

A. J. MARSHALL

καὶ

ΛΑΜΠΡΟΥ ΧΟΥΣΙΑΔΑ

PERCEPTION BASED ON THE INFORMATION
IN STIMULATION

[ΛΕΥΚΗ ΣΕΛΙΔΑ]

Information has become very much of a vogue word in psychology, largely because it has a double meaning. In everyday life we use it to refer to items of knowledge gained as news, but it has also a technical meaning which is used by communication engineers when they seek to measure the amount of information that can be transmitted along a given communication channel. Some psychological research in perception does in fact use the term in this technical way, for psychologists are also concerned with the measurement of information. Mostly it is used ambiguously. For the most part 'information' is given its everyday meaning but there is also usually some hint of the possibility of being mathematically precise about it. In his latest statement of his own theoretical position on perception, J. J. Gibson has used such phrases as «perception being based on information», and «information available in physical stimulation». Gibson believes that it should be possible eventually to describe mathematically the complex forms of stimulation but this is a more general matter and does not involve the technical usage deriving from the communications engineer. When Gibson uses the phrase «perception based on information» as a label for his position, he is less concerned to stress the technical meaning of 'information' than he is to find some term that is neutral as regards the kinds of sensory and perceptual processes involved. If one reads this phrase, giving 'information' its everyday meaning, it boils down somewhat tautologically to become «perception based on what is perceptible in stimulation», so perhaps Gibson is relying on some of the overtones of a secondary meaning.

Although Gibson may be pleased to use a term currently in vogue for the purposes of exposition and persuasion, it should be noted that in his professional work he has shown no eagerness to follow tamely any of the fashions that from time to time have shown up in experimental enquiry in the field of perception. Early American Behaviorism, with which he was associated, arose in opposition to a trend in Psychology that stressed sensory phenomena and the use of introspective methods. Whilst the early Behaviorists were prepared to speculate in a semi-philosophical

* Prepared for a seminar on J. J. Gibson's theories held at the University of Thessaloniki, May, 1970.

way as to how perceptions and awarenesses might be constituted of implicit and overt movements, the effects of the methodological strictures of their position was to avoid perception as not being a fruitful field for experimentation. But the study of perception, as an area of empirical enquiry, was a central issue throughout Gibson's professional life. It would be sad indeed if the results of such long extended work amounted to nothing more than some semi-tautological statements that could never be shown to be wrong, no matter what the empirical findings. The use of a slippery term, without making greater efforts to pin down its meaning, creates these hazards but no position should be judged by its label, and Gibson's theory of perception as based on the information in stimulation is certainly worthy of critical study. A contrary kind of difficulty tends to arise with anyone meeting for the first time the set of positive assertions that he is currently making. The tendency is simply to reject these as untrue. This is at least more consonant with Gibson's claims that his position is a revolutionary one. Probably the way to approach his current position most sympathetically is by considering the theoretical statements made by him at various stages of his empirical enquiries. To do this, means to review his work with some consideration of its historical setting.

1. GIBSON'S ENQUIRIES INTO PERCEPTION

Any American student of perception over the years 1925-1935, who wanted a general theoretical framework for his enquiries, could make a choice between two different kinds of theories. One kind was based on the characteristics of the experience immediately following the reception of fairly simple kinds of stimulation, whilst the second kind was based on the way in which stimulus objects, present to the senses, entered into our actions and complex adjustments to the environment. The theories that regarded perception as being based on units of reception were concerned with problems of how stimuli were received and of what kinds and amounts of stimuli needed to be presented to have certain kinds of sensory or perceptual experience. Theories of perception as based on action were more concerned with what stimulus objects or stimulus properties were involved in the behaviour. The student's choice then lay between a general theory of perception that assumed that all perceptions were based on simple sensations or possibly on more meaningful 'gestalten' as the units of reception of stimuli, and, on the other hand, some general theory of perception that regarded perception as being based on motor actions and adjustments. His preference might lean towards basing

perception on reception units because of the convincing evidence already available of psycho-physical correspondence between simple physical stimuli and the reception units of the theory. There was however still the difficulty of finding out how more complex perceptions developed or were constructed out of these units. In favour of the theory of 'action-based'-perception was the fact that it was not difficult to find evidence of complex perception being involved in, and explicable in the same terms as, skilled motor action and adjustment to the environment. Here the difficulty lay rather in defining the stimulus, of finding, that is, just which physical properties among the complex and changing properties of objects and events in this situation were effective and responsible for given perceptual properties (Held, 1965). Such a tie-up required, on the theory, also the finding of a correspondence between component adjustments underlying the perception and the stimuli, if the Stimulus-Response analysis were to have any scientific meaning and relevance for perception theory.

In a research project, carried out in his student days, J. J. Gibson repeated a study in which drawings were made of two-dimensional shapes at different intervals after their perceptual presentation. On the basis of his findings he denied the claim made by Gestalt psychologists that the memory trace suffers systematic and autonomous changes as a result of sheer lapse of time and with no further action involving the object. Gibson believed that all the errors in the drawings could be explained in terms of habits of perceiving and habits of making drawings. His preference was to think of perception as based on action and adjustment rather than on units of reception that had to be built up into perceptions along with the changing traces of prior perception. Although at times he seems to be dealing with a kind of reception unit uncovered by exploratory action, he probably never went back on his original choice between the two kinds of theories but this does not mean that there weren't considerable changes to be made in his theoretical position over the next forty years. Something of the stages of his thinking and progression of his research programme can be gained from a tally of the work done in each of the four ten year intervals.

