

PERCEPTION WITHOUT PROCESSING: J.J. GIBSON'S  
ECOLOGICAL APPROACH

By

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B.A., The University of Calgary, 1983

A THESIS SUBMITTED IN PARTIAL FULLFILLMENT OF  
THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF ARTS

in

THE FACULTY OF GRADUATE STUDIES  
DEPARTMENT OF PHILOSOPHY

We accept this thesis as conforming  
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

August 1988

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### Abstract

The ecological movement in the psychology of perception, founded by James J. Gibson, hold that traditional approaches to perception are based upon certain fundamental mistakes. The chief one, ecological theorists claim, is that perceptual information pickup consists of the application of certain cognitive processes to sensory input which is not specific to features of organisms' environment. Gibson's fundamental claim is that perception does not require the processing of some form of sensory input. In this sense, the ecological approach is said to be a theory of direct perception.

An important debate over the Gibsonian view concerns the question of whether or not perceptual information pickup without cognitive processing is a coherent notion. Among the more recent writers who claim that the ecological view will not work as it stands are Jerry A. Fodor and Zenon W. Pylyshyn. They claim, essentially, that Gibson's approach has no means for accounting for intentionality. Fodor and Pylyshyn are answered by four prominent Gibsonians who claim such criticisms are utterly baseless. These ecological theorists, Michael Turvey, Robert Shaw, Edward Reed, and William Mace endeavour to show how their approach can indeed account for intentionality. This debate between Fodor and Pylyshyn on the one hand, and Turvey, Shaw, Reed, and Mace on the other is a perfect example of the kinds of misunderstandings that have arisen between Gibsonians and proponents of traditional view.

In this thesis, I supply a detailed description of Gibson's model

as it relates to the issue of how intentionality could survive perception without processing. Fodor and Pylyshyn's understanding and assessment of the Gibsonian position will then be examined. Although these defenders of traditional views have some important concerns, they also seem not to have a proper grasp of some Gibsonian concepts. In particular, Fodor and Pylyshyn have an unsatisfactory grasp of the notion of an invariant.

There are more serious misunderstandings evident in the response to Fodor and Pylyshyn given by Turvey et al. I point out that these ecological theorists have difficulties with philosophical terms and theories they employ in defense of Gibson. As a result of evident confusions over notions of intension, extension, and property, and confusions over the nature of Fred I. Dretske's theory of natural laws and Hillary Putnam's theory of natural kinds, Turvey et al do not manage to show how Gibson's approach could account for intentionality.

I conclude by suggesting that the ecological approach nevertheless is compatible with the idea of analyzing perceptual information pickup in terms of behaviour, or dispositions to behave. On such an interpretation, the ecological approach is similar in many important respects to the D.M. Armstrong's philosophical theory of perception. The comparison provides ecological theorists with a precedent as well as philosophical model to consult in order to better understand the philosophical language and terminology. On the other hand, the comparison with Armstrong provides philosophers of perception with a means for approaching Gibson's view and the problems with which it will be confronted.

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### Acknowledgements

I would like to express my appreciation to Dr. Gary Wedeking and Dr. Steven Savitt for their considerable help in the development of my thesis topic, and for the many hours they have spent carefully reading drafts. I would also like to thank my parents, Max and Sylvia Smart, and my wife Louise, for all their support, material and otherwise. Finally, I would like to express my gratitude to G.M. Grieg, professor of philosophy (emeritus) at the University of Calgary for all that he taught me about philosophy. His unequalled dedication to his students will be an example to me always.

## Chapter One

James J. Gibson's ecological approach to perception<sup>1</sup> is an approach still very much undergoing refinement and hard critical scrutiny. Gibson claims to have begun developing the theory shortly after the Second World War. A number of well-known psychologists continue today to expound Gibson's basic view and to attempt to contribute more detail to it.

Gibson's approach is taken by its founder and his followers to constitute a new form of direct perceptual theory. Some even suggest that it is a variety of direct realism. All Gibsonians regard the outlook as radical, as being an important divergence from virtually all previous perceptual theories. A few of them have even speculated that the ecological approach's supercession of prior traditional views would amount to a Kuhnian-style revolution.<sup>2</sup> Others who are rather less indiscrete in their prediction (Gibson being one of these) are nevertheless at pains to emphasize the alleged radical nature of their ideas. Jerry A. Fodor and Z.W. Pylyshyn believe there is a way of reading the ecological theory which reconciles it with the "Establishment" (Fodor and Pylyshyn's term for traditional theorists), but go on to note quite rightly that Gibson does not want his views interpreted in such a conciliatory fashion.<sup>3</sup>

This first chapter is one half of an outline of the ecological approach. I will endeavor to introduce Gibson's view in a very general way. The emphasis will be on his motivation: what he believes are the mistakes of the Establishment and why. Detailed questions relevant to the philosophical aspects of the Gibsonian Theory will be dealt with in subsequent chapters.

(i)

Gibson cites five important points over which his view differs from that which he regards as the traditional approach to perception<sup>4</sup>:

1. The notion of perception is conceived as the pickup of information. To perceive is to pick up information about oneself or one's surroundings.
2. The categories of perception are reconceived. Gibson suggests that organisms perceive their surroundings predominantly in terms of utility. Organisms perceive their environment in terms of what it affords.
3. There is a new view of the basis of perception (Gibson often refers to this as "information for" perception). This is Gibson's notion of an "invariant", or invariant structure of ambient energy.
4. Perceptual systems are taken to be hierarchies of organs rather than individual organs or banks of receptors. These sets of organs function together in order to facilitate the pickup of information.
5. Perceptual systems must concurrently register persistence and change in the flux of ambient energy to which each system is sensitive.

4) and 5) are relevant to the main issues with which this thesis will be concerned although they are not central. To the extent that they require elaboration, they will be explained in Chapter two. Chapter two will deal far more with terminology of the ecological approach. Much of it will be devoted to 3) since the concept of an invariant is both a crucial and difficult idea of Gibson's. As with 3), 2) also pertains to a showpiece, so to speak, of the ecological approach. To explain what it means to say that an organism perceives its environment in terms of utility requires an explanation of the notion of an "affordance". That will be one



of the later tasks of this chapter.

First it is necessary to expand and comment on 1), however. The assertion from which Gibson's theory grows is that to perceive is to pickup information. For a number of reasons, the focus here will mainly be on visual perception. Not least of these reasons is that Gibson's last book, in which his new approach is most developed, is written entirely about vision. Clarity of exposition is also facilitated by thus constraining the discussion. One should not, however, take the concentration on vision to be a tacit assumption that an explanation of visual perception is, with only terminological adjustments, a suitable account of the operations of other modalities.

Gibson supposes there are always two different sorts of information available for pickup: information about the environment and information about oneself. These two varieties are correlated with his terms "exteroception" (perception of the environment) and "proprioception" (perception of one's own body).<sup>5</sup> As one examines the ecological approach, it should become apparent that the two kinds of information pick up are very much interconnected. The information one can pick up about one's own surroundings is partially contingent upon proprioception. Nevertheless, my discussion will be concentrated on exteroception since this is the kind of perception which is typically of interest in the philosophy of perception. Thus, as it is to be considered in subsequent chapters, perception will mainly refer to the pickup of information about the environment via visual systems.

A very important point to make about Gibson's theory is that information pickup is an epistemic notion. Perceiving considered as information pickup is epistemic perception. Epistemic perception occurs when and only when the process of perceiving yields knowing, believing, judging, or the like (that is, some kind of epistemic state). It is to be distinguished

from so-called "simple perceiving",<sup>6</sup> which is not the acquisition of some epistemic state. The key difference between the two is that perceiving, in the epistemic sense, denotes an intentional relation whereas simple perceiving does not.

It is important to remember that Gibson's approach is an account of epistemic perception, because a large criticism of the ecological approach will turn out to be that it cannot explain the intentional component in perceiving. This criticism could only be a problem for a theory concerned with epistemic perception. Although in ordinary language it is often evident from the context whether an occurrence of the word "perceives" is being used in the simple or in the epistemic sense, the use will be made explicit throughout this thesis. Any occurrences of "perceives" in the simple sense will be clearly indicated by some construction such as "(simple) perceives", or by substituting "senses" for "perceives". Otherwise, the word should be taken in the epistemic sense.

Finally, the distinction between epistemic and simple perceiving is sometimes identified with the distinction between "perceiving things" and "perceiving that". This is not quite accurate because epistemic perception is any sort of perception which requires the perceiver to be in some epistemic (usually belief) state. "Perceiving as",<sup>8</sup> as well as "perceiving that", is a variety of epistemic perception. These two notions differ both grammatically and substantively.

With respect to grammar, when "perceives that" occurs in a sentence, "perceives" acts as a bridge verb, taking a sentence as its grammatical object. "Perceives as" takes a noun or noun phrase as its grammatical object.

Also, the truth of "John perceives that there is a hawk overhead" (for example) requires the embedded sentence, "there is a hawk overhead", to be

true. However, "John perceives the thing overhead (that, it, something...) as a hawk" can be true even if that which John sees as a hawk is not a hawk at all. There is an exception to this general observation, though, whenever the noun phrases occurring to the left and to the right of "as" are either the same, as in "perceives X as (qua) X", or effectively the same, as in "perceives X as such".

Both "perceiving as" and "perceiving that" form referentially opaque contexts since both involve epistemic states of the perceiver. With reference to the previous example, suppose that the very hawk John perceives is a red-tailed hawk. From the truth of "John perceives that there is a hawk overhead", it does not follow that John perceives that there is a red-tailed hawk overhead. Similarly, from the fact that John perceives something as a hawk, it does not follow that John perceives it as a red-tailed hawk. The difference in the locutions' opacity is that whereas "perceives that" does not guarantee truth - preserving substitution of codesignative terms anywhere to the right of the verb, "perceives as" restricts substitution only to the right of "as". With the exception of the expressions "perceives X as such" and "perceives X as X", noun phrases occurring to the left of "as".

The important substantive difference concerns the aforementioned difference in the truth conditions of the expressions. That is, John can perceive something as a hawk, but cannot perceive that there is a hawk when there are only ravens overhead. If one bases a theory of perception on the notion of "perceiving that", then non-veridical perception must simply be regarded as failures to perceive. If one's perceptual theory is based on the idea of "perceiving as", then non-veridical can be counted as misperception, but perception nonetheless.<sup>9</sup>

It is not clear which notion of epistemic perception Gibson would adopt, partly because he is not completely decided on how to handle perceptual mistakes, and partly because he is not as careful about his terminology as would be philosophically desirable. Fodor and Pylyshyn sometimes seem inclined to categorize Gibson as holding a theory which analyzes perception in terms of "perceiving that".<sup>10</sup> However, Gibson's discussion can be read very comfortably in terms of "perceiving as". My discussion will therefore make far greater use of the latter locution.

(ii)

It must seem quite presumptuous of Gibsonians to claim that virtually the entire community, past and present, of researchers in perception have been labouring under certain mistaken assumptions. This is especially true since there is no systematic discussion in Gibson of various Establishment alternatives and how they particularly exemplify the mistakes he suggests. As a result, Gibson stands accused by some critics, such as S. Ullman,<sup>11</sup> of arguing selectively against proposed alternatives. Although there is a certain force in the complaint, the adequacy of Gibson's approach will of course depend upon its own success in explaining the phenomena to which it is supposed to apply, rather than on the deficiencies of rivals (I am in no way suggesting that Ullman is unaware of this). It is therefore not merely presumptuous, but unnecessarily so, for Gibsonians to assert that nearly the entire history of perceptual theory indulges in the same basic errors. Alternatively, one can simply identify the general assumptions Gibson supposes philosophers and psychologists should abandon and take the Establishment theories to be whichever theories happen to subscribe to these. Ultimately, Gibson must show that his own view succeeds in avoiding the difficulties in accounting for perception that he envisages (without, of

course, raising further ones).

A fairly general attempt of Gibson's to differentiate between the tradition and his own view is as follows:

Up to the present time, theories of sense-perception have taken for granted that perception depends wholly on sensations that are specific to receptors. I have called these theories of sensation-based perception. The present theory asserts the possibility of perceptual experience without underlying sensory qualities that are specific to receptors, and I have called this a theory of information-based perception.<sup>12</sup>

Now one reason that Gibson is accused of selectivity is that, in spite of his use of "sensation" and "sensory quality", he means to take aim at modern-day "information-processing" views as well as such traditional theories as those of Hermann von Helmholtz,<sup>13</sup> or even John Locke.<sup>14</sup> Gibson takes the information-processing theories to be little more than dressed-up versions of Lockean or Helmholtzian views:

Not even the current theory that the inputs of the sensory channels are subject to "cognitive processing" will do. The inputs are described in terms of information theory, but the processes are described in terms of old-fashioned mental acts: recognition, interpretation, inference, concepts, ideas, and storage and retrieval of ideas. These are still the operations of the mind on the deliverances of the senses, and there are too many complexities entailed in this theory.<sup>15</sup>

In a similar vein, Gibson complains about theorists who have taken computer analogies too much to heart:

Adherents to the traditional theories of perception have recently been making the claim that what they assume is the processing of information in a modern sense of the term, not sensations, and that therefore they are not bound by the traditional theories of perception. But it seems to me that all they are doing is climbing on the latest bandwagon, the computer bandwagon, without reappraising the traditional assumption that perceiving is the processing of inputs.<sup>16</sup>

To put matters in the most neutral language possible, Gibson's objection is to the view that perceptual pickup of information is a matter of sensory/perceptual systems receiving meaningless input which is then

transformed into information by cognitive processes that interpret it. The conception of input Gibson purports to have in mind is "sensory or afferent nerve impulses."<sup>17</sup> Elsewhere, however, Gibson's attack is directed against views on which the input would be called sense-data, sensations, visual or retinal images, or qualities or disturbances in sense-fields. His chief concern is with the idea of input being "specific to receptors" rather than to features of one's surroundings (environment).

The term "specification" is a technical one on the ecological approach, one that is important in understanding the view. In general, if a sensory input is uniquely associated with some state of the nervous system, then the input is said to be specific to that state (Gibson has such a general notion of input that it is difficult to define, but I take it that it is something of which perceiving organisms may be cognitively aware. More will be said about the notion of sensory input shortly). In terms of the ecological notion of "specific", the traditional view amounts to the claim that a sensory input specifies a state of the nervous system or of the receptor. That is, by obtaining input, a perceiving organism picks up information about some state of itself.

One and the same kind of environmental phenomenon can bring about different states of one's nervous system and one and the same state may be brought about by different kinds of environmental phenomena. Therefore, a sensory input which is specific to a nervous system state will only be specific to such a state. It will not also be uniquely associated with some environmental feature. Any psychological theory of perception which has some form of sensory input as its basis will count as an Establishment theory for Gibson. The ecological theory of specification, as it has been explained by some of Gibson's supporters, will receive more thorough,

critical treatment in later chapters. The problems Gibson envisages for receptor-specific approaches to perception will be described presently.

Gibson claims that sensation-based theories (theories based on sensory input that is) require a cognitive structure capable of getting information about one's environment out of the meaningless input. Operations postulated to explain how receptor-specific input is transformed into information about one's environment are the sorts of cognitive, mental, or internal processes Gibson claims are not necessary for perception. These processes fall in the general area of inference and memory (storage and recall). In listing operations he takes to be those invoked by sensation-based approaches,<sup>18</sup> Gibson uses, in addition to memory, the categories of "mental", "semilogical", and "decoding operations". Examples found under these headings range from Kantian-style application of a priori categories of understanding, through deduction of features of the world via unconscious inference (attributed to Helmholtz), to the decoding of signals and use of perceptual cues.

Language communication can be used as an analogy to illustrate the basic model of traditional approaches for Gibson. A language, in the general sense, consists of a set of symbols (physical signals) which has some interpretation. A receiver's being communicated to is therefore a two-stage process. A tokening (occurrence or use) of some of the symbols must be detected by the receiver. This is the correlate of reception of sensory input. No information is imparted to the receiver by the mere reception of signals, however. It still must have interpretative skills of certain kinds in order to determine what the received input is supposed to convey. Inferential processes are necessary, for example, in order to recognize a token as being one of a given type. Also, depending on the complexity of the system (and language) some symbols may be ambiguous. Some function of

the receiver therefore must be to recognize the context in which a symbol occurs in order to determine which of several meanings the given token bears. Finally, any such system has to have some memory system so that stored knowledge of the relations between symbols and what they denote can be recalled at the appropriate time and applied to present input.

Any perceptual theory conforming to the "sense-and-interpret" analogy constitutes a version of the traditional approach in the sense Gibson means. While he and his followers exhibit a broad suspicion of cognitive/mental processes in perceiving, however, Gibson is most lucid and persistent in his doubts about the role of memory. His main conceptual concern pertains to the notion that epistemic perception of one's environment is dependent upon previously acquired background knowledge, or concepts (innate or learned), and prior sensory input. Regarding sensation-based theories, Gibson notes that "All theorists seem to agree that past experience is brought to bear on the sensory inputs, which means that memories are somehow applied to them."<sup>19</sup> Contrarily, Gibson's own view is that perceiving does not require the application of memory to input.

Before indicating the kinds of support Gibson cites for his approach, a comment should be made on the status of sensory input. Nowhere does Gibson deny that there are such things as visual sensations. His view is that these simply do not figure in a cognitive theory of perception. Sensations, rather, are by-products of the physiological equipment with which organisms perceive. In fact, far from being the basis of perception, sensations are thought by Gibson to be a hindrance to it. He lists the obtrusion of sensations on perception as a source of deficient perception.<sup>20</sup> For vision, the obtrusion would amount to a perceiver attending in an uncharacteristic way to a two-dimensional visual field rather than the three-dimensional world.



Claiming they are irrelevant to an account of perceptual cognition might well be the task Gibson plans for any notion of sensory input, although the specific reason need not always be the same. In the case of sensations or similar "mentalistic" notions (sense-data, images in a visual field, for example), or even with regard to retinal images, it is fairly plausible to suggest these are just by-products rather than the basis or cause of perception. Perhaps with other, physiological construals of input, such as nerve impulses or excitation of receptor-banks, it could be claimed that, although these figure in the causation of perception, they are part of a physiological, rather than a cognitive or psychological account of perceiving. On Gibson's behalf one could say that a psychologist or philosopher concerned with perception is not expected to analyze perception in terms of neural impulses any more than he would be expected to analyze it in terms of chemical reactions or the behavior of energy particles. Making this kind of point requires only the recognition of the existence of some hierarchy of levels of description and explanation in science. Gibson and his followers clearly do recognize some such hierarchy.<sup>21</sup> One should therefore not be too quick to suppose Gibson denies the very existence of well-recognized psychological or physiological phenomena.

(iii)

Gibson states that his original motivation for considering a different approach to perception is the result of studies involving the notion of depth-perception (this is a term, incidentally, that Gibson tries to avoid) in the 1940's. The experiments were an attempt to apply psychological theory concerning depth-perception to problems in aviation and flight training. An important initial assumption apparently was that depth-perception was based on the detection of cues in a flat (two-dimensional) visual field. Gibson notes:

The trouble was that none of the tests based on cues for depth predicted the success or failure of a student pilot, and none of the proposals for improving depth perception by training made it any easier to learn to fly...<sup>22</sup>

To this he adds:

I now say that there is information in ambient light for the perception of the layout of surfaces but not that there are cues or clues for the perception of depth. The traditional list of cues is worthless if perception does not begin with a flat picture. I tried to reformulate the list in 1950 as "gradients and steps of retinal stimulation (Gibson, 1950b, pp. 137ff). The hypothesis of gradients was a good beginning, but the reformulation failed.<sup>23</sup>

Since Gibson first attempted to develop a new approach to perception, he has suggested a number of problems for so-called Establishment views, including a variety of experimental results which he takes to count against different versions. The main general objections, though, continue to be founded on the same theme underlying the foregoing quotes that the very basis for perception as it is traditionally conceived is deeply flawed and needs to be replaced. This is often put, to repeat, by claiming that sensory input is specific to receptors (states of a sensory or nervous system), rather than being specific to features of the environment. Properties, objects, events, processes, states of affairs may all be captured by the use of "features": although Gibsonians take special interest in the perception of events, and of certain kinds of properties, they are not as particular about their ontological commitments as a philosopher might be.

To say that input is not specific to environmental features, in Gibson's view, is to say that with respect to the environment the input is meaningless. Gibson objects to the notion that the pickup of information (perceptual) awareness of what one's physical surroundings contains, must somehow be mentally derived or constructed from meaningless sensory input. The processes one needs to postulate in order to explain how information is gleaned from receptor-specific input, Gibson thinks, lead to too many

theoretical complexities and/or perplexities. He also suggests that perception based on meaningless input is fundamentally flawed because it requires possession of prior knowledge or concepts in order for a perceiving organism to process present input into information.

If sensory input is specific to receptors, then a given input is supposed to be uniquely associated with some state of an organism's sensory or nervous system. It uniquely corresponds to a kind of receptor-state. It may or may not also be peculiarly correlated with some feature of an organism's environment. When a given kind of sensory input is uniquely associated with some environmental phenomenon, it is a mere accident that it is so related. It is an accident in the sense that it merely happens that only one sort of environmental phenomenon is uniquely correlated with a certain kind of sensory input and therefore to a particular state of the organism's nervous system.

If sensory input is specific to receptor-states, then changes of input will correspond to changes in these states. As is the case with associations between given sensory input and environmental phenomena, there may or may not be correlations between changes of input and changes (whether of a particular type or of different ones) in features of one's environment. Alterations in the frequency-mixture or direction of the source of illumination will change the state of one's sensory system, as will altering one's perspective (position relative to one's physical surroundings). Some states and changes of state of an organism's nervous system are the result of physiological vagaries, connected either indirectly or not at all to perception of the environment (after-images and hallucinations for instance). At the same time, many of the alterations in the sensory portions of an organism's nervous system are the result of changes in its environment. Any perceptible event or process will do as an example.

Since receptor-specific input may or may not be uniquely associated with particular kinds of environmental phenomena, it does not reliably indicate constituents of an organism's physical surroundings. Similarly, since change of input may or may not correspond to change in the environment, it is no consistent indicator for the occurrence of environmental transformations. Gibson supposes that because sensory input is meaningless in this sense organisms must be endowed with capabilities for interpretation, means for adding to sensory input, that leads to some difficult questions:

A) Given a theory on which input is not specific to features of the environment, a particular sensory input could hardly be expected to be especially informative. That is, it is more plausible to suppose on an Establishment theory that information about one's surroundings is the result of processing a series of inputs rather than individual ones. Unless one happens to be fixating, a highly non-typical condition for an active organism, a series of visual inputs is going to consist of differing individuals. In spite of the variable input, perceiving organisms (human ones at least) are aware of their environment as stable and unchanging. Gibson takes it to be a mistake to try to explain this phenomenon in terms of somehow applying mental processes, recall of past similar occurrences, applying appropriate prior knowledge (concepts) and the like to the input in order to derive awareness of unchanging features of one's physical surroundings. He writes:

The century-old problem of why the world does not seem to move when the eyes move and the analogous problem of why the room does not appear to go around when one looks around are unnecessary. They only arise from the assumption that visual stimuli and visual sensations are the elements of visual perception.<sup>24</sup>

Although the solution to the puzzle given by Gibson involves a good deal more than is indicated in this passage (a new notion of the contribu-

tion of vision to proprioception and of the relation between proprioception and exteroception), its resistance to resolution in the past is clearly seen as resulting from the assumption that perception is based on sensory inputs (visual sensation, in this case).

B) A puzzle closely related to how stability, or nonchange, is perceived in the face of variable inputs, is that of how an object is perceived as persisting in the face of variable input. Any given kind of environmental feature may be associated with an indefinite variety of sensory input. Some part of an organism's sensory apparatus, then, must recognize any of an indefinitely large set, or any of indefinitely many sequences of input as related to some particular kind of environmental phenomenon. To the extent that it remains mysterious as to how a sensory system could perform this task, Gibson would regard the question of how large and variable sets of inputs manage to yield awareness of the same, persisting object as a problem the Establishment has yet to resolve. This is a close kin to a problem that has troubled certain philosophers<sup>25</sup>: how can one recognize an object as one and the same by obtaining different sense-impressions, sense-data, or the like, belonging to it?

C) While these first two issues concern perception of persisting features of the environment, Gibson thinks the Establishment approach leads to complications in the perception of events (changing features) as well.

