REFERENCES

Dillon, M.C. 1997. *Merleau-Ponty's Ontology.* Evanston: Northwestern University Press.

Einstein, Albert. 1961. *Relativity.* Translated by Robert W. Lawson. New York: Wings Books.

———. 1982. *Ideas and Opinions.* New York: Crown Publishers.

Hass, Lawrence. 1999. "Sense and Alterity: Rereading Merleau-Ponty's Reversibility Thesis." In Merleau-Ponty, *Interiority and Exteriority, Psychic Life and the World* (pp. 91–106), edited by Dorothea Olkowski and James Moreley. Albany: State University of New York Press.

Merleau-Ponty, Maurice. 1962. *The Phenomenology of Perception.* Translated by Colin Smith. London: Routledge & Kegan Paul.

———. 1964. "Eye and Mind." In *The Primacy of Perception.* Translated by James M. Edie. Evanston, IL: Northwestern University Press.

———. 1968. *The Visible and the Invisible.* Translated by Alphonso Lingis. Evanston, IL: Northwestern University Press.

———. 1970. *Themes From the Lectures at the Collège de France, 1952–1960.* Translated by John O'Neill. Evanston, IL: Northwestern University Press.

Plato. 1971. *Timaeus.* Translated by Benjamin Jowett. In The Complete Dialogues of Plato. Edited by Edith Hamilton and Huntington Cairns. Princeton: Princeton University Press.

Yount, Mark. "Two Reversibilities: Merleau-Ponty and Derrida." In Merleau-Ponty, *Hermeneutics and Post-Modernism* (pp. 213–226), edited by Thomas Busch and Shaun Gallagher. Albany: State University of New York Press.

JAMES J. GIBSON'S ECOLOGICAL APPROACH

PERCEIVING WHAT EXISTS

WILLIAM M. MACE

ENVIRONMENTAL PHILOSOPHY AND EPISTEMOLOGY

The purpose of this paper is to help an audience attracted to environmental philosophy get to the core of Gibson's system in a compact form and to appreciate the necessity for an account of the environment in epistemology. I hope to show that Gibson's is a consistent and scientifically progressive account of knowing that gives the environment its due and that this is not a simple matter of fiat but a call to extended scientific investigation. I want to stress that Gibson's work is scientifically progressive in the sense that it has consistently opened new avenues for research. If one could be assured tomorrow that Gibson was correct and his critics wrong, the ecological psychology enterprise would not have to be shut down with nothing left to do. The goal of the enterprise, certainly for Gibson, was not to be declared a winner but to open doors for discovery. Because Gibson has developed a theory of perceiving the environment, it would be worth exploring as an important topic for environmental philosophers covering a wide range of issues. It offers an intriguing, environmentally based, grounding for epistemology; it offers ways to deal

ETHICS & THE ENVIRONMENT, 10(2) 2005 ISSN: 1085-6633

Direct all correspondence to: Journals Manager, Indiana University Press, 601 N. Morton St., Bloomington, IN 47404 USA iuporder@indiana.edu

with practical issues within "pure science"; and it is open to reorganizing ways to conceptualize problems beyond epistemology.

Gibson developed a richly articulated system that grew steadily over a period of 50 years, 1929 to 1979, which he devoted to "puzzling over" the "perplexities" of vision (1979, xiii). From Gibson's standpoint, knowledge begins with perception, and perception *is* perceiving the environment. The environment, for Gibson, is at least as essential as the brain to the existence and exercise of "the mind."

As an empiricist, knowledge is based on perception for Gibson. But perception, at root, turns out to be perception of the environment. Entities like sense data and representations become "after the fact" curiosities for Gibson, and have no role to play in the foundations of perceptual experience and, *a fortiori,* knowledge. If Gibson is correct, then scientific accounts of perception must converge on environmental perception. A philosopher whose primary focus is epistemology, and who works within Gibson's system, would perforce *be* an environmental philosopher—not (first) because of a special concern for the environment, but because an adequate appreciation of relevant facts requires it. Of great importance to environmental philosophers is that Gibson not only provides an account of perceiving grounded in access to environmental properties, but he establishes a basis for perceiving this *particular* world as a specific arrangement of surfaces. The world we perceive, according to Gibson, is a connected, public world that we share. It is, again, *the* world, the logical individual world and not an abstraction. This is not an account of the experience of abstract shapes, distances, and motions. It is a system in which travelers can visit *the* pyramids and in which I can trip over your garbage.

Is there a symmetric direction of influence? Just as a commitment to understanding knowledge scientifically and philosophically can lead one to focal considerations of the environment, could a deep concern for the environment as a value lead to the serious study of perception and, more broadly, epistemology? It seems entirely plausible. Gibson's is a "yin and yang" system of scientific complementarities beginning with animal and environment and extending to knowledge and value (in his concept of *affordance*). In each complementarity, the terms are differentiable but not entirely independent. Animals and their environments are different entities and should not be confused with one another, but they also are so

mutually dependent that one should not imagine a thorough account of one without the other. In like manner, objects and value (first through use) are not independently comprehensible in Gibson's system. This is a theme worthy of careful examination of detailed examples. I am not doing that in this paper, but hope that enough of the flavor of Gibson's work will come through to allow a reader to understand how one might be steered to epistemology from an initial concern with environment and values and vice versa.