(a) 1931-1940

Early studies of whether one could adapt perceptually to one's environment when vision was systematically distorted, attracted the attention of Gibson as it did that of many other psychologists. He asked himself what would happen if the visual stimulation occurring over a period of time was consistent but unusual, although not made unusual

by wearing distorting mirrors or prisms. Contrary to his expectations, his empirical results showed that perceptual adaptation occurred in this situation also. This important study of the normalisation of the perception of physically curved lines was followed by a series of studies of the changes in sensory experience following the application of a variety of stimuli to different senses. He believed that negative after-effects following stimulation were by-products of the primary fact of adaptation to a norm, and stated that «whenever experiential qualities fall into an opposition-series, then adaptation with negative after-effect may be expected to occur» (Gibson, 1937, p. 225). Further studies were undertaken with visual forms of various shapes and angles of orientation to determine what properties would combine to give an impression of tilt. Not all the enquiries made in this decade were of the laboratory sort, usual in those days, with simple stimuli in different senses and drawings or pictorial shapes in vision. One study was made of success in adjusting oneself to the gravitational vertical when set at a bodily tilt. A second was an attempt to describe the perceptual world of the motorist. The first was concerned with adjustment to a norm and the second with complex perceived properties of the motorist's environment, which included the momentary field of safe driving as influenced by probable as well as visible obstacles and hazards. Gibson was interested in the correspondence between physical and perceived properties. He had been able to measure shifts in their correspondence and obviously he did not intend to restrict himself to studying simple properties of either sort.

(b) 1941-1950

Much of Gibson's war-time work was concerned with the development of motion pictures for the selection and training of recruits. He was critical of Renshaw's method of training for aircraft recognition by giving considerable practice in recognising pictorial representations of the different aircraft shown very briefly in a tachistoscope. He believed that the important thing was to see these aircraft, or models of them, in motion and continually changing their distance away from the observer and their orientation to him. Moving film could be used in training sessions. Questions raised about the best procedures for training in aircraft landings led to an interest in how the trained pilot perceived his surroundings so as to take the appropriate glide path and be able to see the distance to touch-down. Gibson (1950) noted that a surface extending away from the observer's point of fixation provided a gradient of stimulation at the eye, with its further textural detail corre-

spondingly smaller in this perspective. He believed that the perception of the distance of an object by a stationary observer was analogous to the perception of a longitudinal surface and consisted of perceiving that object at a given place on such a surface. There was, incidentally, also a spatial gradation of the excitation occurring at the retinal surface, which was reassuring to anyone trying to account for the resulting perception in terms of reception units. A stationary world provided a moving observer with an ordered flux of stimulation in time. Such regularities of stimulation, as well as that resulting from a moving object could be shown by means of moving film. Gibson believed that the perception of the visual world was based on these regularities in the complex properties of visual stimulation, and, in order to understand visual perception, they needed to be uncovered and described. The concepts of a visual field of sensation and of a visual world of perception were introduced (Gibson, 1950), to emphasise the difference between momentary sensation and stable perception. An observer couldn't have both kinds of experience at the same time since they arose from different ways of dealing with incoming stimulation. Most readers found the concept of the visual field a puzzling one. A chaos of momentary sensation is a comprehensible notion whether it can be experienced or not, but the visual field here spoken about had spatial order and couldn't in this respect be contrasted with a visual world of everyday perception. There was just a hint in this difficult concept of the visual field, that when one gave over the practical task of perceiving and took up this attitude of attending to sensations, certain units of reception, like new 'Gestalten' available in momentary stimulation, became introspectible, and with the changes of the visual field one might get an impression also of units of reception available to perception when the stimulation was appropriately varied over time. Gibson never actually said this. He was content to point out that the visual world of perception was very different from the visual field, and that the perception theorist, just like the practical perceiver, could get along quite well without momentary sensations, or any other kinds of sensations, as immediate units of reception.

(c) 1951-1960

Much of Gibson's writing was concerned with characteristics of environmental stimulation that were important for various kinds of perceptual experience. Any such accounts of perception run dangerously close to being no real explanation at all. Certainly one provides only a very banal explanation of the perception of a book when one notes that a book is pres-

ent to the senses. Gibson during this period moved beyond description of certain situations and demonstration of the occurrence of certain perceptual effects. He used various arrangements of apparatus to control stimulation and to derive phenomenal effects, predictable on his theory, but unlikely on a common-sense basis. The experience of a tunnel, leading away from the observer could be obtained naturally enough with a tunnel having certain optical characteristics. A similar perceptual effect could be obtained where there was no actual tunnel present but with a number of screens set closely one behind the other and having progressively smaller circular apertures for those set further back, these screens being either light or dark and arranged in an order that was alternatively dark and light. This synthetically-produced appearance of a tunnel did not disappear with movements of the observer's head and eyes. Another device for controlling stimulation in an unusual manner was the so-called 'visual cliff' reported by Eleanor Gibson and Walk (1960). This allowed the observer to move around but prevented him from getting any information that specified depth, other than by the eye. It consisted of a transparent surface half of which was made opaque with a regular checkerboard pattern set against its under surface and visible as such from above, whilst through the remaining half could be seen the same pattern set at some distance below. The upper pattern thus had an edge which realistically covered up sometimes more and sometimes less of the lower depending upon the observer's movements. It was also found possible to provide synthetically the visual stimulation changing over time which would give the appearance of a 'rigid' body in motion or as seen by a moving observer. The prescription for the control of stimulation designed to give an experience of rigidity as against non-rigidity was to provide 'perspective' as against 'non perspective' transformations of the stimulation. Such a series of demonstrations and experimental studies entitled Gibson to put emphasis on the role of the complexity of the stimulus, and he now reformulated his position under the slogan that perception could best be understood as a function of the stimulation, provided that account was taken of its temporal successions as well as its spacial adjacencies. His statement of the general hypothesis behind all his work is that «for every aspect or property of the phenomenal world of an individual in contact with his environment, however subtle, there is a variable of the energy flux at his receptors, however complex, with which the phenomenal property would correspond if a psychophysical experiment could be performed» (Gibson 1959, p. 465). Along with this revised understanding of perception went a renewed interest in perceptual learning which enables us to cope