The registering of a sequence of sensory input occurs over time. The input lasts only as long as the environment is constituted so as to cause the state of an organism's nervous system which is specified by the input. According to Gibson's version of the traditional approach, as one perceives some progressive change in the condition of one's environment, there is a succession of sensory inputs as new states of the environment bring about

different, successive receptor-states. An organism must therefore have some complex storage-recall-integration system in order to retain and combine immediately past inputs with successive to bring about awareness of an event. Without some memory process, there would be naught but the discrete registering of individual inputs.<sup>26</sup> Gibson apparently believes any such storage-recall system would be far too cumbersome and that there is no coherent explanation of how individual sensory input could become "fused into a scene" (or some correlate). On the contrary, he claims:

The simple fact is that perceiving is not focused down to the present item in a temporal series. Animals and men perceive motions, events, episodes, and whole sequences. The doctrine of sensation-based perception requires the assumption that a succession of items can be grasped only if the earlier ones are held over so as to be combined with later ones in a single composite. From this comes the theory of traces, requiring that every percept lay down a trace, that they accumulate, and that every trace be theoretically able to reinstate its proper percept. This can be pushed to absurdity. It is better to assume that a succession of items can be grasped without having to convert all of them into a simultaneous composite.<sup>27</sup>

The alternative Gibson alludes to in the last sentence, as will be discussed next chapter, is to suppose there are certain kinds of abstract properties called invariants which are detectable by organisms' perceptual systems and which specify events and processes in the environment.

D) The rejection of the idea that perception is "focused down to the present item in a temporal series" is reflected as well in what Gibson thinks about perception of that which is about to occur. He adopts the idea that information pickup "slops over", so to speak, to include imminent events in addition to those which have already occurred. The conclusion Gibson draws is the result of experiments conducted by himself along with two colleagues<sup>28</sup> and later by W. Schiff.<sup>29</sup>

An observer is placed close to a translucent screen upon which a small silhouette is magnified rapidly. Observers, including a variety of animals

used by Schiff in the later study, apparently experience this as rapid approach of a rigid object (as opposed, for instance, to enlargement or expansion of an elastic, non-approaching one). That is to say, the observer's behavior, when there is rapid magnification to the limit (where the subject's borders of the silhouette extend beyond the boundaries of field of view) indicates expectation of collision. The test-subjects blinked, averted their eyes, cringed, and so forth.<sup>30</sup> Gibsonians would no doubt want to make the general point that the consistency and speed of subject's response, even among fairly primitive creatures (crabs) tested by Schiff, would make an explanation in terms of processing slices of the expanding pattern and inferring "collision" (an alleged traditional explanation) quite implausible.<sup>31</sup> The conclusion Gibson draws which counts explicitly only against explanations of the behavior of the observers in terms of expectation, or inference, based on previous experience, is the following:

The experiments of Schiff, Caviness, and Gibson (1962) and Schiff (1965) on optical magnification of a silhouette in the field of view demonstrate that "looming", the visual information for imminent collision, is often detected by young animals who have never had painful encounters with an approaching object. They shrink away or blink their eyes, or otherwise make protective responses without having any reason to "expect" collision by reason of past experience. In this case the visual nervous system is presumably attuned to the information at birth.<sup>32</sup>

Now Gibson is no more inclined to accept a theory of perception which would explain the "collision" experiments in terms of expectations or inferences from some innate phenomenon, such as innate knowledge or concepts, than he is inclined to accept an empiricist view. It is not clear from the previous quote whether Gibson would also consider these experiments as counting against the so-called nativist version of the Establishment approach, though. However, since he would clearly not consider the results obtained by himself, Schiff, and Caviness as supporting some "innate ideas"

theory, there must be some distinction between such notions and that of "the attunement of perceptual systems at birth". Gibson never makes such a distinction explicit. Perhaps the distinction Gibson has in mind would be that "attunement" of a perceptual system consists in an organism's being physiologically structured so as to pick up certain kinds of information. To Gibson, this would be distinct from a theory which endows an organism, not with a particular physiological makeup, but with the possession, prior to birth, of certain information.

E) Finally, to take input specific to states of receptors as the basis of perception is as Shaw, Turvey and Mace have put it,<sup>33</sup> to subscribe to "the doctrine of intractable non-specificity". Since the postulated input is not uniquely associated with environmental features, it could only yield information about the environment (be taken as an indicator of a particular environmental type, say) if it were known what kind of thing under various circumstances produced the receptor state(s) specified by some input. The conversion of sensory input into information about one's environment therefore requires prior possession of knowledge and/or concepts.

Either the prior knowledge required by an organism to pick up presently available information is itself acquired or it is innate. Taking the former empiricist option produces a regress: an organism cannot pick up information about its environment without already having some other information about its environment that it cannot pick up without still other information, and so on. Taking the latter, nativist, horn only postpones the problem. By postulating certain innate information, concepts, principles of reason, or the like, one can explain the origin of the information an individual organism possesses. However, it still remains to be explained how the species to which an organism belongs has come to possess



innate knowledge (and presumably how it is passed on through successive generations). The nativist is thus seen as encountering a problem at the phylogenic level similar to the one posed for the empiricist at the ontogenic level. A present species member is said to have certain information it acquired genetically. Its parents had the information to pass on because they acquired genetically, and so on without end. The nativist view thus makes the origin of our information as mysterious as the empiricist. In general terms, Gibson explains his version of the objection by saying:

The error lies, it seems to me, in assuming that either innate ideas or acquired ideas must be applied to bare sensory inputs for perceiving to occur. The fallacy is to assume that because inputs convey no knowledge they can somehow be made to yield knowledge by "processing" them. Knowledge of the world must come from somewhere; the debate is over whether it comes from stored knowledge, from innate knowledge, or from reason. But all three doctrines beg the question. Knowledge of the world cannot be explained by supposing that knowledge of the world already exists. All forms of cognitive processing imply cognition so as to explain cognition.<sup>34</sup>

The difficulty Gibson sees, once again, is clearly directed at the assumption that perceiving is based on some form of meaningless input. He objects to any notion that prior knowledge, concepts, or some correlate is required to get further information from sensory input. Thus Gibson writes that "if you agree to abandon the dogma that 'percepts without concepts are blind', as Kant put it, a deep theoretical mess, a genuine quagmire, will dry up."<sup>35</sup> The problem posed for the Establishment here is assigned a great deal of importance by a number of Gibsonians.

There are alternative ways of stating exactly what Gibson intends to reject, although they amount to much the same thing. One may say that he rejects either the necessity of prior information or the necessity of cognitive/mental processing in perception. The rejection of processing leaves no means for concepts or the like to become effective in perception. The rejection of prior knowledge places serious restrictions on that for which cognitive processes could be used. It is not clear which point should

be given precedence but they converge on the same fundamental criticism of the Establishment: the assumption that perceptual pickup of information is based upon what Gibson would regard as meaningless input, input that does not specify features of an organism's environment, is a mistake. Any theory which accepts the assumption to which Gibson objects, whatever the theoretical language in which the view is couched, is an instance of what Gibson and his followers call the traditional approach to perception (the Establishment view).

Gibson's alternative is to develop a new basis for perception on which the input is uniquely associated with particular features of an organism's environment, and on which the detection of such input by some perceptual system, by itself, constitutes the pick up of information. Michael T. Turvey, Robert E. Shaw, Edward S. Reed, and William M. Mace put the new assertion this way:

The fundamental hypothesis of the ecological approach to vision, elaborated at great length by Gibson (1966, 1979) is that optical structure specifies its environmental source and that, therefore, mobile organisms with active visual systems that can pick up this information will see their environments and suitably adjust their activity, if and when they detect that information (and only then).<sup>36</sup>

Gibson himself expresses his fundamental view by saying that information is "simply available",<sup>37</sup> or by claiming that organisms perceive "meanings" or "values".<sup>38</sup> The sense in which the Gibsonian theory is intended to be a theory of direct perception is that the perceptual pickup of information does not require the mediation of cognitive processes, especially as would be used to apply prior knowledge/concepts to sensory input: when input is properly construed, its detection by perceptual systems is the pickup of information.

## (iv)

Any direct theory of perception must be so with respect to some set of phenomena. Gibson's view is no exception. Throughout this discussion, it has been understood that the ecological approach is a theory on which perceptual pickup of information about the environment is direct. I have also, though not explicitly, roughly equated environments with organisms' physical surroundings. "Environment" is a technical notion of Gibson's, however, and even though it cannot be defined precisely, it is important to bring out points about the general constitution of an environment.

Philosophical debate concerning the immediacy of human perceptual connections to things are most frequently concerned with these in relation to physical or material objects or some similar notion, these being taken as suitable samples of the so-called external world.<sup>39</sup> The external world could be thought of as containing, from some given theorist's point of view, all that is material: physical objects, events, processes, or states of affairs of any size and situated anywhere within the physical universe. Among the population of the external, physical world is usually counted perceivers' bodies, although perceivers themselves are to be regarded as distinct and not part of it. Gibson would not make such a distinction. A perceiving organism is part of its environment, on the one hand. On the other, when Gibson talks about proprioception, he is not referring to awareness of an ephemeral self, a Cartesian thinking thing which is distinct from the physical organism that moves through and interacts with its environment. Self-perception, in Gibsonian terms, involves awareness of the states of one's own body and its relations to surrounding features of the environment.

Although environments include perceivers while the external world typically does not, an environment is largely a subset of the external world. It is a place that supports life, holds features necessary for organisms of some kind to live. Put roughly, an environment consists of "animal-relevant" features of the external world. "External" or "physical" world more closely resembles what Gibson means by "the world of physics". Gibson distinguishes the world of physics from an environment by writing:

The world of physics encompasses everything from atoms through terrestrial objects to galaxies. These things exist at different levels of size that go to almost unimaginable extremes. The physical world of atoms and their ultimate particles is measured at the level of millionths of a millimeter and less. The astronomical world of stars and galaxies is measured at the level of light years and more. Neither of these extremes is an environment. The size-level at which the environment exists is the intermediate one that is measured in millimeters and meters. The ordinary, familiar things of earth are of this size -- actually a narrow band relative to the far extremes.<sup>40</sup>

With respect to life on this planet, an environment consists of fairly local physical phenomena. The sun, other planets and more distant astronomical objects would all be excluded. The most important point here, though is the notion of scale. It is very important to Gibson that perceiving should be linked to what an organism must interact with in the physical regions in which it has grown up and in which its species has evolved. In general, animals interact with moderately sized, tangible physical phenomena and therefore these are the kinds of things, Gibson supposes, about which organisms ought to be concerned with and suited for picking up information. What will be said in subsequent chapters will be said bearing in mind that environmental phenomena, that which we perceive, consists of the "narrow band" of physical things with which organisms would typically interact.

The basic components of an environment, to be a little more rigorous about Gibson's concept, are substances, surfaces, and a medium.<sup>41</sup> Gibson

postulates two environments for earth. These are the terrestrial and the aquatic. For terrestrial animals (and it is a species of these which is obviously of the greatest interest), the medium is air. The medium, according to Gibson is "transparent" to perception, terrestrial organisms perceive things in and through it. It permits locomotion. The notions of "substance" and "surface" are a pair because the surfaces of an environment are the surfaces of its substances. Gibson defines "substance" very generally as "solids and liquids that vary in composition and in resistance to change."<sup>42</sup> In short, they are the tangible stuff of which the environment is composed: flesh, wood, granite, and (for the terrestrial environment) water would all count as typical examples. Gibson characterizes "surface" very generally, saying that it refers to the boundary between a substance and a medium. Every substance has some surface. These two notions are vital because the layout of surfaces and the nature of the substances to which they belong (sometimes jointly referred to as the environment layout) are the terms in which Gibson organizes his account of visual perception. Only structured light energy, as will be explained next chapter, can be a source for the visual pickup of information. The substances and the surfaces make up the source of that which serves to provide light with the requisite structure.

The concept of an environment is still obviously fairly general and it seems destined to remain so. There are plenty of examples, for instance, of "poly-environmental animals", such as amphibians and certain aquatic mammals, that could cause trouble for any attempt to clearly individuate the Earth's two environments. Also, some of Gibson's proponents use "environment" to mean "habitat",<sup>43</sup> which would clearly result in hundreds of environments on Earth. The main point to bear in mind, though, is that Gibson wants to

confine his analysis of perception to the consideration of how it allows the pickup of information about the places where an organism lives and the phenomena it must interact with there.

This genuine interest in the ecological or evolutionary considerations is particularly clear in the new categories of perception Gibson suggests. This refers to the second of the five differences he claims between his approach and that of the Establishment. The essence of the claim is that organisms perceive their environments primarily in functional terms, or in terms of utility. The word "functional" here simply refers to that which the environment can do to and can do for organisms. In Gibsonian terms, organisms perceive environmental properties called "affordances". Affordances can be explained as follows.

Every animal has interests and/or needs, and abilities and vulnerabilities which determine how these can be fulfilled. These abilities and limitations determine how an organism of some type could make use of its environment. The structure of the environment determines what there is to be made use of by an animal, what actual opportunities there are for it to use its abilities to satisfy its needs (or for its vulnerabilities to lead it to grief). This is to consider the environment in terms of that which it affords organisms.

"Affordance" is a word Gibson coins to act as the substantive for the verb "to afford".<sup>44</sup> An affordance is a dispositional property of the environment. The notion is most easily illustrated by example (although it is difficult to convey properly the generality of the notion this way): (relative to humans) a chef's knife affords cutting and also being cut. A rattlesnake affords being bitten and poisoned, and also (it is alleged) eating. Relatively level, solid ground affords standing and walking. Nelson Goodman has written, with respect to dispositional properties, that an object

is full of "threats and promises"<sup>45</sup> and this can be used to give a good, quick illustration of affordances. An affordance is a threat or promise the substances and layout of surfaces of the environment hold for an organism (following Goodman on another point, affordances are often indicated by Gibsonians by the artificial addition of the suffixes "-ible" or "-able"). Gibson sometimes puts this by suggesting that affordances are values or meanings.<sup>46</sup>

One of the most intriguing and unique aspects of the ecological approach to perception is Gibson's assertion that perception of affordances is the basic form of perception. He takes the Establishment to be committed to the primacy of "form perception", perception in terms of manifest, sensible qualities. Contrarily, Gibson would deny that we recognize things primarily as red, bulgy, heavy or the like, claiming instead that things are primarily recognized as edible, hide-in-able, cut-with-able, fall-off-able, and so on.

Thus Gibson holds that the perceptual pickup of information only requires the detection of invariants by perceptual systems. He also maintains that the values or meanings of things (relative to a perceiving organism) are the terms in which the environment is primarily perceived. The result is a theory according to which it is claimed that things are directly perceived as having some meaning. Gibson and his followers are sometimes inclined to put their point in even more startling terms: organisms "directly perceive" meanings.

## Chapter Two

The previous chapter began the task of explicating the Gibsonian theory of perception, explaining the first two of the five essential differences Gibson sees between his own view and traditional approaches.

The other three respects in which Gibson is supposed to differ from the Establishment is by:

3. suggesting a new basis for perception: invariant structure or properties
4. taking perceptual systems to be overlapping hierarchies of organs
5. saying the function of perceptual systems involves the concurrent registering of persistence and change

This chapter will continue the task which chapter one begins. The necessary detail will be added to explain (visual) perceptual pickup of information through the notions of visual, or optic arrays and invariants. The foregoing points 3, 4, and 5 will thereby be explained. This chapter will conclude with a discussion of Gibson's use of the term "information".

(i)

In The Senses Considered as Perceptual Systems, Gibson identifies five perceptual systems<sup>1</sup>: the basic orienting system, the auditory system, the haptic, the taste-smell, and the visual systems. Each of these is sensitive to some form of energy (on a very liberal use of "energy"). The basic orienting system is responsive to gravity and acceleration and the auditory, system is sensitive to vibrations in the medium, to give two examples. The only system to be elaborated here is the visual system, which is sensitive



to (stimulated by) light energy.

Gibson says that traditional views hold that perceiving requires only the stimulation of receptors, or banks of receptors. He calls these passive senses. These "passive" senses are active only insofar as the activity concerns the firing of neurons in the part of the brain to which the receptors are connected. Perceptual systems, on the other hand, are active sets of organs designed to "orient, explore, investigate, adjust, optimize, resonate, extract, and come to an equilibrium."<sup>2</sup> It is left largely up to the reader to imagine precisely what is entailed by these activities which is especially unfortunate in the case of "extracting" or "resonating". The detection of invariants, which serves as Gibson's replacement for the registering of input, is often described as extraction of or resonating to an invariant by a perceptual system. It could only have aided Gibson's case had he taken care to explain these activities of perceptual systems in some detail.

The constitution of the visual system is given in terms of its constituent organs and their adjustments:

First, the lens, pupil, chamber, and retina comprise an organ. Second, the eye with its muscles in the orbit comprise an organ that is both stabilized and mobile. Third, the two eyes in the head comprise a binocular organ. Fourth, the eyes in a mobile head that can turn comprise an organ for the pickup of ambient information. Fifth, the eyes in a head on a body constitute a superordinate organ for information pickup over paths of locomotion. The adjustments of accommodation, intensity modulation, and dark adaptation go with the first level. The movements of compensation, fixation, and scanning go with the second level. The movements of vergence and the pickup of disparity go with the third level. The movements of the head, and of the body as a whole go with the fourth and fifth levels.<sup>3</sup>

All of these adjustments, activities, and movements are undoubtedly important to the proper functioning of a visual system but only those related to the last two levels will find their way into the discussion of

invariants. The adjustments of the eye-head system constitutes the pickup of information by looking around. The adjustments of the superordinate organ of eyes in a mobile body constitute the pickup of information through changing perspectives that an organism takes on its environment.

The crucial difference between a bank of receptors and a perceptual system is that the former is incapable of the kinds of adjustments Gibson envisages for perceptual systems. This difference captures the sense in which receptors are said to be "passive". Receptors merely register changing patterns of stimulation and therefore do not comprise the "input-output loops" of information pickup and adjustment that are supposed to be comprised by Gibsonian perceptual systems. There is no doubt, of course, that receptors and the regions of the brain to which they are connected are parts of perceptual systems. It is clear Gibson does not deny this from column three of his table mapping perceptual systems in Senses Considered.<sup>4</sup> His point is just that such sets of receptors, because they merely register stimulation, are not by themselves suited for the detection of invariants. They can therefore only be parts of the systems required for the perceptual pickup of information.

(ii)

Once again, the form of energy to which the visual system is sensitive is light. However, this is only to say that the receptors contained in the organs of the visual system are stimulated by light energy. Not all that stimulates the visual system yields perception since, in Gibson's terms, only structured, ambient light is a source of information.

Ambient light surrounding a perceiving organism is described by Gibson as a "sea" or a "flux" of energy. In ecological terms this is known as the visual or optic array. "Ambient array" is the general case for referring to

any modality. Since ambient light occurs in the absence of perceivers, though Gibson defines "optic array" more accurately and generally as the ambient light surrounding a "point of observation". The specific use of "ambient light" is to distinguish between energy which is reflected by environmental surfaces and therefore is typically structured, and radiant light, which is light from a source and is never structured in Gibson's sense.

"Point of observation" itself requires a little explanation. Gibson says it should be regarded as a place or position, not as a point in some geometric sense.<sup>5</sup> It is quite similar to the concept of a station-point in perspective geometry except that a station-point is fixed. Gibson intends his notion of a point of observation to be a moving point. Since any given point can move in relation to any other and since they need not be occupied by organisms, it is quite difficult to imagine the terms in which these points of observation are supposed to be identified or differentiated: perhaps it is easier to envisage Gibson's conception in terms of actual and possible perceivers, rather than in terms of points, places, or positions with no apparent co-ordinates.

The two operative words in the conception of the optic array as the flux of light energy surrounding a point of observation are "structure" and "surround". An optic array consists of illumination, light that has been reflected by surfaces of the environmental layout. It is structured so long as it is not homogenous. An unstructured array could, for example, be produced by total darkness, blindingly intense levels of illumination, or by some diffusing substance, such as a thick fog. Leaving aside such exceptions, an optic array has two kinds of structure: "variant", which Gibson sometimes refers to as "perspective structure", and "underlying invariant structure". These two kinds and their interrelation will be made clear once the functioning of the optic array has been explained.

For structured ambient light to surround a point of observation, or to be "ambient at a point", as Gibson sometimes puts it, is explained when he writes:

To be ambient, an array must surround the point completely. It must be environing. The field must be closed in the geometrical sense in which the surface of the sphere returns upon itself. More precisely, the field is unbounded.<sup>6</sup>

A particular visual field is confined to that which is in sight for a fixed pair of eyes in an unmoving organism. This makes a visual field bounded. An array, contrarily, is unbounded in the sense that it is not confined to that which is in sight from a given, fixed position, but consists of all the illuminated surfaces which face a point of observation and are not obstructed by other surfaces from that point.

The structure of the visual array consists of "visual solid angles", or "angles of intercept", of surfaces.<sup>7</sup> Gibson mentions Euclid and Ptolemy in this connection for postulating, respectively, visual cones and visual pyramids. These notions are virtually the same as the Gibsonian one, except that Gibson shows recognition of the obvious fact that environmental surfaces are not neatly classifiable as either ellipses or rectangles. Thus, considered as bases for three-dimensional figures, these surfaces do not invariably form either cones or pyramids.

A visual solid angle is a figure with some surface as its base and an eye (better still: a point of observation) as its apex. Every surface which is unobstructed (or unoccluded) from a point of observation subtends some visual solid angle. Among other things, this implies that there is no "figure-ground" distinction in the ecological approach. Also, the angles are "nested" within others, the smallest being surfaces of very small objects or textures of larger surfaces. A very rough distinction is made by Gibson between these relatively small elements of the optic array, which he calls

"facets" and the larger surfaces that he calls "faces". An optic or visual array, then, is a set of visual solid angles, typical comprised of a nested set of facets and faces of the environmental layout. Gibson's explanation may be found in the following quote:

There are several advantages in conceiving the optic array in this way, as a nested hierarchy of solid angles all having a common apex instead of as a set of rays intersecting at a point. Every solid angle, no matter how small, has form in the sense that its cross-section has form, and a solid angle is quite unlike a ray in this respect. Each solid angle is unique, whereas a ray is not unique and can only be identified arbitrarily, by a pair of coordinates. Solid angles can fill up a sphere in the way that sectors can fill up a circle, but it must be remembered that there are angles within angles, so that their sum does not add up to a sphere.<sup>8</sup>

There is one further piece of terminology to add here. Solid angles are separated from one another by edges and corners. The significance of this point has to do with the importance in Gibson's theory with the behavior of edges relative to a moving point of observation as part of the foundation of variant structure, thereby playing a key role in the detection of invariants. This will be explained presently.

The study of visual solid angles is called the study of natural perspective by Gibson and he says it is "a continuation of ancient and medieval optics". This kind of optics is mainly supposed to be the examination of trigonometric relations elements of the environment and visual angles. He distinguishes it from the study of "artificial perspective". This latter study is what Gibson refers to as "the art of picture-making"<sup>9</sup> because it pertains mainly to problems of representing three dimensions in two. Gibson is very careful to differentiate between the two disciplines but he nevertheless concedes that, as they are traditionally conceived, they share the same limitation of being concerned with "frozen" or arrested structure rather than the changing structure available at a moving point of

observation. The ecological approach therefore extends the study of natural perspective so that it considers changing structure.

Gibson also modifies the traditional discipline in two other respects. First, objects are replaced by illuminated surfaces as the basic items of study. Second, Gibson gives consideration to shading of the layout of environmental surfaces. This is a point apparently not accounted for by the optical theorists Gibson takes himself to be following. Shading and changes therein are the result of the fact that the prevailing source of illumination which is reflected by surfaces typically comes from some direction and the specific direction varies.

After elaborating his idea of the optic (orvisual) array, Gibson goes on to note that the term "structure" is vague as it applies to his theory of information pickup because there are two different sorts of structure in an array. The distinction is originally cast in terms of perspective structure that is disturbed with every movement of the point of observation versus what is known in the ecological theory as "underlying invariant structure".<sup>10</sup> Later in Gibson's discussion, however, it comes to light that the proper contrast is a more general one between invariant and variant structure.<sup>11</sup> Perspective structure is actually merely one of four sources of variant structure. The other sources are 2) movements in an organism's eye-head system, 3) changes in illumination, and 4) perceptible events that occur in an organism's local environment. These will be explained shortly.

With regard to 2), movements of the eye-head system are distinguished by Gibson from the other bodily movements that would constitute a disturbance of the point of observation. Looking around is the chief function of the eye-head system. Scanning with the eyes might be included as well although Gibson does not explicitly say so when he discusses scanning. With

regard to 3), both direction and the frequency of sources of illumination are considerations.

In Gibson's exposition of invariants, there is a division made among the four sources of variance, the first three being discussed prior to and independently of the fourth. The main rationale behind the order could be that sources 1), 2), and 3) are all in some sense "external" to an organism's environment. A source of radiant light, illumination is never part of the environment (although, Gibson would note, the object providing the source could be). Also, from the point of view of a particular organism, it is distinct from its environment (although from a purely objective standpoint animals are of course part of the furniture of the environment): all of the organism's perceptions of its own body are proprioceptions and these are clearly distinguished on the ecological approach from the pickup of information about its environment. From a perceiving organism's own unique perspective, then, its own body is as "external", as much a non-environmental phenomenon, as a source of illumination. Adjustments of an organism's body and changes of illumination, therefore, are in some sense not changes in the environment. The fourth source of variance, environmental events, quite obviously constitutes change in the environment.