Gibson's system is not simply new answers to old questions or new spins on old views. Questions and phenomena throughout psychology get repackaged. The most immediate illustration is memory. As I shall describe later, a core Gibsonian insight is that during change, not everything changes. Some things stay the same. They are invariant. He noted that surface patterns of the environment that go out of sight as one scans an environment in one direction, come back into sight upon reversing the scan pattern. The surfaces can be seen to have a continued existence even if not seen all at the same moment. If the pattern of an existing surface can be seen over time this way, as a unit, then perceiving extends over time. Put another way, one can separate out the time course of scanning surfaces from the continued existence of surfaces being scanned. Parts of persisting surfaces that come into view during head movements do not look the same as something coming into existence. If this kind of temporal exploration helps to reveal an extended surface with continued existence, and this is a core example of perceiving, then there is no added value to invoking memory to deal with the case. Many theorists presume that memory is necessarily involved in temporal experience. By making perception foundationally temporal, Gibson forces thinkers to find more precise cases for discussions of memory. Thus, the reorganization of the psychological landscape implied by Gibson's work is immediately evident in the case of relations between perception and memory. To anticipate a wider range of potential cascading out of Gibson's ideas, I'll mention three more—"thinking," "identity," and "motivation." Take "thinking" first. A student with an interest in "thinking," who is at home with Gibson's ideas, would be inclined to eschew "thinking" as an abstract, disembodied, objectless process. Rather the Gibsonian should envision a real person engaging in actual bouts of thinking. Under what conditions of body and environment does one think well? What are the roles of

fatigue, pain, sickness for example? Well-conditioned runners can think better at certain times during their run. The locations where people think clearly matter. The chair, the room, the lighting, the temperature, and so forth may be more than incidental props but part of thinking activity. These factors rarely appear in epistemology or cognitive psychology, but they do appear in biography. The importance of both body and place on the opportunities for thinking by Charles Darwin have been repeatedly described (e.g., Browne 2002). Darwin's devotion to his chair and his "walk" are well-known, as is his struggle with ill-defined sickness. Anyone who needs to study or write or create art understands the need for an acceptable bodily state and effective surroundings.

A second example might be what psychologists think of as a person's *identity*. This is natural to formulate, from Gibson's framework, as environmentally dependent (consider the effects of change of routine and environment that many people experience when they retire to different places and different routines). Gibson's system is saturated with the attitude that "to be" is to act and actions require settings and objects. Any sense of "who one is" is meaningless without the world that supports action. To be sedentary requires chairs and couches, to be athletic requires surfaces to perform on and supporting equipment. What would it mean to be a philosopher? There must be materials to preserve information relevant to philosophers as well as occasions for using such material. There need to be other people (a rather significant part of any person's environment) to argue with. What I mean to indicate at this point is merely that Gibson's work leads one to discover roles for the environment in a full analysis of what might otherwise seem like mentalistic or abstract concepts with no material import.

Finally it is natural to consider motivation from Gibson's standpoint. Where environmental layouts present clear opportunities for action, people feel inclined to perform those actions. The "urge" to slide on ice surely presents itself differently in an empty skating rink with smooth ice compared to a carpeted office. Or take a healthy five-year old child to a large empty space like a university field house. What are the chances that a child will "want" to run? This "motive" need not be regarded as only internal. I do not claim that Gibson himself investigated thinking or identity or motivation. He studied perception. I do claim, however, that he developed a framework that would lead one to include the body and the

environment in the study of any psychological phenomenon, including "pure" thinking. Lest my enthusiasm for showing that Gibson's ideas can be extended widely be seen as a surrender of critical faculties, I hasten to point out that Gibson himself did not extend his system casually or imperialistically. He was extraordinarily ambitious. He wanted a totally comprehensive system, but he moved cautiously and kept his claims to what he knew he could defend on the basis of evidence and argument. He once told me that he was unsure of whether or not his system (emphasizing the role of the ground) could apply to aquatic life. For those of us who thought it was straightforward to make the case for the role of the environment under water as readily as on the ground, this was startling conservatism. After a seminar with philosophers at SUNY Binghamton, he wondered aloud, "what does my theory have to say about *concepts*? What does my theory say about a concept like the *integral*?" (The italics represent his penchant for melodramatic emphasis on certain words in a way that matched the twinkle in his eye.) He regarded Kant as the source of enormous scholarly mischief. Accordingly, I never heard him say Kant's name without a pause to make sure that all within earshot could hear it rhymed with 'can't.' I'm not aware that he even started to give an answer to that last question about integrals, but he was willing to be challenged by it.

MOVES REQUIRED TO BUILD A THEORY OF PERCEIVING THE ENVIRONMENT

Rather than explore the consequences of Gibson's ideas for the philosophy of mind, I have chosen to focus this paper on what it takes to build a good psychology and epistemology on environmental foundations. What has to go on behind the claims? While it might be sufficient for some purposes to demonstrate the need for including the environment in an understanding of mind, I would like to emphasize *how* Gibson did that. He did not arrive at his conclusions simply by wishing them to be true or by constructing an argument that such ideas *must* be true. He arrived at many conclusions on the basis of experimental results and puzzling over consistencies and inconsistencies. Most impressive to me was his ability to ferret out interdependencies of concepts in classical theories and to build an alternative system with its own mutual dependencies. To make a system possible in which one could say that the environment was

directly perceived required (among other things) reformulating the concept of the stimulus (no small task), reformulating the assumed ontology of the environment (completely unprecedented), reformulating what a "sense" could be, rejecting the concepts of "space" and "time" and reorganizing what could count as "memory." This is demonstrably not a simple tweaking of other systems but it is startling to consider how often it is read that way. Commentators often present Gibson as someone who asserts that perception of the environment is direct (correct) without an appreciation for the full context required both to explain the claim and to support it. It is common to read him as if he shares most of the presuppositions and analyses with other perceptual psychologists save for a few. For example, it is common to ignore his critique of the concept of the "stimulus" (Gibson 1960) and to regard his alternative concepts like 'invariant' and 'information' as incidental preferences for different words that really mean the same things as 'stimulus' despite Gibson's arguments that 'stimulus' is used in vague and contradictory ways. Gibson denied that space and time were meaningful concepts and has given good reasons. These conclusions are largely overlooked even as people use the parts of his work they think they understand. The ambition of Gibson's ideas can be regarded as exhilarating or quixotic, but it is important to appreciate that an environmental philosopher signing on to examine Gibson's ideas will be drawn back to the core problems of epistemology.