with these orders of complexity in stimulation. Eleanor Gibson had for some time been conducting learning experiments using perceptual situations. Now they jointly proposed that it was best to consider perceptual learning as an increase in ability to uncover the invariances of stimulation by discriminating, differentiating and abstracting what ever yielded clearer perception within the flux of stimulation. This need not be regarded as having to involve feats of memory provided that invariances could be isolated or extracted in this way from a succession of stimulation. Conventional perception theory called upon association and memory traces to account for any normal perceptual experience: the problem was how to build the meaningful from the less meaningful or simpler units of reception. Gibson believed that this endeavour was a misguided one and became unnecessary on his theory of perception as a function of stimulation. Order, structure, relatedness was already in the complex stimulation available to the perceiver. He could uncover some of this and learn to discover more, without having to associate something present with something not present. He was at some pains to stress that stimulation itself could occupy some time and wasn't necessarily momentary or simultaneous.

(d) 1961-1970

Gibson's demonstrations of certain visual perceptual effects had been found very impressive even by some psychologists who were not disposed to accept his theoretical position. Work of this sort continued and even more spectacular effects were produced with controlled stimulation that gave the subject the impression of an impending collision (Schiff, 1965). But such studies did not provide the chief object lesson that Gibson in these last ten years had sought to provide. A gradient of texture, or the expansion of the texture to simulate approach, could be thought of as providing a gradient of excitation, or of changing excitation on the retina as a reception surface. Gibson now sought to bring home his more recent conviction that not all the transformations of stimulation, important for perception could or should be pictured in this fashion. Instead of the environment typically providing invariants to a passive observer, such invariants in stimulation, Gibson claimed, could normally be uncovered only by active movement and exploration on the part of the observer. He now began to undertake studies in active touch, which he considered brought this out more clearly. He used small, solid, sculptured objects of no conventional shape. Although not easy to describe, their geometrical structure could to some extent be sensed when they were grasped in one hand, and, even more readily, when they were actively

manipulated and explored by touch. Gibson also showed that it was relatively easy for a subject to identify visually which of a set of such objects now on display had previously been felt by active touch. From such studies he deduces firstly, that there is some equivalence of the information available in the stimulation gained by means of the hand grasp and that obtained from the successions of contact and kinetic stimulation with the moving fingers, and, secondly, that there is an equivalence of the information in the stimulation obtained by visual and tactual explorations of the same object. However different the manner of sampling might be on different occasions and despite the fact that different stimulus energies were involved with different senses, Gibson considered that the processes of perception, that involved the uncovering of the properties of stimulation specifying the distinctive features of these objects, was likely to be analogous on different occasions and as between vision and touch. Recognition occurs with the greatest confidence when head and eyes are free to move in visual exploration. Such studies, Gibson believed, provided him with effective demonstrational to illustrate and support his arguments for a theory of perception based on the information in stimulation.

Gibson (1968, p. 245) notes that with the normal functioning of the senses stimulation almost always has complex structure. It is possible to use the term information where one is assured that it has this rather than some other possible structure, and hence be able to describe in abstract informational terms the discriminations that one can make as between a number of possible stimulations. Much more important for Gibson is the fact that stimulation resulting from energy changes of light or air or pressures on the skin can be specific to the presence of certain objects and the occurrence of certain environmental events. The stimulation can therefore convey information about these objects and events. This is the meaning Gibson gives the term 'information' when he says that we are able to obtain stimulation and uncover the information in stimulation that makes perception possible. This is nearer to some of the everyday meanings of information which don't imply that the information is obtained by means of a pictorial representation or by word of mouth (Gibson, 1968, 12-15, 187). With this meaning of 'information-about-something', there is little difficulty in agreeing that equivalent information could be obtained despite the different stimuli affecting the eye and the hand in these sight-touch recognition studies. The stimulation in each case specifies the same object or the same object characteristics. His latest book, *The senses considered as perceptual systems*, attempts to show

in some detail how the different senses acting, separately or in combination, as exploratory systems could register various kinds of stimulus information, thus giving rise to the perception of environmental objects and events, contacted by these senses.

Any analysis of activity in terms of systems demands that one should give some separate account of the output of the system, of the input and of the way in which output controls input. This has been done fairly successfully in the case of motor action and skill in which complex coordinated muscular movements are carried out appropriately to achieve the goals of the action. When the senses are considered as perceptual systems their output can be described according to Gibson as various kinds of investigatory activity, which involves the obtaining of stimulation in such a fashion that certain invariants of stimulation can be registered. The inputs via the sensory receptors may include stimulation stemming from the external environment or proprioceptive stimulation from the organs and limbs of the body. Inputs to the nervous system can occur when the sense organs are passive and when the body, its limbs, etc., are not actively moving but the inputs to perceptual systems are typically obtained when the sense organs are active and the body is actively moving. That is, according to Gibson, the senses only act as perceptual systems when stimulation is obtained rather than imposed. He notes that receptors can be stimulated in ways that yield little or no information about the body or about external objects or events, the resulting experiences he would prefer to call sensations rather than perceptions. Typically perceptions arise from inputs obtained with exploratory activity. The succession of stimulations, enable invariances to be registered and these by specifying objective events and situations allow the perceptual system or systems to pick up the required information. The output of investigatory activity thus controls inputs and on achieving the goal of finding the information in the stimulation, the perceptual system ceases to function, at least for this particular purpose.