All of the sources of variance are such in the sense that they produce disturbances of optical structure (changes in the optic array -- Gibson actually prefers to use "disturbance" and "non-disturbance" in relation to the optic array, confining "constancy" and "change" to features of the environment).<sup>12</sup> Variances due to eye-head adjustment or change in either point of observation or illumination can be, and by Gibson are, discussed with respect to an unchanging environment. The discussion concerns the perception of constancy or persistence through disturbance of optical structure.

The addition of environmental events adds a new twist to the theory because it pertains to the perception of environmental change through optical disturbance.

Now a theory in which the mere registering of variances in the optic array brought about the pickup of information would still be a kind of Establishment theory in some respects. Perception would still be based on some notion of variable input; it could still require some means of constructing information from variable series. On the ecological approach, however, disturbance of optical structure is essential to the pickup of information but is not the basis of pickup. Information is picked up only when underlying invariants are detected by an organism's visual system. The relation between invariant and variant structure is complementary though. While the former is the basis of perception, the latter allows its detection because, as Gibson would put it, the "flow" of the array, series of optical disturbances produced by changing perspective and so on, "separates off" the underlying invariant structure from the changing, ambient flux.

The perceptual pickup of information thus involves the concurrent registering of persistence and change. More precisely, it involves the concurrent registering of disturbance and non-disturbance of optical structure. This is one of the previously listed five respects in which Gibson's theory is alleged to be revolutionary. From the ecological point of view, the traditional approach to our perception of constancy (of a stable environment) would suggest that it is perceived in spite of the registering of variant structure. The Gibsonian approach is that, although variant structure is not itself a source of information about the environment, it plays a crucial (causal) role in enabling perceptual system to extract the abstract



ratios and relations, which are invariant properties and which remain intact through movements of the perceiving organism, the source of illumination, or even environmental objects themselves. When a visual system detects an invariant specifying some persisting feature of the environment, an organism perceives stability through, not in spite of, disturbance of the optic array. This different way of thinking about the role of variance in perception explains, for example, why Gibson is opposed to studying perception through experiments that unduly constrain a perceiver's movements.<sup>13</sup>

(iii)

In the most general terms, invariant properties are ratios and relations involving substances and surfaces of the environment that remain constant through certain kinds of optical disturbance. Gibson postulates four types of invariants, each associated with one of the four sources of variance in the visual array. These are entitled: "Invariants underlying change of point of observation", "Invariants of optical structure under changing illumination", "Invariants across sampling of the ambient optic array", and "Local invariants of the ambient array under local disturbances of its structure".

A. Invariants Under Changing Perspective

From a temporarily fixed point of observation, certain surfaces facing it will be obstructed by others. As the point of observation changes, that is, the perceiving organism takes different perspectives on its environment, previously covered surfaces become uncovered and vice versa. The covering of one solid angle in the visual array by another is referred to by Gibson as occlusion.<sup>14</sup> In ecological terms, a moving point of observation produces deletion of optical texture (what visual solid angles consist of) along certain edges and accretion of texture along others. Where there

is deletion of texture, a surface is being occluded. Where there is accretion of texture, a surface is becoming unoccluded. One must of course remember that these disturbances occur in comprehensive patterns, not as isolated instances.

Among the kinds of things one may suppose would be specified in the deletion and accretion of texture along edges would be spatial relations. Patterns and rates of occlusion relative to particular changes in the point of observation specify things in the environment as being behind or in front of others, as being certain distances apart, and as being at certain distances from the perceiver. Sitting down produces a compression of some of the solid angles in the visual array. Perhaps the degree of compression relative to the amount of displacement of point of observation specifies the angle of the surface relative to an organism's line of sight.

Examples might also be constructed which do not really involve an actual movement of the point of observation but which may still be thought of as the detection of invariants through changing perspective. Perceivers are sometimes in a position to see different environmental phenomena which are of the same kind (exactly similar in some respect) but which are positioned rather differently from them. In his book, Gibson uses the example of a series of telephone poles, all of the same height, extending into the distance away from a perceiver. In open country, the poles are seen as the same height, even though, because the perceiver is taking a different perspective on each, each pole subtends a progressively smaller visual angle. The supposed explanation is that the ratio of the portion of optical texture above the horizon to the portion below is constant. Perceiving the poles as the same size is the result of its detection of this invariant.

In general, more or less complex ratios, rates, and relations emerge through the patterns of disturbance, the "optical flow", as Gibson sometimes

has it, produced by a perceiving organism moving through its environment. These are invariants under changing perspective. Such constancies to be extracted from the optical flow perhaps would specify sizes, spatial positions, rigidity. If Gibson's approach to perception were correct, they would certainly specify objects as being sized, shaped and situated so as to afford shelter, grasping, climbing, walking, and so on. That is, the invariants would specify affordances of the environmental layout.

#### B. Invariants of Optical Structure Under Changing Illumination

The three sources of variance falling under "changing illumination" that Gibson mentions are changes in direction of the prevailing source, changes in intensity, and changes in colour or frequency-mixture.<sup>16</sup> The distribution of shaded and lighted surfaces in the environment, for example, is a function of the direction of the prevailing source of illumination.<sup>17</sup> As the direction changes (the sun moving across the sky, a perceiver moving around a cave with a hand-held lantern, are a couple of examples), there are patterns of optical disturbance in the shading. Arrangement and patterns of disturbance would be thought to bring out invariants that help to specify size and distances of things, and convexities and concavities in surfaces.

Change in spectral composition or intensity of prevailing illumination means a difference in the nature of light absorbed or reflected by a surface. The result is differing absolute colour of particular surfaces and of detail in the optic array. With regard to intensity, the extremes simply make the visual pickup of information impossible. If the illumination is too strong, blinding occurs. If it is too weak, it is said that conditions are too dim in which to see. I mention this to underscore the fact that, on Gibson's view, visual perception can fail to occur even when the receptors in the visual system are receiving some measure of stimulation. Each of these cases

can provide an example of how there can be visual sensation without visual perception.

Among the features of the environment that are detected as constant through both changing intensity and spectral composition are texture and pigmentation. Perception of a surface as being of a constant colour would involve the detection of characteristic ratios of reflectance for various pigmentations. Pickup of information concerning environmental substances may be related to characteristic scatter-patterns that remain constant under changes in the source of illumination.<sup>18</sup>

### C. Invariants Across the Sampling of the Ambient Array

This kind of invariant is related to adjustments of the eye-head system. In particular it is related to the specific task of getting information by looking around. As I have already noted, movements of the eye-head system are distinguished in Gibson's classificatory system from other bodily movements (eg., sitting down, crouching, walking). Adjustments of the eye-head system are therefore, not counted as a change in the point of observation.

An explanation of invariants across sampling of the optic array requires some account of the notion of the process, and of "sample". A sample of the optic array is the portion of it which is in from a temporarily fixed viewing position. Any motion of the eye-head system produces a new sample. That which is in sight from a fixed eye-head position constitutes the contents of an organism's field of view.

"Field of view", incidentally, is a notion Gibson clearly wishes to distinguish from "visual field"<sup>19</sup> A field of view and a visual field are both bounded in some sense, but Gibson takes the latter to refer to some form of sensory mosaic accessible only through introspection, a "patchwork

of visual sensations". A field of view is a bounded portion of the optic array and therefore consists of illuminated surfaces.

To look around is to sample the optic array via movements of the eye-head system, to obtain successive, overlapping, and often reversible series of samples. There is somewhat of a complication in this explanation in that the eye-head system must move whenever the point of observation does. However, this can be remedied simply enough by specifying that the eye-head system itself must change state for invariants to be detected through sampling, rather than a change in perspective.

There will no doubt be some similarities in the contribution made to visual information pickup by looking around and by changing perspective. Use of the eye-head system will produce series of samples of optical structure through which there will occur systematic and progressive deletion and accretion of optical texture along edges of solid angles. As is the case with occlusion (and its reverse) through changing perspective, the covering and uncovering of texture along edges through looking around should be important to perception of spatial positions of things. Gibson also regards the reversibility often associated with occlusion and with things going out of and coming into the field of view as important to the perception of persistence, and of the coexistence and connectedness of that which is temporarily in sight with that which is temporarily out of sight.<sup>20</sup>

#### D. Local Invariants of the Ambient Array under Local Disturbances of Its Structure

The invariant-types considered so far have been explained in relation to a "frozen" environmental layout (though they should not be thought of only as related to an unchanging environment). A tenet in the ecological approach, however, is that events and the perception of events must be part

of an account of perception. Environmental events are themselves a source of optical disturbance, through which invariant properties are separated off and may be detected, as well as being perceptual objects. Unlike the other sorts of invariants, the source of disturbance of optical structure (some environmental event) can be that which is specified by the invariant revealed by the associated optical disturbance.

Elaboration of invariants under local disturbance of environmental structure requires some description of events. Gibson's discussion particularly concerns what he calls "terrestrial events". The only example given of a non-terrestrial one is that of the sun's progress across the sky. The point of the distinction Gibson makes seems only to confine the discourse, in accordance with his rough notion of the "terrestrial environment", to events at or near the surface of the earth.

Three general event-types are cited.<sup>21</sup> "Change of layout" includes disruptions and deformations of surfaces, collisions, turns and displacements of objects. "Change in colour and texture due to change in composition" pertains to chemical metamorphosis, such as the bluing of heated steel. Heating, oxidation, reduction, the production of chemical substances by living things (one of Gibson's examples is of the fading colouration of a plant surface through a decrease in chlorophyll). Finally, there is "waxing and waning of a surface due to change in the state of matter", such as the rotting of vegetable matter, evaporation or freezing of liquids, or the dissolution of crystals in liquid. Changes of these kinds constitute coming into or going out of existence of surfaces. In general, the list Gibson provides takes into account alteration of a given surface, alteration between surfaces, and their creation or destruction.

The supposed revolutionary approach to events in perception taken by

Gibson and his followers is that events are perceived just the same as persisting features of the environment.<sup>22</sup> That is, on the Gibsonian view there are persisting, abstract ratios and relations underlying disturbances of optical structure which specify events of certain kinds, as well as specifying objects and their unaltering properties. Also, a distinction needs to be maintained between events as sources of optical disturbance and events considered as perceptible features of the environment. In short, the ecological approach treats environmental events both as objects of perception and as sources of optical disturbance. Gibson could perhaps have made this point clearer.

The reason for such a distinction is that not every event that results in some characteristic optical disturbance is necessarily perceived as such. Optical disturbances produced by events should be able to separate off invariants that specify things other than simply the source of the disturbance. After all, changes in perspective and illumination reveal invariants that specify features of the environment, rather than the sources of those disturbances (point of observation or light-source).

One of the favourite examples for ecological theorists of disturbance of optical structure by local events that allows the detection (or extraction) of an invariant is the previously mentioned case of the perception of imminent collision:

The magnification of the visual solid angle of an object normally accelerates as it approaches the limit of a hemispheric angle, as the object comes up to the eye. The accelerated portion of this sequence was called "looming" by Schiff, Caviness, and Gibson (1962). It specifies impending collision, and the rate of magnification is proportional to the imminence of the collision.<sup>23</sup>

An explosive rate of surface magnification is part of the invariant structure that specifies a certain event-type: collision with an object or surface. This particular example is so frequently cited by Gibsonians

because it is taken as a source for one of the first concrete examples of an invariant. David Lee<sup>24</sup> has apparently worked out a mathematical variable to explain human reaction to impending collisions in ecological terms.

Another somewhat similar example (this one is mainly of my own design: it is intended to illustrate the notion of invariants in environmental change but the details may or may not be borne out in experiment) would be of a ball thrown toward a perceiver.<sup>25</sup> The disturbance of the optic array would consist of the solid angle subtended by the ball occluding progressively greater amounts of surrounding texture. The perceiver's visual system, on Gibson's view, would register the optical disturbance created by the ball's changing position relative to the surrounding environment.

This event, for one thing, is quite different from a perceiver moving toward a stationary object, however quickly. Part of the reason could be that a projectile has a characteristic arc that is not reproduced when one merely approaches a still object. Part of the reason would also no doubt be linked to proprioception (via the visual system and otherwise). An organism's ability to perceive change and constancy in the environment is connected very clearly to its awareness of its own temporarily changing or fixed position in it. Also, the relation between the solid angle subtended by the ball and those subtended by surrounding surfaces is quite different when the perceiver is in motion relative to a stationary ball, as opposed to the reverse. Surrounding texture is increasingly occluded by the ball's solid angle in each case, but when the ball is still and the perceiver is moving toward it, the "background" texture will be magnified at the same rate. When the ball is in flight (assuming a stationary perceiver), the background texture will not be magnified at all. The clear result is a striking difference in the texture that is occluded in each instance. The different patterns of optical disturbance which result from the two dif-



ferent occurrences would therefore make different invariant ratios or rates available for detection by one's visual system.

A perceiver's ability to time his catch, or to avoid being hit by the ball, is no doubt contingent upon his ability to perceive the speed of the ball accurately. At least a partial factor involves the detection of a rate of magnification. Another factor could have to do with the ball's arc. A faster ball has a flatter arc. A ball travelling relatively quickly would therefore produce somewhat less decretion of surrounding optical texture along its lower edge and somewhat less accretion of texture along its upper edge than would a solid angle associated with a slower-travelling ball that covered the same distance with greater arc.

Perceiving a ball's speed and path of flight, in these terms, would thus be a matter of the detection of a certain invariant, consisting of fairly subtle mathematical relations amongst a set of visual solid angles which are not in motion, but are undergoing structural disturbances.

It is important to remember that even though the two examples given concern perception of changing spatial relations, visual perception of events concerns far more. There are chemical events as well as mechanical ones. Chemical events bear some similarities to changing illumination because a chemical (including biochemical) event produces change in substance, usually resulting in some difference in pigmentation or surface texture. The invariants underlying such change will, as with changing illumination, pertain to how light from a source is reflected, absorbed, and scattered by surfaces.

While the thought Gibson has put into the categorization of environmental events is impressive, it involves a curious oversight. Not everything on Gibson's list of terrestrial events would produce a disturbance

of optical structure because noticeable change occurs in some of the cases over very long periods of time. Some environmental events, like the ripening of a peach, will not be registered as changing optical structure, unless one is extremely vigilant. Others, like the motion of tree-branches in the wind will count as sources of disturbances of optical structure. Gradual events may be considered as things perceived on the ecological approach: it is conceivable that peaches are perceived as ripening, stalactites as lengthening, or whatever. These sorts of gradual changes in the environment, however, cannot be considered as sources of optical disturbances because no change is registered by the perceptual system. One is aware of a peach's ripening because of a state the fruit is in, not because of a discernible change it is undergoing.

(iv)

Some general points about invariants should be made in summary. These are, to emphasize, abstract ratios and relations (mathematical, but not necessarily geometric) that hold among components of the ambient array, and are constant through certain kinds of disturbance of ambient (optical) structure. These are said to be detected or extracted by perceptual systems from the array. It is also said by Gibson that perceptual systems (or "nervous systems") resonate to invariant properties. Neither "detect" nor "extract", nor "resonate" is explained.

Invariants should by no means be thought of as some novel conception of sense-data, as one might be inclined to do. An invariant is not, and in many cases, Gibson believes, could not be an object of awareness. In fact, he claims they will for the most part fail to be "open to analytic introspection".<sup>26</sup> This must mean more than that one is not standardly aware of invariants. Rather, it must be that one could not attend to

one's own perceptual experience in such a way as to discover the invariants upon which pickup of certain information is based. Invariant properties are quite unlike sense-data or similar notions in this respect. Representational theorists as early as Locke are prepared to grant that perceivers are not typically perceptually aware of the sensory qualities upon which their awareness of the world is based.<sup>27</sup> It is customary to maintain some conditional view instead: a perceiver could be aware of bare sense-data if he were to attend to his perceptual experience in the right way. For Gibson to claim that invariants will often not be introspectible is to deny they can be objects of awareness even in this weak, conditional sense.

An immediate consequence of this point is that (assuming of course that invariants are indeed discoverable), to the extent that they are not revealed by analytical introspection, they must be so through independent, empirical testing. This explains Gibson's (otherwise puzzling) remark regarding invariants under changing illumination that "they are not yet known but they almost certainly involve ratios of intensity and color among parts of the array".<sup>28</sup> The study of invariants consists of discovering which particular ones there are (that the study is relatively new perhaps stands as a temporary explanation for the decided lack of concrete examples). This makes the finding of invariants, what they specify, and hence the question of what information can be picked up via their detection of all empirical issues. This is an important point for understanding how Gibson distinguishes perceptible and non-perceptible features of the environment, which will be a central issue in the next chapter.

Finally, there is the matter of the relation between the notions

of "invariant properties" and "information", or of the nature of information, on Gibson's conception. In important respects, it is an issue that cannot be resolved until later in this discussion since the major controversy between Gibsonians and Establishment theorists centers on the notion of information and whether it manages to do all that is required of it. The only certainty is that Gibson wants to distinguish clearly between his conception and one that has come to philosophy and psychology via communication-theory:

The information for perception is not transmitted, does not consist of signals and does not entail a sender or a receiver. The environment does not communicate with the observers who inhabit it.<sup>29</sup>

Elsewhere, Gibson notes that information, when defined (as in communications-engineering) in terms of the reduction of uncertainty, allows discrimination, not "perception of" (presumably meaning "meaningful perception").<sup>30</sup>

The basis of the controversy consists of whether or not invariant properties and information should be identified. Some of Gibson's comments and the locutions he uses suggests that the two should be identified. He talks, for example, about "information for perception" and information specifying features of the environment".<sup>31</sup> The most natural reading of these phrases results from assuming that "information" here refers to invariants: properties of structured, ambient energy that uniquely (and lawfully) correspond to environmental phenomena. Also, information about the environment is said to be "simply available", in the ambient array.

On the other hand, invariants are supposed to be generally non-introspectible: they could not be objects of awareness. Surely it would be incredible to hold such a view of the information organisms pick up about their environments. The pickup of information is anyway defined by

Gibson sometimes as awareness of features of the environment and this raises a precise logical problem for the identification of information and invariants. Additionally, examples of information pickup would be such as "awareness of a surface as walk-on-able", "awareness of something as an enclosure". The information picked up about the environment could be reducible to or analyzed into invariant properties of the optic array. If there is such an analysis in Gibson's works, it is not the least bit explicit.

Now Turvey, Shaw, Reed, and Mace have written that "optical structure specifies its environmental source and that therefore mobile organisms with active visual systems that can pickup this information will see their environments and suitably adjust their activity, if and when they detect that information (and only then)".<sup>32</sup> By substituting "invariant" for "information" in this quote (since "invariant" is fairly clearly what the authors have in mind), one can derive a workable proposal. Since there is some (justifiable) controversy over whether Gibson has a single notion of information that can bear the theoretical weight he places upon it, let the basic ecological claim be that an organism perceptually picks up information about its environment when, and only when, the appropriate invariant is detected by some of its perceptual systems. One suspects that Gibsonians would like to identify information about the environment with invariant, ambient, structure. Pending clarification of certain apparent conflicts, however, this relation should neither be assumed nor granted. Instead, I will regard the invariant-information relation only as a biconditional one. Such a relation would hold if "information" and "invariant" were identifiable. It does not entail this identification, however.

### Chapter Three

The grand philosophical claims made by ecological theorists -- not merely that the Gibsonian approach is a direct theory of perception of the environment, but also that the view provides a new basis for realism, a new theory of cognition generally, and even a new approach to epistemology<sup>1</sup> -- has drawn very little reaction from mainstream figures working in the relevant areas of philosophy. This is not surprising for there is rarely a generous flow of discourse between different academic disciplines. The writings of some of the Gibsonians, moreover, are quite inaccessible.

Fodor and Pylyshyn's commentary<sup>2</sup> is a rare exception to the evident philosophical lack of interest. It is even more rare because, since it is relatively recent, the article takes into account The Ecological Approach To Vision, which contains the most developed and detailed version Gibson gives of his theory. The Fodor/Pylyshyn article, additionally, constitutes one half of a lengthy debate, having drawn a response from four prominent Gibsonians.<sup>3</sup> However, the debate is incomplete: first of all, subsequent to the original two (lengthy) articles, and probably owing to the intransigence of the participants, there has been no comprehensive follow-up or rebuttal. Second, Turvey, Shaw, Reed, and Mace (hereinafter TSRM) do not so much respond to Fodor and Pylyshyn's attack on Gibson as restate general ecologist qualms and redescribe Gibson's "theory of specification". As a result, the ecological side fails to address the points, good or bad, that Fodor and Pylyshyn make. The debate does, however, centre around the key issue which, in Fodor and Pylyshyn's terms, is how the ecological

approach deals with intentionality in perception. The following chapters will focus on the criticism of the Gibsonian view by Fodor and Pylyshyn, and TSRM's reply, with the underlying issue being this one of intentionality (roughly put, whether or not Gibson's concept of information and theory of pickup could explain epistemic perception, how one perceives things as such). It is not at all clear how TSRM's response, although it is intended to handle the intentionality issue, even approaches the question. The task of this chapter, however, will be to discuss the Fodor/Pylyshyn side of the debate.

The initial argument against Gibson made by Fodor and Pylyshyn is that Gibson has not provided appropriate constraints on his notions of "direct pickup" or "invariant". In other words, it is not clear what limits, if any, there are on that which may be perceived.

They write:

The main line of our argument will go like this: Gibson's account of perception is empty unless the notions of 'direct pickup' and of 'invariant' are suitably constrained. For, patently, if any property can count as an invariant, and if any psychological process can count as the pickup of an invariant, then the identification of perception with the pickup of invariants excludes nothing.<sup>4</sup>

I will show that this particular critical line is not a problem for Gibson. He does have constraints of a kind, although they are not obvious, and he is not caught in the dilemma Fodor and Pylyshyn fashion from their argument.

The ecological approach can be understood as claiming that all "genuine" (in some sense) perception is direct perception, and therefore invariant-based. The perceptible, then, is constrained in terms of what invariants there (in fact) are, and what they (in fact) specify. This will be elaborated upon later.

The first step the authors take is to pose what they call a trivialization problem, the purpose of which is to show Gibson cannot do without constraints. They then suggest four different constraining principles (Fodor and Pylyshyn call these "gambits") for which they claim Gibson shows some support in his writings. These gambits are that only ecological properties, only projectible properties, only phenomenological properties, or only that to which 'perceptual systems' respond are directly perceived. Each is rejected in turn as being either inherently unworkable or anyway incompatible with the basic structure of Gibson's approach. To Fodor and Pylyshyn, this outcome is inevitable since they see Gibson as being caught in a dilemma: he needs some constraining principle but cannot introduce one without allowing that some perception requires cognitive processing (inference). In short, Fodor and Pylyshyn argue that either "direct pickup" is vacuous or else Gibson must forsake his claim that perception only involves the "pickup of invariants". They base this claim partly on what they regard as a common assumption:

Gibson and the Establishment agree that pickup and inference exhaust the psychological processes that could produce perceptual knowledge; hence the more pickup is constrained the more there is left for inference to do.<sup>5</sup>

Since one of Gibson's fundamental tenets is that perceiving does not require inference, then his agreement with this assumption would seem to place him in great difficulty. The dilemma Fodor and Pylyshyn attempt to set for Gibson, however, does not work because it is based on some misunderstandings about the ecological approach. One is that the Fodor/Pylyshyn dilemma requires an improper use of "invariant". Another is that the authors fail to appreciate the extent to which the ecological approach to perception is an empirical theory.

The first mistake allows the trivialization problem, which Fodor



and Pylyshyn describe as follows:

Suppose that under certain circumstances people can correctly perceive that some of the things in their environment are of type P. Since you cannot correctly perceive that something is P unless that thing is P, it will always be trivially true that things that can be perceived to be P share an invariant property: namely, being P. And since, according to Gibson, what people do in perceiving is directly pick up an appropriate invariant, the following pseudo-explanation of any perceptual achievement is always available: to perceive that something is P is to pick up the (invariant) property P which things of that kind have. So, for example, we can give the following disarmingly simple answer to the question: how do people perceive that something is a shoe? There is a certain (invariant) property that all and only shoes have -- namely the property of being a shoe. Perceiving that something is a shoe consists in the pickup of this property.<sup>6</sup>

For good measure, they add a second example of such trivial explanations using the alleged ability of Bernard Berenson to "tell by looking" whether a painting is a genuine DaVinci.

