an empty claim that learning is a function of contiguity or reinforcement contingencies.

A brief overview must suffice to make the point. The celebrated Garcia effect (Garcia & Koelling, 1966) is that an animal can rapidly learn to avoid a situation that made it ill even where the situation and the onset of illness are not temporally proximate. Importantly, the situation the animal learns to avoid under these conditions is not species-neutral: For the rat, the situation must be chemically distinct; for the quail, it appears that the situation must be distinguished by a dimension that is detected by sight rather than by taste (Wilcoxon, Dragoin, & Kral, 1971).

Avoidance behavior, of course, has always been a thorny issue for learning theory, especially where the theory emphasized reinforcement; there is no reinforcement that can be explicitly defined, and an appeal to the nonoccurrence of, say, shock is logically embarrassing since a good many other things besides shock do not occur. What makes learning to avoid an especially recalcitrant puzzle is that there appears to be no consistency in the patterning of the experimental contingencies relating to the learning (Bolles, 1970, 1975). Bolles (1970, 1975) pinpoints the required avoidance behavior as the all-important factor. But to require of an animal in a given experimental setting an avoidance behavior with a high operant rate or one that is successful in some other setting is not to

guarantee that the avoidance behavior will be learned without difficulty, if at all. More precisely, what is important is the relation between the given situation and the given avoidance behavior. A behavior easily learned by a given animal in one situation may be unlearnable, or at least very difficult to learn, by that animal in another situation. Situation and avoidance behavior are coimplicative, and the ease with which an experimenter-chosen behavior is learned depends—or so runs the argument of Bolles (1970, 1975)—on whether the animal perceives the situation as implicating the chosen behavior.

To return to the Garcia effect: It is a phenomenon that contravenes the premise of equivalence of associability—that any conditioned stimulus can be connected with any unconditional stimulus and that any response can be connected with (modified by) any reinforcement (Seligman, 1970). For the rat, illness contingent on bright and noisy water does not result in avoidance of the water. Learning, it would seem, is not a general-purpose plasticity. On the contrary, learning is a special-purpose plasticity that operates within the constraints defined by the relation between a species and its environment. Echoing this theme, the complication noted earlier—of situation and avoidance behavior—cannot be species-indifferent; the behavior implicated by a given situation for a given species of animal will not necessarily be the behavior implicated by that situation for another, different species of animal.

Consider the following curious observation. Where either food or the song of conspecifics is contingent on the behavior of pecking a key, a chaffinch will learn the behavior with respect to the food contingency but not with respect to the song contingency. In contrast, the chaffinch will learn to perch at a particular location with conspecific singing as the reinforcement but not with food as the reinforcement (Stevenson-Hinde, 1973). In the light of this observation and others, it is easy to venture the claim (Bolles, 1975) that “the proper understanding of learning requires us to know something about an animal’s ecological niche; we must know how it solves its problems [p. 176].”

In part, this brief aside into contemporary puzzles in animal learning theory is intended to shore up, with distinctively different conceptual materials, the claim that psychology must be ecological. What is meant by this claim can now be summarized.

The theoretic language required for launching the enterprise of ecological psychology should be one in which the terms used to describe the animal’s environment as perceived and acted upon (i.e., its econiche) constitute an “ecologized” physics whereas those terms used to describe the animal as a perceiver and actor constitute an “ecologized” biology. Ecological psychology will be the common language where the terms of an ecological physics and an ecological biology are symmetrical and reflexive—that is, where descriptions of the animal are always given in reference to the environment and those of the environment, in reference to the animal.

“Possible-Worlds” Semantics

The “possible-worlds” approach to perception and action constitutes a radical departure from traditional conceptions, which are implicitly based upon correspondence theories of semantics and truth. In classical logic, a statement is evaluated as meaningful or anomalous, or as true or false, based on how well that statement corresponds to some specified state of affairs that obtains. The statement “Snow is white” is meaningful if and only if there is an object, snow, that has properties such that the designated property, whiteness, might conceivably be found among its property set; similarly, the statement is true if such a corresponding property is indeed found among its property set.

By contrast, the “possible-worlds” approach evaluates the meaning and truth of statements about the world in terms of their coherence when elaborated, rather than their correspondence to isolatable simple facts about the world somehow objectively ascertained. This approach has the virtue of avoiding the need to evaluate prematurely the meaning or truth of statements, before an internally consistent scheme of description is attained. Admittedly, the “possible-worlds” approach, unlike the correspondence approach, does not promise to deliver immediate assessments of the truth or falsity of statements considered in isolation by somehow comparing them against observed facts of existence. Rather, it offers only a conception of meaning or truth based upon a very carefully constructed model that exhibits coherence in the account given of reality, much the same as a cogent legal case can be built upon circumstantial evidence. In other words, it produces no absolute, objective account of what is true or meaningful but produces an account to be evaluated against other accounts to see which is most “fit” to survive at advanced stages of elaboration. The view that can incorporate the most consistently meaningful statements wins the crown of reality.

Thus the difference between the two approaches that is important for our purposes is the implicit dependence of the correspondence approach, as opposed to the coherence approach, on some means of objectively determining what states of affairs may obtain in the world to which the correspondence of the statements holds. The only method that ultimately holds is ostensive specification, which depends by definition upon the establishment of perceptual rapport between the content of the statement in question and the relevant state of affairs. But clearly, the existence of semantic correspondence relationships between statements and states of affairs necessarily depends upon an epistemic act that establishes perceptual rapport with existing states of affairs, a process typically termed *ostensive specification*. Thus the correspondence approach to semantics is ultimately circular: It assumes ostensive specification to get correspondence going and then attempts to explain it by correspondence. Thus, it follows that the correspondence that depends upon perception *qua* ostensive specification cannot itself provide an explanation of perception as a fundamental epistemic act.

Consequently, some other logical approach to modeling reality is needed that does not depend on perception as an ad hoc or a priori means of assessing reality. The technique required must be a posteriori like perception but must be existentially more primitive than perception. In other words, it must be the means of rooting perceptual experiences in existing states of affairs without prejudging the nature of those states of affairs prior to experience. As argued earlier, the required approach should rest on the force of existence to shape experiences (knowledge from acquaintance) rather than on the force of argument (knowledge from description). This means in the final analysis that the coherence of consistent statements that may be offered as surrogates of experience by the "possible-worlds" approach must ultimately *be* the experience of the content; where meaning and truth by correspondence can only be argued for indirectly and after the fact of experience, coherence of experience is direct and sui generis of meaning and truth. We experience the meaning of perceptions and the felicity of actions as we experience the cogency of a mathematical proof—by its coherence, not by how it corresponds to something outside itself.

This direct apprehension of the experience of reality as coherence is much like our ability as native speakers of a language to recognize what utterances are grammatical and therefore capable of meaning and what utterances are ungrammatical and meaningless. In this sense, taking a leaf from Chomsky's book of syntax, we can view the "possible-worlds" semantics as an attempt to provide a theory of one's intuitions—as a native of the real world—of what is real, just as a formal grammar is meant to provide a theory of one's intuitions—as a native speaker—of what is grammatical in English. It is the native's intuition of its species' reality, like a speaker's intuition of his or her language, that is to be explained by the "possible-worlds" approach. This is the primary datum for what is real and cannot be abrogated by perception, since perception is founded upon the act of apprehending and comprehending this datum.

The remainder of this part presents a more detailed discussion of the "possible-worlds" approach to semantics.

The idea of a "possible-world" can be grasped intuitively through an analogy. We might call a "complete novel" a set of sentences in some given language that is consistent but that cannot be enlarged without making it inconsistent. A "possible-world" would be described by such a complete novel. Usually, however, "possible-worlds" are less than completely specified; such partial specification, nevertheless, can be very useful so long as what they purport to describe is really *possible*. Hintikka (1969) has called such partial descriptions of "possible-worlds" "model sets"; in this chapter they are referred to, more simply, as "semantic contexts."

In the case of virtual objects—that is, energy displays that produce spontaneous effects in experience that resemble those effects typically produced by other displays—we might speak of "possible-worlds" as the different semantic con-

texts or world situations that must be assumed to make each appearance of the virtual object consistent with the appearances of other virtual objects. Thus in all cases where an energy display resembles other energy displays, the resemblance relation specifies—as a self-presenting fact of experience—"possible-worlds" in which the percipient may be living. Such "possible-worlds" have no necessary existential import but are mere *virtual* worlds that resemble the world to the extent that they remain internally consistent when elaborated. The elaboration takes place through actions or inferences—but with the former having power to compel through the force of existence whereas the latter receives its power from force of argument.