Gibson believes that in principle the task of explanation in perception is completed as soon as the investigator is able to point to the invariances in stimulation providing the necessary information for the perception. He believes that his theory gives a clear lead as to what research needs to be done and the main difficulty, likely to cause some delay in research productivity, is the lack of mathematical concepts or procedures necessary to describe the invariances to be found in the complexities of stimuli which are the inputs of perceptual systems.

2. EXPLICIT ASSERTIONS

Gibson's choice of what needs to be explained is very different from that of most other theorists, who attempt to make pronouncements on general perceptual theory. He considers that to try to find how complex perceptions come to be organized out of less meaningful sensations or other reception units, is to waste time on a pseudo-problem. Stimulation is structured. This provides the opportunity for perception, and the main problem is to track down the parts or features of the stimulation yielding the information on which any given perception is based. Gibson obviously allows certain subsidiary problems relating to the conditions accounting for the obtained stimulation. Besides the obvious causative factors to be found in the properties of objects etc. of the environment influencing the sense organs, there are factors of importance in the ways in which the senses are used to explore the environment. The following statements are a sufficiently close paraphrase of Gibson's crisp and radical assertions so as not to be misleading as a summary of his general theory of perception based on the information in stimulation.

(a) *Assertion on opportunities for perception:*

Although stimulation from the external environment changes continuously, the permanent properties of the world are correlated with (or specified by) unchanging relationships (invariants) in the flux of stimulation.

(b) *Assertions on selectivity as a causative factor:*

Both perception and sensation are dependent on stimulation but perception is not caused by or mediated by sensation. When an observer attends to certain invariants he perceives objects: when he attends to certain variants he has sensations. This means that the stimuli that cause sensation are different from those providing an opportunity for perception. Stimulation, providing the objective information of perception, can be obtained by an observer only when he selectively orientates himself to listen, touch, taste, smell, feel the action of a tool that he is wielding, or look at an object, etc..

(c) *Assertions on development as a causative factor:*

The adequate use of the opportunities for perception offered by stimulation, turns on the development of ability to find important properties of the world 'hidden' in stimula-

tion. We can learn to make appropriate exploratory movements as well as to find what it is appropriate to focus on, in order to uncover them. This means learning to use the 'specifying' features of a great variety of transformations of stimulation, some produced by changes of position or of the physical structure of objects, some by our own bodily or exploratory movements.

3. SOME COMMENTS ON THE THEORY OF INFORMATION-BASED PERCEPTION

Despite some changes over the years, Gibson's theoretical statements and research programmes have always been directed to unravelling the nature of the stimulation in perceptual situations, to determine what was available and what parts of it were effective. These were questions raised by the very general theory of action-based perception which Gibson had favoured from the beginning of his career. His experiments showed that the properties of stimulation, important for perception, were largely due to the perceiver's own movements and exploratory actions. Here was a sufficient change in what needed to be emphasised in his theory to warrant relabelling the theory as information-based perception, but, since information in stimulation arose through action, it was also a fitting development of action-based perception theory.

Gibson has always called in question the assumption of sensation-based theories that perception must be the result of processes of construction. He argues that there is no such requirement since the information in situations only needs to be registered, found or used. Especially has he been opposed to the notion, which Gibson believes to be quite widespread if not always stated by the holders of such theories, that perception involves the building of copies, pictures or mental representations of objects and events. These copies would then have to be stored for later use in the building-up of new perceptions or the recognition on a second occasion of objects previously encountered. Despite his conviction about all of this being wrong, Gibson frequently found when dealing with problems of visual distance perception, that it was easy, at least in exposition, to be unclear about whether he was giving a strict account of visual stimulation and its physical laws or whether he was dealing with the devices of representational perspective that would be referred to in accounts of landscape paintings. The gradient of texture in stimulation at a retinal surface could be reproduced in the spatially extended retinal excitation pattern just as it could be represented in a two dimensional drawing. To avoid the dangers of language and the tendency to think

in pictorial metaphors when dealing with visual space, Gibson spelled out in some detail the properties of the stimulation in situations with everyday objects seen in ambient light, by scatter - reflection from surfaces. Despite some forbidding talk about ecological optics, Gibson is able to convince his readers readily enough, that a perceiver, who changes his bodily position and the direction of his gaze, is able to obtain a wealth of information about the geometry and lay - out of the surfaces of objects, now displayed and now occluded by the edges of other objects in the room, about the textures and micro - structures of these surfaces, and about the perceiver's own bodily movement. The arrays of light are unique for each viewing point and the spatial properties of the room and the structure of the contents are specified by the arrays of light converging on these viewing points. Of course the complete set of possible viewing points and possible arrays of reflected light could never be sampled but only a few changes of eye - position would provide firm information on the existence of an edge and its relation to some edge of another object. Further viewing would not yield anything surprising unless the objects themselves changed or a fresh object was uncovered, since the information overlapped and was redundant. Gibson's thesis is that the visual stimulation as so structured is replete with information. Since the demonstration of what is involved can be done with drawings or moving film, it still does not tell, as assuredly as Gibson might have hoped, against copy - models of perception.