Gibson thought of himself as an experimental psychologist building his ideas on a solid empirical foundation. Experiments always were important to him. Nevertheless he was mindful of relevant philosophy. Being an experimental psychologist, aware of and open to contributions from philosophy, was consistent with his pedigree—William James via E. B. Holt. His teacher at Princeton in the mid 1920s was E. B. Holt, who was in turn the student of William James (Heft 2001). Holt, known as one of the "New Realists" in the early 20th century, worked both as an experimental psychologist and as a philosopher. In his book on consciousness (Holt 1914), he stressed that consciousness was not "in the head" and that the *objects* of cognitive activity were essential to understanding cognitive activity.

Through Holt, Gibson absorbed much of James's "radical empiricism." I say *through* Holt because James's essays on radical empiricism seem to set the stage for Gibson's ideas very well, but there is little evidence that Gibson studied this aspect of James. The James that Gibson studied with intensity and admiration was the *Principles of Psychology* (James 1890), especially James's treatment of the stream of consciousness. Gibson appropriated the imagery of a stream for perceiving, arguing that perceiving was continuous and uninterrupted from birth to death, an activity that could vary in detail and intensity, but never go to zero. As with James, when considering flow and discreteness, Gibson gave the priority to flow. He stressed that discreteness precipitates out of flow; flow does not build up from discreteness.

DEFINING THE SUBJECT MATTER

James Gibson's ecological approach to visual perception (1950, 1966, 1979) is an account of how an animal perceives its environment. The emphasis of that sentence should be on the word *environment*. Many psychologists and neuroscientists could honestly write the same sentence without subscribing to what Gibson believed because they would emphasize the word *how*, giving lip service at best to the word *environment*. Most commonly, perception is studied as experience, whether of the environment or not. According to the received views, while some experiences might be of the environment, they need not be to qualify as perception. Perception of the environment would be a subset of a broader class of perceptual experiences.

As formulated by Gibson, however, perception is an achievement. It is a success word (Ryle 1949; Shaw, Turvey, and Mace 1982) reserved only for cases of perception of the environment. The phrase 'perception of the environment,' for Gibson, is almost redundant (I say 'almost' because the self is also perceived and it would seem confusing to refer to the self as part of the environment, even though it is specified in the same ways—e.g., optically for vision). Shaw, Turvey, and Mace (1982) have added that perception, as treated in ecological psychology is not propositional. It is not like a belief, which may be true or false. We (Shaw, Turvey, and Mace 1982) argued that perceiving is a state of affairs. To *perceive* a place to sit is comparable to *sitting on* a sitting place. We have said, following Hintikka (1975), that the object of intention and the object of reference are the same. This is *not* to say that perception is ever perfect or complete. Perception in the interest of actions can be more or less adequate. It cannot be true or false. This is a lot for philosophers to chew on.

We think the ecological position is pragmatic, and that what even though we argued that perception is not propositional, that this does not disqualify it from being relevant to epistemology. We'll see these properties in Gibson's definition of perception quoted at the end of this section.

The challenging task taken on by ecological psychology is to develop an understanding of awareness of the environment *at its best,* its most stable; the kind of apprehension that is the "bottom line" of experience. Even if illusions and misperceptions give us pause about what we can trust, the perceptual theorist must explain our *best* perceptual access to the world as well as the errors. For example, consider how illusions typically are discussed. An observer is asked to make a judgment about size, the straightness of a line, the lightness of a surface, the weight of an object, or any number of other properties. Then that judgment is evaluated in light of the "true" state of affairs. The illusion is "wrong." But how is the "true" state of affairs ascertained? How is "true" size, straightness, weight, or lightness determined? The same "sense" that is fooled in some limiting situation, say vision in visual illusions, also may be used to determine the clarified, "real" state of affairs under conditions of full viewing opportunity. That is the kind of case Gibson ultimately addressed. If the stick in water looks bent, we take it out of the water to show that the stick "really" is not bent. But the straightness we're sure of, that is contrasted with the bent look at the water line, is still judged visually. Suppose we have two lines of equal length with arrow heads on either end, those on one line facing in and those on the other facing out. This is the well-known Müller-Lyer illusion. One line now looks longer than the other and the argument from illusion leads some people to conclude that vision should not be trusted. However, if we want to show the "real" length of a line, we measure it. The match between lines on a ruler and the line being measured is established through vision just as much as the illusion was. Without a visual (or other perceptual) basis for determining the "true" state of affairs, an illusion could not be defined. Our criterial measurement is often established by vision just as much as the illusion itself. With weight, we *look* at the output of the scales we use for weighing. Nevertheless, people often proceed as if the subject matter of visual perception is better represented by the appearance of the stick *in* the water rather than the stick *out* of the water; or by the Müller-Lyer lines rather than by the sight of the lines as visually compared to marks on a

ruler. It's all vision. I like to say that our goal, as ecological psychologists, is to study the perception of the methods section of a research report, rather than the introduction or results sections. I say this because in research papers, it is in the methods section where materials and circumstances are supposed to be described "objectively," so that other researchers can establish the same conditions. It is in the methods section where researchers say how long the lines are, how bright the lights are, how much the weights "actually" weigh, where the materials are placed, who the participants are, how many of them there are at a time, and so forth. How does the experimenter know these things? Largely through vision. If not through vision, then through some other perceptual systems or combination of them. This is the world we take for granted. Gibson's goal, I take it, was to understand *this* situation. By what means do people get to a "bottom line" about their circumstances?