The trouble for Fodor and Pylyshyn rests in the fact that the kind of thing they want to fill in for "P" fail even to be candidates for the title of being an invariant property. Optical invariants are the features of and relations between the faces and facets (explained in Ch.2) comprising a visual array that remain constant through various kinds of disturbances of the structure of the array. "Being a shoe", "having been painted by DaVinci", or the generic "being P", do not even remotely qualify as the sort of thing Gibson has in mind.

The trivialization problem relies on a use of "invariant property" according to which one can postulate the existence of an invariant for virtually any distinguishable class of environmental phenomena. Fodor and Pylyshyn take the process of visual information pickup to be similar to "telling by looking". On their interpretation of Gibson, any feature of the environment an organism can (learn to) be aware of by looking is called an "invariant". The result is arm-chair science: the proliferation of

"explanations" of how certain things are perceived that need no backing of empirical tests. However, optical invariants are empirical properties of visual arrays so the matter of what constant ratios and relations of optical structure there are is only determinable by scientific investigation.

The empirical nature of invariants suggest one sense in which Gibson's view of the perceptible might be thought of as unconstrained. As an empirical scientist, he (rightly) leaves questions of which invariants there are and what they specify relatively open. He cannot draw conclusions as to the existence of specific invariants prior to the appropriate tests.

At the same time, one must of course grant that Gibson has some clear, general views, both on the nature of invariants and on the properties which will prove to be specified. The views Gibson has can manage to constitute constraints of a kind even though questions as to the existence of particular invariants and specifications are not known.

Not even the question of types of invariants for different perceptual systems has been settled, because Gibson comments that:

There are also surely invariants in the flow of acoustic, mechanical, and perhaps even chemical stimulation, and they may prove to be closely related to the optical, but I leave them to the readers' speculation. The study of invariants is just beginning.<sup>7</sup>

If invariants were simply arbitrary properties one could postulate at will, it would be difficult to understand that of which the study of invariants might consist.

Even given a corrected interpretation of the Gibsonian concept of an optical invariant, it may still be tempting to think the ecological approach is susceptible to some form of trivialization problem. Considering Gibson's description of visually perceiving in terms of "looking at" and "looking around",<sup>8</sup> there is a reasonably strong basis for the Fodor/

Pylyshyn claim that visual perception is akin to telling by looking. Telling by looking can be regarded as the pickup of information by looking. The revised issue is whether or not Gibsonians are committed to saying any instance of the pick up of information by looking is based on the detection of the appropriate invariant. If not, how does Gibson avoid supposing that some visual perception involves cognitive processing after all? If so, then is not Gibson committed to the assumption of invariants in fairly unrealistic cases? The latter horn of this dilemma yields a kind of trivialization: although one is not postulating the existence of a particular invariant (as Fodor and Pylyshyn do with their "pseudo-invariants", "being a shoe", etc. ...), one still assumes the existence of some invariant or other for any example of information pickup by looking.

An enormous number of instances of epistemic, visual perception (for this exposition, "seeing X as P", that may involve the visual system either as a mere partial determinant or not at all. Consider the statement "Daniel Ortega sees the possibility of a liberal President as a chance to normalize relations between the U.S. and Nicaragua". This statement refers to some non-perceptual judgement of Ortega's and does not make any use of the visual system at all. There are other cases, such as (from Fodor and Pylyshyn) Berenson seeing a painting as an authentic DaVinci or a meteorologist seeing black clouds over the ocean as an approaching hurricane, which requires some form of expert knowledge, not generally possessed and perhaps not even learnable by human perceivers, in addition to the normal functioning of the visual system, for the pickup of certain information. One should think that cases such as these, cases in which the visual system only partially determines the information which is acquired, would not be considered to be instances of direct pickup. Yet,

expert perceptions of meteorologists or art connoisseurs, of which the perception of genuine DaVinci's or of approaching hurricanes are examples, are sometimes a mere matter of telling by looking. If one assumes that any information pickup by looking is the mere product of invariant-detection, it would seem that one must suppose that such perceptions are cases of direct pickup, that there are invariants to specify genuine Da Vinci's and the like.

Examples of seeing X as P which do not involve the visual system at all (that is, where "sees" is being used in the sense of "understands", or "thinks of", for example) of course pose no problem here. If seeing X as P does not involve the visual system at all, it could hardly be described as an instance of telling by looking. Cases in which the visual system is a partial determinant are the difficult ones.

The environment is full of customary signs in virtue of which perceivers move from the contents of their field of view, from that which is manifestly before their eyes to information which goes well beyond this. When this occurs unthinkingly, as it so often does, it constitutes a case of telling by looking - but it is one in which the pickup of information is not exclusively determined by the visual system. For example, Will may see that Abner is finally planting his corn, when all there is for Will to look at is Abner leaning on a fence post next to a freshly furrowed field, bag of seed in one hand, cigarette in the other. Abner actually putting seed in the ground is not before Will's eyes but the contents of his field of view is such that, without any conscious computations, Will picks up the information that Abner is in the midst of doing his planting. Even though Will undergoes no conscious process to get this information, it would surely be correct to assume there are some kinds of mental

processing involved. This is why it would be a trivialization of a notion of "direct pickup" or "invariant" to suppose that, because Will picks up the information he does, there must be some invariant specifying "man planting" that Will's visual system detects this when he looks at Abner resting against a fence post.

It sometimes seems that Gibson and his followers are content to accept the interpretation that any instance of the pickup of information by looking is to be explained simply in terms of invariant-detection. They have occasion to express the expectation of the specification by invariants of environmental phenomena which must appear to non-Gibsonians to be most unpromising candidates. Michaels and Carello, for instance, speculate on the possibility of "very high-level" invariants for aesthetic qualities.<sup>9</sup> It is important to understand such indiscretions, however, as speculation, fueled partly by the enthusiasm that is often characteristic of a relatively new theoretical approach.

A most interesting case can also be made for suggesting that Gibson is not committed to the view that any case of information pickup by looking requires only the detection of the relevant invariant. Although all epistemic perception, according to the Gibsonian theory, is the pickup of information, the reverse need not obtain. Hence, not all cases of information pickup need be regarded as merely perception, and, in particular, not every instance of information pickup by looking need be considered as merely the functioning of the visual system. Some information picked up by looking, in other words, may not be visual perception, even though the visual system is a partial determinant.

The basic claim here is that only some information pickup by looking is the result solely of the detection of some invariant by an organism's

perceptual system. On a Fodor and Pylyshyn interpretation of the ecological approach, this claim would raise two problems for Gibson. First, he would need to supply the principle(s) differentiating between information that is directly picked up and information which is not directly picked up. Second, he would have to grant that such information as is not directly picked up involves cognitive processing. The implication of the first point would be that Gibson lacks a coherent principle of differentiation, the implication of the second that he would have to concede some instances of perceiving involve mental processing after all.

The answer to the first problem begins with the assertion that that which is directly picked up is that which invariant properties specify. This assertion, which Fodor and Pylyshyn would no doubt find inadequate, avoids being circular or otherwise inherently defective because of a point mentioned previously. The question of what invariant properties there are is an empirical one. It is a question that is presumably to be answered through the study of natural perspective (with Gibson's emendations). If the existence of invariants is only scientifically determinable, then so too must be that which is specified by invariants and hence that which is directly picked up. Thus there is a general constraining principle: that which is directly picked is that which is specified by invariants. There is also a suggested method for determining particular instances that explains why one cannot merely list by reflecting or introspecting the information about the environment that can be directly picked up: the determination of particular invariants and what they specify rests upon mutual testing of perceptual and behavioral responses of various organisms and testing for invariant properties in structured energy.

The availability of this move can be missed for a couple of reasons.

The main one is that Gibson does have, as part of his theory, very strong views on the terms in which the world is perceived. Affordance-perception will prove to be basic according to Gibsonian doctrine. This is the "new theory about what there is to be perceived".<sup>10</sup> A key reason for the inclusion of a view about the terms of perception is that Gibson believes perceptual theory should take account of evolution. Hence, it is a fairly natural move for him to claim that the main categories of perception for an organism are linked to its needs and abilities in relation to its environment.

Now the idea of perception being invariant-based makes some environmental properties better candidates as possible objects of direct perception than others. In particular, properties that can be linked to a more or less restricted range of physical parameters are the only ones which hold the promise of proving to be associated with given persisting ratios and relations in the optic array. Because affordances are dispositional properties objects possess relative to specific abilities and needs of organisms, they are just such properties. It could have helped Gibson's case if he had mentioned this point but he unfortunately does not.

Some examples of these "best case" properties would be "enclosure", "supporting surface", "opening", and "cliff". In order for things in one's environment to be a place one can pass through or a place one can fall from, they have to meet some physical requirements. Where these requirements are sufficiently specific (some additional limiting principles will be mentioned later), there is initial plausibility in the suggestion that all things having the affordance share some common invariant. Sameness in some tangible respect, constancy of size, pigmentation, or texture are also relatively plausible candidates because it is not too difficult to imagine

how optical invariants might specify these. The predominance of properties characterizing the environment in terms of utility (in functional terms) among the properties which are initially plausible candidates for specification may help to render the Gibsonian move to "affordance-perception" more understandable .

To reiterate, in order for something to be an affordance for an organism with a given physical constitution depends on its meeting certain physical specifications. Everything of the affordance's kind will therefore share this feature. Because there is some common, general feature amongst things which afford a certain kind of behavior for the organism in question, there is something which could explain why they are all related to the same optical structure.

Since there are best cases, there are also worse and worst ones -- properties picking out sets of objects for which it is virtually impossible to imagine there being some associated invariant. Many object names fall into this category. Hence one could imagine a Gibsonian saying that "being a shoe" is not an ecologically coherent category, meaning only that the extension of that property constitutes so loose and eclectic a collection of items it is unlikely in the extreme that there should be an invariant specific to "being a shoe".<sup>11</sup> To adapt a point of Wittgenstein's,<sup>12</sup> there need be no further significance to a thing's having the property of being P than that it is called a "P". Where this is most likely the case, it is most unlikely that the set of phenomena should be specified by some invariant structure.

To repeat, the supposition that only some information pickup by looking is just the result of the detection of some invariant (and hence constitutes direct pickup) raises two (related) questions. The first, as



discussed, is the issue of the principle of differentiation between information pickup by looking which is direct and that which is not. Only information that is in fact specified by an invariant property can be directly picked up. The second issue is that of how Gibson can avoid admitting some perception must involve cognitive processing since some information pickup by looking is not merely the result of invariant-detection.

Fodor and Pylyshyn clearly would think Gibson could not find a way around this problem. In considering how direct pickup might be constrained, the authors suggest stronger and weaker forms of the ecological approach's basic thesis. The stronger corresponds to the claim that all information pickup by looking is direct pickup. The weaker would correspond to the claim that only some information pickup by looking is direct pickup.

Fodor and Pylyshyn write:

In short, the weak version of Gibson's claim is that there are some visual properties of the layout which are, to a first approximation, causally necessary and sufficient for properties of the light, which latter properties are themselves directly picked up. Our point has been that the Establishment theories say that too; in particular, the Establishment theories provide precisely that account<sup>13</sup> in the case of the sensory properties of the layout ...

Translating out of Fodor/Pylyshyn terms, this passage has Gibson's "weaker claim" as being that only some features of the environment (properties of the layout), whose presence can be determined by looking, are specified by invariant properties in the optic array. Thus only some environmental features are directly picked up. Fodor's and Pylyshyn's contention is that this weak, Gibsonian view amounts to a version of the Establishment approach, at least with respect to the role of cognitive processing in perception. In short, the criticism would be that Gibson simply claim that only some information pickup by looking is direct pickup

without caving in to the Establishment.

Gibson does have a way of avoiding the envisaged problem, however, without saying that all information an organism picks up by looking is directly picked up. He can do this by distinguishing between information pickup by looking and visual perception (or visual information pickup: it is convenient for my purposes to use this expression as equivalent to visual perception, rather than as an equivalent of information pickup by looking). The next move is to say that only cases in which there can be direct pickup of information by looking can there be visual perception. There can only be direct pickup of information by looking when there is some invariant specific to the environmental feature. Awareness of the environmental phenomenon constitutes the instance of information pickup in question.

Gibson is committed to the claim that all visual perception is direct pickup but this can be shown not to be the strong claim it appears to be. Fodor and Pylyshyn, because they fail to see how direct pickup can be constrained in terms of what (in fact) invariants specify, take it that anything about the environment that can be found out by looking is perceptible. Perhaps they side here with some notion of common usage: that which is perceptible is that which is commonly (colloquially) said to be perceptible. If this were Gibson's criteria for deciding what is perceptible, then "all perception is direct perception" would be the strong claim Fodor and Pylyshyn imagine. However, Gibson's criterion is that the features of the environment which are perceptible are those, and only those for which there are in fact invariant properties. This may be regarded as a recommendation for a (strict) usage of "Perceives". In spite of ordinary usage, only that which is directly picked up can be said to be

perceived and only that which is specified by an invariant is perceptible (a matter to be settled by empirical investigation). Gibson's view is not, as Fodor and Pylyshyn perhaps think, that for everything one can ordinarily be said to perceive, or for everything one can find out by looking, there will prove to be some associated invariant. Hence the ecological approach avoids an absurdly strong reading of the kind Fodor and Pylyshyn suggest, without caving in to the Establishment by saying that some visual perception is direct, some not.

One can make use here of the earlier point that some cases of information pickup by looking, including ones which would sometimes be referred to as "seeing X as P", are only partially determined by the use of a perceptual system. The distinction between the involvement of the visual system as partial and as exclusive determinant could be used as the basis of a distinction between those instances called "seeing X as P" which constitute "genuine" perception, so to speak, and those instances which constitute degenerate cases. Perceiving X as P is a genuine perceptual achievement if and only if an organism is perceptually aware of the very environmental feature, X's being P. This can obtain only when there is an invariant which specifies phenomena of the kind to which X's being P belongs. Degenerate cases are those in which one is perceptually aware of something else, such as X's being Q, from which awareness of X's being P is derived by some cognitive process.

Because the ecological approach is concerned with perception as such, a notion that produces semantic opacity, that an organism perceives X as P is no guarantee that, even when "P" and "Q" are co-designative, it therefore perceives X as Q. Moreover, the relation between X's being P and X's being Q may vary. X's being P may be necessary and sufficient for it to be Q in

some cases. In others, X's being Q may be no more than some reliable or typical indicator. The epistemological distance in the association between X's being P and its being Q can vary immensely. Hence, some cases of being aware of X as P by being perceptually aware of X as Q will involve deliberate inference/computations, making use of fairly extensive specialized knowledge and training. In other cases, the move will be natural and more or less automatic. The degenerate instances are not to be distinguished from the genuine on the basis of what information the theorist feels he obtains automatically versus that which requires cognitive effort. If appropriate empirical testing shows subjects' awareness of X as P can only be the result of the detection of an invariant specific (for instance) to phenomena of X's being Q's kind, then an organism can only be said to perceive X as P in some degenerate sense. In the proper, or strict sense of "perceives", the ecological theorist should regard this kind of "perception" of X as P as an intellectual, rather than a perceptual, achievement.

TSRM contend, contrary to Fodor and Pylyshyn, that the only "gambit" Gibson requires is the gambit of direct perception.<sup>14</sup> They further claim that it is the Establishment who insufficiently constrain their key notion of perceiving.<sup>15</sup> The charges may initially appear to be a mere case of academic bravado but in light of the discussion of how Gibson constrains the perceptible, TSRM's counterclaims may be understood. First, the gambit of "direct perception" is just the idea that only the information picked up by the mere detection of an invariant counts as a genuine case of perception. Second, TSRM are suggesting that the Establishment, represented by Fodor and Pylyshyn, offer no workable criteria of their own for distinguishing between the perceptible and the non-perceptible. The basis

of this criticism would be that Fodor and Pylyshyn consider what TSRM would regard as degenerate instances of perception to be genuine ones. The particular example which comes to mind is that of the perception of paintings as "authentic DaVincis". The general complaint could be that while traditional approaches acknowledge that some instances described as perceiving are not exclusively determined by the operation of a perceptual system, they have no agreed-upon, satisfactory account of the distinction between such instances and those which are exclusively determined by the functioning of a perceptual system.

There is a possible irony in this understanding of the ecological approach. Fodor and Pylyshyn call object recognition a "perceptual process par excellence",<sup>16</sup> with perception of shoes (as such) being a perfectly good, typical example of it. However, if the criterion for determining the limits and categories of the perceptible is that for which there are associated invariants, Fodor and Pylyshyn's example of a perceptual process par excellence may well turn out to be an intellectual achievement, not a perceptual one.

The prospect of discovering that which is genuinely perceptible via experimentation raises an important problem as well. This interpretation of Gibson clearly carries a recommendation for altering the use of "perceives", not in ordinary language but at least in theoretical communities. It is a recommended change of usage in the sense of suggesting a criterion of differentiation that stands an extremely good chance of doing violence to conventional views of which environmental phenomena are genuinely perceptible and which are not. Embedded in a recommendation of the envisaged kind are promises to the effect that acceptance of it will yield some significant benefit, that it will do more good than harm. One of Gibson's

specific promises is that counting only invariant-based perception as genuine will not too severely limit the class of environmental phenomena which actually turn out to be perceptible. As Ulric Neisser notes, the "crucial invariants have not yet been isolated", and that "the claim that they exist is the largest outstanding promissory note in ecological optics".<sup>17</sup>

Another promise is that the invariants that will turn up will be sufficient to explain the evolutionary success of organisms and their behavior. Gibson's main complaints against the Establishment is that their theories pay insufficient regard to ecology and evolutionary theory.<sup>18</sup> This is supposed to result in theories which cannot explain adequately how perception results in organisms having any knowledge about their environment at all. There must therefore turn out to be invariants sufficient to explain the origins of the knowledge various organisms evidently possess about their environments. Also, given the concern for evolution and the ecological, there is a promise that invariants will produce ecologically useful information for organisms. There is a promise that they will specify the environment in terms of its needs, abilities and vulnerabilities. This point about ecological concern is another part of the explanation for Gibson's interest in affordance-perception). The ecological approach will ultimately stand or fall based on its ability to show that there is an abundance of invariants that specify the environment in useful terms to various organisms.

(ii)

To summarize, Gibson's notion of that which may count as the direct pickup of information is constrained. Any instance of perception is one of direct pickup of information. Direct pickup must be the mere result of

the detection of the relevant invariant property by an organism's perceptual system.

It is very much worth keeping in mind, however, that this constraining principle says nothing at all about what is specifically entailed by the process of "direct pickup", or, alternatively, that which constitutes the mere detection of an invariant. As matters were left at the end of chapter two, the relation between information about the environment and invariant properties of the optic array was vague. As a result, it is not clear what must obtain in order for an organism to get from the detection of invariant structure in the array by its visual system to the pickup of some information (awareness of some feature of the environment as such).

Fodor and Pylyshyn are among a number of critics who have raised questions in this area. The general suggestion is that Gibson's theory is in some sense incomplete, or that it leaves a "gap".<sup>19</sup> On the Fodor/Pylyshyn version, it is claimed that information about the environment is literally in light only in the sense that informative properties (that is, invariants) are in light. Informative properties, in other words, are simply structural features of light. They write:

So, for example, the frequency of the light can cause a state of a detector, and the frequency of the light can be defacto informative about the color of reflecting surfaces in virtue of a correlation that holds between frequency and color. But the fact that the frequency of the light is correlated with the color of reflecting surfaces cannot itself cause a state of a detector, and appeal to that fact exhausts Gibson's construal of the notion that the light contains information about the color of surfaces. So we are back to the old problem: how (by what mental processes) does the organism get from the detection of an informative property of the medium to the perception of a correlated property of the environment? <sup>20</sup>

Fodor and Pylyshyn's claim is that no alternative to "perceptual inference", as they call it, has yet been suggested.

This apparent gap in Gibson's theory, as the authors go on to explain it, consists in the absence of an account of the intentionality in (epistemic) perception. This issue quite rightly takes up the bulk of TSRM's reply to Fodor and Pylyshyn. They argue that Gibson's "theory of specification" provides the basis for a new theory of intentionality. In remaining chapters, I will consider TSRM's attempt to defend the ecological approach, arguing that this defense is not successful. Their discussion nevertheless suggests a way of understanding the Gibsonian approach which shows it can accomodate some account of intentionality. This will involve construing Gibson as what might be called a "perceptual behaviorist". I use this title to describe theorists who analyze the perceptual awareness of organisms in terms the acquisition of behavior-states. Two general forms, the more sophisticated of which might more properly be considered a variety of functionalism, will be described in Chapter six.



## Chapter Four

As I noted at the end of last chapter, Fodor and Pylyshyn are among a group of critics who suggest that Gibson's account of perception does not explain something important. Different attempts have been made to make it clear what is supposed to be missing, but none of these have found much sympathy from Gibson's followers. Fodor and Pylyshyn initially explain the gap they feel as the lack of an explanation of "how an organism gets from the detection of an informative property of the medium" to the perceptual pickup of information about the environment. They later develop their criticism of Gibson as the claim that he has no "theory of intentionality", or no account of the intentional component in epistemic perception:

Everybody has to face the issue about intentionality somewhere. For Gibson, push comes to shove with the question: What is it for an event (a configuration of the light, etc.) to specify a property? To say that Gibson has no theory of intentionality is to say that he has no answer to that question. Or, to put it the other way around, the failure of Gibson's theory of specification is no minor flaw in his theory. It marks the precise point at which Gibson's treatment of intentionality proves to be bankrupt.<sup>1</sup>

D.W. Hamlyn expresses essentially the same concern by writing:

... when an object in a given context affects a perceptual system in such a way that information is derived about it because of the structure of stimulation, the perceiver is enabled to see the object in a certain way, as a such and such. It is impossible for something to see something as X unless it has some idea of what it is for something to be an X. To say this is to say that it must have in some way, and to some extent, the concept of X. Thus to speak of it as obtaining information is not in<sub>2</sub> fact to rule out as unnecessary any reference to concept.<sup>2</sup>

The point which Fodor and Pylyshyn make and which Hamlyn makes is roughly the same. There are only two differences. First, Fodor and

Pylyshyn refer to representations where Hamlyn refers to concepts. Second, Fodor and Pylyshyn are slightly more conciliatory than Hamlyn. Hamlyn appears to suggest that the ecological approach simply cannot do without concepts/representations. Fodor and Pylyshyn argue only that the Gibsonians have in fact given no alternative means of accounting for the intentional component. They leave open the possibility that the ecological approach could come up with some alternative.

To repeat, the underlying theme in both Hamlyn's and Fodor and Pylyshyn's remarks is the same. If Gibson were merely taking account of the extensional concept of simple perception, his view would be in no difficulty over the intentionality issue. The ecological theory is in principle a perfectly adequate explanation of the extensional notion of how perceptual systems detect structure in the ambient array, for instance. The perceptual pickup of information, which is perceptual awareness of environmental features as such is clearly an intentional notion. One way to put this is that perception of X as P requires something to mean "P" to the perceiver. The alleged gap in Gibson's theory may now be thus explained: the ecological approach explains the detection of an invariant property by an organism's perceptual system, but not how a case of detection manages to mean anything to the perceiving organism.

The substantial reply given by TSRM to Fodor and Pylyshyn's critique of the ecological approach consists predominantly of an attempt by the authors to clarify Gibson's view so as to illustrate why it is not susceptible to the "gap" problem. A considerable amount of philosophical machinery is brought to bear on this issue by the four Gibsonians, but there are essentially two notions upon which their re-explanation of Gibson's view rests. These are "natural kinds for animals" and "natural

law". I will argue that the philosophical terms and theories which are meant to ground TSRM's explanation, however, do little or no work because they are misapplied or the authors hold other points inconsistent with them. The theories to which TSRM appeal are Hilary Putnam's theory of natural kinds<sup>3</sup> and Fred I. Dretske's theory of natural laws.<sup>4</sup>

Because the appeal to these two theories is not the kind of thing TSRM need to explain how information can be picked up by mere invariant detection, they fail to explain how the ecological approach avoids the "gap" problem. However, it is possible to interpret Gibson as avoiding this problem by accounting for that which the detection of an invariant means to an organism in terms of behavior states of some sort. Such an understanding of the ecological approach is suggested, perhaps only unintentionally, by parts of TSRM's discussion.