When Gibson came to study active touch, he was dealing with a perceptual system which suffered less from these dangers of confusion from metaphors of pictorial representation, but it was also very different in that it did not have to do with a medium such as ambient light which could be packed with information about the objects reflecting this light and occluding the light reflected from other objects. Has the policy of concentrating on the properties of stimulation been warranted in the case of touch? Two things about touch Gibson found very interesting. Firstly in exploring a surface with moving touch, each instance of touching in itself could not be regarded as providing any copy or representation of the object, and secondly the order of making contacts over the period of the exploration, did not seem to make any marked difference. One had a clear perception of the object given adequate time to explore but if one tried to introspect on what was given by any single touch contact one seemed to be dealing with something quite different. In many ways Gibson found touching and looking to be closely analogous and in the recognition studies with objects perceived first by one sense and then

by the other, he was able to show that vision and touch could pick up the same information about the shape of an object. Since touching did not involve conventional pictorial representation, Gibson believed it might provide the better paradigm of a perceptual system. Neither the picturing-possibilities of the single glance in vision nor the order of fixations in visual explorations should be regarded as being of great importance in the working of the visual perceptual system. But obviously there was a great deal of difference between vision and touch in that the stimulation of ambient light could carry more information than could ever be uncovered by the perceiver. Gibson does not spell out the analogy as regards touch. Certainly he says that in the situation of an object being explored by touch, the moving fingers uncover the invariants in the situation. Obviously if this is to be an explanation of perception something has to be invariant in the situation besides the physical object itself. Feeling pressures and touch contacts may not supply the important, required information. In vision one has spatial relations in ambient light space, with dynamic touch one may be dealing with relations in kinaesthetic motion space. If one has an object wedged in the cutting part of the scissors with which one is trying to cut, or if one grasps an object with a pair of pliers, one may well perceive the size, toughness and other characteristics of the object without ever seeing it. It is an obstruction, a gap in the otherwise free - to - move space in the normal action of the tool. Similarly in feeling shapes of objects by the moving fingers, the object forces a gap in their free - to - move kinaesthetic motion space. The invariants uncovered by making many different kinds of pincer and other fingers and hand movements, are those of the gap. What is perceived however, is the shape of the solid object, as well as other of its characteristics. Gibson's explanation could go forward in this fashion, since this fits in with his conception of the typical way in which perceptual systems function. Even so, the non - Gibsonian theorist could argue that the person exploring an object by hand is building up a kind of map of the object. Subsequent movements made can check on the adequacy of his plan to confirm it, or to refashion it. With sufficient time he could arrive at a satisfactory plan of the object, or a derived set of hypotheses as to where and when certain kinds of exploratory movements are going to be blocked. One would get answers consistent with this alternative account if one asked a subject what he was doing when he actively explored an object by touch.

What objection has Gibson to explanations of this sort, other than his dislike of any consideration of constructive processes and mental representations in perceptual theory? Gibson would claim that his kind

of explanation is simpler. Invariants are there in the stimulation created by the moving fingers, and the haptic perceptual system can uncover them. Perhaps Gibson's account only remains simple while it stays as broad generalisation.

Two major problems beset perception theorists. The first is the problem of how it is that we can perceive constant objects despite considerable changes in the stimulation, and the second is the problem of how we can have our normal assured perception despite the inevitable ambiguity of any momentary excitations of a single sense organ. On Gibson's theory of information-based perception these problems are successfully by-passed. We just do not have to construct our perceptual objects and indeed it is only by having changing stimulation that perceptual systems can get at the invariants, which are the information required for the perception of objects with constant properties. As for ambiguity, much of this, says Gibson, has been created by the artificial situations devised by psychologists. The best way of finding how perceptual systems work is not that of creating situations in which they cannot function properly. For example, the spatial arrangements of a room may be quite ambiguous if only a momentary glance is permitted, but, if time is allowed and the perceiver is free to make exploratory movements, this initial ambiguity must necessarily disappear. For all senses that can obtain more than a minimal amount of stimulation from present objects, a wealth of information about these objects can be obtained by perceptual systems functioning normally in normal environments. In such situations obtained stimulation is not ambiguous: it provides the information that enables the perception of objects with their true, constant or permanent properties. On Gibson's position these problems therefore vanish. Perhaps some contrary problems arise as to why we ever make mistakes or make compromises and perceive objects in ways that would suggest some contradiction or inconsistency in the information obtained or the way in which it has been used.

Clearly the great wealth of information available in potential stimulation raises the question of how we can be sufficiently selective to get usefully at any of it. Gibson answers that with any of the senses working as a perceptual system the individual has oriented himself to pick up certain kinds of information about certain objective properties or events. The adjustive and exploratory movements made serve to uncover invariants in the stimulation. We don't perceive these invariants as such but perceive the objects or environmental properties they specify. Concentration on the object will continue until its perception is suffi-

ciently clear for our current interests and actions. Such things Gibson believes to be quite readily demonstrable facts. He has evidence of still other facts concerning the improvement of selectivity in perception as a result of repeated contact with much the same situations. Learning to perceive involves finding out what are the distinctive features of objects, also very importantly, it turns on discovering where we must focus our attention and what exploratory efforts should be made to reveal them. Perceptual situations involve us in making movements of many different kinds, and with the repetition of the situation because of feed-back there is bound to be some anticipation of occurrences such as the sound of our own footsteps. In this way perceptual systems are self-tuning systems that achieve greater perceptual mastery of such situations largely through improved selectivity. For all these facts Gibson offers a rather meagre explanation with his speculation that the nervous system, and hence each perceptual system, resonates to the invariants in the stimulation so as to bring about more appropriate exploratory movements that will bring about further stimulation that will favour the isolation and registration of these invariants. As an explanation it has decided limitations by being little more than a way of re-thinking his theory of information-based perception in neurological terms.