Gibson's approach was not the result of a simple preference or even a philosophical argument. It developed from experimental findings and frequent revisions to accommodate those findings. An important possibility that gradually dawned on Gibson was that an adequate theory could not be confined to psychology or even neuroscience. In the most mature account of his position (1979), Gibson outlined a comprehensive position that included (1) a theory of what there is to be perceived, that is, an ontology, (2) a theory of the information for perceiving, and (3) a theory of the activity of detecting that information. Gibson realized that a comprehensive theory of perceiving the environment required commensurate treatments of each of these components. The theory of the environment, the theory of information for that environment, and the theory of detecting information had to fit together. Ecological psychology could not stand alone, but required that the theorist identify the relevant physics and biology as well. That is, even though physics and biology are crucial, Gibson recognized that physics developed to realize the goals of physicists and biology developed for the purposes of biologists do not automatically yield the physics and biology appropriate to the psychology. Physics and biology themselves come in multiple levels and do not require that one level be fixed as more real than others. A sheet of brass is just as real, physically, as a copper atom, and tissues and organs in animals are just as real as cells. It is instructive to examine the number of hypothesized psychological processes whose purpose amounts to converting one kind of

description into another. If, for example, one were to describe light at the eye in terms of photons, and an experience as the experience of environmental surfaces, there might be a temptation to ask how psychological and physiological processes converted photons to the experience of surfaces. Alternatively, if one found that arrangements of photons could carry patterns specific to surfaces to begin with, just as surfaces can be said to be made of atoms and molecules, then the levels of patterning could be recognized as alternative descriptions of light. The task of neurophysiology and psychology could then be to discover the patterns relevant to perception and then to understand how these relevant patterns could be appreciated. No psychological process would need to be imagined for the purpose of converting one level of description into another. Gibson came to realize that building an ecological psychology required coordinated attention to selecting (and sometimes developing) appropriate biology and physics as well.

To summarize essential features mentioned thus far in the paper and to set the stage for further presentation of Gibson's ideas, I offer his last definition of perception in the next paragraph. Gibson wrote and rewrote very carefully. Each word was deliberately chosen and each phrase refers to a topic that Gibson elaborated in multiple nonredundant publications. This definition comes at the *end* of, and is a succinct summary of, years of investigation. The reader should note the centrality of Gibson's use of the word 'surface.' This is crucial to his ontology, and his ontology is crucial to his epistemology. A surface, for Gibson, is a real, material surface in the world. We can see it as such, we can experience it directly, because a real surface is optically (for vision) distinct from non-real alternatives. In a number of places, including his 1979 book, he lists important characteristics of surfaces and distinguishes these from abstract concepts, images, and representations (to list a few contrasting concepts). A surface reflects light. Think about it. An abstract triangle or circle does not reflect light. An image on the retina or in the brain does not reflect light. It is a longstanding puzzle of vision to wonder how animals can tell the difference between reflected light and radiant light when it's all the same at the eyeball. Establishing conditions for seeing surfaces implies one is making the distinction between reflected and radiant light. Surfaces have characteristic texture. The texture of the material consists of patterns within patterns that are revealed as one gets closer. Getting very close to a painting does not reveal the texture of a depicted scene, but of the canvas or whatever material was painted on. Very close scrutiny of a museum painting is the province of the art restoration expert and the structure revealed by scrutiny is one distinction between a real surface and an image or representation. Keeping in mind the fundamental role of real surfaces, connected throughout the environment, for Gibson, I move to the promised quotation.

"To perceive is to be aware of the surfaces of the environment and of oneself in it. The interchange between hidden and unhidden surfaces is essential to this awareness. These are existing surfaces; they are specified at some points of observation. Perceiving gets wider and finer and longer and richer and fuller as the observer explores the environment. The full awareness of surfaces includes their layout, their substances, their events and their affordances. Note how this definition includes within perception a part of memory, expectation, knowledge, and meaning—some part but not all of those mental processes in each case" (Gibson 1979, 255).

What is essential at the beginning of this definition is Gibson's identification of a coherent topic—the detection of *existing* surfaces—and distinguishing this from the study of the appreciation of surfaces that do not exist. Existing surfaces can come into view by changing the place of observation. That is, if they exist, they can reflect light and be visible from some point of view. If they do come into view or go out of view, they do so in the characteristic way specific to changes of viewpoint. Those changes do not indicate any change in the existence of a surface. Other changes do affect surface existence—evaporation, disintegration, melting, and burning, for example (Gibson, Kaplan, Reynolds, and Wheeler 1969). Note again that the topic of study here is the existence of surfaces based on the differing behavior of optical information structured in a real environment by real surfaces. How many psychologists have presumed to grapple with existence?

Surfaces are not all that are seen, of course. The second clause says that one is aware of oneself in the environment. Gibson stressed that this too was a matter of optical specification, not "stored knowledge." The view of each eye is bounded by eye sockets, nose, and facial features. Much of the remainder of the body is visible as well. The perspective view on an arrangement of surfaces, beginning with the earth stretching to the horizon, is specified, and part of what there is to be seen. That's what he

means by awareness of the environment and "oneself in it." Seeing is not disembodied and it certainly is not perspective free. The surfaces are not abstract and are not merely surfaces. As he notes, they are made of substances, they move characteristically (events), and they support (afford) the activities of individual animals. Privacy, in the sense of a unique point of view, unshared by any other animal, is embodied. It is not "internal" experience alone. No one else can see my nose, my cheeks, my body, from my point of view.

DIRECT PERCEPTION: ACQUAINTANCE AT FIRST HAND

An assertion long associated with Gibson and his followers is that perception is direct. I maintain that although true, it also has been misleading. Direct perception, for Gibson, names something we'd like an account *of* and not just the account itself. There presumably is a difference between being in the presence of John and being in the presence of some representation, some surrogate of John. Are we likely to be embarrassed by a social miscue in front of a picture of John in the same way that we would be in the presence of John? This ought to go to the core of concerns for environmental philosophers of any ilk. Why do people travel? What's the difference between the real Yosemite and pictures from Yosemite? Let me count the ways. Framed in this way, a question like "why do people travel?" ought to be an absurd question. Nevertheless traditional philosophers and psychologists have had nothing to say about it, so far as I can tell. Am I in love with my wife or a surrogate of my wife? Do I drive my children to soccer practices and music lessons or do I drive representations and images of them to various events? Are the events we travel to real events? If not, why waste gasoline? Gibson provides a framework that allows for the distinction between first-hand experience (direct perception) and mediated experiences (experiences of the environment with tools or movies or photos), then poses graded series of research questions.