Fodor and Pylyshyn suppose that perception of X as P has an intentional component that needs explaining. They give this explanation in terms of a perceiving organism's relation to a (mental) representation of X's being P ("concept of", "intension", or "meaning" could all be substituted for "representation of" as it is used here), suggesting that any perceptual theory needs to subscribe to this view of intentionality, or to another that does the same work. So, for example, an organism's perception of X as P would require the detection of the appropriate corresponding invariant which, though cognitive processes of certain sorts, eventuates a representation of X's being P (in some sense, the apprehension by the organism of the intension that X (something) is P). The alternative which seems to be open to the ecological theorists, which is by no means novel, is to make a reductionist move: that the detection of some invariant means "X is P" to an organism is to say only that its detection produces certain sorts of

behavior, or behavior-producing states in the organism. As I will later suggest, the ecological approach to perception is very like D.M. Armstrong's so-called "Belief-theory" (where "belief" is analyzed as "states apt for the production of certain sorts of behavior"). Further detail of this will be given after an evaluation of TSRM's own attempt to avoid the gap.

(ii)

To begin, there are some troubling points about the logic of portions of TSRM's commentary. Part of this is attributable to a less than adequate grasp of terms as they would typically appear in philosophical discussion. Their difficulties are also attributable to TSRM's failure to appreciate the implication of statements they make. The latter is evident in a criticism directed at Fodor and Pylyshyn, for example.

TSRM spend a considerable length of time criticizing what they refer to as Fodor and Pylyshyn's "argument from the philosophy of science". Since this is a title of TSRM's choosing, and since there is no specific reference given for the Fodor and Pylyshyn article, it is not clear what TSRM take the argument from the philosophy of science to be. What the argument may be, TSRM's criticism is that it is based on notions which are too controversial:

It is painfully obvious ... that no substantive argument can be built from the notions of kinds, projectibles, laws, and counterfactuals given the current state of the art. In the philosophy of science these notions are notoriously opaque and notoriously uneven in their usage and are commonly recognized as such without undue embarrassment ... insofar as Fodor and Pylyshyn have chosen to ground their argument in the philosophy of science, we feel it incumbent upon us to show that that foundation is porous - lest the philosophical wool be pulled over the eyes of the non-philosopher.<sup>5</sup>

This criticism is a hopelessly general one of a kind that TSRM cannot afford to make. There is nothing wrong with making use of notions, when theorizing in one area of philosophy, that are still subject to

debate in other areas: TSRM ought to show specifically how the contentiousness of a given term actually bears on Fodor and Pylyshyn's criticisms of Gibson. At best, they show only that some equivocation may be occurring in Fodor's and Pylyshyn's use of "law", and of "natural kinds". These points are unconvincing and are not developed.

The incredible part about TSRM's argument is that their own defence of the ecological approach and their objections to the Establishment are based on some of the very notions which they claim provide too porous a foundation for "substantive argument". Additionally, Shaw, Turvey and Mace have elsewhere attacked traditional views and defended their own in terms of the notion of a proposition and of a possible world.<sup>6</sup> These two ideas are subject to no small amount of controversy in their own right. If Fodor and Pylyshyn must be discounted for their use of concepts whose meaning and the nature of whose referents is not at all decided, then so too should be TSRM. In the interest of avoiding closure of this, and most other philosophical discussion, the kind of general complaint TSRM make ought to be dropped.

(iii)

Anyone whose background is predominantly in philosophy (perhaps non-ecological psychology as well) is bound to be somewhat confounded by the language found in TSRM's article. There are some words, "property", "intension", "extension", and "natural kind" being chief instances, which often find a place in philosophical discussions and are also employed by TSRM. Their use of these words are of course the subject of some controversy. Nevertheless, there are accepted general usages for each, however rough. In places, it is not clear at all that TSRM are following any general practice, but are instead usurping it by employing reasonably familiar terms in ways that merely suit the author's purposes. Also, in

at least one instance TSRM are flatly mistaken in their employment of one of these notions.

Before proceeding, it is necessary, for purposes of subsequent discussion, to briefly describe a study mentioned in TSRM's article. The study in question concerns the visual perception of plant stems by marsh periwinkles. TSRM are fond of referring to it as an illustrative example for various points they make.

The marsh periwinkle is a small snail found only in upper intertidal zones containing vegetation. For the most part, the periwinkle's activities consists of making its way, on the ground, amongst and around the plant stems inhabiting its habitat. When the tide advances, however, the snail climbs the plant stems to avoid water-bound predators. In a well-controlled study, Paul V. Hamilton finds convincing evidence to suggest that the periwinkle's ability to locate plant-stems is visually controlled:

Snails released on the substrate amid plant stems, just prior to the release area being inundated by the advancing tide, moved in a relatively straight path and usually (67%) ascended the closest plant stem. The propensity of these snails to ascend the closest stem was shown not to result from collisions resulting from snails travelling a straight path in a random direction. Field experiments involving transparent and black rods of equal size showed a significant tendency for snails to move toward black rods.

The high percentage of instances in which the periwinkle selects the nearest plant stem suggests a non-random process of orientation. The high proportion, in the subsequent field study, of selections of black rods (forty-four black, six transparent, with ten snails reaching the perimeter of the plexiglass arena in which the rods were placed, out of sixty trials) suggest that it is vision which guides the periwinkle.

TSRM refer to this study as suggesting that when the periwinkle

selects and climbs a plant stem, it is visually perceiving something as climb-upable. When it moves around the stems (when the tide is not advancing), it visually perceives them as a barrier. Hamilton himself does not speculate on the specific content of the snail's perception of its environment. In particular, he makes no mention of perception of barriers. This causes no special problems for TSRM but it should be made clear that Hamilton's study, which TSRM do not describe, receives a certain amount of embellishment in order to serve the ecological theorists' purposes.

One use to which the authors put the marsh periwinkle example is in an objection to the Establishment approach to perception. TSRM claim that the Establishment has no coherent explanation of why the periwinkles climb plant stems in one instance and avoid them in others. They claim this is because Establishment views take an "extensional" view of perceiving (such that if one perceives some property, one perceives anything coextensive with it). Why this is supposed to be a feature of traditional approaches generally is not clear. In the marsh periwinkle situation, the idea is that, in the intertidal zone in which the snail is found, climb-upable things and impassable things (barriers) happen to be co-extensive. TSRM assume, because the Establishment view allows the substitution of co-extensive terms (apparently the authors mean in general), a marsh periwinkle always perceives "climb-upability" and "impassibility" together. That is, its perception of things in its environment is indifferent between perception of things as climb-upable and perception of them as barriers.

The first mistake TSRM make is in their understanding of coextensionality. They write:

Let us say that for a thing to be a barrier it must have the properties  $p, q, r$ . That is,  $(p, q, r)$  is the intension  $b$  of "barrier". And let us say that for a thing to be a climb-upable thing it must have the properties  $s, t, u, v$ . That is,  $(s, t, u, v)$  is the intension  $c$  of "climbable". The extension of  $b$  (in the intertidal zone) is the plant stems and other snails. The extension of  $c$  (in the intertidal zone) is the plant stems (other snails being unwilling and too short to comply). Thus  $c$  is coextensive with  $b$ .<sup>8</sup>

The same idea is repeated a little later in a table which purports to make the "Establishment analysis" of the marsh periwinkle case explicit.<sup>9</sup> The intent is to show that, on traditional views, the inputs to the snail's visual system is not specific to "climb-upable" and "barrier". The ecological theorists conclude that the snail's ability to climb plant stems sometimes and avoid them at other times can only be explained by the Establishment by attributing inappropriately sophisticated cognitive processes to the periwinkle.

First, it is fairly obvious that "climb-upability" and "barrier" are not coextensional: TSRM's example contains a mistake. The extension of  $c$  in the intertidal zone, since it is comprised only of plant stems is included in the extension of  $b$ , comprised as it is of both plant stems and other snails, just as the class of spouses includes but is not coextensive with the class of husbands. If TSRM have some valid point to make against the Establishment, the example could, of course, be altered. However, that TSRM should make such a mistake over the relatively simple notion of coextensionality, while using it to make a point they clearly regard as important, is rather a blow to the authors' credibility. One cannot help but be a little suspicious of TSRM's understanding of the other, more difficult philosophical concepts that they employ.

In addition, the criticism TSRM are attempting to make carries little weight. The universal principle of substitutivity of coextensive terms



that the authors attribute to the Establishment is far too strong. Virtually any philosopher who has thought about questions of substitution recognizes the existence of some opaque contexts in which coextensive terms may not be substituted. One of the more common of these contexts, and it is one which Fodor and Pylyshyn explicitly recognize, is that of epistemic perception. Therefore, if a blanket principle of substitutivity of co-extensive terms is taken by TSRM to be some essential tenet of the Establishment position, they are objecting to a straw man, to a theory to which few, if any, would be committed.

Another difficulty arising in TSRM's article is the manner in which the authors jumble together the terms "property" (and "parameter") and "intension". For example, they write that "... the intimation is that a law relates intensions (properties and magnitudes) rather than extensions (domains of propertyless individuals) ...",<sup>10</sup> and also that "the predilection for extensionalism is sustained, one is told, by the failure to provide a criterion by which two properties, two intensions, can be judged the same".<sup>11</sup>

There are legitimate and illegitimate ways of using "intension" as an alternate for "property". It is legitimate to equate the two terms when "property" is taken in the abstract or universal sense, as that which is instantiated by some set of individuals. Another way of defining an abstract property (to use an example of Fodor and Pylyshyn's) is as that which is expressed by an open sentence, such as "is a shoe". An intension can be very generally understood as that which is expressed by a given form of words. It could thus be considered a property in the general sense whenever the form of words expressing it is an open sentence.

However, the term "property" is sometimes also used in a non-general

sense of property-instances or, put another way, as particulars that possess. Properties as particulars cannot sensibly be identified with intensions. Yet, this is what TSRM must do since, in spite of using "property" and "intension" interchangeably, they deny the existence of abstract, universal properties, saying there are only "propertied things". This denial of TSRM's will come up again in connection with their endorsement of Dretske.

The absence of a proper distinction between different notions of "property" seems to lead TSRM to attribute the view that the world only contains bare, or "propertyless" individuals to Establishment theorists. According to TSRM, traditional views consider the intension ("c") of "climb-upability" to be a mental representation or concept. This is at least true of Fodor and Pylyshyn. Since TSRM also equate properties (in any sense) with intensions, they conclude that the traditional approach must consider properties to be mental representations. TSRM would then proceed to argue that these internal representations are attributed to the environment and are not features, hence not perceptible features, of it. Therefore, the Establishment is committed to the notion that only bare, propertyless individuals are perceived. This is a very strange claim given that there is an abundance of examples of traditional perceptual theories on which properties are not only perceptible, but serve as the basis of perception.

In defense of the Establishment, two points ought to be kept in mind. First, there are two different notions of perception: simple and epistemic. Second, acceptance of universal properties does not automatically preclude the postulation of some particularistic sense of "property" (as instances or as instantiations of the universal, for example) as well.

Now in the simple sense of "perceives", anyone, whether he is an ecological theorist or not, who allows that there are properties as particulars may grant that organisms (simple) perceive properties. The theorist may do so independently of whether or not he additionally believes there are properties in some general sense. The simple sense of "perceives", however, is not the sense which should be of concern to TSRM. On the other hand, in the epistemic sense of "perceives" (which is intentional, unlike the simple sense), organisms are not related to particular instances of properties anyway. To perceive something as climb-upable is to recognize a particular thing as being of a kind, so the relation is between a perceiving organism and the general property of "climb-upability". Essentially, TSRM need to be much more clear on their conception of properties. They need to develop a better understanding of what can be sensibly claimed about properties as particulars (they are not intensions and they reside in the environment) and what can sensibly claimed about universal properties (they are intensions and they do not reside in the environment).

(iv)

Because TSRM confuse two different notions of "property" and take the misleading result to be interchangeable with "intension", they tend to shift between talk about simple perception of properties and talk about epistemic perception of things as having some property. One reasonably clear example of the difficulties that can arise occurs when TSRM favourably refer to an argument of Gibson's about affordances. Gibson reasons:

... if there is information in light for the perception of surfaces, is there information the perception of what they afford? Perhaps the composition and layout of surfaces constitutes what they afford. If so, to perceive them is to perceive what they afford.<sup>13</sup>

Gibson goes on to claim that this is a "radical hypothesis" according to which values or meanings are directly perceived.

There are a couple of separate issues raised by this passage. First, Gibson's reasoning in the conclusion of the foregoing passage, to perceive the composition and layout of surfaces of things is to perceive what they afford, requires a notion of "perceives" that allows truth-preserving substitution. Only the simple sense allows this, and it does so because it is an extensional sense of the term. Perceptual information pickup is intentional. It does not admit of the requisite kind of substitution. Moreover, TSRM explicitly assert that the ecological approach does not want substitution of coextensive terms in perception contexts. With regard to Gibson's overall theory, this argument therefore relies on an equivocation of which TSRM are also guilty because they endorse the Gibsonian argument.

In addition to the slippage in uses of "perceives", there is a second sort of equivocation in TSRM's article about which one must be careful. It sometimes appears as though TSRM are taking affordances themselves (which are dispositional properties) to be objects of perception, instead of taking the (actual) things having the affordance to be the object. Taking affordances to be "possibilities for action", they write:

... the ecological approach, with its commitment to realism..., focuses on real possibility; for it takes possibility to be an ontological category ... Possibilities for action or, more precisely, things with possibilities for action, are among the kinds of things that populate an animal's niche and are, therefore, things to be seen or heard or smelt etc.<sup>14</sup>

This move between "possibilities for action" and "things with possibilities" is no indifferent matter. The claim that some non-occurrent property, the possibility of being climbed, is itself simply perceived is rather different from the claim that things having the possibility are perceived (and in such a way that the organism may thereby be said to

perceive the object as having the property in question). The assertion that a marsh periwinkle perceives (the intension of) "climb-upability" is a quite misleading way of saying that it perceives some environmental thing (a stem) having the affordance as a climb-upable thing. The slide between these two claims, which is no doubt encouraged by the confusion of "property", in the sense of some kind of particular, and "intension", should be avoided. One is owed some explanation of how the detection of an optical (or other) invariant associated with things which are climb-upable for the snail in the intertidal zone manages to mean "climb-upable thing" to a periwinkle. It would be easy to lose sight of this fact if the ecological theorists are permitted to talk too freely as though the meaning (intension) of "climb-upability" was itself simply perceived.

This second issue raised by Gibson's argument is basically the issue of what sense is to be made of the assertion that (actual) composition and layout constitute (dispositional) affordances. There are two distinguishable concerns. One is how this claim may be turned into a reasonable view about affordances (qua dispositional properties). The second, which will mainly be dealt with in the next chapter, is how this view explains how things having particular affordances are perceptible as such.

TSRM's view of how environmental substances and layout of surfaces could be understood as constituting affordances amounts to a fairly standard sort of modal realism. Even though this interpretation makes Gibson's use of "constitutes" a very queer one, TSRM's view fits very well with Gibson's discussion. TSRM's view of affordances is that the affordances that things possess they possess in virtue of their actual manifest (occurrent) structure. In short, the non-occurrent properties a thing holds are grounded in its occurrent properties. It has been pointed out

to me<sup>15</sup> that this principle may not be universally true, that it may not hold for subatomic particles. It does, however, work at the macroscopic level, and since the ecological approach is confined to considering the physical world at the environmental level, it will not matter that the principle is not generalizable to include basic, physical particles.

A neutral, physical example that TSRM use to indicate what they mean by saying that dispositions (there is no relevant distinction to be made here between "disposition", "affordance", and "possibility") are grounded in the occurrent is that of the solubility of salt. Salt has the property of solubility because it is comprised of lattices of ions, bonded by electrical attractions, the values of which are substantially reduced by the high dielectric constraints of certain liquids. TSRM's account of affordances is along the very same lines:

A climb-upable thing must possess a certain rigidity, a certain surface area, a certain height, a certain textual quality, etc., to support the climbing of the snail and the snail must be of a certain mass, its mucous of a certain viscosity, its ventral surface of a certain flexibility, etc., to effect the climbing.<sup>16</sup>

A stem's being climb-upable for the snail, in other words, consists in it having the appropriate occurrent physical dimensions. There is only one complication in the notion of affordances grounded in occurrent properties over the explanation TSRM give of dispositional properties in general. This is that the common, physical structure among members of the affordance must somehow also produce an invariant specific to it in order for the affordance to be perceived as such.

(v)

Affordances constitute what TSRM call natural kinds for animals. The notion itself fairly straightforwardly serves to further restrict the classes of environmental phenomena which must be considered as specific to

be a given invariant, as I will explain a little later. It is likely to produce a certain amount of perplexity, however, because the use of "natural kind" by TSRM is an atypical one. Moreover, the authors claim several times to be using the term in accordance with the views of Hilary Putnam when it is neither clear what they take to be Putnam's use of "natural kind" nor that what Putnam in particular says is relevant to their case.

As is far too common in the TSRM article, there is no proper reference to indicate what is said by Putnam with which the authors find agreement. The only concrete attribution to Putnam occurs when TSRM write:

Freeing the conception of a natural kind from the requirement of inclusion in a natural law is the tack taken by Putnam (1970a, b): a natural kind term merely serves to draw commonalities among things that are superficially different; it is a scientific convenience and an intentionally temporary one at that.<sup>17</sup>

Three ideas are attributed to Putnam in this quote:

1. Natural kinds need not be included in natural laws
2. Natural kind terms only serve to draw attention to commonalities amongst the superficially dissimilar
3. Natural kind terms are "intentionally temporary"

In "Is Semantics Possible?" (TSRM's reference is "(Putnam, 1970a)").

Putnam introduces his discussion of natural kinds by writing that:

An important class, philosophically as well as linguistically, is the class of general nouns associated with natural kinds -- that is, with classes of things that we regard as of explanatory importance; classes whose normal distinguishing characteristics are "held together" or even explained by some deep-lying mechanisms. <sup>18</sup>"Gold", "lemon", "tiger", "acid" are examples of such nouns.

Some examples of "deep-lying mechanisms" are "proton donor" for acids, a particular DNA structure for tigers or lemons, atomic weight and number for chemical elements like gold.

TSRM say that on Putnam's view natural kinds are not required to be included in natural laws. There seems to be two possible interpretations of this claim. The first is that what counts as a natural kind is not determined by that about which the current scientific community have (discovered or postulated) natural laws. Since natural kinds are taken by Putnam to be classes held together by non-superficial structure (mechanisms) which scientists may or may not have discovered, this interpretation of 1) is very likely true. TSRM want to postulate natural kinds (in some sense) about which there are presently no expressed natural laws, so there is some basis for thinking the authors do mean that a kind is not a natural one in virtue of having laws postulated about it. The alternative interpretation is that there need not exist any natural laws (discovered or not) concerning a given natural kind. The kinds of deep-lying mechanisms which would make natural kinds suitable subjects for laws. Thus this second interpretation, that natural kinds need not be in fact included in natural laws, is surely not Putnam's view.

Regarding 2), TSRM seem to be mistakenly taking the existence of "superficial differences" among members of a natural kind to be some key feature of natural kinds. Perhaps the authors have not quite grasped the points which Putnam attempts to make? Putnam uses different examples<sup>19</sup> (green lemons, three-legged or non-striped tigers) in an attempt to stress the point that since members of natural kinds could be, and sometimes are observably different, it is implausible to hold that membership in natural kinds is determined by superficial, observable properties. This point is made in support of a view about the meaning of natural kind terms.<sup>20</sup> Whether or not members of the extension of a general noun do happen to be superficially dissimilar is quite irrelevant to the question of whether



that noun picks out a natural kind. The meaning of a natural kind term (and the class it picks out) therefore cannot be fixed in terms of superficial, observable similarities between things.

The attribution of 3) to Putnam may embody the very same kind of confusion. To say that the use of some term is "intentionally temporary", one must assume, means only that its meaning is subject to change. It is part of Putnam's view about natural kind terms that their meanings can change but it is not Putnam's view that changes in meaning are either a common or distinguishing characteristic of natural kind terms. Putnam says that which is conveyed by a natural kind term is its extension and an associated stereotype.<sup>21</sup> The meaning of such a word can change because, for example, scientific developments can bring about a change in the associated stereotype (and hence that which is thought to be a member of the extension). Putnam is writing in contrast to those who would hold that the meaning of a natural kind term, unlike the meanings of other general nouns, is permanently fixed.

The large puzzle, however, is why TSRM bother to refer to Putnam's particular theory at all. The positive use that is made by the ecological theorists of "natural kind" does not obviously require acceptance of the Putnam account. In fact, TSRM's use of "natural kind" may not even be the notion over which philosophers debate. Their use is of "natural kinds for animals", explained as follows:

Construed as natural kinds for animals, affordances do not require grounding in occurrent properties that satisfy the explanatory strictures of science but in occurrent properties that satisfy the pragmatic criteria of successful activity in a restricted universe of possibilities, viz., an ecological world.<sup>22</sup>

"Occurrent properties", as TSRM mean this could be taken as the same as what Putnam means by "underlying mechanism" and therefore one can

speculate that the authors have simply hit on this particular feature of Putnam's view. But what is to be made of the reference to "pragmatic criteria"? The point TSRM are attempting to make turns out to be considerably simpler than the obscure phrase would suggest.

In the phrase "natural kind for an animal", the word "natural" is given a rather different emphasis than is customary in talk about natural kinds. The affordances environments hold for perceiving organisms are grounded in the manifest structures of the furniture of the environment, as noted previously. Anything at all meeting certain physical specifications could afford certain kinds of behavior. The general class of things which could afford some particular activity, though, will almost invariably be larger than the subclass of those things that naturally or typically occur in an organism's local environment ("habitat" is a word that corresponds most nearly to TSRM's use of "environment").

So, for example, anything at all of a certain minimum height, rigidity, of a certain textual quality, and so could be climbed by a marsh periwinkle as long as it satisfies some general, mostly minimum requirements. This general class of things the snail could climb may well include objects such as pencils, plastic plant stems or swizzel sticks. As TSRM use the phrase, none of these are natural kinds for the periwinkle. Swizzel sticks and the like are not members of "climb-upable thing" because they are non-typical features of the habitat (the upper intertidal zone) in which the species resides and in which (this is an important point to the oecological theorists) it evolved. The idea TSRM therefore want is not so much that of a natural kind as that of a restricted kind: "climb-upable thing", as a perceptible category for the periwinkle, consists only of the usual constituents of its environment (a subclass of plant stems) that afford climbing for members of that species.

To clarify TSRM's conception, the periwinkle's environment is upper intertidal zones containing certain kinds of vegetation. This local environment and its natural contents constitutes the "restricted universe of possibilities" in which the species and its perceptual systems evolved. The so-called natural kinds for the marsh periwinkle, or for any other organism, are defined by TSRM in terms of the things in its environment that afford a certain kind of behavior. In the present case, "climb-up-able thing" has as its extension plant-stems falling within some set of physical dimensions represented in TSRM's discussion by the set  $s, t, u, v$ . These constitute the occurrent properties, TSRM's correlate of Putnam's "underlying mechanisms", which ground or explain the ability of things with the physical characteristics of the periwinkle to climb a subclass of plant-stems.

If an affordance, which is a natural kind for an animal, is restricted to items in an organism's environment that allows a particular kind of activity, then it is within this context that some invariant property must be specific to environmental features that afford an activity. The idea would then be that if periwinkles do perceive climb-upable things, there is some optical invariant in the periwinkle's habitat associated with all and only things having  $s, t, u, v$  (plant stems of certain minimum dimensions). These dimensions are the ones in virtue of which plant stems are climb-upable. The periwinkle's responding climbingly, as it were, only to the detection of a particular optical invariant works in its local environment in the sense that a successful bout of climbing is, other things being equal, the inevitable result.

Outside the restricted universe, matters may be quite different. This includes the removal of the organism from its habitat and also the

introduction of some non-typical element in its habitat. In either case, the periwinkle could be expected to pass up things it could in fact climb and try out many "non-climbables". The latter would occur if there were phenomena outside the habitat which happens to produce the same optical invariant associated with climb-upable plant-stems. The former holds because the optical invariant to which periwinkles respond is not necessarily produced by anything the organism could climb. In particular, it would not be produced by things which the periwinkle could as a matter of fact climb, but does not possess the structure  $s,t,u,v$ . Hamilton's study would seem to indicate, for example, that (if the periwinkle's perception is in fact invariant-based) the relevant optical structure is not produced by clear plexiglass rods.

To summarize, the extension of a natural kind for an animal consists of the naturally occurring features of the environment in which its species evolved and lives which afford some kind of activity. Two general points need to be made about this. First, TSRM's account of affordances has the advantage of reducing the size of the classes of things to which invariants must be specific from anything that would afford a certain activity for an animal to the usual constituents of its environment which do so. Thus narrowing the field, so to speak, makes it all the more easy to envisage a particular optical invariant being uniquely associated with the class of phenomena an organism perceives as affording some kind of behavior. At the same time, it is worth observing that the marsh periwinkle, because its habitat is quite restricted, provides a misleadingly simple case. As one moves on to consider more adaptable and mobile organisms (humans, for instance), it will become increasingly difficult to clearly identify their particular "restricted universe". It will consequently become ever more difficult to identify perceptual categories and

their extensions for those organisms.