Gibson continues to stress the importance of learning to perceive, but he is quite opposed to any explanation of this learning that would make it dependent upon memory and the formation of associations. He believes that in recognition the past is not reinstated. Perceptual systems, on his theory, resonate to the invariants in obtained stimulation and must do so not merely more effectively on repetition but also in some distinguishably different fashion that specifies the fact of there having been these previous encounters. Thus familiarity with the situation or with our ways of investigating it must in some way be specified in this perceptual situation. Gibson (1968, p. 46) has drawn up a clear-cut classification of inputs as either coming from the environment or as coming from, and being informative about, bodily movements. He goes on to water down this strict dichotomy when he notes that for adequate control, perceptual systems need to be proprioceptive also. Feedback control must be part of any system. Perceptual systems could improve their functioning by using information about bodily movements and the outcomes of their explorations. Gibson's thesis is that perceptual learning need involve no extra loading on memory. However subtly the nervous system may be required to resonate to the many invariants of exteroceptive stimulation and to the invariants of the familiar feed-back of

investigatory action, still on his theory, no memory load is involved: perceptual systems become attuned to given situations and function more adequately to produce more useful information more economically.

For Gibson the possibilities of perception lie in the information available in stimulation. Naturally able and educated perceptual systems isolate invariants of stimulation corresponding to the constant features of objects, and to regularities of movements, etc. Perceptual systems explore until perceptions are sufficiently clear and definite. Gibson tends to couple this general way of accounting for perceptions with more common sense types of explanation. Perceptual systems can selectively uncover interesting information. This means a greater urgency of exploration and greater concentration on parts of the environment arising from the natural way the system works in such situations or as a result of learning to perceive interesting objects of this sort. Gibson tends to make this kind of explanation plausible by giving everyday examples as in his description of the series of visual explorations made by a man who comes into a room to find another person there pacing up and down. «The face of this person reflects a pinkish patch in the array, a patch that wipes across the background texture and undergoes complex deformations. Our observer will almost certainly apply his foveas to this small patch and track it with his eyes, for this part of the array probably carries more interesting information than any other. He will even scan its fine details, with minute fixations superposed on the pursuit fixation, identifying a smile, and observing whether the other person does or does not look directly at *him*» (Gibson, 1968, p. 260). No accumulation of such facts on highly selective exploratory activity is likely to force other theorists to abandon their own theories for they too have ways of accounting for selectivity in perception and might very well be prepared to put very considerable limits on the extent to which it is possible to explain perception in terms of some revival by a present stimulus of something associated with it in the past. Probably these others would seek answers to rather different questions such as how perception comes to be affected by the context. For example one might ask how an unidentified object comes to be seen as being at a given position on a clearly perceived ground and seen to have a size appropriate to that position. Gibson has much to say about how different invariants, gradients of textures, surfaces and edges of objects are registered, but he has much less to say about their meaningful interaction or how they come to be fitted together. Gibson has pointed out that we do not have to make a major point of explaining the organisation of perception since the stimulation

obtained by perceptual systems already has structure and organization. However, facts suggestive of perception being to some extent determined by their contexts could be examples of an ordering imposed on perception, which although deriving from the structure of stimulation, could yet be done differently depending on the priorities, or rules of interaction, being followed by that perceiver or in those particular circumstances.

Gibson's explanations of perception are in terms of the efficient action of perceptual systems. It is possible to extend somewhat this explanation in terms of systems by noting the analogy or kinship of perception to perceptual - motor skills. Skills can also be analysed as examples of feed - back systems and in general terms they may be understood as coordinated action that strives to achieve some goal whilst maintaining certain standards of performance in achieving this goal. Besides referring to the particular objects of perception one can speak in an analogous way of our perceptions as having the general goals of gaining important and interesting information. Thus perception may be understood as being useful by giving guidance to our action and thought. It is also important that we should not miss signs of things significant to us though possibly little subject to control by our actions. As regards the standards maintained, these seem mainly to be concerned with the economy and conclusiveness of perception. Thus the perceiver appears to be dissatisfied if his perceptions aren't stable and consistent enough to avoid constant revision, and are not as clear and definite as conditions will allow. If these goals and standards, and indeed the whole analogy of perception to skill, is taken seriously many questions are raised about how the goals are achieved or the standards are maintained. Gibson does not evade such topics although at times he just accepts them as facts to account for the particular working of a perceptual system. On the matter of clearness he notes that in order to specify a given object in all its complete uniqueness very many invariants would need to be extracted from stimulation gained by varied exploration. This tells about how it would be possible to be quite definite in perception without going into the question of what parts of his perception a perceiver would allow to remain somewhat indefinite. Practical perception does not normally concentrate for so very long on a single object nor ever concentrate on all possible objects. There must obviously be some quickly applicable rules or priorities to account for what we do perceive, for as regards vision, our visual environment is not perceived as a patch - work quilt of discovered properties and possibilities plus blank unexplored regions. Gibson says that this follows from the fact of our dependence on information. One cannot

perceive a gap unless one has information about a gap being present. We need to pick up both some constant general characteristics of the whole scene and some particular distinguishing features to be definite about some objects in it. Perception done skilfully can be both informative and definite despite little time for exhaustive exploration. But the explanation then would need to deal with the nature of the skill revealed in the given kind of perception rather than pointing to the possibilities for perception and the act of being selective.