It makes sense to ask of any theoretical position how it accounts for direct perception as the difference between first-hand experiences of an environment and other experiences. Combining the two senses of "direct perception," it is amusing to note that one can ask if a given position's account of direct perception is direct or indirect. Gibson wrote,

> Direct perception is what one gets from seeing Niagara Falls, say, as distinguished from seeing a picture of it. . . *Direct perception* is the activity of getting information from the ambient array of light. . . This is quite different from the supposed activity of getting information from the inputs of the optic nerves, whatever they may prove to be. (Gibson 1979, 147)

The contrast here is to the picture. We can see the difference between pictures and the parts of the world they are pictures of—thus the "real" Niagara Falls and the picture of Niagara Falls. Wherein lie the differences? If one supposes that vision begins with the retinal image and the retinal image is basically a picture, then one has obscured the distinction between environmental entities (first-hand) and pictures of them (second-hand), or the distinction between the optic array and a retinal image. If one were to insist that the retinal image is the basis for vision, and that it is pictorial, but that it also is the case that the picture of the "real" Niagara Falls is different from the picture of Niagara Falls, the original problem, how a "real" environmental entity is distinguished from a picture of it, reemerges.

Seen as a *topic*, one could view Gibson's solutions to be one among many; and that competitors would offer alternative theories of direct perception. When construed as a process, "direct perception" is taken as the theory itself and not a topic. I do not deny that Gibson's approach is direct theory of process, just as both sympathetic and unsympathetic commentators say it is, but I also suspect that Gibson's solutions would be better appreciated if the *problem* they addressed were acknowledged. At the moment, I cannot think of anyone other than Gibson who has embraced the *topic* of direct perception and offered alternative testable accounts. Workers in "virtual reality," especially video games, are likely to come the closest to appreciating the need to distinguish between the "real" world and pictured worlds. The appeal of virtual reality is a strong indication that people know full well that there is a difference between "reality" and its surrogates. The prominent philosopher of perception, Fred Dretske (1994), has misinterpreted Gibson's program as one solely about process and not about objects. This was unfortunate because Dretske formulated the option of considering direct perception to be about the objects of perception rather neatly, but then asserted that this was not what Gibson was writing about. In light of the above quotation

from Gibson, and the material around it in the same chapter, it is hard to grasp how one could miss his point.

For the philosophers that Gibson addressed in 1967, the key step in the analysis of optical patterns for Gibson was the 'invariant.' He pointed out that when there is change in a pattern, not everything changes. As one sees varying perspective on a solid surface, textures and other internal adjacencies remain the same. Gibson argued that there were more than enough such invariants to account for the perception of unchanging features of the world amid the standard systematic changes such as change of viewpoint in locomotion or change of illumination as the sun's position changes relative to the earth. Detecting invariants, he argued, not only provided a basis for experiencing a world that existed apart from us, but made possible a public world, a world that could be experienced in common. That is, two people cannot be in the same place at the same time, but over time, they can occupy enough positions to extract the same invariants. Establishing a basis for public knowledge is another emphasis of Gibson's work. Not only does he establish a basis for public knowledge, but presses the reality of the extended surface of the earth and the sky as example "objects." The surface of the earth, as a perceptual object, is not an example one usually encounters in psychology and philosophy. Yet it provides a very concrete theoretical anchor for an extended consideration of public knowledge, the shared environment. Gibson's system, as a fundamental basis for perception, for epistemology, is about this shared world. His system is not about an abstraction, not about a category, but about this individual, specific world. In the next section, I shall say a bit more about this, but do not forget that it is a short step from appreciating his focus on a reality that everyone can share to considerations of the qualities (for good or ill) of that shared environment.

INTERIOR PERCEPTION

General ideas are best kept grounded in specific examples. This is especially important for presenting Gibson's ideas because the representative cases are frequently so different from the exemplars fixed on by scientists discussed in most textbooks of perception. I take the perception of interiors to be close to a minimal case (short of Niagara Falls) for dramatizing the direct perception situation, something to be perceived which is not readily captured by thinking about pictures.

The phrase *interior perception* would commonly lead psychologists to expect a discussion of some kind of introspection, a looking inward. In this case it is the perception *of* interiors that will be the focus. For Gibson, all perceiving occurs within interiors, the outermost shell being the earth-sky pair, ground or water below, sky above. In an open terrain, the ground extends to the horizon in all directions. It is important to note that the observer is *surrounded,* both by the ground and sky as environmental lower and upper bounds and the optic array structured by those features. The momentary, local view that an observer gets is a sample of this surround. The sample is bounded by the eye sockets and the body on one (the limit of *near*) end and the horizon on the other (the limit of *far*). For vision, these extremes are components of the same optic array and do not, therefore, differ in kind. That is, Gibson rejected the distinction between so-called distal and proximal "stimuli." Traditionally, the "objects" of the environment are said to be "distal" to observers and optical patterns are said to be "proximal" because one can imagine a pattern impressed on the retina (how much closer, or proximal, can one get?). The proper appreciation of the proximal pattern is then said to give rise to an experience of the distal object. Gibson argued that a careful analysis of what one could mean by these things left the metaphorical value of "near" and "far" equaling "optical pattern" and "environmental referent" to be close to nil. Whereas it is intelligible to analyze information in optical patterns for the near (boundaries of the head and body) and the far (horizon).

By analyzing the optical structure of "occluding edges" Gibson could distinguish between information for separation (occluding edges separate surfaces from one another and from parts of themselves) and connectedness in the same pattern. If the observer turns his or her head, portions of the surface that are hidden by the head come into view, and parts that begin in view go out of view by virtue of occlusion. The new parts that come into view are connected to what was seen before, as are the parts that go out of view. The boundaries are the boundaries of the viewing "window" as it were, not the extended terrain itself, just as the boundaries of any window are not taken to be boundaries of the scene observed through the window. The visible terrain is bounded only by the occluding edge of the horizon. Texture can come into view and go out of view reversibly with head rotation only if the surface to be viewed *exists*. Por-

tions brought into view are seen to preexist and those that go out of view are seen to continue to exist. The revealing and concealing of texture at the boundaries of the eye are seen to be the result of a change in the point of view. In this way, surfaces, beginning with the largest one, the ground, are revealed as unitary across many successive, overlapping, views. This earth-sky enclosure is a fundamental perceptual "object" but hardly what leaps to mind as an association to the word "object." However far one travels, the earth-sky shell remains fixed as an invariant framework for a person's entire life (before space travel). Everything else goes on within that shell. At this outer limit, we spend our entire lives exploring features of this *single* connected surface, if we focus on the ground half. Lewis and Clark took in more of it than Immanuel Kant did. Gibson's insight meant that one could experience the connectedness of an extended but existing surface without seeing all of it at once—because the persistence and connectedness of the surface over time can be based on invariants extracted over time. Change of pattern over time, recall, does not necessarily change every aspect of a pattern. Again, invariance forms the basis for the (direct) perception of an extended, shared environment. Environmental philosophers should find this a useful basis for examining the consequences of this formulation for problems of interest to them. By bringing the epistemological focus to the individual environment that we share with others on earth Gibson provides a basis for connecting to the concerns of anyone else focusing on the utilization of this common environment.