The *real* world, as opposed to a virtual or merely possible world, is defined as whatever remains consistent *across* all "possible worlds" after they have been elaborated by action (or reason). By definition, we speak of *right* action (like right reason) as the activity the percipient-as-actor engages in whenever the elaboration increases the consistency of a selected "possible-world" over the others—that is, when the agent's actions are consistent with the interpretation of the world that his or her primary perceptual experiences entail. Thus, the *real* world, properly speaking, is not a possible-world per se but a set of resemblances that is invariant over all possible-worlds. The real world garners existential import from the consistent or mutually compatible properties that hold across all "possible-worlds." In this sense, ecologically valid knowledge an animal has of its world is knowledge of these "transworld" consistencies discovered through perceptions and elaborated through actions. For instance, an open-minded traveler on the desert who experiences a virtual object, or objects, disambiguates the situation by following appropriate patterns of action; namely, the individual elaborates the possible-world specified by what may be the case, if the virtual object should prove real, by walking toward the shimmering optical display and investigating it.

The shimmering optical display is an existential fact, a primary fact of experience, or necessary a posteriori truth and, therefore, must be a property of all possible-worlds—that is, all the consistent semantic contexts specified by taking the virtual object to be a real object and acting toward it accordingly (e.g., walking toward the water). The resemblance of the shimmering optical display to water is also a datum of primary experience and cannot be impeached. What can be impeached by further experiences is the premature judgment that the display *is* indeed water. To be real water, all primary experiences of the virtual object, arising through elaboration by appropriate actions (e.g., the primary experiences of splashing in the water or drinking it), must be consistent with the affordance structure of water. That is, the actions specified in reference to the virtual object of experience must be felicitously realized. The effectivities that *are* the percipient-as-actor must be logically consistent with the affordances of the object specified to the actor-as-percipient. The *real* world of the animal-as-actor/

percipient is designated by the mutual compatibility, or reciprocal consistency (or *duality*, in the technical sense), between the affordance structure of the possible (or virtual) world (that only partially specified semantic context) and the effectivity structure of the animal by whom the affordances are noticed and acted upon.

Of course not all objects of experience at every moment get disambiguated by right action; sometimes the actions are wrong or irrelevant. Thus we must recognize the fact that since experience is broader than perception, the world we truly experience—and to some extent know—is never fully specified nor completely disambiguated from other “possible-worlds.” The validity of knowledge an animal possesses of its world that determines the quality of life rests upon the possibility of identifying true (logically consistent) knowledge with useful knowledge (i.e., knowledge that prompts right action). Consequently, humans—like other animals—live in the seams between all “possible-worlds,” a realm from which actions unfold previous unseen paths into new semantic contexts. Hence, under this view, truth is dynamic rather than static, for facts struggle for existence in the same competitive way that species do.

“Possible-worlds” that reveal inconsistencies when elaborated through appropriate actions receive no ontological status. But this does not prevent them from being the intentionally specified object (semantic contexts) of false belief. This must be allowed because false propositions may still entail meaningful propositions and, therefore, require some kind of context of interpretation and evaluation. However, by definition, false belief cannot arise from perception or memory, since it gives rise to inappropriate action whereas they do not. For instance, a delusional system constructed as a “possible-world” in the imagination of a paranoid schizophrenic reflects true fears and has real connections with the patient’s prime facts of experience. But such delusions do not constitute knowledge, since they lead inevitably to inconsistencies when elaborated more fully. Thus possibility of inconsistency is predicated on the ability of the real world to intrude existentially into the possible-world of the schizophrenic and make its presence known in such a way as not to be ignored or doubted. That the reality of such intrusions is so recognized by the patient as both salient and indisputable is evidenced in the fact that he or she tends to treat it as a real threat to be acted against. In other words, the patient seeks right action, usually in the form of aggressive acts, by which to ward off the intrusion or, failing this, to redesign the delusional system to accommodate it.

So are we all, animals and humans, like the paranoid in this one regard: We feel the intrusive force of the real world as primary facts of experience, which can neither be ignored nor doubted. Doubting, contrary to some opinion, is not at all a psychological attitude as easily assumed as others—say, as lying. It is an immense burden to be lifted, not a cloak to be put on and off lightly. Doubt, too, must be earned; it is never a gift. Doubt arises because the experienced inconsistencies of actions intrude upon us with the force of existence, not merely the

force of argument. We cannot doubt the import of our perceptual experiences because we cannot ultimately fail to acknowledge them in our deeds.

Token-Reflexive Expressions: A Modal Operation for the Semantic Schema of Perception and Action

To approach an understanding of the relation between affordances and effectivities, we pursue the preceding assumption—that perceiving is a modal operator that qualifies propositions asserting facts about the world—and the assumption, which we now add, that action is a modal operator of like kind. Following Hintikka’s (1969, 1975) suggestion and consonant with the theme of the immediately preceding part, these modal operators will be viewed as involving a reference, albeit tacit, to more than one “possible-world.” Our hypothesis is that perceiving and acting, as modal operators, qualify the same schemata of variables. They do so in reciprocal, or complementary, ways; moreover, they are only intentional in a very special non-Brentano sense. Where intentionality in Brentano’s sense referred to some kind of inexistent, immanent object, perception and action operators refer to the same object over all “possible-worlds.” That is, the object they refer to is a *necessary truth*. (A contingent truth is one that is *not* true in all “possible-worlds” but is true in at least one.)

Our primary task, then, in this part and the next is to introduce a way of talking about perception and action that befits the hypothesis just forwarded and that, on elaboration, promises to dispel the problem of incommensurability of natural kinds. Let us consider again the notion of affordance and, at the risk of being repetitive, why a notion of this kind is necessary and unavoidable from the perspective of a commitment to realism.

The assumed dualism of animal and environment seduces the perceptual theorist to distinguish between what a thing is and what a thing means; a thing that simply *is* inhabits the physical domain, whereas a thing that *means* inhabits the mental domain. In this vein, Koffka (1935) distinguished between the geographical world (noumena) and the behavioral world (phenomena) and proposed the latter as the framework for behavior. Thus, Koffka (1935) would say that a handle “invites” or “demands” grasping. But a physical description of the surface and substance properties that constitute the material nature of a handle contains no animal-referential or activity-relevant terms; the physical dimensions used to describe the handle are animal-indifferent. So what is the status of the characteristics of surfaces and substances to which behavior is in reference? Since they are not characteristics or dimensions of the geographical or physical environment, they must be dimensions of the behavioral or phenomenal environment. The claim is that the dimensions of surfaces and substances that behavior is in reference to *are not ordinary physical dimensions* and therefore *are not real dimensions*. These dimensions that invite behavior owe their very existence, on Koffka’s (1935) reasoning, to an animal’s needs. Thus a configuration of surface

and substance properties (that make up a handle) has the character of being graspable only when an animal needs to grasp it; a mailbox, Koffka would say, invites letter mailing only when there is someone in its vicinity who needs to mail a letter; and so on. Here we have, in plain language, the incommensurability of natural kinds: The reference object, the mailbox as an object described in physical terms, is logically distinct from the intentional object, the mailbox as an object that invites a particular behavior. And though the reference object may have (for a phenomenalism of Koffka's kind) an existence independent of perception, the intentional object cannot.

From the perspective of a commitment to realism, the foregoing conclusions are anathema. They can be avoided, however, by taking the following as a fundamental precept for realism: The dimensions of configurations of surfaces and substances that behavior is with respect to may not be ordinary physical dimensions, in that conventional physical language fails to describe them; but they are, none the less, real dimensions. It would seem that conclusions opposed to realism arise from describing the reference object in a physical language that is committed to a reality but is noncommittal or neutral with regard to animals as epistemic agents, and from describing the intentional object in a phenomenal language that is noncommittal on reality but *is* agent oriented. Another way of putting this distinction is that the physical language is in the impersonal third person (*it* causes it to happen; *these* things caused *these* things to occur), whereas the phenomenal language is in the personal, first-person singular (*I* had such and such an experience when *I* was in such and such a situation)(Shaw & Pittenger, 1977). This distinction, we can appreciate, is in the spirit of animal-environment dualism. What is needed is a *single* theoretical language—in the spirit of animal-environment synergy (Fitch & Turvey, 1978; Turvey & Shaw, 1979)—that manages to incorporate both the objectivity of the physical language and the agent orientation of the phenomenal language.