The second general point is to emphasize the fact that TSRM's sole criteria for determining the content of the periwinkle's, and other organisms', perception is its behavior. The basis for the claim that periwinkles perceive certain plant stems as climb-upable things is that the snails in fact respond climbingly in certain circumstances to those stems. The step from using behavior as the criteria for determining what organisms perceive things as to analyzing what they perceive things as in terms of behavior (or behavior-states) is a fairly short one.

In this chapter, I have indicated that TSRM's discussion is bedevilled by some confusions about certain philosophically common notions. They allow themselves to make mistakes about extensionality and intensionality and about the relation between properties and intensions. These lead to confusions about commitments the Establishment must make. TSRM also have a very queer understanding of "natural kind" which leaves it unclear as to why they are so favourably disposed toward the views of Putnam. Their concept of natural kind turns out to be a concept of a "restricted kind". The kinship with Putnam seems to consist only in the idea of underlying mechanisms that "ground" certain properties. The next chapter will continue the critical discussion of TSRM's article. This continuation will finally focus on TSRM's attempt to show how Gibson's theory can account for intentionality, which will largely involve TSRM's adoption of Dretske's theory of natural laws.

## Chapter Five

The idea of natural kinds for animals and a particular view about natural laws is the basis of TSRM's description of the Gibsonian theory of specification. TSRM attempt to use these notions answer the charge that the ecological approach has no account of intentionality in perceiving. The basic idea is that the ecological approach somehow manages to account for intentionality in perceiving because there are lawful connections between ecological properties (natural kinds for animals or any other environmental features the ecological theorists take to be perceptible) and occurrent physical properties of the environment, and between invariants and the manifest environmental ones.

According to TSRM, failing to recognize the point that there exist lawful connections of certain kinds is the crucial mistake Fodor and Pylyshyn make in their criticisms. They claim that Fodor and Pylyshyn repeatedly attribute a "weak correlational view" to Gibson, meaning, one would suppose, a view on which relations between ecological properties and invariants are correlated merely in some statistical sense.<sup>1</sup> However, it is not clear that Fodor and Pylyshyn do attribute this weak view to Gibson or that it would affect their central objections in any case. That is to say, it will prove unclear as to how, through the postulation of lawful relations between occurrent "underlying mechanisms", ecological properties, and invariants, TSRM can show how the theory of specification has an account of intentionality.

Now a central feature of TSRM's supposed alternative account of inten-

tionality in perception is their adoption of Dretske's intensional theory of natural laws.<sup>2</sup> The most reasonable way to proceed with this discussion, therefore, is as follows. First, TSRM's version of the theory of specification should be explained. They clearly indicate that the notion of a natural law on a more conventional understanding of laws, is of no help. I will then examine TSRM's claims in light of the Dretskean theory to see why TSRM might think they derive some advantage from embracing this theory in particular.

(i)

TSRM's version of the theory of specification consists of four large claims. The first two of these were elaborated in the previous chapter but it is useful, for clarity, to list all four of them here. Given some occurrent, physical structure, P, and optical invariant, O, both of which are associated with the ecological property, A:

1. In the context of an organism's environment, P is a necessary condition for A
2. A must be grounded in P, in the sense that, in the organism's environment, A's presence is explained by the presence of P
3. Among the typical constituents of an organism's environment, things having O are uniquely correlated with things that have A
4. The environmental constituents having A and those having O are uniquely correlated in an organism's environment because the same physical structure which explains the presence of A also explains the presence of O

1) and 2) just serve to indicate that A constitutes a natural kind for some organism, and that the relation between P and A is non-accidental.

3) states that, under certain restricting conditions, O is specific

to things having A. The main restricting condition, mentioned in chapter four, is that the relation only needs to hold between occurrences of O and the presence of A in the organism's natural habitat. Outside this environment, things may have A but fail to exhibit O because the property A can be produced by occurrent properties other than P (other than the only occurrent structure in the organism's environment which in fact produces it). Similarly, things may produce O but fail to have A because, outside the organism's environment, O may be produced by occurrent physical structures other than P.

Another limitation TSRM mention is that O only needs to be specific to A from the "perspectives" which an organism normally takes on its environment. By "perspectives" the authors mean the positions from which, and the conditions under which members of a given species naturally observe features of their environments. Hawks and field mice may be found largely in the same kinds of regions, but the perspectives they would have on their terrestrial environment would be quite different. The claim must be that the invariants available to each species would similarly differ.

4) states that the manifest property that grounds A is the very one that produces O. Since the manifest property, P, produces O, the connection between the two is non-accidental. Similarly, since P produces A, the connection between these two properties is non-accidental. TSRM use these points that they make in order to claim that the relation between A and O is also ~~non-accidental~~. The argument used for this purpose will be examined shortly.

Assertion 4) places an obvious restriction on the ecological approach's conception of which particular invariants could specify which features of



the environment. The restriction is that the very same manifest physical property responsible for the presence of some ecological property must also be the very one which produces the invariant which specifies the ecological property in question. Visual, spatially-oriented examples seem to lend themselves readily to this idea: A sit-onable, climb-upable, or cut-withable thing for a human is so because of the size and angles between the surfaces (as well as the rigidity and perhaps other things), for instance. If there is an invariant specific to any of these affordances, it is likely to be similarly due to such physical parameters as size and angular arrangements. The ecological approach is supposed to be generalizable to other sorts of ecological properties and other perceptual modalities (including those which are not analyzable in terms of surfaces), though. These other instances may not prove to be so promising. There is no particular reason, for example, to expect that the very same underlying properties which make certain things edible are the very ones which could produce the invariant that would specify it as such.

To continue with the main topic, TSRM are very clear in insisting that only an intensional view of laws will help their case. They are quite committed to the view that the ecological approach gains no advantage by asserting that specification of ecological properties is lawful, given some extensional conception of laws. One can make a reasonable guess as to why the authors believe this based on what they have to say about Establishment views. They claim that such traditional views as Fodor and Pylyshyn defend can only explain an organism's ability to differentiate between two perceptible properties, A and B, that happen to be coextensive by appealing to concept acquisition and possession and the cognitive processing.<sup>4</sup> Where such appeals can not work, TSRM claim, the Establishment must simply concede that the perceiver in question does not differentiate between A and

B, even when the organism's behavior indicates that it can. The problem is alleged to arise because of a commitment to an extensional or empiricist, theory of natural laws on the part of the Establishment. TSRM (mistakenly) suppose that an extensionalist view takes statements' status as laws survive substitution of coextensive terms. On such a view, any laws in which A participates are ones in which B equally participates. The authors would then go on to reason that if some law explains an organism's perception of A, it also explains its perception of B.

The lesson which TSRM wish to draw from this problem they envisage for the Establishment is that a better explanation of how organisms differentiate between coextensive properties must be devised. The prominence of the notion of natural laws in their discussion suggests very clearly that TSRM think the postulation of certain kinds of lawful connections will yield the explanation they want. In general, their account seems to come to the following: even though properties A and B are coextensive, A is lawfully related to a different invariant than is B. The organism sometimes behaves in ways appropriate to the perception of something as A because it detects the invariant which is lawfully related to A. Because A and B are coextensive, B is always and only present when A's invariant is present, but B's relation to that invariant is "merely correlational". The organism responding as though it perceives something as A when its perceptual systems detect a particular invariant is supposed to be explained in terms of the fact that the relation between invariants of that sort and the ecological property A is non-accidental, while its relation to B is accidental.

As an example, one might consider again TSRM's case of the marsh periwinkle, amending their description so that "climb-upable thing" and

"barrier" are genuinely coextensive in the snail's habitat (that is, other snails and plant-stems are barriers if and only if they are climb-upable). TSRM imagine that certain manifest properties,  $s, t, u, v$ , are the ones which make something climb-upable. If this is a perceptible property,  $s, t, u, v$  (or perhaps some subset of them) must be the properties which produce the invariant the periwinkle detects whenever it perceives something as climb-upable. TSRM are assuming that some other manifest properties,  $p, q, r$ , are the ones which make something a barrier for the periwinkle.

Assuming that it is not plausible to attribute concepts, cognitive processes, or the like to snails, TSRM claim that the Establishment has no explanation of how periwinkles differentiate between "climb-upable" and "collide-withable". It is also assumed, of course, that the creature's behavior is sufficient evidence that they do so differentiate. The Establishment, so the argument goes, does not have cognitive processing available to explain the differentiations made by the periwinkle. Since "climb-upable thing" and "barrier" are coextensive, they are equally correlated with the invariant which  $s, t, u, v$  produces. Therefore, neither can the Establishment claim that the periwinkle's perceptual systems have picked up on some association between a property of the optic array and "climb-upable" that does not exist as well between that optical property and barriers. TSRM want to conclude that traditional theorists such as Fodor and Pylyshyn must therefore disregard the periwinkle's evident ability to differentiate between barriers and climb-upables.

TSRM claim to solve such puzzles in terms of the lawful connections they postulate: climb-upability, grounded as it is in the properties  $s, t, u, v$  is lawfully related to the invariant produced by  $s, t, u, v$  (call this invariant  $O(c)$ ). Collide-withability, on the other hand, is only

accidentally related to  $s, t, u, v$  since it is grounded in other manifest properties (namely  $p, q, r$ ). Thus the invariant  $s, t, u, v$  produces lawfully specifies "climb-upable thing", and does not lawfully specify "collide-withable thing" (barrier). Therefore, TSRM would conclude, the periwinkle perceives something as climb-upable, and not as a barrier, whenever it detects  $O$  (c).

Two points should be made about this suggested explanation of how organisms differentiate between instances of ecological properties. First, in defence of the Establishment, it is not at all clear why they should be caught in the difficulties that TSRM seem to be suggesting. One should think the problem of explaining differences in the periwinkle's behavior toward the very same class of physical things (plant stems) could be handled in terms of a notion such as readiness or expectancy sets: given one set of background conditions (receding tide, for example) which the periwinkle can sense, the detection of a given invariant constitutes the perception of something as a barrier. That is, the periwinkle moves around the objects perceived. Given a different set of background conditions that the periwinkle can sense (advancing tide), detection of the very same invariant constitutes the perception of something as climb-upable. Perceived background conditions prime the periwinkle, as it were; they cause it to be in an expectancy set such that the snail responds "climbingly" to the detection of the invariant.

Second, it is not at all clear how, on any conventional understanding of natural laws, they will do what TSRM require of them. That  $O$  (c) lawfully specifies climb-upable things but is merely invariably correlated with perceived barriers does represent a difference between the two ecological properties, but the key question is whether or not this is a dif-

ference of which perceptual systems of organisms could take advantage. The two ecological properties are correlated to precisely the same degree in the periwinkle's environment. In order for the difference to be usable, the visual system of the organism must somehow be sensitive to the relation between  $O(c)$  and climb-upability. However, the visual system does not detect the relation in question: it detects the optical invariant,  $O(c)$ , itself. Given this, and the fact that the presence of  $O(c)$  is equally and invariably correlated with the two ecological properties, it should be a mystery as to why a species that has evolved in this environment should have evolved so as to perceive things as climb-upable (but not as collide-withable) whenever it detects the invariant optical structure,  $O(c)$ . In other words, a general appeal to natural laws does not explain how organisms manage to perceptually differentiate between coextensive ecological properties.

For this reason, and also because TSRM take the acceptance of a particular theory about natural laws to be of fundamental importance, it is reasonable to assume that TSRM's account of intentionality in terms of the ecological theory of specification could not possibly work without Dretske's intensional view of natural laws. Since acceptance of Dretske's particular theory is to be regarded as essential to TSRM's case, therefore any one of the following three points would show that their account of intentionality does not work:

1. Dretske's theory is mistaken
2. The intensional view of laws affords TSRM no advantage which would not have been available to them on a conventional, empiricist conception of laws
3. TSRM cannot consistently accept the Dretskean theory because of other views the authors hold.

My discussion of the Dretskean theory in relation to what TSRM say about it will reveal reasons for both 2) and 3).

(ii)

There are a number of confusions which TSRM appear to make about Dretske's view that a natural law is a relation between intensions. The largest one might be the idea that embracing this intensional theory of laws will somehow grant their theory of specification the ability to relate perceivers to (some conception of) intensions. In any case, a thorough discussion of the mistakes about Dretske's account should show that it is doubtful TSRM have any proper understanding of Dretske's theory at all.

Dretske's account is written against what he calls "empiricist" conceptions of natural laws. The empiricist view is taken to be basically the view that what is expressed by a law-statement is the very same kind of thing which is expressed by any (true) universally general statement of fact, plus an additional, special ingredient:

This response to the alleged uniqueness of natural laws is more or less standard fare among empiricists in the Humean tradition. Longstanding (= venerable) epistemological and ontological commitments motivate the equation: law = universal truth + X. There is disagreement among authors about the differentia X, but there is near unanimity about the fact that laws are a species of universal truth.<sup>5</sup>

Dretske says that that which is expressed by some universal conditional, "All F's are G", is a relation between extensions: every member of the extension of F is also a member of the extension of G. He takes the empiricist models of laws to similarly consist of this extensional sort of relation. The puzzle, then, is to find the special ingredient X which explains the necessity of the relation. One must find whatever it is that confers on laws the peculiar functions and feature that are not possessed by

just any universal generalization. Dretske's alternative, which he neatly encapsulates by saying a law is a singular relation between intensions, is introduced thus:

To say that it is a law that F's are G is to say that "All F's are G" is to be understood (in so far as it expresses a law), not as a statement about the extension of the predicates "F" and "G" but as a singular statement describing a relationship between the universal properties F-ness and G-ness. In other words, (C) is to be understood as having the form: (6) F-ness  $\rightarrow$  G-ness.<sup>6</sup>

("(C)", in this passage, denotes "It is a law that F's are G".)

There are two points which need to be made about this quote. First, a footnote is attached to it in which Dretske indicates that the arrow used in (6) is to be taken as a "dummy connective", meaning that he does not intend it to indicate a given relation (material or causal implication, for example). Second, the theory Dretske is proposing is a conditional one. If there are any natural laws, then they are singular relations between universal properties. The idea is that the acceptance of the existence of natural laws entails a form of Platonism.<sup>7</sup>

The first point relates to the argument by which TSRM attempt to show that the relation between an ecological property and its associated invariant is non-accidental (lawful). Using Dretske's notation, TSRM try to argue by an appeal to transitivity:

Thus we have two laws relating properties: "o-ness  $\rightarrow$  c-ness" (between occurrent property and affordance) and "e-ness  $\rightarrow$  o-ness" (between optical property and occurrent environmental property). By transitivity we have: "e-ness  $\rightarrow$  c-ness". That is, there<sup>8</sup> is lawful specification of an affordance by an optical property.

Since Dretske "attaches no significance"<sup>9</sup> to the arrow, it is a little premature for TSRM to endow it with specific logical properties without saying what relation they specifically have in mind. They need to defend a particular view of the relation involved in laws on which it is transitive. TSRM also need to give some explanation of why the o's, c's, and e's in

their argument occur in just the order they do. If the order matters (that is, the relation is not symmetrical), then TSRM need to give an account of lawful relations which make sense, for example, of why "o-ness  $\rightarrow$  c-ness" and "e-ness  $\rightarrow$  o-ness", rather than "c-ness  $\rightarrow$  o-ness", or "o-ness  $\rightarrow$  e-ness". That is, it seems a little odd that the occurrent physical structure (which produces both the ecological property and the invariant by which it is perceived) should be the first term in the one relation and the second term in the other. If the order in which the o's, c's and e's occur does not matter then TSRM need to provide some conception of lawful relations on which they are symmetrical.<sup>10</sup> Until these conditions have been met TSRM's attempt either to derive or to explain lawful relations between ecological properties and invariants in terms of their "transitivity argument" is quite without substance.

The point that the belief in natural laws, given Dretske's view, requires one to postulate abstract, universal properties, is a feature of the intensional theory of laws that TSRM miss entirely. They write:

Let us ecological realists put our major ontological cards on the table: (i) there are no bare particulars (individuals) and there are no pure forms. The nominalist claim that universals are collections of individuals is denied as is the Platonist claim that individuals in themselves are clusters of universals (Bunge, 1977). There are no universals in themselves but there are properties that are invariant across a given collection of evolving individuals ... (vii) Properties are not a separate category of individual, for there are only propertied things (Bunge, 1977).<sup>11</sup>

I will not speculate on whether or not there is a viable position in what TSRM say. The important point here is their rejection of the idea of Platonism about properties. They are firmly and clearly committed to the existence of natural laws, and also to Dretske's view of them. But according to Dretske, his intensional model requires, if there are any natural laws, the sort of Platonism that TSRM reject. A law cannot be a



singular relation between certain kinds of existents if there are no existents of that kind.

Something has to be sacrificed here. Since TSRM's entire defence of the Gibsonian approach is grounded in the notion that there are laws connecting organisms' perceptions and their environment, TSRM can hardly be expected to abandon their commitment to ecological laws. The authors must therefore either give up the advantage, whatever it is, they are supposed to derive from the Dretskean model, or they must take up a metaphysical view about properties on which there will be relata for their relation. As it specifically affects the ecological approach, it does not seem to matter particularly which alternative one adopts. On the one hand, the issue of whether there are universals is quite irrelevant to the acceptance of Gibson's, as opposed to any other, approach to perception. On the other hand, there are only three imaginable reasons suggested by TSRM's article as to why they should think they require the intensional theory of laws. None of these prove to be genuine grounds for adoption of the theory by the ecological theorists. These possibilities are as follows:

A) TSRM mistakenly believe alternatives to the Dretskean view allow substitution of coextensive predicates in law-statements. In relation to the periwinkle discussion, TSRM claim:

The Establishment/extensional analysis goes through on the following assumptions: (i) that the generalization of law or of fact is in the form of a syntactic universal ...; (ii) the substitutivity of coextensive predicates ... Assumptions (i) and (ii) follow from the traditional conception of law. They are both rejected in the view of law advanced by Dretske (1977), a view which sustains the ecological/intensional analysis.<sup>12</sup>

The "ecological/intensional" analysis referred to here is the assertion that the periwinkle's differential behavior toward plant stems is

to be explained in terms of the detection of different invariants which lawfully specify, respectively, "climb-upable thing" and "barrier".

The implication, in the foregoing passage is that the empiricist theories of laws (upon which, TSRM would claim, Establishment accounts of perception must rely) hold that substitution of coextensive predicates in law-statements will yield another statement which expresses a law. This "principle of substitutivity" is not part of traditional theories of laws and Dretske in no way suggests (as the TSRM quote implies) that it is. The authors appear to have mistaken something which Dretske regards as a puzzle for something he is claiming to be a tenet of other theories.

Dretske introduces his description of empiricist accounts and his own view of natural laws by making the point that substitution of a coextensive predicate into a statement of law does not always produce another law-statement. He puts this more simply by noting that substitution of coextensive terms within the scope of the functor "it is a law that ..." is non-truth-preserving.<sup>13</sup> This kind of opacity is one important way of showing the difference between statements which express laws and those which merely express universal generalizations. The purpose is not to suggest that the empiricists are incognizant of differences between laws and simple universal generalizations, but that their approach to explaining the differences is wrong from Dretske's point of view. No-one, however, whether they are empiricist or not, imagines that the substitution of any coextensive predicate into a statement of law will always result in another statement of law.

TSRM's adoption of the intensional model of laws might be explained by this mistake of attributing a blanket principle of substitutivity to Dretske's rivals. TSRM want certain linguistic contexts that are relevant

to perceptual theory to be opaque. Any theory which interpreted "it is a law that ..." as referentially transparent would allow substitution in the contexts TSRM take to be opaque. Since they think empiricist theories about natural laws are offenders in this respect, TSRM perhaps think they must adopt Dretske's theory in particular. However, an empiricist theory of laws does not contain the principle of substitutivity TSRM have in mind, but would regard failure of substitution as a puzzle, as Dretske does. TSRM thus gain no advantage here by taking up the intensional model.

B) Another possible source of TSRM's conclusion about laws is not based on anything they directly say, but is instead the product of a body of circumstantial evidence.

First, Dretske likes to describe laws as singular relations between intensions, where an intension is some kind of abstract, universal property. Hence, Dretske sometimes uses "property" (in the abstract sense) in place of "intension". Second, TSRM both endorse Dretske's notion of a law, and similarly take up the practice of using "property" and "intension" interchangeably. TSRM explicitly reject the idea of abstract, universal properties, however.<sup>14</sup> Third, the important criticism Fodor and Pylyshyn make against Gibson may be thought of as the claim that perception as mere invariant-detection lacks an alternative the Establishment's relation between a perceiver and an intension (in the sense of some sort of internal representation).<sup>15</sup> Finally, as noted earlier, TSRM, with explicit support from Gibson, tend to think of meanings or values as being (simply) perceived. Gibson asserts that affordances are directly perceived, and that to perceive what things afford is to perceive what they mean.<sup>16</sup>

Given these points as background, it is possible that TSRM think that by accepting Dretske's view about laws, they can relate perceivers

and intensions (of some kind) without recourse to the attribution of mental representations to perceivers. The lawful specification of some ecological property, A, by some invariant, O, is (qua lawful relation) a relation between the intensions "A" and "O". So TSRM might then be trying to argue that when an organism's perceptual system detects O, it perceives the "intension" A. In other words, the idea would be to conceive intensions so that they would somehow be in the world as particular features of objects.

If this happens to be what TSRM have in mind, they gain nothing at all from Dretske's view. The foregoing line of reasoning rests on the relatively obvious fallacy of confusing "property" in the abstract sense with "property" in the sense of an instance. Dretske's relation is between abstract entities (universals). When an organism's perceptual system functions, it detects particular instances of invariants. This does not relate a perceiver to an intension on any theory of natural laws. Adoption of the intensional theory of laws, to put it briefly, does not in any way change the conception of what organisms are related to when they perceive.

It should be emphasized, once again, that TSRM may not be committing the suggested fallacy. Working out the motivations behind a view is not exactly like showing what it entails: logic is often not on one's side, and this is especially so when the author(s) being studied appears to have been led astray. Therefore, in spite of the uncanny coherence in a certain body of evidence, it would indeed be unfair to simply conclude that TSRM are guilty of the suggested confusion. One can only hope that they are not and note that if their reason for adopting Dretske's model of laws is an attempt to relate perceiving organisms with "intensions" TSRM are quite

misguided. Any advantage the ecological approach might therefore hope to gain from the intensional construal of natural laws does not lie here.

C) Finally, TSRM might be adopting the Dretskean view because they think it allows them a notion of laws which are restricted in scope. They evidently want such a notion in order to have natural laws that hold only in certain environments. Once again, they take Dretske to be expounding the point they wish to make:

The universal scope of laws of nature should not be taken to mean that the same laws apply everywhere and everywhen, for laws can apply only where they are instantiated. The laws governing electron orbits are universal, but no one expects them to operate in the solar nucleus, where atoms are deprived of their electron shells by the intense play of other forces. Following Dretske, we take laws to be particular statements about properties that are more or less widely distributed in space-time.<sup>17</sup>

There is a great deal to puzzle about in this quotation, which makes it a fair sample of TSRM's very brief and very difficult discussion on the scope of natural laws. The authors want a relation between invariants and ecological properties such that, in a restricted natural environment, an invariant and an ecological property are the result of the same underlying, occurrent property, and the invariant is found in the available optical (or other) structure always and only when the ecological property is present. Why TSRM should think they need Dretske's theory of laws to postulate this relation is mysterious.

A couple of points about the foregoing quote should be made. First, the statement "laws can only apply where they are instantiated" could only have one of two interpretations here. It could be meant as "laws can only apply where they apply". Alternatively, it could mean that a law can apply only where the properties which are the subjects of it are instantiated. The former interpretation is trivial while the latter is plainly false and does not follow from anything Dretske says.

The example of the electron orbits, as well as the comment that laws are about properties "that are more or less widely distributed in space-time" suggest that TSRM are taking the false interpretation. They seem to claim that laws whose subjects are atoms with electron shells do not hold where there are no atoms with electron shells. However, one of the main problems in analyzing laws, and one of the reasons Dretske gives the formulation he does is precisely that if "F-ness  $\rightarrow$  G-ness" is law, it obtains even when and where there are no F's.<sup>18</sup>

A closely related point pertains to a logical mistake that TSRM make in the foregoing passage. It cannot be the case both that laws about electron orbits are universal and that they fail to obtain at the solar nucleus. If the latter were true, the laws would fail to hold universally. On the other hand, if the laws apply universally, then the laws apply to the solar nucleus as well as anywhere else. If they are universal, the laws apply counterfactually: if atoms could have electron shells at the solar nucleus, the electrons would conform to the relevant laws concerning their orbits. It just happens that there can be no atoms in the nucleus that possess their electron shells, which is only to say that in certain regions, there are no subjects of laws about electron orbits. This fits with Dretske's conception of laws just as much as empiricist ones.