MUTUALITY

Throughout his writing, Gibson emphasized the reciprocity of animal and environment. The physical world as such is not an environment. It can be an environment for a given animal. An animal cannot exist apart from its environment. Each implies the other. Real perceiving is embodied. The eye sockets—nose—head—body that one sees are *here*. The horizon is *there*. We saw that the perception of self was included in Gibson's definition of perceiving. I have just emphasized the fundamental earth-sky interior as something to be perceived, especially the extended surface of the earth. The perception of the persisting, connected, earth-sky, is plausibly connected to the perception of a persisting self. The continuity of self over a lifetime is supported by the continuity of the earth-sky framework. The reciprocities still hold. When one looks at the environment, one sees oneself, not as a reflection but as a perspective on the environment. Where there is no environment to be seen, as in an unstructured field of homogeneous light called a *Ganzfeld,* one might expect a correlatively diffuse sense of self.

Gibson's most famous idea to reach a broader audience is his concept of *affordance*. This is meant to capture the fact that what animals see can be partitioned relative to the scale of the animal. A supporting surface that is about knee high is something that a person can sit on. Stairs that allow climbing look different from stairs that do not. The fact that these are relational properties does not make them mental. The fact that they are scaled to an animal means that they are not strictly physical either. Yet the relation exists in the world. This kind of relational entity, reflecting environmental properties and, simultaneously, an animal's point of view, is a hallmark of Gibson's emphases from at least 1950. Before affordances, he stressed the concept of the occluding edge as a similar kind of relational entity. The optical boundary where an opaque surface hides other surfaces depends on a point of view. There is no occluding edge without specifying a point of view. It is clear what the role of a point of view is in the definition, and it also is clear that there is nothing mental about it. As Gibson said repeatedly, such entities are real and not mysterious even though they are relational. The role of the animal in defining an occluding edge does not go beyond that of the geometric point of observation. The affordance concept uses more of the size and action capabilities of an animal (what can be grasped with the hands, for example) than a mere point of view, but the logic is the same. The arrangement and properties of surfaces in the world can be scaled relative to the animal's capabilities. The relational entities so defined are not spooky, and can be said to be objective, real properties of the world taken relative to given animals.

CONSEQUENCES OF GIBSON'S REFORMULATION

This chapter already has stressed that a fundamental realization within ecological psychology is that the appropriate "stimuli" for perceiving are not given by some other discipline. Both the ontological bases and the informational bases (structure of light when considering vision) must be considered relative to the scale of a given animal. This does not mean, however, that such entities are created by the theorist. They exist and they

can be discovered. The embodied activities that constitute perceiving must be reformulated (Gibson 1966). If information in the environment contains invariants that must be separated from variants, then exploratory activity to do this, on the part of animals, is necessary. Thus perceiving is expected to be better in active than passive animals. The active case that allows invariants to be extracted is simpler than cases of limited observation that contains too little variety. New perceptual activities can be identified. Because 'what there is to be perceived" is not "given" and obvious from Gibson's point of view this too can be the subject of hypothesis and test, the normal procedures of science.

Thus the perceptual scientist's scope must include the physical world and the biological world as well as the psychological, and the concepts used to discuss them must be scaled to be mutually compatible. Otherwise, there's no reason to expect the pieces to fit and one gets a sense of the enterprise resembling Richard Gregory's view of perception which is at the opposite extreme of Gibson's. Gregory says,

> Perceptions are constructed, by complex brain processes, from fleeting fragmentary scraps of data signaled by the senses and drawn from the brain's memory banks—themselves constructions from snippets of the past. On this view, normal everyday perceptions are not selections of reality but are rather imaginative constructions—fictions—based . . . more on the stored past than on the present. On this view all perceptions are essentially fictions: fictions based on past experience selected by present sensory data. Current sensory data (or stimuli) are simply not adequate directly to control behavior in familiar situations. . . . The fact is that sensory inputs are not continuously required or available, and so we cannot be dealing with a pure input-output system. (Gregory 1972, 707)

See Mace (1974) for a collection of other quotations along the same lines. These are not difficult to find. What Gregory describes is a view of the brain's job based on a severe mismatch between perceptual experience and what is given. If indeed all that is "given" are "fleeting fragmentary scraps of data," then Gregory's view of the job of the brain is compelling—at the cost of animal survival becoming almost miraculous. Moreover, there is no way, in Gregory's view, to conceive of an environment that people share, that is public, and first hand.