We see, in short, that a concept such as affordance is not optional; rather, it is mandated by a commitment to realism. That commitment also mandates that the affordance of a given thing is always there to be perceived. An affordance exists as a real property of the ecosystem and not by virtue of its being perceived; nor does the affordance of something change with a change in the animal's needs (see Gibson, 1977). What does change with an animal's needs is the *attensity* or perceptual salience (Shaw & McIntyre, 1974) of an affordance, its likelihood of being attended to. In sum, at any given time, a configuration of surface and substance properties may afford several behaviors for a given animal; which behavior occurs (which affordance is individuated) depends on the occasion in which the animal finds itself—that is, whether it is hungry, afraid, involved in nest building, etc.

We can now partially anticipate the task that the present part and the next must address if the hypothesis advanced at the outset of this part is to be supported and a commitment to realism preserved. In the schematic sharpening of the affor-

dance notion already given, four terms were identified: a term referring to an aspect of the surroundings, a term referring to the animal, a term referring to the mutual compatibility between the preceding two terms, and a term referring to the occasion. (We take these first three terms to be irreducible and the fourth term as a partitioning on the set of mutual compatibility relations.) In perceiving an affordance, an animal perceives a relationship—a symmetry—between its action capabilities and the properties of the surfaces and substance(s) of an aspect of its surroundings. More formally, in perceiving an affordance, an animal perceives, as a single particular, the complex coordination of the four terms identified in the foregoing. By the realist program, this perceiving is unmediated. What is needed, therefore, is a way to model perception as an act that directly apprehends the affordance schema.

Let us proceed with an attempt to provide a modal operation for *noticing* as a self-referenced or self-directed act of *ostensive specification* after due consideration of the italicized terms. From a realist point of view, to perceive something is to notice that it exists; to notice something, however, is not logically equivalent to *perceiving* that it exists—although it is necessarily the case that whatever the object, it must exist before it can be noticed. All this is to say that perceiving *x* entails that *x* exists; similarly, noticing *x* entails that *x* exists; but *noticing* does not necessarily entail *perceiving*, although *perceiving* necessarily entails *noticing*. Thus *perceiving* is *noticing* of some special kind, not to be confused with *noticing* of other kinds (e.g., feeling one's pain, examining one's belief).

Ostensive specification is a technique for making another person, or animal, notice what you notice. A technique that fails to achieve this outcome, no matter how arduously applied, is *not ostensive specification*. If, as Wittgenstein suggests, you point to an object you wish your dog to retrieve and your dog—rather than retrieving the object—bites your finger, we say that pointing is not a technique that achieves ostensive specification for your pet. On the other hand, if your Irish setter points its nose toward the fallen duck and you notice where it is, then the dog's technique qualifies as ostensive specification. *Noticing is ostensive specification sui generis*; and as far as epistemic acts are concerned, there can be none that are logically more primitive.

However, noticing is neutral with respect to whether the source of control over the "pointer"—the vehicle for the ostensive specification—is based in the self (that is, is self-directed) or in the world. A loud noise or garish color points to itself by capturing one's attention, whereas a lost thimble in a haystack may require hours of arduous sifting to be noticed. Thus whatever means successfully objectify or segregate one thing from a background of other things is ostensive specification—whether self-initiated or other-initiated. Self-initiated means of ostensive specification are desires, wants, intents, interests, fears, and, perhaps, attitudes in general.

Let us consider how the evaluation of a special type of linguistic act, token-reflexive expressions, can be used to characterize a very special case of

noticing—namely, the noticing of speech acts. This concept of token-reflexive speech acts is generalized in the following part to define the concept of *event-reflexive operations*—a set of operations that apply to acts of any sort and that, by doing so, provide exactly the kind of intentional schemes needed to characterize perceptual acts in general. Such intentional schemes are later shown to specify necessary a posteriori truths.

Semantically distinct individuals (particulars) are such things that none can be substituted in the place of another without altering the meaning of a token-reflexive expression. *Token-reflexive expressions* contain indefinite terms whose semantic evaluation requires the ostensive specification of a coordinated reference complex. This complex consists of the designation of the person using the expression and the designation of the circumstances (where, when, how, and why) under which the expression was used. For example, "I shall become President of the United States next election" is a token-reflexive expression requiring knowledge of who the speaker is (or was) and the circumstances under which it was uttered. If the "I" designates Abraham Lincoln and the assertion was made just prior to his successful presidential campaign, then the expression is both meaningful and true. On the other hand, if it was uttered by Thomas Dewey prior to his unexpected defeat by Harry Truman, then the expression is meaningful but *not* true. But if this token-reflexive expression was uttered by a cocky young politician whose boast to be his party's next candidate is unfounded, then it is both meaningless and false (in the sense that it has no reference to satisfy the intention). (It would be as if Polly Parrot or the speech synthesizer at Haskins Laboratories had said it with the qualification that the parrot and synthesizer are not capable of true speech acts.)

In general, token-reflexive expressions need not be self-reflexive in the preceding first-person sense; nor do they always refer to people; they may also be second-person assertions about other people, animals, inanimate objects, situations, or places. For instance, *this book, that camel, her home, its number, etc.*, are all token-reflexive expressions whose meaning and truth value can only be evaluated when an operation is given (e.g., pointing, describing) that ostensively specifies when, where and by whom the expression is used.

In the earlier example, regarding the pledge to be president, the ostensive specification of who authored the statement (e.g., Lincoln, Dewey) was indirectly given by linguistic description. However, the ultimate validity of the stipulated evaluation must come from direct acquaintance with the occasion on which the expression was used. In a sense, token-reflexive expressions are like confessions; they must be witnessed to count as valid testimony. For this reason, such expressions are self-presenting in that the evidence for their proper evaluation is evident in their presentation. For instance, the reference for the ambiguous assertion "Pass me that!" is semantically *opaque* if you do not understand the circumstances under which and by whom the request is made. On the other hand, being a witness to the assertion, in the sense of understanding who is

speaking and what is being pointed to, is to be privy to the information needed to evaluate the speech act. In this case we would say the reference of the token-reflexive expression is semantically *transparent* rather than opaque.

The meaning of the token-reflexive expression is ostensibly specified in the very act by which it comes into being. And for this reason, to perceive this particular kind of speech act is to know what it means by the very force of its existence. A word of caution: The semantic content of such an expression, as a token-reflexive expression, does not refer to the proposition or propositions to which the expression may be affixed. For example, in the statement, "He confessed to the killing of his wife," we must distinguish the token-reflexive, "He confessed to it," which—whether true or not—cannot be evaluated simply by witnessing the confession since the truth or falsity of the confession rests on other grounds, such as: Was his wife actually killed? Or did he only imagine he killed her? Moreover, the portion of the statement containing the token-reflexive expression always entails an explicitly or implicitly defined modal prefix expressing a psychological attitude of the person uttering the proposition.

Notice that the ostensive specification, required to make transparent the otherwise opaque reference of token-reflexive expressions, directly entails the existence of both an agent (the person who utters the expression) and the semantic context in which the agent is inserted. This semantic context includes a designation of the *situation* (time and place) within which, and the *occasion* (psychological attitude) upon which, the expression was uttered or written. Thus, three variables must be stipulated in the evaluation of a token-reflexive expression: an agent variable, a situation variable, and an occasion variable. We refer to the complex coordination of these three variables as a complex particular.

The main point of the preceding discussion to be generalized, to account for the perception of a wide variety of events, can now be anticipated: The reference of a token-reflexive expression is to be evaluated in terms of a scheme of three semantic variables that, taken collectively, intentionally specify an object, a complex particular. This complex particular is therefore both the intentional object of the schema as well as its reference object; it is both that which is evaluated and that by which evaluation is given. In other words, the complex particular specified by a token-reflexive expression is self-presenting (it represents itself) rather than being representational (representing something outside itself).

Because of this property required for a person to evaluate a token-reflexive expression, it suffices that that person *notices* precisely who says what, about what, where, and when. No representational knowledge—say, as derived from memory or inference—is necessarily required for this task; perception alone suffices. But because perception can achieve, in a direct fashion, the evaluation of this special form of speech act, something important is revealed about its nature: Perception in the case of speech events is revealed to be *an act that directly apprehends a speech event as a complex particular.* Even more pre-

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Not much seems like
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* | cisely, we can define perception as an indexical act that ostensibly specifies a self-presenting object (the complex particular), an object that is both its own intention and reference. In this way perception can indeed be a source of necessary a posteriori truths about the world.