Most perceptual theorists regard perception as complex and the outcome of many causes. They use such terms as selective filtering, categorising being limited to task requirements, and coding and scaling procedures, none of which involve the reinstatement of any particular items or events from the past. They also use such terms as imaging, representational processes, and identification procedures which may well involve such reinstatement. The orthodox account in terms of schematic perception envisages both selective processes and regenerative, if not reproductive, processes. These explanatory terms overlap a good deal and would not all be used by any one theorist. Gibson prefers to use none of them for they all carry overtones of perception being the construction of something that is a copy of what is there to be perceived. In view of what needs to be explained in perception, Gibson's suggestion of the nervous system resonating to invariances is inadequate. Even to explain selectivity and improved selectivity of perceptual systems as a result of experience, this explanation needs to be bolstered up with some as yet missing facts of the evolutionary history of organisms and of the neurological processes involved in improvements with repeated contact by each individual with the same or similar objects and situations.

If memories are to be invoked to explain our perceptions whenever these comprehend stimulation beyond that momentarily present to the senses, practically all perceptions will have to be given this dual base of memories plus that stimulation. It would then follow that there would be no other way of explaining perception except by assuming constructive processes that would produce as a synthesis, perceptions having the everyday characteristics of being unitary, concrete and definite enough to guide our actions or satisfy our curiosity. Gibson argues that memories from the past are often brought in quite unnecessarily to account for perceptions resulting from a succession of environmental happenings. Why not instead, simply accept it as a fact that the information on which perception is based can be obtained from a sequence of stimulation. To cope with sequences says Gibson, is the main function of per-

ceptual systems. There is no reason to suppose that perceptual systems have to evoke memories or retrieve the earlier part of the stimulation from storage whilst dealing with those changes most recently occurring. Once accept that perceptions do not have to be based on memory and many of our conundrums will in fact disappear. As an example take the sequence of stimulation that arises when a person looking freely about a room sits down at a table which as a result stops any reflected light coming to his eyes from some given object in the room. The person perceives this object as now being hidden by the table. According to Gibson this is not a case of memory making a bridge from the present to an earlier perceptual situation. Nor is it simply a matter of poorly reporting the experience. The perceptual experience is real enough. Of course it would be upset if the perceiver were to be challenged about what he could actually see. Using the terminology of his first book (1950), Gibson says that the hidden object is perceived in the perceiver's visual world although not present in his momentary visual field, in such occlusion situations (Gibson, 1968). The situations to which Gibson refers are those in some studies by Michotte et al. (1967, p. 26 - 27). The stimuli providing the sequence were pictorial and gave rise to the perception of a circular black disc gradually disappearing under a straight edge as through a slit in the paper surface. Both the slit - edge and the hidden circular disc were physically non - existent. In these studies the characteristics of stimulation needed to provide information about occlusion and screening have been experimentally isolated. The perceiver isolates the invariance from the sequence of stimulation whether pictorial in origin or from a real object setting. There is no reason to suppose that any reference is made back in memory from the screened situation to the former unscreened situation.

In general Gibson would wish to assert that the perception of the permanence of objects is not the result of memory and constructive processes but of the direct isolation of invariance in the stimulation. It is not built on the basis of previous experiences of having found objects after they had been perceptually lost. Nor does he consider that Michotte's screening situation gains its compelling character from some reference being made from the pictorial to actual or possible real situations by imaging or by any other representational processes. Just what is involved in the perception in such situations, pictorial and real, is not easy to check. In the Michotte situation one can determine the limits to the perception by introducing breaks in the sequence of diagrams, that prevent the 'edge' or 'screened disc' being experienced. Similarly in the si-

tuation of sitting down at the table, the visual stimulation from the object could be interrupted just before occlusion by the table edge. An experimental blink could be easily arranged. Would the subject still perceive the object as screened in much the same position since he has no information to suggest that it has melted or evaporated? If so, would he nevertheless fail to have the experience of occlusion, of the table edge covering up the object or of its disappearing under the edge. Depending on the findings, could one argue that processes of imaging or of constructive completion must be involved? Gibson would very likely draw attention to the fact that there still remain some stable relationships, between bodily movements, eye positions, and objects which are normally used to fixate stationary objects and pursue moving ones. These provide other invariances in the stimulation that would give the information about object position so that the theorist need not bring in any inferred representational processes.

Part of Gibson's reasons for stressing the value of his studies of active touch is that the tendency to introduce representational processes into theoretical accounts of perception is less pressing in this area than in vision. Gibson has argued that as perceptual systems vision and touch are very closely analogous. If he can continue to maintain the close analogy in the working of the two systems and the equivalence of their information about the spatial layout of the environment, he will be able to argue that representational processes so prevalent in vision apply to the trimmings rather than to the essentials of perception. If the functioning of these systems are so closely similar, Gibson should be able to parallel in the area of dynamic touch his exciting demonstrations of sufficient conditions of stimulation that will yield information about, and very compelling perceptions of, such things as impending collision from visual displays in a fronto - parallel plane, as distance in depth on the 'visual cliff' and the synthetic 'visual tunnel'. Synthetic sensations of heat were produced by nineteenth century psychologists, but Gibson has not yet produced any situations yielding synthetic perception with dynamic touch comparable to those he has produced with visual stimulation. Possibly he has not seen that he needs to do this to support one of the main contentions of his theory. For without such further demonstrations, the stand that he has taken against the importance of symbolic and representational processes, indeed of constructive processes generally in perception, must inevitably be regarded as being somewhat arbitrary and lacking in supporting evidence.