In Gibson's treatment of vision, the natural case to treat always was a flow, what Gibson called a flowfield. Without a flow, there would be no

way to separate nonchanging structure from changing structure. I emphasize invariants earlier, but the concept of invariant is defined relative to relevant variation. Gibson's reliance on flow imagery in his theorizing, influenced by James, is an important contrast to most other theorists. Gregory, as noted, is as good a representative of traditional assumptions as any other. J. Hochberg (1982) is another. Each very clearly sees perception built up from discrete sources. Hochberg places great store in "the single glance." For Gibson, the flow is primary and stable entities emerge within the flow, as eddies or whirlpools emerge in the flow of a stream. Gibson declared,

> The act of picking up information, moreover, is a continuous act, an activity that is ceaseless and unbroken. The sea of energy in which we live flows and changes without sharp breaks. Even the tiny fraction of this energy that affects the receptors in the eyes, ears, nose, mouth, and skin is a flux, not a sequence. The exploring, orienting, and adjusting of these organs sink to a minimum during sleep but do not stop dead. Hence, perceiving is a stream, and William James's description of the stream of consciousness (James 1890, Ch. 9) applies to it. Discrete percepts, like discrete ideas, are "as mythical as the Jack of Spades. (Gibson 1979, 240)

Ironically, to trust physics to provide biology and psychology with immutable entities that biology and psychology have to work with can be viewed as a source of cutting psychology off from physics, disconnecting it from a coherent science and making psychology a standalone, modular, discipline, a "special" science. Alternatively, as I mentioned earlier, some of us have argued (Shaw, Turvey, and Mace 1982) that psychology, physics, and biology can be parts of the same system of scientific laws, and therefore of a piece with the rest of science, if Gibson's strategy is adopted. Then, and only then, can information and its detection be transparent and specific to its sources. Gibson talked about needing a new optics, an ecological optics. Shaw and his colleagues have generalized that to ecological physics. All this means is that the "physical" environment can be cut up at many levels and in many ways, each of which serves its own purposes and no one of which is more fundamental than the others. Thus, "surfaces that can support locomotion by elephants" are just as real as hydrogen atoms or photons and far more relevant to the tasks of elephant perceiving.

Some writers have described the ecological view as maintaining that

the "physical world" is what is perceived. If so, the "physical" entities perceived are rather strange because they come with a definite point of view (e.g., the occluding edge, its special case in the horizon, and affordances). We argue that they are objective and real, but the incorporation of a point of view is contrary to the physicist's impulse to transcend perspectives, to express truths that are perspective free.

Let us now return to Gibson's definition of perception. It focuses partly on the awareness of existing surfaces, including very large, extended surfaces—surfaces that are much too large to take in with a single glance—up to the largest surface, the surface of the earth (both land and water), which is too large to take in during a single lifetime. It nevertheless, in Gibson's approach, is a single, connected entity that can be perceived as such. It never can be perceived completely, of course, but one learns more about its layout, substances, events, and affordances through exploration. Perceiving becomes "wider and finer and longer and richer and fuller" as one explores.

Reflect, then, on the end of Gibson's definition of perception. "Note how this definition includes within perception a part of memory, expectation, knowledge, and meaning—some part but not all of those mental processes in each case." If one can explore a surface over time, an instance of extracting invariance over time, to reveal something separated out from time, it is a most noteworthy. It means that the thing revealed, the extended surface, is not subject to the same temporal units as the exploration process. Gibson stressed that changes of existence (like the creation or destruction of a surface) are different from changes of what is in or out of sight without a change in existence. If texture comes into sight by "disocclusion," a change in which the surface is seen to come into *view* rather than *existence,* then, as Gibson said, the surface is seen to "preexist." Likewise, the parts of surfaces that go out of view in occlusion are not seen to be destroyed, but to continue to exist. If one accepts that invariance over time can be detected, then many traditional psychological categories do look quite different. We realize that what we have thought of as the division of "processes" into perception, memory, cognition, and so on, are indeed enmeshed in a host of assumptions. It is easy to think about perception as referring to the present and memory to the past. But when the information revealed over time is about persistence, such as a persisting surface, the categories threaten to become less categorical.

The Gibsonian, ecological approach to perception, began as pure experimental psychology. The consequences go far beyond experimental psychology, however, to all areas that intersect with psychology, including epistemology. Gibson provides a system that shows bases for asserting what is importantly real in the world, how animals can perceive those real things, and distinguish them, perceptually still, from non-real things. There is no demarcation, in Gibson, between "pure" and "applied" science. By extending his work to affordances, the realm of practical activity, he is offering a way to conceptualize, within his system, what other theories set apart as mere applications. Not only has Gibson shown a way to make the environment central to epistemology, but he has done so in a way that can provide a foundation to pursue a variety of topics of interest to environmental philosophers. I have mentioned several of those in the course of this paper. For Gibson, the difference between first hand encounters with the environment and non-first hand encounters, can be conceptualized. What are the consequences? People can have encounters with pristine forests and with garbage dumps. They can be told about them. What are the differences between first-hand encounters and second-hand knowledge? This would seem to be a scientifically and philosophically empowering set of ideas which can lead to numerous fruitful explorations.

REFERENCES

Browne, J. 2002. *Charles Darwin: The Power of Place.* Princeton: Princeton University Press.

Dretske, F. 1994. "Meaningful Perception." In *Visual Cognition: An Invitation to Cognitive Science* (pp. 331–352), edited by S. Kosslyn and D. Osherson. Cambridge: MIT Press.

Gibson, J. J. 1950. *The Perception of the Visual World.* Boston: Houghton Mifflin.

———. 1959. "Perception as a Function of Stimulation." In *Psychology: A Study of a Science,* I (pp. 456–501), edited by S. Koch. New York: McGraw-Hill.

———. 1960. "The Concept of the Stimulus in Psychology." *American Psychologist* (16): 694–703.

———. 1962. "Observations on Active Touch." *Psychological Review* (69): 477–491.

———. 1966. *The Senses Considered as Perceptual Systems.* Boston: Houghton Mifflin.