But are these primary facts of experience to be restricted to this admittedly peculiar type of speech act, or may they not extend over a wide range of ecologically significant events? In the next part, it is shown that indeed they can.

Event-Reflexive Operations: A Way of Satisfying the Ecological Thesis

Linguistic acts are but a particular kind of event. Hence token-reflexive expressions can be considered a special case of a more general class of event-reflexive operation, whose evaluation involves noticing self-presenting, complex particulars, which may or may not be speech acts. In this way, it may be argued *mutatis mutandis* that if perceiving provides necessary a posteriori truths about semantic evaluation of token-reflexive speech acts, then it may also provide such truths about other events—whenever circumstances make available perceptual information for ostensibly specifying, to a properly attuned agent, the state of affairs in which and the occasion upon which the agent is presented with such information. For instance, the occasion upon which someone is hungry—that is, in a psychological attitude of DESIRING (x) where *x* is food—happens to be the situation in which the person also notices (i.e., indexes) that on the kitchen table there is both a piece of apple pie and a newspaper. ?

Under such circumstances, ceteris paribus, it is reasonable to argue that the intentional object, ostensibly specified by the event-reflexive schema for the agent on the occasion in question (being a hungry person) and in the situation depicted (being in the kitchen, noticing the table and its contents), is that object whose reference (affordance structure) receives the highest attensity (i.e., when the edibility of the pie receives greater attensity than the readability of the newspaper). On the other hand, if the person's psychological attitude (occasion) had been different—say, one of boredom rather than hunger—then this attitude would selectively specify a different reference object to interpret the intention—namely, the newspaper, whose affordance structure (readability) was more relevant (attentive) to the appropriate effectivity structure of the agent (i.e., piqued interest in acts that dispel boredom, such as reading).

Hence, in general, the intentional object of the schema—namely, a desire for something that dispels boredom or something that dispels hunger—is also the reference object, something that affords reading or something that affords eating. Notice, however, that although the intentional object specified by the schema takes an opaque reference (i.e., *something* that), the proper evaluation of the schema, through some form of ostensive specification (e.g., noticing the relevant properties of the situation), makes transparent the reference object with the

affordance property (e.g., the *edible* object, the *readable* object) that satisfies the effectivity intended (e.g., the eating of something or the reading of something). Consequently, this allows for a very brief rendition of the pragmatic rule required to satisfy the ecological thesis: Ecologically valid knowledge of its environment arises for an animal whenever the animal acts in such a way (and circumstances permit) that a mutual compatibility is created between its effectivities and the affordances of the environment. These conditions will be found to prevail whenever the semantic schemata for perception and action, whereby the reference object (affordance structure) and intentional object (effectivity structure) are defined, *dually* specify one another. Beck's

The semantic scheme needed to specify ecologically valid knowledge of events in general is what may be called an affordance/effectivity schema and consists of a compounding of the *dual* schemata for perception and action as discussed earlier: *X* affords *Y* for *Z*, and *Z* effects *Y* on *X*, if and only if *X* and *Z* are mutually compatible in certain ways to be specified (i.e., specified as the values required of the agent, occasion, and situation variables for the appropriate compatibility relation to hold). Furthermore, since the variables implicated in the perception schema by which the reference object (affordance structure) is specified are the same as those implicated in the action schema by which the intentional object (effectivity structure) is specified, then the two semantic schemata and thereby the objects they specify, must be commensurate. We take this to mean that theoretical psychology, by being rendered an ecological science, has at its disposal a single language in which to describe perceptual experiences and the objects perceived. Ideally, this dissolves the traditional dualism in psychology and, consonant with the ecological thesis, lays to rest the perennial problem of the incommensurability of natural kinds.

Ecological Knowledge

Ecological knowledge is a qualified form of knowledge; it is neither metaphysical nor logically perfect. Because it is not logically perfect, a significant issue in the study of the specification of an environment for an organism is: "How much is enough?" The answer to this question should be sought within a theory of affordances and effectivities.

Consider the locution "*Z* perceives *x*" to be true, it is not incumbent upon *Z* to notice every characteristic of *x*. Indeed, perceiving an object cannot realistically require noticing every property of that object—an impossible task given that the property set for any real object is probably infinitely dense. Rather, what is called for is simply that *Z* notice certain *significant* properties of *x*. The troublesome term, of course, is *significant*; consequently, a theory of significant properties seems called for. *

Essentialism is the metaphysical doctrine that purports that every object has essential, as opposed to accidental, properties that are both necessary and suffi-

cient to its definition as a kind. A most popular theory of significance has been simply to endorse essentialism. Under this view, the perception of any object merely entails noticing that every property on the essential list is ostensibly specified *sui generis*. This is tantamount to claiming that perception must provide knowledge of the objective properties of objects independent of any psychological attitude on the part of the percipient. Under such a view, it would not matter if the percipient *Z* were a human, a horse, or a hermit crab; if *Z* perceives *x*, then whoever or whatever *Z* may be does so by noticing the very same property list.

There is considerable evidence showing that various species of percipients do not perceive the same objects in the same way, and that even the same percipient does not perceive the same object in the same way on different occasions. Perception does not seem to be so cut and dried an activity but one that is modulated by evolution and by experience (what Gibson [1966] has called genetic preattunement and the "education of attention," respectively). Indeed such Platonism is anathema to the ecological thesis, since the latter proposes that psychological attitudes (such as fear, thirst, love, or anger) act as modal operators on the potentially infinitely dense property set of objects to ferret out the appropriate properties to be noticed on a given occasion.

Support for this ecological concern—namely, to keep the animal and its world bound together in a harmonious synergy—can be provided simply by considering the way the verb *to perceive* can be used (Chisholm, 1957). This verb is not at all like the verbs *to carry*, *to own*, or *to contain*. A truck cannot carry a box without carrying every part of the box; a baron cannot own a country estate without owning all of it; and a plot of land cannot contain a garden unless it contains every square inch of it.

The grammar of perceiving is rather like that of biting or inhabiting: A dog can surely bite a postman without biting every part of him, and a tribe of Indians can inhabit the state of Utah without inhabiting every nook and cranny of it. Similarly, if *Z* sees *x*, this does not require that *Z* see all of *x* or that *Z* perceive every characteristic of *x*. We say that the mother saw her child hiding behind the sofa when nothing more than the child's hand or foot was noticed. Clearly, a friend can truly be said to have seen his smiling, nattily dressed neighbor without having noticed whether his teeth were newly capped or what he wore.

To quibble that this is merely an imprecise manner of speaking suggests that the mother really noticed only a disjointed hand or foot without an owner, and that our friend saw his neighbor toothless and naked. Is it not more appropriate to say the mother saw the occlusion of her child by the sofa, and that our friend saw his neighbor with unspecified teeth and clothing? Amputated limbs and edentate mouths are totally distinct perceptions with property sets that include information for discontinuities and abrupt changes in texture gradients. Like public nakedness, the attentivity of these properties of objects is so high that it is unlikely they would go unnoticed.

Thus *significant* properties of objects, as opposed to trivial ones, are those specifying the true nature of the objects to which they belong and that possess

great attentivity for the circumstances under which they are perceived. However, since these circumstances may vary, the property set of the object may be partitioned differentially by the psychologized attitude of the percipient. For example, a less concerned mother may not have noticed the childlike appendages behind the sofa; and a different friend, who is a fashion buff or a dentist, may have been quick to notice the wardrobe and cosmetic changes of his neighbor.

The ultimate criterion for whether *Z* perceives *x* is not how many properties of *x* that objectively define its essential nature are noticed, but what properties *Z* can notice that are appropriate to the nature of *Z* and the attitude *Z* assumes on a particular occasion with respect to *x*—say, on the occasion of being hungry, thirsty, cold, angry, lonely, bored, curious, and so forth. Again we see, as in the preceding parts, that for the ecological approach, the perceived object is functionally defined in reference to both the animal's nature and the particular psychological attitudes held, rather than being structurally defined in terms of so-called objective essences. What a collection of surface and substance properties means for a given animal is specific, in part, to the nature of the animal and what it intends and, in part, to the properties that can be noticed by the given animal. To reiterate, what is knowable ecologically is neither metaphysically nor logically perfect. To grasp the form of what is ecologically knowable, we consider doxastic logic an important branch of intensional logic, which studies the logic of belief acts, belief attitudes, and belief propositions.