There are also two mistakes evident in TSRM's discussion with respect to their view of Dretske's theory. First, they claim that, on the intensional theory, laws are "particular statements", which is false because they are not conceived of as any kind of statement at all. This is an instance of a confusion against which Dretske specifically warns, between statements of law and the laws expressed by them. Unfortunately, Dretske cautions at the same time that he sometimes speaks "indifferently" between the two.<sup>19</sup>

The other mistake TSRM make here again has to do with the conception of a property. "Properties", in the sense in which these are the subjects of singular relations Dretske conceives, are not "more or less widely distributed in space-time". In fact, they are not distributed in space-time at all. To reiterate, Dretske is using "property" in the sense of universal properties. The only sense TSRM have available is that of properties as particulars.

Part of the difficulty in TSRM's discussion of the scope of laws is that they do not appear, once again, to understand the position against which they are (through Dretske) arguing. They suppose that traditional accounts of laws are based on the assumption "that laws must be expressed as universally quantified statements about extensions" and that this "implies to many that the scope of any law is universal".<sup>20</sup> Of course no-one thinks that laws must be expressed as universal conditionals (universally quantified sentences) although there are undoubtedly those who believe they must be expressible by some universal conditional.

Dretske's own position is that "law-like statements are singular statements of fact describing a relationship between properties or magnitudes",<sup>21</sup> hastening to add in a footnote:

I am not denying that we can, and do, express laws as simply "All F's are G" (sometimes this is the only convenient way to express them). All I am suggesting is that when law-like statements are presented in this form it may not be clear what is being asserted: a law or a universal generalization.<sup>22</sup>

TSRM clearly cannot be getting at the heart of the matter by complaining about views which allow law-statements to be "universally quantified statements". TSRM cite "A rigid object with a sharp dihedral angle, an edge, affords cutting, it is a knife" as a typical example of an ecological law. They go on to note that it is not the kind of example of a law that philosophers would give because "it does not fit the schema  $(x)(Fx \rightarrow Gx)$ ". There is absolutely nothing for TSRM to gain by making this

claim. According to Dretske, the form a statement has or lacks does not determine whether or not it can be a law-statement. This is just as well for TSRM because, unless their example of an ecological law is meant to refer to a particular rigid object, it is a universal generalization and does fit the schema  $(x)(Fx \rightarrow Gx)$ .

Again TSRM appear to be confused over the difference between making claims about certain kinds of statements and claims about what these express. Dretske's denial of "universality" of laws comes to the denial that for a statement to express a law is for it to express a universal truth (In this context, "universal truth" should be taken to mean simply a true universal generalization). This is not to deny that the same form of statement by which universal generalizations are expressed might also express laws. In fact, Dretske even holds that a given statement that expresses some law can also express a universal generalization. He claims only that, when a statement does express a law, this is not a matter of its expressing a special kind of universal generalization. This point exhausts Dretske's denial of "universality" of laws.

The point that TSRM want is that lawful specification may be restricted in scope. That is certain invariant properties are present only when a particular ecological property is present in specific natural environments. This is because, in these limited conditions, only the underlying manifest property which grounds the ecological one produces the particular invariant. TSRM's denial of "universality", in other words, comes to the claim that certain unique, non-accidental correspondences hold between invariant, ecological, and occurrent properties when the frame of reference is confined to particular local environments.

TSRM's point is thus that some lawful relations hold only in certain



places (ie., some non-accidental correlations hold only in certain places). Dretske's claim is that a statement does not express a law in virtue of expressing a true universal generalization. It should be readily apparent that there is no connection between the two. As such, there is no particular reason to think that TSRM must adopt Dretske's, as opposed to the more conventional empiricist view of laws in order to make their point about restricted scopes.

Finally, there is a bit of irony in TSRM's use of the Dretskean view to develop some concept of non-universal, lawful relations. One of the chief problems Dretske claims against the empiricist formula is that the result cannot be universal enough. Using the analogy of legal imperatives, he writes:

If a law was to be interpreted as of the form: "For all x, if x is (was or will be) President of the United States, then x must (legally) consult Congress on matter M", it would be incomprehensible why Sally Bickle, were she to be President, would have to consult Congress on matter M. For since Sally Bickle never was and never will be President, the law, understood as an imperative applying to actual Presidents (past, present, and future), does not apply.<sup>24</sup>

Dretske's claim here, in relation to the empiricist model, is that his view allows laws to apply to additional things (to which they should apply): not merely actual F's, but things that would be F in different counterfactual situations, or things that are F in different possible worlds. Hence, if Dretske's assessment is correct, the intensional view of laws makes them, in one respect, more universal than other accounts of natural laws.

To summarize, TSRM cannot accept Dretske's theory because they hold that there are natural laws while denying the existence of universals. Their failure to appreciate the role of universal properties in the intensional view, as well as some of the other very odd mistakes TSRM make

regarding Dretske's theory, suggest very strongly that their grasp of the theory is tenuous at best.

Three possible reasons have been proposed as to why TSRM imagine they need the intensional theory of laws in particular, and none of these do in fact give the ecological theorists any advantage over an interpretation of their theory of specification on a conventional view of laws. Dretske does not need to have any different view regarding the substitutivity of coextensive predicates in law-statements. No-one with a theory in this area would claim that the substitution of any coextensive predicate into a statement governed by "It is a law that ..." would preserve the truth-value of the statement. Second, adoption of the Dretskean view of laws does not allow organisms to simply perceive intensions nor does it allow their perceptual systems to detect them. This would be to confuse abstract properties with their instances. Third, the intensional theory of laws is not required in order to postulate unique, non-accidental correspondences that obtain only in certain animal-environments.

## Chapter Six

The important point which TSRM wish to make to explain how the ecological approach accounts for intentionality in perceptual awareness is that the theory of specification postulates lawful relations between invariants and ecological properties (especially natural kinds for organisms). TSRM take it as central to their case that one understands the natural laws holding between invariants and ecological properties on the Dretskean, intensional view of laws. The authors regard this point as key, and it is anyway quite unclear how the postulation of natural laws on a more conventional conception of these could help their case. Therefore, let it be assumed that if TSRM's efforts to adopt the Dretskean theory fails, so too does their explanation of how the so-called theory of specification manages to account for intentionality in perception.

There are three grounds upon which TSRM's defence in terms of the intensional conception of natural laws could fail:

1. Dretske's view is mistaken
2. The intensional view affords TSRM no advantage which would not have been available to them on a conventional, empiricist conception of laws
3. TSRM cannot consistently accept the Dretskean theory because of other views the authors hold

I have endeavoured to show both 2) and 3). That I do not attempt to show 1) as well is no indication of acceptance of Dretske's theory of laws, however. There may well be good reasons for rejecting it. However, since

the advantage TSRM imagine themselves as gaining by endorsing Dretske's theory in particular is so mysterious, it seems unfruitful to go on to criticize the theory as well.

One should note that there are different, more or less sophisticated versions of perceptual behaviorism as I intend to use this notion. The least sophisticated would be classical, stimulus-response behaviorism: an organism is perceptually aware of some phenomenon when, and only when, particular behavior is elicited as a result of the detection of a certain kind of stimulus. More sophisticated variants would not require actual behavior: an organism is perceptually aware of some phenomenon when, and only when, it comes to be disposed to behave in some way as a result of the detection of some stimulus. The forms of perceptual behaviorism become increasingly sophisticated as one attempts to account adequately for dispositions, relevant behavior, and the interaction between states of perceptual systems and other states of the organism.

The result of all such considerations is a family of views. Some of these may more properly be called versions of functionalism. It is convenient for me to refer to the entire family as forms of perceptual behaviorism. What makes these theories a family is that each is an attempt to explain perceptual awareness of organisms with reference to the output behavior produced by the functioning of their perceptual systems. There is a great deal of controversy in the philosophy of mind and perception about whether analyses of cognitive or perceptual awareness in terms of output behavior (manifest or dispositional) are plausible. On the side of those who do not think any such theory is plausible is Dretske,<sup>1</sup> a philosopher with whom TSRM are familiar.

Treating the Gibsonian theory as a form of perceptual behaviorism

allows the approach to avoid a serious initial difficulty: the charge that it has no account of how the detection of some invariant manages to mean anything to a perceiving organism. This is managed by giving an answer to the question of what it is for the detection of an invariant to mean something to an organism (or, alternatively, what it is for an organism to be perceptually aware of some feature of its environment as such). Indeed, one might speculate that the reason certain philosophical critics do not see how Gibson could account for intentionality in knowing perception is that they have a different answer to the "what"-question, a different view on what it is for the deliverances of a perceptual system to mean something to an organism, in mind.

Now there is a certain amount of evidence for thinking that Gibson and his followers might actually subscribe to perceptual behaviorism (as opposed, that is, to holding a theory which happens to be compatible with it). Ecological theorists in general are at pains to stress a tight connection between perception and activities of organisms. Both perceiving and knowing are conceived of more as acts than as relations of an organism to either descriptions or propositions.<sup>2</sup> While commenting on affordances on the classification of objects Gibson writes that "If you know what can be done with a graspable detached object, what it can be used for, you can call it whatever you please".<sup>3</sup> Evidently, the possession of some particular description by a perceiver is not nearly so important as its being in a position to make some use of some environmental thing.

In TSRM's commentary, the main clues that the authors may have some form of perceptual behaviorism in mind occur in connection with their view of perceptual error and with what they call their "semantic theory".<sup>4</sup> They claim to adopt a semantic theory consisting of three terms: the referent (or extension), the designation and the meaning. For example, if

a marsh periwinkle perceives a climb-upable thing, the referent is the plant-stem, the designation is the invariant which specifies the climb-upable things in its environment (I suppose the idea is that the invariant "designates" the plant-stems which can be climbed), and the meaning is the description "climb-upable thing". The last component is not available to the snail, but is ascribed to the perceptual situation by some observer. From the snail's perspective, then, all that is involved in the situation is the detection of some invariant and subsequent performance of the appropriate behavior.

This same idea is found in TSRM's very strange attempt to deal with so-called errors in perception in normative terms.<sup>5</sup> A number of examples are given, all of which have the same basic structure and moral: Suppose that one reproduces an invariant by non-natural means so that it does not have its usual physical accompaniment relative to some species' environment. A member of that species whose perceptual system detects the invariant will take it that an instance of the usual environmental accompaniment is present. TSRM want to say the organism is not wrong because the detection of the invariant ought to have yielded an environmental phenomenon of a certain kind.

One of the examples used is that of a shark which is aware of something as edible whenever it detects a certain kind of bioelectric field (TSRM refer to it as a "type F" electrical field) because this field, in the shark's habitat, is produced only by the species of fish which serve as its food. TSRM describe a case in which a type F field is reproduced by placing electrodes in the sand at the ocean bottom. The result is that the sharks exhibit the same predatory behavior toward the electrodes as they would toward the flatfish they normally eat:

The shark digs tenaciously at the source of the field departing from the site only when the act fails to reveal an edible thing (Kalmijn, 1971). Now there is no intelligible sense in which it can be claimed that the source ought to have appeared inedible if the shark's perception were free from error and if the shark's perceptions of affordances were direct.<sup>6</sup>

The crucial issue to raise here is that of what TSRM could conceivably mean by something appearing inedible or edible, or what they could mean in predicating (as they do) "takes to be an edible thing" to the shark. Quite obviously, TSRM's attempt to handle errors in perception does not contact at all the epistemological issue of how one can wrongly take oneself to perceive some phenomena of one is supposed to directly perceive it. TSRM's claim that the shark is somehow "not wrong" in taking the electrodes to be edible flatly contradicts the simple epistemological fact that if one takes something to be edible that is in fact inedible, one is mistaken. The shark can only be said to be correct in some normative sense when it takes buried electrodes to be edible. That is, given the constitution of its natural environment, the shark behaved as it ought to have.

TSRM are insisting that the shark correctly perceives something as edible even though nothing in the given example is in fact edible for sharks. The only way to combine these two points is if one assumes that the shark's perception of something as edible is just a matter of it exhibiting predatory behavior. This is to analyze what it is for the detection of a type F electrical field to mean "edible" for a shark in behavioral terms. The shark exhibits predatory behavior as a result of the detection of an invariant which is specific to edible things within its environment.

There are two general comments I wish to go on to make in concluding this thesis. The first will be that there are very close similarities

between D.M. Armstrong's so-called "belief-theory" of perception and the ecological approach, especially understood as a form of perceptual behaviorism. The kinship may be mutually beneficial. The second, and final point will be that Ecological theorists do not establish the strong hypothesis that all perception is the mere result of the detection of invariant properties.

(ii)

There are sufficient superficial similarities between Armstrong's belief-theory and the ecological approach to invite *prima facie* comparison. Further investigation reveals still deeper resemblances. To develop the comparison, I will briefly describe Armstrong's theory, which he introduces by writing:

It is clear that the biological function of perception is to give the organism information about the current state of its own body and its physical environment, information that will assist the organism in the conduct of life. This is the most important clue to the nature of perception. It leads to the view that perception is nothing but the acquiring of true and false beliefs concerning the current state of the organism's body and environment ... Veridical perception is the acquiring of true beliefs, sensory illusion the acquiring of false beliefs.<sup>7</sup>

In well-founded anticipation of resistance to the attribution of beliefs to many evident perceivers (including pre-linguistic humans), Armstrong is quick to subject his claim to qualification. His notion of belief is said to be a "sub-verbal" conception, so that linguistic ability is not a prerequisite to the possession of beliefs. Still no doubt concerned that some will regard a belief as too sophisticated a state to attribute to some perceiving organisms, Armstrong goes on to suggest the word "information" as an alternative.<sup>8</sup> Part of the motivation for using "information" in particular is that it makes good grammatical sense to talk about "false" information, whereas Armstrong notices there is no



correlate to describe what he calls sensory illusion with other alternatives that he entertains. Subsequent to an elaboration of his basic theory, he then proceeds to analyze beliefs as "states apt for bringing about certain behavior".<sup>9</sup> Armstrong thus has a view on which perceptual awareness will receive some form of behavioral analysis. The belief-theory can be considered as a form of perceptual behaviorism even though Armstrong (as, for that matter, does Gibson) disavows orthodox behaviorism.

A number of superficial similarities thus exist between the two theories:

1. Perception is fundamentally conceived as the acquiring of information
2. The main function of perception is to allow organisms to serve their ecological needs (conduct their life)
3. That the service of ecological needs is the chief function of perception is taken to be the key to understanding the nature of it
4. Organisms are said to be related to, and to conduct their lives in an environment
5. The information organisms acquire is categorized as either being about itself (propriospecific), or being about its environment (exterospecific)
6. Perception is treated as an epistemic notion

These similarities, of course, hardly suffice to show the two theorists are committed to the same view. The idea expressed in 2), as well as the concept of an "environment" are given fairly extensive treatment on the ecological approach, but are undeveloped by Armstrong. He mentions 2) in rationalizing the approach he takes, but it does not pervade Armstrong's thought on such advanced issues as the terms of perception as it does with Gibson. Gibson's use of "environment" is a technical one, whereas Arm-

strong's need not be regarded as anything more than accidental. The significance of 4) is also affected by this point.

6) at least indicates that Armstrong and Gibson are endeavouring to give theories on the same topic (as opposed to authors who are writing about simple perception, or about the justification, rather than the causation, of perceptually acquired knowledge). I have indicated two general forms of epistemic perception: "perceiving that" and "perceiving as". The main difference is that it is always false that one perceives that a particular thing is P unless it is true that the thing perceived is P. On the other hand, one may perceive something as P when the thing perceived is not in fact P. Since Armstrong allows that perceiving may be the acquiring of false information, his theory must be (in spite of what he evidently thinks) based upon "perceiving as". Gibson occasionally makes use of this locution, but he is unsettled on how to handle non-veridical perception. One's approach to non-veridical perception is the best indicator of a commitment to one locution or the other in the absence of an explicit statement.

On the handling of errors in perception there exists a clear possibility of difference between Gibson and Armstrong, though. Many of the ecologists are inclined to try to explain away apparent errors. It is sometimes suggested that when organisms appear to have made a perceptual error, they have simply failed to explore their immediate environments long or hard enough, and so have not picked up all the available information. TSRM's curious normative view is another example of an attempt to explain away evident perceptual error. Gibson himself, after suggesting a variety of examples he considers to be perceptual error, writes:

Optical misinformation enters into each of these cases in a different way, but in the last analysis, are they explained by misinformation? Or, is it simply a matter of failure to pickup all the information ...?<sup>11</sup>

Gibson would like to explain away evident mistakes somehow but he is more conciliatory than some of his followers. That non-veridical perception is to be accounted for as the acquiring of false information remains a possibility, and acceptance of such an approach would be tantamount to taking the "perceiving as" approach to epistemic perception.

Similarly 1) is crucial since it turns out to be a deeper resemblance than one might be initially inclined to suppose. Armstrong equates "belief" and "information", whereas the Gibsonians sometimes seem to be trying to equate "information" and "invariant property". Armstrong is certainly not likely to suggest that information, in his sense, is "simply available". On the other hand, some of the Gibsonians, Shaw, Turvey and Mace, expressly deny a connection between perception and belief.<sup>12</sup> Their reasoning, however, is both terribly obscure and irrelevant to this context. Once one has seen that Armstrong interprets beliefs in terms of behavior-states, and that the ecological approach would lack some account of intentionality in perception if it were not interpreted as analyzing perceptual awareness in terms of behavior, one can see that the two approaches to perceptual information pickup bear a striking similarity.

In addition to the similarities in the two theories, there are two important differences that should be mentioned:

7. It is not clear that the belief-theory and the ecological approach should be seen as giving the same kind of behavioral analysis
8. The two theories differ on the terms in which organisms perceive their environments

With respect to 8): on the issue of the categories of perception, Armstrong must be regarded as an Establishment theorist. In the examples he chooses, and through his discussion of the problem of secondary qualities, it is apparent that Armstrong accepts the basic categories of perception which have remained substantially unchanged since Locke's time. Armstrong shows no sign of deviating from the traditional formula that the environment is perceived in terms of colours, shapes, textures, weights, and the like (sensible qualities), and useful information is constructed out of these. Gibson, who takes affordance-perception as basic, would regard such properties as felt weight, sensed colour and perspectival shape as qualities of sensation. As such, they would neither be perceived nor the basis of perception of the environment. On a physical construal of sensible qualities, awareness of a thing as having a particular colour, shape, or the like, the Gibsonian line would presumably be that these are derivative, a product of the perception of ecologically significant parameters of the environment.

There is nothing in Armstrong's central view that is incompatible with the Gibsonian conception of the categories of perception, though. Moreover, the belief-theory could derive a couple of advantages from the idea that ecological properties are perceived. In the first place, although Armstrong takes the fact that the chief purpose of perception is to provide an organism with information important to the "conduct of life" to be a key determinant of the nature of perception, he does not make use of this basic point in subsequent discussion. This claim as to the purpose of perception is just the kind of point which motivates Gibson to adopt his theory about affordances. Gibson's approach thus shows how Armstrong could develop his claim. In addition, Armstrong's theory has very little

to say about the behavior a given state is apt to bring about. What behavior, for example, is apt to be produced by the perception of something as red, cubical, or soft? Beyond certain obvious suggestions, such as verbal behavior or discriminative behavior produced in artificial test conditions, which have limited applications nothing comes readily to mind. On the supposition that the environment is perceived in terms of what it affords, it is rather easier to give substantive descriptions of the behavior-states which constitute perceptually acquired information.

With regard to 7): there are both dispositional and non-dispositional ways of trying to analyze perception. Armstrong is explicitly committed to a dispositional view. In particular, he maintains that to perceive is to acquire a belief, where a belief is analyzed as a dispositional states apt for bringing about certain behavior. A non-dispositional account of perceptual information pickup in behavioral terms would be to claim that an organism perceives some phenomena when, and only when it actually exhibits certain behavior.

TSRM might be held to a non-dispositional view since in such examples as that of the shark or of the periwinkle, they make no mention of invariants producing dispositions to behave. If the authors have any tendency to embrace such a view, they should abandon it. The non-dispositional form of perceptual behaviorism is very strong and not very plausible.

The main problem the non-dispositional view raises is that every instance of a perceiver failing to exhibit some sort of behavior must be counted as a failure to perceive, even when circumstances make it implausible to believe that the perceiver has failed to notice some environmental item. If I look at a pen but do not pick it up and write with it, must I have failed to perceive it as write-withable? Does a shark, because it only exhibits predatory behavior when it is hungry, fail to perceive edible

things unless it is in this state? Unquestionably, an animal's attention is selective, and this selectivity is directed by present wants and needs. However, it would be rash to suppose that an organism always fails to notice features of its environment whenever they would not actually elicit behavior of a certain kind because the organism is in some state.

Various tactics for avoiding such potentially embarrassing cases might be suggested. One is to expand the range of overt, physical behavior which constitutes perception of the environment in particular terms. For example, an opossum's running away, climbing a tree, remaining motionless, or defending itself may each constitute perceptual awareness of a fox as a predator. There are limits to this tactic, however, because the more one expands the range of relevant behavior for perception of something as a such-and such, the more unclear it becomes as to why this should constitute perception as a such-and-such in particular. As one expands the range of opossum-behavior that counts as perceiving something as a predator, it becomes increasingly difficult to explain how this differs from perception of non-predators in certain terms (other opossums as mates, competitors, and so forth), or perception of foxes as things other than predators. It becomes correspondingly difficult to explain why a certain activity by the opossum is appropriately described as perception of a fox as a predator.

Other possible tactics would be to count verbal and/or intellectual behavior among that which constitutes perceptual awareness. Both would obviously be limited in terms of the organisms to which they could be applied, though. Moreover, it would be difficult to argue that calling phenomena such as "thinking of X as P" behavior is not merely as semantic trick by which the perceptual behaviorist is allowed to smuggle in the

very representational component of perception that he purports to analyze away.

However, philosophers attempting behavioral accounts of intentional states abandon the non-dispositional analysis rather than try to use my suggested compromises. It is far more preferable to take up a dispositional account such as Armstrong suggests.

Now it is possible to sketch roughly a possible ecological analysis of perception. The first step is to characterize the detection of (or resonance to) an invariant by an organism's perceptual system as the acquired state that tends to produce a certain kind of behavior. Given this, an organism perceives  $X$  as  $P$  if and only if:

1.  $P$  is specified by some invariant,  $O$ , according to the principles of the theory of specification
2. An instance of  $O$  is detected by a perceptual system of the organism
3. The instance of  $O$  in question is produced by some underlying mechanism of  $X$

To repeat an earlier point, Gibson does not elaborate on such functions as detection or resonance. It is therefore open to question whether these functions should be said to produce a behavior-state or to constitute the state. The stronger interpretation that I use seems to be called for by TSRM's previously noted assertion that organisms pick up information when, and only when, their perceptual systems detect/resonate to invariants.

With respect to the enumerated conditions, 1) stipulates that  $P$  is a genuinely perceptible property. If 2) fails to obtain, the state of the organism is not the product of the normal functioning of its perceptual system. 3) is a simple causal condition that ties perception of  $X$  as  $P$  to  $X$ . The detection of  $O$  means " $P$ " to the organism in that the result is invariably a disposition for behavior appropriate for it toward things having

P. This is partly a theory of what it is for perception of things to mean something to the perceiving organism.

On this dispositional view, some failures to behave, in circumstances in which perception should be expected to occur, can be explained in terms of modifications of the state which is produced by a given invariant. The invariant-caused perceptual state may be modified, that is, by other conditions or states both of the perceiving organism and its environment. For example, the shark may detect a type F bioelectric field, but fail to exhibit predatory behavior because it is sick or not hungry, or because it senses danger or some intrusion into its surroundings. On the alternative non-dispositional analysis, such modifying states and conditions must always be explained as causing failures to perceive rather than as mere failures of the perceptual state to produce the usual behavior.

However, there is a disadvantage to explaining the intentional component in perception in terms of being in states apt for the production of certain sorts of behavior. On the non-dispositional view, it is quite clear that nothing in the perceptual process could be regarded as representations of the environment in another guise. Given Armstrong's account of information pickup in terms of the production of certain behavioral states, it would be incumbent upon an ecological theorist to explain his notion of a state in a way which would show that it should not be regarded as yet another form of internal representation. In particular, he would have to construe these in some physical terms, as physiological states apt for bringing about behavior, for example. Armstrong's own view is designed to leave open this question of whether or not such states are mental or physical (Remember that Armstrong claims his notion of a state is compatible with, but does not entail materialism). The ecological theorist would thus need



to give a convincing account of the reduction of cognition to physical phenomena, a task which has proven intractable.