———. 1967. "New Reasons for Realism." *Synthèse* (17):162–172.
———. 1974. "A Note on the Relation between Perceptual and Conceptual Knowledge." Unpublished manuscript. Available online at «http://www.trincoll.edu/depts/ecopsyc/perils/folder6/perceptcon.html»
———. 1979. *The Ecological Approach to Visual Perception.* Hillsdale, NJ: Lawrence Erlbaum Associates.
Gibson, J. J., G. Kaplan, H. Reynolds, and K. Wheeler. 1969. "The Change from Visible to Invisible: A Study in Optical Transitions." *Perception & Psychophysics* 5: 113–116.
Gregory, R. L. 1972. "Seeing as Thinking. An Active Theory of Perception." *London Times Literary Supplement,* 23 June, 707–708.
Heft, H. 2001. *Ecological Psychology in Context: James Gibson, Roger Barker, and the Legacy of William James's Radical Empiricism.* Mahwah, NJ: Lawrence Erlbaum Associates.
Hintikka, J. 1975. *The Intentions of Intentionality and Other New Models for Modalities.* Dordrecht, The Netherlands: D. Reidel.
Hochberg, J. 1982. "How Big is a Stimulus?" In *Organization and Representation in Perception* (pp. 191–217), edited by J. Beck. Hillsdale, NJ: Lawrence Erlbaum Associates.
Holt. E. B. 1914. *The Concept of Consciousness.* London: George Allen.
Kanizsa, G. and W. Gerbino. 1982. "Amodal Completion: Seeing or Thinking?" In *Organization and Representation in Perception* (pp. 167–190), edited by J. Beck. Hillsdale, NJ: Lawrence Erlbaum Associates.
Mace, W. M. 1974. "Ecologically Stimulating Cognitive Psychology: Gibsonian Perspectives." In *Cognition and the Symbolic Processes,* I (pp. 137–164), edited by W. Weimer and D. Palermo. Hillsdale, NJ: Lawrence Erlbaum Associates.
———. 1977. "James J. Gibson's Strategy for Perceiving: Ask Not What's Inside Your Head, But What Your Head's Inside Of." In *Perceiving, Acting, and Knowing* (pp. 43– 65), edited by R. E. Shaw and J. Bransford. Hillsdale, NJ: Lawrence Erlbaum Associates.
———. 1986. "J. J. Gibson's Ecological Theory of Information Pickup: Cognition from the Ground Up." In *Approaches to Cognition: Contrasts and Controversies* (pp.137–157), edited by T. J. Knapp and L. Robertson. Hillsdale, NJ: Lawrence Erlbaum Associates.
Shaw, R. E., M. T. Turvey, and W. M. Mace. 1982. "Ecological Psychology: The Consequence of a Commitment to Realism." In *Cognition and the Symbolic Processes,* II (pp.159–193), edited by W. Weimer and D. Palermo. Hillsdale, NJ: Lawrence Erlbaum Associates.

NOTES ON CONTRIBUTORS

Tim Adamson in Assistant Professor in the Department of Philosophy and Religion at Iowa Wesleyan College and Adjunct Professor of Religion at the University of Iowa. He is author of several articles dealing with the role of embodiment and metaphor in human cognition, the links between phenomenology and cognitive science, and Kant's notion of Reflective Judgment as a model for contemporary approaches to cognition. E-mail: tadam@iwc.edu

Jim Cheney (aka Shagbark Hickory) is Professor Emeritus at the University of Wisconsin- Waukesha, and currently visiting flora with Zenlite. He has been a Rockefeller Foundation Visiting Humanities Fellow with the Native Philosophy Project at Lakehead University in Thunder Bay, Ontario, and the inaugural Visiting Scholar of Ecophilosophy and Earth Education at Murdoch University in Western Australia. E-mail: shagbarkhickory@sbcglobal.net

Trish Glazebrook is Associate Professor of Philosophy at Dalhousie University in Nova Scotia. Her research interests are in environmental philosophy, philosophy of science and technology, feminism, and Heidegger. Her recent book, *Eco-Logic: Erotics of Nature,* is in progress. E-mail: pglazebr@dal.ca

William M. Mace is Chair and Professor of Psychology at Trinity College in Hartford, Connecticut. He is a founding director of the International Society for Ecological Psychology (ISEP), performs the executive functions of the Society, and is editor of the journal, *Ecological Psychology.* He has held visiting positions at Cornell University and the University of Texas at Austin, and has a continuing affiliation with the Center for the

ETHICS & THE ENVIRONMENT, 10(2) 2005 ISSN: 1085-6633

Ecological Study of Perception and Action (CESPA) at the University of Connecticut. E-mail: William.Mace@trincoll.edu

Bonnie Mann is Assistant Professor of Philosophy at the University of Oregon in Eugene. Before returning to academia full-time she spent many years working in anti-domestic violence organizations, homeless shelters, and with a number of feminist activist groups. E-mail: bmann@uoregon.edu

Andrew Pickering is Professor of Sociology at the University of Illinois at Urbana-Champaign. He is the author of *Construction Quarks* and *The Mangle of Practice,* and is the editor of *Science as Practice and Culture.* He is currently completing a book on the history of cybernetics in Britain. E-mail: pickerin@uiuc.edu

Christopher J. Preston is an environmental philosopher with expertise in philosophy of science and feminist epistemology. He has worked for the National Park Service and has been involved with issues concerning commercial fishing and oil-spill response in Alaska. He is the author of *Grounding Knowledge: Environmental Philosophy, Epistemology, and Place* (2003). Currently he is Assistant Professor of Philosophy at the University of Montana. E-mail: christopher.preston@mso.umt.edu

Holmes Rolston III is University Distinguished Professor and Professor of Philosophy at Colorado State University. He was Templeton Prize Laureate in 2003. Advocating environmental ethics, he has lectured on seven continents. He is featured in Joy A. Palmer, ed., *Fifty Key Thinkers on the Environment.* E-mail: rolston@lamar.colostate.edu

Mark Rowlands is Professor of Mental and Moral Philosophy at the University of Hertfordshire, and has written a number of academic books and articles on philosophy and ethics. Currently he is writing for the general reader on philosophy and popular culture. He has had numerous media appearances. Two recent publications are *The Philosopher at the End of the Universe* (2003) and *Everything I Know I Learned from TV* (2004). E-mail: m.rowlands@herts.ac.uk

OUR THANKS TO THE REFEREES 2004–05

Baird Callicott
Claudia Card
Chris Cuomo
Deane Curtin
Kevin DeLuca
Frederick Ferré
Greta Gaard
Trish Glazebrook
Christine Harold
Dale Jamieson
Andrew Light
Holmes Rolston III
Catriona Mortimer-Sandilands
Gary Varner
Steven Vogel
Anthony Weston
Clark Wolf