Doxastic logic can be traced in its origins to Plato's dialogues, especially the *Meno* and *Theaetetus*, where the distinction between knowledge and belief are debated. Here we find some of the earliest discussions of the pragmatic doctrine that truth is what is *useful*. Earlier we argued that successful evolution, adaptation, and coping may not require that an animal or species have perfect perceptual knowledge of its surroundings but only that such knowledge be ecologically valid in the sense that it "works" to protect the animal from harm and to enrich its life appropriately. The criterion for determining what counts as ecologically valid knowledge therefore requires a pragmatic rule to specify the notion of "working." A prototype of such a rule was suggested by Plato in his original study of *doxa*, or opinion, in the later parts of the *Meno* dialogue (Ryle, 1967).

Socrates is portrayed as despairing of trying to prove that virtue is teachable and, consequently, is a kind of knowledge. He reminds Meno that in the course of daily affairs, correct opinion, or *doxa*, serves just as well as knowledge. For instance, the guide who only *thinks* that this is the road to Larissa but who is quite right gets us to Larissa as surely as one who actually knows it. Thus *doxa*, as correct opinion or true belief, is a form of pragmatic "knowledge" differing from true knowledge in that it can be shaken by criticism, conflicting evidence, authority, etc. Plato makes a great deal of this contrast, devoting much of the *Theaetetus* to its discussion.

It should be noted, however, that *doxa* is more general than our "opinion" of things; it also includes the case of seeming or appearing (e.g., APPEARS [*x is y*]). Moreover, the experience of a virtual object is a case of *doxa*, such as the

appearance that the earth is flat, that the sun moves across the sky, that Necker cubes reverse, and so forth. Similarly, the convict who took the optical display to specify water, since he had no knowledge from that distance, was providing *doxa*. The fact that his opinion, unlike that of his unfortunate skeptical friend, was indeed proven true does not make it any less a case of *doxa*. Therefore, we consider *doxa* to be any case where evidence is insufficient to specify with logical certainty the nature of that referred to by the *doxa*.

The question that must be addressed with respect to ecological psychology is this: Is perception a case of correct *doxa*, or pragmatic "knowledge," in the sense of the guide's true and useful opinion that *this* is the road to Larissa, or in the sense of the convict's true and useful opinion that the shimmering optical display *is* water? Or is it a case of philosophically certain knowledge, in the sense that the available information is logically sufficient (perfect) for making all ontological distinctions that can be made? Both questions are of course offered rhetorically since arguments have been given throughout the paper against both extreme views.

On the other hand, there is a nuance to Plato's concept of correct *doxa* that is not perfectly reflected in the translation of it as mere opinion. Correct *doxa* is not idle opinion that is fortuitously true, but connotes efficacious opinion that not only is true but is true for the right reasons—namely, that it conforms to reality at least to the extent that it motivates useful actions. The guide's correct *doxa* gets us to Larissa, or the thirsty optimist to an oasis, not merely by chance decision but by constrained and motivated choice. The guide does not randomly elect to set out for Larissa down the chosen road by mere happenstance, but chose this road because going down roads in this general region, rather than roads in another region, is more likely to lead to success than just sitting around idle or wandering aimlessly. Similarly, the thirsty convict pursues a course through the desert that is motivated by the existence of what might be water. He does not set out in random directions, nor does he randomly select between not seeking and seeking water. Not to choose to choose is a forced option, the alternative choice being death by thirst.

In all cases of correct *doxa*, choice is constrained rather than random; a choice is made under mitigating circumstances that direct opinion down paths of decision that are relevant to given goals. A ball park for constraining the formation of opinion is given, no matter how marginal the constraint might be. This ball park of constraint provides the semantic context, a "possible-world," in which *doxa* may be logically interpreted with respect to relative standards of truth and meaning.

Doxa may or may not achieve pragmatically desirable outcomes, but unlike mere opinion, they are never totally irrelevant either. Thus *doxa* may not qualify as unmitigated knowledge; indeed it would be unwise even to call it *probable* knowledge (as some perceptual theorists might); but *doxa*, unlike fortuitously correct opinion, may lead to knowledge. The guide who thinks *this* is the road to

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Larissa and acts upon that belief, like the thirsty man in the desert who seeks water in the direction of the shimmering optical display, is engaged in appropriate action that may result in knowledge; thus *doxa*, at least as opinion taken sufficiently seriously to be acted upon, is more likely to be validated or invalidated than the mere holding of idle opinion. More importantly, unlike idle opinion, correct or otherwise, where no actions necessarily follow, no "ball parks" of constraint obtain, and no "possible-worlds" are entered; the holding of *doxa* is relevant to the possible attainment of knowledge since if the entailed actions are appropriate, then knowledge is forthcoming.

Indeed, in the *Meno*, Plato has Socrates recognize the fact that correct *doxa* may, under appropriate circumstances, be transformed into knowledge:

True opinions are a fine thing and do all sorts of good so long as they stay in their place, but they will not stay long. They run away from a man's mind, so they are not worth much until you tether them by working out the reason... Once they are tied down, they become knowledge, and are stable. That is why knowledge is something more valuable than right opinion. What distinguishes one from the other is the tether... so that for practical purposes right opinion [*doxa*] is no less useful than knowledge, and the man who has it is no less useful than the one who knows. (p. 571-82).

We have labored over these distinctions among correct *doxa*, merely true opinion and perfect knowledge, because the distinctions are crucial to an understanding of the special nature of ecologically valid knowledge, a form of knowledge that differs from mere correct opinion in the fact that like correct *doxa*, it can be "tied down" to a relevant semantic context—a "possible-world"—by means of a pragmatic principle of right action. Right action has the felicitous effect on correct *doxa* of bringing about a change in the existential circumstances of the agent (e.g., by reaching the desired goal), so that belief is transformed into knowledge—opaque references of beliefs are rendered transparent—whenever the effectivities of the person-as-actor are mutually compatible with the affordances of the situation experienced by person-as-percipient.

Thus ecological knowledge, like all forms of knowledge permitted under critical realisms, is trapped somewhere between totally perfect knowledge of noumena and mere opinion of phenomena. Ecological knowledge is no more than correct *doxa* in the sense of motivating pragmatically true (useful) action that leads to success as relatively defined in a given semantic context. But this is enough.

This ecological account of knowledge as correct *doxa*, defined relative to a given semantic context, is close, but not identical, to the pragmatist's doctrine that an idea or proposition is true if it "works" to achieve some warranted end. John Dewey (1916) illustrated it this way: A man lost in the woods uses his idea as a working hypothesis to guide his action. Not until he succeeds or fails to find his way home can he ascertain whether or not his idea is true. Thus by the

Action can be perceived (self) as well as what is acted upon, explored,

Memorial Hall, "Writings - P. 200
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pragmatist's account, *doxa* (e.g., a thought, perception, plan, belief, and so forth) is true in an instrumental sense only; it is true *if* it motivates actions that are felicitous to some desired or required end. This instrumental criterion for valid knowledge is close to the tenor we want for ecologically valid knowledge in one sense—namely, that right action is necessarily entailed by knowledge; but it is seriously inadequate in another sense—that having to do with how successful or right action should be defined.

Arthur O. Lovejoy (1908) criticized William James' (1907) pragmatic theory that truth is what works because the concept of "working" and being true do not seem logically synonymous. The Jews' belief in the coming of the Messiah *worked* in the sense that it sustained them and gave them hope as a people during hard times. But the belief did not work in a second sense because the Messiah failed to appear to save them. Thus the belief was useful but untrue.

Bertrand Russell (1910) raised the same criticism in a different way: That other people exist is a true proposition. However, this proposition is in no way entailed by the proposition that it is useful to believe that other people exist. As argued earlier, BELIEVE (x is y) is a contingent proposition that does not necessarily entail that x is y . Consequently, if the notion of ecologically valid knowledge is *true doxa*—and "true" here means *pragmatically* true (i.e., useful)—then the ecological program is in serious difficulty unless it can answer these criticisms of the pragmatic doctrine.

Again we try to show how the "possible-worlds" semantic of modal logic comes to our rescue. But let us recognize that Russell's and Lovejoy's criticisms are incisive and not to be extenuated; a serious rebuttal to their points is sorely needed if the ecological program is not to be stillborn. Such a rebuttal must demonstrate the tenability of ecologically qualified knowledge—namely, useful knowledge that, like Plato's correct *doxa*, is less than perfect but more than idle opinion and that springs from veridical perceptions and leads to felicitous actions.