One of the problems that would have to be faced is the product of a distinction which is ignored on the ecological approach. It is generally held that there is a distinction between the mere discriminative behavior of organisms that is produced by the functioning of their perceptual systems, and genuine epistemic states so produced. A marsh periwinkle successfully climbing a plant stem as a result of the functioning of its visual system would no doubt be regarded by many theorists as an example of mere discriminative behavior and not as the product of perception in some intentional sense at all. In fact, it is a weakness of TSRM's defence of the ecological approach that the examples which they treat in any detail involve most unsophisticated perceivers (low-grade intentional systems in Daniel Dennett's terms<sup>13</sup>), ranging from household scales to gannets. Some philosophers, such as Karl Pfeifer and C.B. Martin,<sup>14</sup> would undoubtedly even consider the use of such subjects as scales and bean plants in giving an account of the intentional component in perception as showing that TSRM simply have the wrong criteria for identifying intentionality.

If one were to account convincingly for epistemic perception in terms of manifest states apt for the production of behavior, one would need to give examples involving creatures which are capable of some reasonably high degree of novel and/or adaptive behavior as subjects. The tendency to suppose that something more is involved in perceptual information pick-up by human beings than by marsh periwinkles might ultimately prove to be unfounded. Until such time as it does, the distinction between states apt to produce some behavior and genuine epistemic states, the distinc-

tion which underlies the tendency to differentiate between human and periwinkle perceptions, has to be acknowledged. This is done by defending the view that the intentional component in perception is accounted for in terms of dispositional states of perceiving organisms using examples which are clear cases of epistemic perception (hence, cases which involve perception in some intentional sense). The difficulty lies in the fact that the ease with which one may achieve consensus on whether a given case of perceiving is an instance of epistemic perception is inversely proportional to the ease of giving convincing reasons for saying that case is analyzable in terms of the causation of some physiological state likely to produce certain sorts of behavior.

To summarize, it appears that in their general structure the ecological approach and Armstrong's belief-theory are quite similar. Moreover, the apparent differences, as well as the superficiality of some of the similarities, are not insurmountable. They are no doubt partly a mere reflection of the fact that, because Armstrong and Gibson come from different academic fields, they have somewhat different priorities and also ways of looking at problems. Thus there are points which both authors make that are subsequently developed in detail by one and not developed at all by the other.

The main contribution Armstrong can make to the ecological approach is his idea that the operations of organisms' perceptual systems produces dispositional states of the perceiver apt for bringing about behavior. It provides the ecological theorists with something they need: a way of showing that they avoid the initial problem of lacking some account of the intentional component in perception. Also, if it is correct to interpret the ecological approach in this light, Gibson's view turns out to be somewhat

less singularly revolutionary than some of his disciples would wish. The good news is that there is a precedent for the theory which could make it more accessible and understandable from a philosophical point of view.

(iii)

To repeat, it is still a matter of great controversy as to whether or not perception or cognition can be accounted for in terms of some kind of behavior-state. The possibility of such an analysis, however, shows that, contrary to Fodor and Pylyshyn's criticism, the Gibsonian theory is not completely lacking in providing some view about the intentional component in perceiving. One job of the ecological theorist is to pursue the intentionality issue along behavioral lines by developing a viable account in detail.

However, there would still be at least two important reasons for reserving judgement on the general hypothesis of the ecological approach. This general hypothesis is that all perceptual information pickup is direct, in the sense of being the mere result of the detection of some invariant by an organism's perceptual systems. The two reasons for remaining doubtful are as follows:

1. As I have noted (along with Ulric Neisser), it remains to be seen whether or not enough invariant properties (specifying environmental phenomena of the right sort) can be discovered.

The view contains a criterion for differentiating between genuine and degenerate cases which are commonly described as instances of perception. The criterion is that only the cases in which the information an organism acquires is exclusively determined by the detection of an invariant by some of its perceptual systems should be considered as a genuine case. The acceptability of this criterion is contingent upon its ability

to fulfill some very large promises. There is a general promise that common usage of "perceives" and/or commonsense conceptions of what is perceptible will not be disrupted to too great an extent. There is the more specific promise that sufficient invariants will be discovered to satisfy general conceptions of how much of one's environment is perceptible.

Also, Gibson and his followers object to traditional approaches largely by claiming that they cannot explain the origins of knowledge of the environment, and that the basic terms in which such theories assume animals perceive their environments are not ecologically useful. There are therefore promises to the effect that such invariants as will be found in future research will specify the environment in useful terms, and will be of a sort to explain the knowledge various animals have of their environment.

As long as it remains for the ecological theorists to actually find considerable numbers of the underlying invariant structures which are supposed to serve as the basis of perceptual information pickup, these promises go unfulfilled.

2. The chief general objection to Establishment views, as Shaw, Turvey, and Mace put it, is that they subscribe to "the doctrine of intractable non-specificity".<sup>15</sup> This is just to say that Establishment versions of the input to perceptual systems is not specific to features of an organism's environment. It must therefore get the information via cognitive processing. The ecological theorists claim this requires prior knowledge or concepts, the means for representing the world in particular terms. They argue that if all perception is of this kind, one cannot explain how an organism acquires information about its environment in the first place.

The pickup of some information requires possession of prior information, which requires still prior possession of information, ad infinitum.

The conclusion the ecological theorists draw is that perception should be conceived so that all perception is the direct pickup of information. In other words, no genuine perceptual information pickup involves the application of prior knowledge (cognitive processing) to the present deliverances of the perceptual systems. This conclusion, however, is too strong and does not follow from the premisses from which it is derived. Given the initial premisses, one can at best conclude that at least some of the genuine cases of perception cannot involve cognitive processing. Hence, the ecological theory's most important argument against Establishment views yields only the conclusion which is a form of Fodor and Pylyshyn's Establishment position: perceptual awareness of some features of the environment is direct. Acceptance of the stronger, intended conclusion is at least contingent at least upon the satisfaction of the promises indicated in point 1).

(iv)

Overall, Gibson's ecological approach does not contain the fundamental conceptual flaw suggested by certain critics since it can be interpreted as analyzing the intentional component in perception in behavioral terms. This is a difficult position to argue, but it is one with which I find a great deal of sympathy. On the other hand, ecological theorists do not manage, by any means, to establish their hypothesis, partly because it embodies a recommendation to adopt a criterion for determining genuine cases of perception which has not yet proven acceptable. Moreover, the "origins of knowledge" argument does not yield the strong conclusion desired of it.

In spite of this, the ecological approach contains many challenging ideas for perceptual theory, not all of which have been given the discussion they deserve in this thesis. Nor do all of these ideas require acceptance of Gibson's general view. There are two such ideas that I have in mind. One is the novel conception of perceptual systems and their functioning. One can only wish that Gibson had spent some time in expanding on such notions as the extraction, resonating to, and detection of invariant structure. The second idea is that an organism perceives its environment predominantly in terms of affordances. The theory of affordances constitutes an interesting and rare challenge to mainstream views on what is perceived. Assumptions in this area of the categories of perception, especially in the philosophy of perception have too often gone unexamined.

## Footnotes

### Chapter One

<sup>1</sup>The theory I will outline is developed by Gibson mainly in The Senses Considered as Perceptual Systems (Boston: Houghton Mifflin Co., 1966) and The Ecological Approach to Visual Perception (Boston: Houghton Mifflin Co., 1979). Also helpful is James Gibson, Reasons for Realism, ed. Edward S. Reed and Rebecca Jones (Hillsdale, N.J.: Lawrence Erlbaum Assoc., 1982).

<sup>2</sup>Claire F. Michaels and Claudia Carello, Direct Perception (Englewood Cliffs, N.J.: Prentice-Hall Inc., 1981), 115.

<sup>3</sup>Jerry A. Fodor and Zenon W. Pylyshyn, "How Direct is Visual Perception?" *Cognition*, 9, no. 2 (1981): 141.

<sup>4</sup>Gibson, Ecological Approach, 239.

<sup>5</sup>Gibson, Ecological Approach, 75, 116; Gibson, Senses, 33-34, 200-201. Related terms include "proprioceptor," "exteroceptor," and "propriospecific," and "exterospecific information."

<sup>6</sup>Frank Jackson, Perception, (Cambridge: Cambridge University Press, 1977).

<sup>7</sup>Jackson, Perception, 154-172. A classic discussion given in terms of propositional versus non-propositional perceiving may be found in Roderick Chisholm, Perceiving, Ithaca, N.Y.: Cornell University Press, 1957.

<sup>8</sup>G.N.A. Vesey, "Seeing and Seeing As," Perceiving, Sensing and Knowing, 68-83, ed. Robert J. Swartz (Berkeley and Los Angeles: University of California Press, 1965), is an example of an analysis of "perceiving as".

<sup>9</sup>D.M. Armstrong, A Materialist Theory of Mind, (London: Routledge and Kegan Paul, 1968), 208-244. Armstrong holds that perception is the acquiring both of true and false beliefs.

<sup>10</sup>Fodor and Pylyshyn, "How Direct?", *passim*.

<sup>11</sup>S. Ullman, "Against Direct Perception," *The Behavioural and Brain Sciences*, 3 (1980): 375.

<sup>12</sup>Gibson, Senses, 266.

<sup>13</sup>Herman von Helmholtz, Epistemological Writings, Centenary edition of 1921 ed. Paul Hertz and Moritz Schlick, new trans. by Malcolm F. Lowe, ed. Robert S. Cohen and Marx W. Wartofsky, Boston Studies in the Philosophy of Science, 37 (Dordrecht, Holland and Boston: D. Reidel Publishing Co., 1977), 117 ff.

<sup>14</sup>John Locke, An Essay Concerning Human Understanding, 2 vols, collated and annotated by A.C. Fraser (New York: Dover Publications, 1959), Book II, chapter 9, sections 9-10.

<sup>15</sup>Gibson, Ecological Approach, 238.

<sup>16</sup>Ibid., 251.

<sup>17</sup>Ibid.

<sup>18</sup>Ibid., 251-252.

<sup>19</sup>Ibid., 251; Gibson, Senses, 275.

<sup>20</sup>Gibson, Senses, 306 ff.

<sup>21</sup>Gibson, Ecological Approach, chapter one (especially 9-10, 12). The existence of levels of explanation and/or description in science of some kind is widely accepted in the philosophy of science, although there is considerable dispute as to the exact nature of these levels and as to the extent to which the hierarchy is collapsable. It is an interesting part of Gibson's view that he believes traditional perceptual theorists have difficulty because they have not established the proper level of explanation of psychological theories of perception and cognition. One of Gibson's goals is to establish the proper level, mainly through his notion of perceptual systems and the parameters of physical energy to which these are sensitive. I will not discuss the ecological approach in terms of levels of explanation and description. This interesting issue is discussed by Lawrence Carleton in "Levels of Description and Explanation," *Philosophy Research Archives*, 11, 89-109 (Hillsdale, New Jersey: Lawrence Erlbaum Assoc., 1986).

<sup>22</sup>Ibid., 148.

<sup>23</sup>Ibid., 148-149.

<sup>24</sup>Ibid., 220.

<sup>25</sup>David Hume, Enquiries Concerning Human Understanding and Concerning the Principles of Morals, 3rd edition, ed. P.H. Nidditch (Oxford: Clarendon Press, 1975, a reprint from the 1777 edition, ed. with introduction by, L.A. Selby-Bigge) 151-153. Hume's problem here is epistemological rather than psychological, though.

<sup>26</sup>Gibson, Ecological Approach, 221.

<sup>27</sup>Gibson, Senses, 276.



<sup>28</sup>W. Schiff, J.A. Caviness, and J.J. Gibson, "Persistent Fear Responses in Rhesus Monkeys to the Optical Stimulus of 'Looming'," *Science*, 136 (1962): 982-983.

<sup>29</sup>W. Schiff, "Perception of Impending Collision," *Psychological Monograph*, 79, no. 604.

<sup>30</sup>Gibson, Ecological Approach, 175-176.

<sup>31</sup>Michael T. Turvey et al., "Ecological Laws in Perceiving and Acting: In Reply to Fodor and Pylyshyn (1981)," *Cognition*, 9, no. 3 (1981): 294

<sup>32</sup>Gibson, Senses, 280.

<sup>33</sup>R.E. Shaw, M.T. Turvey, and W.M. Mace, "Ecological Psychology: the Consequences of a Commitment to Realism," Cognition and the Symbolic Processes, 2, ed. Walter B. Weimer and David S. Palermo (Hillsdale N.J.: Lawrence Erlbaum Assoc., 1982), 164-167.

<sup>34</sup>Gibson, Ecological Approach, 253.

<sup>35</sup>*Ibid.*, 3.

<sup>36</sup>Turvey et al., "Ecological Laws," 243. Similar description of the Ecological Approach in E.S. Reed, "Two Theories of the Intentionality of Perceiving".

<sup>37</sup>Gibson, Ecological Approach, 243, 262-263, 307.

<sup>38</sup>*Ibid.*, 127, 238. Gibson, Senses, 267.

<sup>39</sup>G.E. Moore, "Proof of an External World," Philosophical Papers (London: George Allen and Unwin Ltd., 1959; reprint ed. New York: Humanities Press Inc., 1977), 127-130.

<sup>40</sup>Gibson, Ecological Approach, 8-9.

<sup>41</sup>*Ibid.*, chapter 2, 307.

<sup>42</sup>*Ibid.*, 307.

<sup>43</sup>Turvey et al., "Ecological Laws," 237-304.

<sup>44</sup>Gibson, Ecological Approach, 127.

<sup>45</sup>Nelson Goodman, Fact, Fiction, and Forecast, 4th ed., with forward by Hillary Putnam (Cambridge, Mass.: Harvard University Press, 1983), 40.

<sup>46</sup>Gibson, Ecological Approach, 127, 137-141.

## Chapter Two

- <sup>1</sup>Gibson, Senses, 50.
- <sup>2</sup>Gibson, Ecological Approach, 245.
- <sup>3</sup>Ibid.
- <sup>4</sup>Gibson, Senses, 50.
- <sup>5</sup>Gibson, Ecological Approach, 65-66.
- <sup>6</sup>Ibid., 65.
- <sup>7</sup>Ibid., 68-69.
- <sup>8</sup>Ibid., 68.
- <sup>9</sup>Ibid., 283-286. Gibson, Senses, 235-237.
- <sup>10</sup>Gibson, Ecological Approach, 73.
- <sup>11</sup>Ibid., 87.
- <sup>12</sup>Ibid., 247.
- <sup>13</sup>Ibid., 166-168, 169, 244. There may be others: this is a favourite point of Gibson's.
- <sup>14</sup>Ibid., 78-86. Gibson, Senses, 203-206..
- <sup>15</sup>Gibson, Ecological Approach, 165.
- <sup>16</sup>Ibid., 310.
- <sup>17</sup>Ibid., 87-91.
- <sup>18</sup>Michaels and Carello, Direct Perception, 21-22.
- <sup>19</sup>Gibson, Ecological Approach, 114. Gibson, Senses, 237.
- <sup>20</sup>Gibson, Ecological Approach, 208-209. Gibson, Senses, 284-285.
- <sup>21</sup>Gibson, Ecological Approach, 95-100.
- <sup>22</sup>Ibid., 10-12, 100-102.
- <sup>23</sup>Ibid., 175.
- <sup>24</sup>David Lee, "A Theory of Visual Control of Braking Based on Information about Time-to Collision," Perception, 5 (1976): 431-459.
- <sup>25</sup>Gibson, Senses, 280 (in passing).

<sup>26</sup>Ibid., 237.

<sup>27</sup>Locke, Essay, Book II, chapter 9, sections 8-10.

<sup>28</sup>Gibson, Ecological Approach, 310.

<sup>29</sup>Ibid., 63.

<sup>30</sup>Gibson, Senses, 245.

<sup>31</sup>Turvey et al., "Ecological Laws," 243.

### Chapter Three

<sup>1</sup>Michaels and Carello, Direct Perception, ch. 5; Shaw, Turvey, and Mace, "Ecological Psychology," *passim*; E.S. Reed and Rebecca Jones, "Gibson's Theory of Perception: A Case of Hasty Epistemologizing?" *Philosophy of Science*, 45, no. 4 (Dec. 1978): 526-529 are three examples.

<sup>2</sup>Fodor and Pylyshyn, "How Direct?" 139-196.

<sup>3</sup>Turvey et al., "Ecological Laws," 240.

<sup>4</sup>Fodor and Pylyshyn, "How Direct?" 141.

<sup>5</sup>Ibid.

<sup>6</sup>Ibid., 142.

<sup>7</sup>Gibson, Ecological Approach, 311.

<sup>8</sup>Ibid., 203-205.

<sup>9</sup>Michaels and Carello, Direct Perception, 178.

<sup>10</sup>Gibson, Ecological Approach, 134-135, 240.

<sup>11</sup>Turvey et al., "Ecological Laws," 261.

<sup>12</sup>Ludwig Wittgenstein, The Blue and Brown Books, (New York: Harper and Row, Pub., 1958; Harper Torchbooks, 1965).

<sup>13</sup>Fodor and Pylyshyn, "How Direct?" 169.

<sup>14</sup>Turvey et al., "Ecological Laws," 282-284.

<sup>15</sup>Ibid., 244-245.

<sup>16</sup>Fodor and Pylyshyn, "Ecological Laws," 188.

<sup>17</sup>Ulric Neisser, "Gibson's Ecological Optics: Consequences of Different Stimulus Description," *Journal for Theory of Social Behaviour*, 7, no. 1 (Apr. 1977): 24.

<sup>18</sup>Robert E. Shaw and John Bransford, "Introduction: Psychological Approaches to the Problem of Knowledge," Perceiving, Acting, and Knowing, ed. R.E. Shaw and J. Bransford (Hillsdale, N.J.: Lawrence Erlbaum Assoc., 1977), 1-10.

<sup>19</sup>John Heil uses this term to describe the problem in Gibson's approach that (he suggests) both D.W. Gamlyn and Ulric Neisser attempt to point out in "What Gibson's Missing," Journal for the Theory of Social Behaviour, 9, no. 3 (Oct. 1979): 265-269.

<sup>20</sup>Fodor and Pylyshyn, "How Direct?" 167.

#### Chapter Four

<sup>1</sup>Fodor and Pylyshyn, "How Direct?" 192.

<sup>2</sup>D.W. Hamlyn, Perception, Learning, and the Self (London: Routledge and Kegan Paul, 1983), 30-42.

<sup>3</sup>TSRM's references to Putnam are Hillary Putnam, "Is Semantics Possible?" Language, Belief, and Metaphysics, ed. H.E. Kiefer and M.K. Munitz (New York: SUNY Press, 1970), 50-63 and "On Properties," Essays in Honour of Carl Hempel, ed. Nicol Rescher et al. (Dordrecht, Holland: D. Reidel Publishing Co., 1969), 234-254.

<sup>4</sup>Fred I. Dretske, "Laws of Nature," Philosophy of Science, 44, no. 2 (June 1977): 248-268.

<sup>5</sup>Turvey et al., "Ecological Laws," 255.

<sup>6</sup>Shaw, Turvey, and Mace, "Ecological Psychology," 182-185, 194-203.

<sup>7</sup>Paul V. Hamilton, "Daily Movements and Visual Location of Plant Stems by Littorina Irrorata (Mollusca: Gastropoda)," Marine Behaviour and Physiology, 4, (1977): 293-304.

<sup>8</sup>Turvey et al., "Ecological Laws," 249.

<sup>9</sup>*Ibid.*, 268.

<sup>10</sup>*Ibid.*, 256.

<sup>11</sup>*Ibid.*, 265.

<sup>12</sup>*Ibid.*, 251.

<sup>13</sup>Gibson, Ecological Approach, 127. Turvey et al., "Ecological Laws," 267.

<sup>14</sup>Turvey et al., "Ecological Laws," 262.

<sup>15</sup>By G. Wedeking.

<sup>16</sup>Turvey et al., "Ecological Laws," 264.

<sup>17</sup>Ibid., 255.

<sup>18</sup>Putnam, "Semantics?" 50.

<sup>19</sup>Ibid., 51, 53-54.

<sup>20</sup>Ibid., 50.

<sup>21</sup>Ibid., 58-59.

<sup>22</sup>Turvey et al., "Ecological Laws," 264.

### Chapter Five

<sup>1</sup>Turvey et al., "Ecological Laws," 273.

<sup>2</sup>Ibid., 265, 267-275.

<sup>3</sup>Ibid., 266.

<sup>4</sup>Ibid., 249-250, 284-295.

<sup>5</sup>Dretske, "Laws," 252.

<sup>6</sup>Ibid., 252-253.

<sup>7</sup>Ibid., 267.

<sup>8</sup>Turvey et al., "Ecological Laws," 266.

<sup>9</sup>Dretske, "Laws," 253 n.

<sup>10</sup>Turvey et al., in "Ecological Laws," 237, favourably note a comment of Gibson's that would indicate the lawful relations they have in mind are causal ones. In the first place, causal relations are not symmetrical, so some story needs to be told as to how TSRM arrive at the arrangement of the predicates in their "transitivity argument" since it does make a difference to the truth of the premisses (because causal relations are not symmetrical) as to how the predicates are ordered. In addition, there is no causal relation that fits the order TSRM use. Suppose the relation is "causes": While it makes sense to suggest that an occurrent, physical property is the cause of affordance (o-ness  $\rightarrow$  c-ness), it is clearly false that an optical property causes the occurrent property (e-ness  $\rightarrow$  o-ness). Suppose, then, that the relation is "is caused by": the result is the reverse of the foregoing. It could be true that an optical invariant is caused by an occurrent property (e-ness  $\rightarrow$  o-ness) but it could not be true that an occurrent property is caused by an affordance (o-ness  $\rightarrow$  c-ness). Moreover, the affordance neither causes nor are caused by an optical invariant. If the relation is causal, therefore, the order of the predicates o, c, and e, matter in TSRM's argument, and as they are presently arranged, at least one

of the premisses is bound to be false no matter which way one tries to express the causal relation.

<sup>11</sup>Turvey et al., "Ecological Laws," 260.

<sup>12</sup>Ibid., 268-269.

<sup>13</sup>Dretske, "Laws," 250.

<sup>14</sup>Turvey et al., "Ecological Laws," 260.

<sup>15</sup>Fodor and Pylyshyn, "How Direct?" 168, 188-193.

<sup>16</sup>Gibson, Ecological Approach, 127.

<sup>17</sup>Turvey et al., "Ecological Laws," 274.

<sup>18</sup>Dretske, "Laws," 266.

<sup>19</sup>Ibid., 249 n.

<sup>20</sup>Turvey et al., "Ecological Laws," 274.

<sup>21</sup>Dretske, "Laws," 253.

<sup>22</sup>Ibid., 253 n.

<sup>23</sup>Turvey et al., "Ecological Laws," 274.

<sup>24</sup>Dretske, "Laws," 265.

### Chapter Six

<sup>1</sup>Gibson, Ecological Approach, 239; Shaw, Turvey, and Mace, "Ecological Psychology," 191-194.

<sup>2</sup>Gibson, Ecological Approach, 134.

<sup>3</sup>Dretske, Knowledge and the Flow of Information (Cambridge, Massachusetts: MIT Press, 1981), 202-206. Dretske's main complaint is that he thinks one puts the matter backwards by analyzing (or giving "content" to) intentional states in terms of the behaviour or dispositions to behave that are produced by them. He believes on the contrary, that it is the content an intentional state already has which explains the output. This is by no means an original criticism of behavioural analysis of intentional states.

<sup>4</sup>Turvey et al., "Ecological Laws," 290.

<sup>5</sup>Ibid., 275-282.

<sup>6</sup>Ibid., 277.

<sup>7</sup>Armstrong, Materialist, 209.

<sup>8</sup>Ibid., 210.

<sup>9</sup>Ibid., 245-248.

<sup>10</sup>Ibid., 227-229.

<sup>11</sup>Gibson, Ecological Approach, 243.

<sup>12</sup>Shaw, Turvey, and Mace, "Ecological Psychology," 177-178, 182-183.

<sup>13</sup>Daniel Dennett, "Conditions of Personhood," The Identities of Persons, ed. Amelie O. Rorty (Berkeley and Los Angeles: University of California Press, 1976), 179-180.

<sup>14</sup>Karl Pfeifer and C.B. Martin, "Intentionality and the Non-psychological," *Philosophy and Phenomenological Research*, 46, no. 4 (June 1986): 531-554. Pfeifer and Martin argue that many typical accounts of Intentionality apply to dispositional properties of purely physical systems. They would take this to show that the criteria for identifying intentionality in question is wrong. Hence, TSRM's view about intentionality, which considers "sensitivity to four ounces or more" to be an intentional state of a balance would be taken by Pfeifer and Martin as showing that the ecological theorists have the wrong criteria for identifying intentional states.

<sup>15</sup>Shaw, Turvey, and Mace, "Ecological Psychology," 164-167.

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