But Plato's concept of *doxa* is peculiarly human. Thus we must depart from his treatment and show *doxa* to be appropriate propositional attitudes of animals as well as humans. Socrates' provocative claim that correct *doxa* "tied down by reason" becomes knowledge implies too narrow an anthropomorphic bias. If ecologically valid knowledge is to be possible for all species—the lowest to the highest in intelligence—then reason, at least of the human variety, can play no necessary role. Rather, we argue that since all that is needed to "tie *doxa* down"—and thus transform it into valid (ecological) knowledge—is appropriate action, an animal's perspective is just as valid for its circumstances as the human perspective is for his or her circumstances. All forms of ecological knowledge draw whatever validity they have from the force of existence rather than the force of argument (reason) and, in this sense, qualify as primary facts of experience, or necessary a posteriori truths.

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Ecological Knowledge at Different Grains of "Possible-Worlds" Analysis

Ecological knowledge must be a nested affair since animals function adaptively at various levels of competence to survive and maintain health: Species evolve because they persist over generations; generations of animals survive because offspring adapt sufficiently well over lifetimes to become parents; lifetimes are traversed because they consist of shorter episodes in which individuals successfully cope with the demands of existence. Consequently, no single grain of analysis of an ecosystem has a monopoly on ecological knowledge; its validity must range over nested "possible-worlds," a Chinese-boxes arrangement of semantic contexts where the *truth* of one level may not be the *truth* of another level.

Thus let us consider the issue of how "possible-worlds" semantics may provide contexts of interpretation at more than a single grain of analysis. By our previous arguments, it should be clear that for ecological knowledge to be possible, the affordances of X must be commensurate with the effectivities of Z at *all* grains—that is, where X ranges from niches to objects and Z from species to individuals on particular occasions, respectively. To illustrate this fact, consider three grains of analysis that are significant for ecological psychology: those of species, individuals, and distinct episodes of experiences.

The "possible-worlds" context for species refers to the distinct niches they live in because of differences in genetic preattunement (i.e., evolution). An niche is a partitioning of the world into affordances or "possible-worlds" of action and determines perceptual experiences that are invariant (or pragmatically true in the sense already described) over all members of a single species. The "possible-worlds" context of individual members of a species refers to how distinctive attensity values highlight particular configurations of affordances specific to subsets of individuals who possess the same skills, such as those who belong to the same language culture or profession, possess the same artistic talents or athletic abilities, and so forth. As already noted, Gibson (1966) has called such differential attunement to affordances by experience the "education of attention." And finally, there are the "possible-worlds" of episodes of experiences specified by the various psychological attitudes that arise on different occasions for the same individual, such as going from anger to hunger or from desiring to knowing.

In a purely abstract vein, we can consider all the foregoing cases as propositions that have been qualified by a modal operator, a propositional attitude, just as in our previous discussion of psychological attitudes; namely, for S OPERATOR (x), where S can be species, individual, or psychological state, OPERATOR is the appropriate intentional qualifier for the S involved (e.g., EVOLVES when S is a species, ADAPTS OR LEARNS when S is an indi-

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vidual, and KNOWS, BELIEVES, etc., when *S* is an individual involved in a particular situation on a given occasion). Here, of course, *x* refers to the intentionally specified propositional object—such as the action consequent required to specify the correctness or incorrectness of the *doxa* in question.

Whether a convenient formal notation can be worked out to capture these different grains of analysis for the “possible-worlds” (semantic contexts) in which animals live and learn remains to be seen; the differences, however, are no less real. The different grains of “possible-worlds” analysis specify some of the different types of knowledge attainment an animal may have with respect to its environment of nested perceptual information and action opportunity. Furthermore, it seems clear that a different modal operator must apply to the propositional descriptions of the animals’ ecosystems considered at different grains of analysis. The emphasis here is on *ecosystem* rather than *environment* because: (1) each propositional description must be qualified by a pair of *dual operators*—one specifying the intentional object of perception (a “possible-worlds” of affordances) while the other specifies the intentional object of action (a “possible-worlds” of effectivities); and (2) the fact that the dual modal operators apply to the same propositional description of the environment to represent a single propositional attitude held by a single agent on a particular occasion guarantees that the perception and the action specified will be commensurate (mutually compatible) and that ecological knowledge is possible. It is in this sense that all the propositions in the domain of this ecological approach to psychology take the abstract form of an event-reflexive operator prefixed to a scheme of the three variables discussed earlier—namely, the situation, agent, and occasion variables.

We appreciate that without extensive elaboration, the foregoing discussion may itself be logically opaque; consequently, some degree of intuitive transparency may be gained by considering examples of “possible-worlds” semantic contexts defined at three different grains of analysis. Such illustrations should provide a glimpse of the formal relationships between these dual modal operators that any more extensive treatments must honor.

Illustrations

In addition to the points just mentioned, the cases discussed also serve to illustrate the relativity of ecological knowledge over species and to clarify the concept of error. It should be clear by now, however, that the ecological thesis does not preclude animals and humans from being mistaken about what their experiences truly mean where the available evidence is insufficient. On the other hand, the ecological thesis also admonishes us that all such experiences that entail incorrect *doxa* are a fortiori not perceptions, since perceptions necessarily entail correct *doxa*.

The first case illustrates why *doxa* that is correct for one species may not necessarily be correct for another; and, similarly, why *doxa* that is “globally”

correct for a species, in the sense that it entails a pragmatic principle that has long-range validity for every member of the species, may not always entail correct decisions at a more local level where the individual members must deal with short-range, variable environmental contingencies.

Case 1: The Frog and the Fly. A frog that preys on flying insects, say houseflies, is genetically preattuned to strike at any small, dark object that darts within range of its sticky tongue. However, when the object attacked is not a housefly but an experimenter’s decoy, then it is tempting to say that the frog misperceives or has made a perceptual error. The ecological thesis would disagree with this assessment, for the frog does not misperceive in this situation nor engage in judgmental error of any kind. Indeed, it is not even proper to say that the frog experiences the experimenter’s decoy as a *virtual* object because of its noticed resemblance to actual houseflies.

The experience of a virtual housefly entails that the frog notice a resemblance between two real things—the small, dark, darting object and a particular type of flying insect. Whereas the former has been shown to be a perceptual object within the possible-world of experience for frogs (Lettvin, Maturana, McCulloch, & Pitts, 1959), the latter most likely is not. The articulate level of detail that humans use to differentiate houseflies from small, darting, dark objects may not be a possible level of perceptual detail for frogs. Frogs are known to strike readily at moving insects but to ignore static (dead) ones; whether they see them at all has been questioned. Thus, there is no paradox in claiming that the frog “sees” the darting object but does not perceive it to be a virtual housefly.

By contrast, at a coarser grain of perceptual analysis, the decoy target is a *virtual* object for the frog. For the frog, small, dark, darting objects typically afford eating; the decoy is a small, dark, darting object and, therefore, specifies this same affordance property. Moreover, if the frog is to be consistent with its knowledge of edible targets, it *must* strike at the decoy, for that is the right action that its *doxa* calls for. In fact, it would be an error at the species level of possible-worlds analysis for it not to do so. Yet this raises an apparent paradox since for the frog to strike does not result in a successful action. The apparent paradox is easily resolved, however, if we distinguish species *doxa* from the *doxa* held by a given individual on a particular occasion, in keeping with the claim that what is valid knowledge at one grain of possible-worlds analysis may not be so at another.

Presumably, frogs and other species thrive because the pragmatic principles they live by as a species are correct *doxa*, entailing actions that are more likely to be successful than unsuccessful. The attensity value of certain properties—such as being small, dark, and darting—is higher than that of others because the perception of them entails correct *doxa* for the animal. The fact that the same properties, when displayed artificially under contrived experimental context, do not result in correct *doxa* on such exceptional occasions in no way detracts from

the pragmatic truth of those same perceptions or actions on other, more natural occasions.

Thus, the unsatisfactory performance is explained as a valid instance of satisfactory functioning in the animal's normal environment. An animal is constrained and motivated to right action in its own econiche by the same perceptual information that may be essentially undefined in someone else's econiche—say, that of a human experimenter. When the semantic context of its experiences is altered, then their meaning varies accordingly. The possible-worlds of experience of one species or one individual may not be those of another. No puzzles for epistemology or psychology, however, are entailed by this fact unless one holds to a rigid, universal theory of truth rather than a more flexible, relativistic one.

Given sufficient time, however, a species or individual may learn to accommodate to such changes in context, to transform incorrect *doxa* into valid ecological knowledge; but the process is never instantaneous. Hence, attempts at instant science—as represented in the arbitrarily contrived “possible-worlds” of experimentation, where the problems of ecological validity of stimuli and responses are often ignored—may prove more misleading than revealing, especially if the data gathered receive only a narrow anthropomorphic interpretation—namely, where the criterion for error is based on human *doxa*.

Case 2: Environments for Cartwheeling. A second case considers how experience may attune given members of a species to experience the same configuration of surfaces and substances in different ways. Since different experiences support different *doxa*, such experiential differences specify distinct varieties of “possible-worlds” in which the animal's behavior must be interpreted. Just as we must avoid the *species-specific fallacy* of treating animals anthropomorphically (as living in the same semantic contexts as humans), indicative of human perceptions, we also must avoid treating members of the same species as sharing exactly the same set of “possible-world” contexts. They surely share the semantics of their econiche, as one among many “possible-worlds” at the species level; but different experiences may educate members in ways that are only suitable to interpretation in distinct “possible-worlds.”

For instance, a person who learns to cartwheel may seek out places where this playful activity is possible. The “possible-worlds” context for a cartwheeling human is therefore distinct *in part* from that of a noncartwheeling human. The cartwheeling aficionado will perceive affordances of terrain that escape the eye of the more sedentary person. The correct *doxa* for cartwheeling hence partitions the properties of the environment into affordances specific to this view of right action (e.g., having a nonrocky, fairly smooth surface without too many trees or shrubs and, perhaps, possessing a very slight declination in one direction). Moreover, the *doxa* for cartwheeling also raises the attentivity level of the relevant properties of the terrain as a direct function of the psychological attitude assumed by the person (e.g., “I'm bored. I think I'll cartwheel for a while”).

The principles for determining correct *doxa* for cartwheelers can of course be

generalized to other activities that may be more subtle and complex. For instance, the task of determining the sex of chickens at a young age is very difficult. Even those who are successful “chicken-sexers” cannot articulate clearly and sufficiently the tacit knowledge that allows them correct *doxa* in their choices. This perceptual skill is not so different from that of the expert microscopist who recognizes cancerous from noncancerous tissue samples; the expert air-traffic controller who accurately anticipates dangerous problems in crowded air corridors on the radar screen; the art connoisseur who detects forgeries of Rembrandt's style; or the radiologist who correctly diagnoses broken or displaced bones when no obvious anomaly is visible to his or her colleagues. None of the perceptual skills of experts can be easily explained to a novice. A novice only becomes an expert through the “education of attention” that permits correct *doxa*.

The ability to decide wisely in such situations is not to be explained by reason, but by a requisite change in the attentivity of certain properties that specify to the percipient the relevant affordances of the situation. In this way, judgment is a form of right action, not of inferential reasoning. The perceptual knowledge of animals achieves correct *doxa* in the same way. Wolves who track the caribou by their scent, like birds who seek shelter because they anticipate an oncoming storm by detecting changes in air pressure, and the giant green sea turtles who follow meandering courses to avoid choppy water at sea in their homing voyage to lay eggs on the Galápagos beaches are all demonstrating correct *doxa* spawned by attunement.

The final example shows how a change in the psychological attitude individuates the affordances of the affordance structure that is a given animal's environment. Such changes require a host of distinct “possible-worlds” in which the success or failure of actions may be semantically interpreted. Moreover, the next illustration also specifies in more detail exactly what is meant by the duality of action and perception and shows how the event-reflexive operator applies to the dual action and perception schema to define the relevant “possible-worlds” contexts.

Case 3: The “Possible-Worlds” of Hermit Crab Perceptions. As argued earlier, the notion of perception as an event-reflexive function is quite general, applying to lower animals just as well as to humans. This can be seen in the case of hermit crabs, who seem to perceive sea anemones as affordance objects rather than merely as crass physical objects (von Uexküll, 1957). On one occasion, a hermit crab that has been robbed of the actinians that it normally carries on its shell for protection against its enemy, the cuttlefish, perceives the sea anemone as a replacement for the lost actinians in the sense that it perceives the anemone as something to be planted on its shell. By contrast, on another occasion, if the hermit crab has lost its shell, it often attempts unsuccessfully to crawl into the sea anemone. Finally, on the occasion that the crab has been left to starve for some time, it will proceed hungrily to devour the sea anemone. Thus, we see that on at

least three separate occasions, different propositional attitudes toward the same (physical) state of affairs (the sea anemone) can intentionally specify three distinct affordance objects for the same agent (the hermit crab)—a protective shield, a portable enclosure, or a tasty repast. Let us now illustrate more precisely our definition of perception as an indexical, or event-reflexive, operation. We begin with the affordance description of the circumstances that must prevail if the hermit crab is to perceive the sea anemone in either of three “possible-worlds”—the worlds in which it is a protective shield to be worn on its shell, a tasty repast to still the crab’s hunger, or a portable enclosure to be worn in place of a shell. The first two cases qualify as perceptions that entail ecologically valid knowledge or correct *doxa* for the crab since they allow it to carry out a line of action that is pragmatically true. However, in the third case, the sea anemone resembles something it is not—namely, a potential portable enclosure to replace a lost shell. Since this *doxa* leads to an unsuccessful attempt by the naked crab to enter the apparently hollow body of the sea anemone, the sea anemone display functions as a virtual object (a virtual shell). Unlike the first two situations, this situation intentionally specifies a “possible-world” without existential import; hence, the psychological attitude qualifying the propositional schema cannot be Z PERCEIVES (*x is y*) but must be Z EXPERIENCES (*x as y*). As pointed out in the case of the frog, this situation would traditionally be treated by the representational realist as a case of perceptual error.

By contrast, a committed realist who is averse to phenomenalist forms of realism would argue that it is a case of the theorist mistaking the intention of the crab’s action because of an anthropomorphic bias rather than a case of the crab misperceiving. Since trying to enter things that afford any degree of access (which the sea anemone does) will eventually lead the naked hermit crab to don a protective covering, it would be inappropriate to call this case of appropriate species *doxa* a misperception. The maxim of the act, regardless of its success or failure, is both right and relevant and, therefore, is motivated by ecologically valid knowledge, correct *doxa*, that the crab has of its environment.

Recall from our earlier discussion of “possible-worlds” semantics that although “possible-worlds” are intentionally specified by propositional (e.g., psychological) attitudes, such specification does not automatically bestow existential import on them. The “possible-world,” which receives existential import, does so because the agent’s primary experiences of it are sufficiently veridical as to lead to right action. If the “possible-world” situation experienced by the agent on a given occasion receives existential import, the experience is said to be a perception and thereby to provide necessary a posteriori truths about the agent’s environment; such truths are of course synonymous with correct *doxa*, or ecologically valid knowledge.

Let us now attempt to characterize formally the event-reflexive operation that specifies “possible-worlds” and delivers existence to them whenever certain mutual compatibility relations hold between an agent and its environment.

And experience the right action

If we consider the two felicitous occasions abstractly, then it is possible to identify the variables, relations, and operations required to give a precise definition of perception, action, and ecologically valid knowledge in terms of event-reflexive operations on schemata containing exactly the same variables. Put differently, correct *doxa* will be shown to be specified by those “possible-worlds” situations in which perception and action function as *dual complements* because certain symmetries hold between effectivities and affordances.

1. “Possible-World” Where the Anemone Affords Eating. The sea anemone, X , affords eating, Y , by the crab, Z , on the occasion of its being hungry, O , if and only if the ingestive/digestive system of the crab, fZ , is mutually compatible with nutritional properties of the sea anemone, gX .

The preceding schema fits the general form: X affords Y for Z on O if and only if certain symmetries hold between the properties of X and those of Z . This reduced form can be translated into an event-reflexive formula as follows:

$$P(X_1, Z_1, O_k | gX \diamond fZ) = Y_1$$

where X_1 = a particular situation—i.e., a state of affairs in the animal’s surroundings.

Z_1 = the agent as perceiver.

O_k = the occasion upon which a particular propositional (psychological) attitude holds.

gX = a particular set of properties belonging to the situation that is relevant to the occasion in question.

fZ = a particular set of properties of the agent that is also relevant to the occasion in question.

| = a symbol designating that the expression on its right is the semantic context of the expression on its left.

\diamond = a symbol designating that a mutual compatibility relation or symmetry holds between the terms on its left and right.

$| gX \diamond fZ$ = the mutual compatibility condition that must be satisfied if the event-reflexive function $P(\quad)$ is to be defined.

Y_1 = the affordance-property or affordance structure, as the case may be, that is intentionally specified by the P -function when all the variables are properly evaluated.

The preceding intentional schema for perception as an event-reflexive function of three variables can be transformed into an intentional schema for defining action in an analogous manner. The only changes required are that the agent variable Z is now interpreted as actor rather than perceiver; the variable Y_1 as an intentionally specified effectivity or effectivity structure of the agent Z rather than an affordance or affordance structure of the situation X ; and finally, we change the ordering of the variables in the argument of the function and its

designation from P (for perception) to A (for action). Thus we obtain the new event-reflexive schema:

$$A(Z, X, O_k | g X \diamond f Z) = Y_1$$

Read: *The agent Z effects Y on X on the occasion O if and only if certain symmetries hold between the properties of X and Z.*

The two formulae for defining perception and action, logically speaking, are *duals* of one another. A *duality* is a transformation T such that when applied to some object x , it transforms it into some new object y and when applied to the new object y , will transform it back into the object x . Hence $T(x) \rightarrow y$ and $T(y) \rightarrow x$. It is clear that such a duality exists for transforming the action schema into the perception schema, and vice versa. Indeed, the simple syntactic transformation mentioned earlier by which we derived the action formulation from the perception formulation is precisely of this nature: $T(P) \rightarrow A$ and $T(A) \rightarrow P$ represents $T: P(X, Z, O | X \diamond Z) \Rightarrow A(Z, X, O | X \diamond Z)$ and $T: A(Z, X, O | X \diamond Z) \Rightarrow P(X, Z, O | X \diamond Z)$, respectively.

Moreover, since the intentional schemata for action and perception are duals, so are the intentional objects they specify—namely, effectivities and affordances, respectively. This simply means that in our preceding example, the affordance property of the sea anemone, its *edibility* for the crab, is a dual expression of the effectivity of the crab, its *ability to eat* the sea anemone. As trivial as this may sound, it has profound implications for promoting the ecological thesis, for it provides the basis for proving that there can indeed be a common theoretical language in which perception and the objects perceived may be precisely described: The objects perceived are not crass physical objects but intentionally specified objects in a "possible-worlds" semantic context.

2. *A "Possible-World" Where the Anemone Affords Shielding.* The sea anemone, X , affords use as protective shielding, Y , for the crab, Z , on the occasion of its loss of actinians, O , if and only if structural properties of the crab's shell, gZ , are mutually compatible with the attachment and support properties of the sea anemone, fZ .

Again the abstract formulations for action and perception in this perception in this "possible-world" of experience for the hermit crab are duals of each other. The possibility of such a duality holding guarantees that the semantic context ("possible-world") so stipulated is ecologically real for the animal and, therefore, that it potentially entails correct *doxa*. The action formulation would be as follows: The hermit crab, Z , can effect the planting, Y , of the sea anemone, X , on its shell to serve as protective shielding if and only if . . . etc. This intentional schema specifies a realizable felicitous action because of the same mutual compatibilities holding between the crab and the anemone that make the crab's

perceptions of the anemone, as a potential shield, veridical. Thus, the event-reflexive operators $P()$ and $A()$, for perception and action, respectively, are propositional attitudes having to do with an agent *noticing* that certain properties (resemblances or symmetries) hold between itself and its world and *intending* to act upon them accordingly. These propositional attitudes are *duals* of one another because the affordance properties of the world are written in a perceptual language that can be read by the agent as an action language, and vice versa. And as argued earlier, *the noticing of resemblances and the intending to act upon them*, like knowing one's beliefs or pains, are primary facts of experience and thus provide the necessary a posteriori truths upon which to build an ecological psychology.

At the risk of belaboring the obvious at this point, let us round out our discussion by considering the case where the hermit crab appears, at least to a human observer with human *doxa* rather than crab *doxa*, to be thwarted in its attempt to enter the sea anemone and wear it as a "shell." We give two "possible-world" versions of this same case—one where an asymmetry, or incompatibility, is defined to hold between the perception and action of the crab with respect to the sea anemone; and the other where a symmetry holds.

We call the first version the *spurious* version because it ignores species *doxa* in explaining the actions of the hermit crab: It assumes, first, that the crab "sees" the anemone as affording a shell function when, in fact, it does not lead to felicitous action, since the crab's body cannot fit into the sea anemone; secondly, it also assumes that the action of the crab is an attempt to don the sea anemone like a shell.

3. *The Spurious "Possible-World" Interpretation.* The sea anemone, X , affords use as a portable enclosure, Y , for the hermit crab, Z , if and only if the structural properties of the sea anemone (e.g., size and shape), gX , are mutually compatible with those of the hermit crab, fZ .

What makes this version the specification of a spurious "possible-world" is that no matter how hard the hermit crab attempts to enter the body of the sea anemone, it will fail because, presumably, *in principle* no member of the hermit crab species can enter the body of any member of the sea anemone species. Therefore, if the affordance defined is a true affordance Y for Z with respect to X , then the possibility of right action must exist, for it is only in this duality that the "possible-world" can become actualized. Hence it is improper to say of the crab that it *sees* the sea anemone as affording something that it in principle does not. This is a misuse of the term *affordance*. To clarify this term, consider a different case.

Let us now try to formulate the felicitous interpretation of what the naked hermit crab must be intending when it notices the sea anemone and approaches it from the standpoint of crab *doxa* rather than human *doxa*.

4. *The "Possible-World" in Which Hermit Crabs Are Investigators.* The object, X , affords being investigated in a particular manner, Y , by the hermit crab, Z , on the occasion of its being naked if and only if the object has certain properties, gX , that are mutually compatible with certain properties of the crab, fZ .

Notice that in this formulation, the object could be anything that has a certain size, shape, texture, rigidity, etc; it need not be a sea anemone per se. Species *doxa* for the crab, like species *doxa* for the frog, has it act toward objects as a member of a rather grossly defined equivalence class. The object only has to invite investigation by the crab, or being struck at by the frog, in order to satisfy the criterion for right action. It is as if you were in a dark hallway, fumbling for your door key, which is one of a large collection of similar-shaped keys on your key chain. You cannot know which key is which merely by feeling the grooves; you must try to see which fits. Your fumbling attempts nonetheless constitute right action under the circumstances, since to do nothing leaves you stranded in the hallway. It matters not whether, unknown to you, the key has been surreptitiously removed from the key chain, since this is execution of an act that is entailed by ecologically valid knowledge of door opening in architectural environments.

Similarly, the naked hermit crab also exhibits a grasp of what is appropriate when it investigates in its fumbling manner various objects whose details are presumably not perfectly differentiated. This is correct action as entailed by its species *doxa*. No perceptual error is involved because the crab cannot take the sea anemone to be more than an object to be investigated, just as you might take a randomly selected key as one to be tried. The action is as felicitous as the perception is veridical: Since they are duals, it could scarcely be otherwise. How else can a "possible-world" among many become existentially actualized?

Reality of this ecological sort draws its force of existence from correct *doxa*, which as a form of knowledge has the same ability to compel appropriate action as Socrates claimed of virtuous knowledge: *One cannot know the good (veridical) and do the evil (nonfelicitous)*. Only ignorance of what is afforded can lead to inappropriate action, and this is certainly not to be confused with knowledge—perceptual or otherwise.

On this point we conclude our arguments. We have attempted to flesh out what a commitment to realism entails for a theory of perception. In so doing, a number of serious problems have been addressed, and ideally, the directions in which their solutions might be sought have been identified. For the student of cognition whose interest is memory, the arguments we have made should not be construed as simply germane to perception. Remembering is a kind of knowing that relates animal and environment, and the issues we have raised for perceiving as knowing must be raised *pari passu* for remembering as knowing. Put bluntly, we believe it a mistake to treat the objects of remembering as numerically distinct from the objects of the original experience. From the perspective of a commitment to realism, talk about remembering cannot be talk about a

present representation of a past event; rather, it must be talk about (a possibly special sort of) knowing of past events themselves (Locke, 1971). What the precise nature of this direct knowing may be remains a problem; but at least it is just one problem in comparison to the several mysteries (such as how to resolve the problems of referentiality and intentionality) that inhere in the characterization of memory from the stance of that form of phenomenalism that assumes a reality—namely, representational (indirect) realism.

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