Throughout all areas of perception, Gibson has been opposed to the

introduction of the typical explanatory concepts since the explanation is basically given, as he believes, by the stimulation together with the normal functioning of perceptual systems. He shows that a wealth of information is available in stimulation. This very wealth raises the question of selectivity which Gibson solves by saying that being selective is just what perceptual systems by evolution and development are fitted to be. Appropriate invariants can be isolated from stimulation. But in many situations there must be a wealth of invariants all in some ways appropriate and relevant. Gibson of course agrees that we do not perceive objects in isolation, indeed there are invariants of relationship between them but in the turgid context of perception and actions, the notion of isolation of invariants from a single sequence of stimulation seems to be somewhat remote from the arena of causal action. Gibson has indicated very well the possibilities for obtaining information and perceiving. He has set out causative factors mainly relating to selectivity. He seems to be less well placed in his theorising to supply causative factors to be found in the contexts and interactions of developing perceptions. Perhaps this is what orthodox perceptual theory with its myriad of explanatory terms is better able to supply. There is plenty of evidence of complex constructive processes of problem solving, and of representational processes being closely associated with perception. This is not what is in question. What is in question is whether such processes are needed to explain the course of perception and the manner in which it reaches its goals and maintains its standards of performance. They may not be needed to explain the perception of a screened object but may be needed to explain the perceptions occurring during the search for a missing object. How is it picked up with such minimal indications of its presence and why is it that we can in some contexts make illusory identifications?

Since perception is complex, it may be that one tends to be more sympathetic towards theorists who make use of many and diverse explanatory concepts. However there is no law that says that complex phenomena are likely to be more successfully attacked by those who look for complex explanations. Gibson's explanations are given in terms of how perceptual systems work. One needs to observe closely to discover the details of how the systems work in each case but the general principles of their operation are quite simple. He always begins with a statement of the almost unlimited possibilities for perception given by action - produced stimulation: If a perception occurs the possibility for it must be there in the stimulation; the job of the investigator is to find just what those characteristics of the stimulation are. This can be difficult

but there is always the excuse for failure that stimulation is very complex and the appropriate constant features of it may be difficult to isolate mathematically or experimentally. However as far as providing general accounts go, Gibson can never be found at a loss. Do you wish to explain the generality of perception or do we wish to explain its concreteness and definiteness? Whatever occurs can be seen to be possible from the nature of the stimulation. Our general perception of a recently visited city will be obtained as a result of a set of different sequences of exploration each supplying different invariants from which what is common may emerge as another higher - level invariant. If one can suggest in advance of the final general impression just what would be likely to be common among the different sequences of exploratory stimulation, then one would have gained some explanatory advantage in this actual situation. And then if we wish to explain the definiteness of perception in a given situation, one can say that exploratory action continued until all the information was obtained that could distinguish this object, event or situation from others that might be mistaken for it. This is not just a restatement of a general item of faith in the possibilities of obtained stimulation. Gibson would be prepared to investigate just what differentiating characteristics would be used in making this perception definite. In such ways he is able to provide relatively complete if sometimes very general explanations in behavioural terms and in terms of the mathematics and physics of environmental stimulation. What then is the additional gain to be derived from his further assertion that what happens when we perceive can be accounted for by the kinds of perceptual systems, and more basically the kind of nervous system that we have. This nervous system resonates to the invariants isolated in stimulation by exploratory action, thus accounting for our perceptions. Gibson does not answer definitely our question as to whether there is always a constant relationship between the isolation of a given invariant and an ensuing perception. The nervous system will certainly as a result of its growth and repeated contact with a given object, resonate more promptly, require less stimulation and so on, but granted that it does isolate a given invariant in the stimulation, will the perception of the specified environmental property be the same on all occasions. If so the perception going with the isolation of an invariant becomes a modern form of reception unit. Another possibility is that isolating a given invariance of stimulation does not bring about the same perception willy - nilly but that we use these invariances differently according to the purposes of our perceiving. Since these questions do not get clear answers this reference to the nervous system adds

little in the way of an explanation of perception. Its advantage for Gibson is that it allows him somewhat more plausibly to avoid explanation of perceptual learning in terms of association and memory. It is nothing of the kind, he says, but simply a natural function of nervous systems. How are we to account for the resourcefulness of perception in coping with novel items and in general getting the information needed? Nervous systems and perceptual systems as they have been formed by evolution and by individual development become increasingly adept at picking up the required information, and getting along perceptually with much less redundant information.

The many theoretical terms of modern perception theory may be useful for filling some of the explanatory gaps left by Gibson. Perception in a complex situation is regarded by many psychologists as being very much like forming a running hypothesis that is continually being subjected to environmental checks. Considerable importance is attached by them to the context of perceptions as a determining factor. Gibson does not altogether neglect context. Information obtained about an object does not come entirely from the object itself. But this is for Gibson largely a matter of physical relationships affecting the information on its size, position, solidity and so on. But if our perceiving proceeds in such a way as to maintain coherence and consistency among percepts it is clear that the context of other percepts must have determinative influence. In these interactive effects it would appear that perceptual processes are more strongly affected by neighbouring processes spatially close to them in the environment or near to them in a sequence of perceptual events. Many processes of coding, interpretation and reconstruction may be inferred to be present to account for perception that occurs in different situations. There is a suggestion of there being many stages with many causes operative at each stage but the whole account of what happens from some original stimulus situation to the final outcome of perception or perception guided action is left quite vague by modern theorists for lack of empirical evidence. Gibson believes that much of this theorizing, which assumes the need to account for the organization of perception, to be misguided and unhelpful. Somewhat complacently he says that with his position to guide the research worker the main hold-up is no longer theory or even method of investigation. The main difficulty is to find the mathematical procedures for adequately describing the invariances in complex stimulation that provides the information on which perception is based. There is as yet no way of being more precise about the theory. The moral for Gibson seems to be that

if we are going to be vague, let us be so without the help of traditional explanatory terms.

Vagueness is not the usual charge laid against Gibson. He has always aimed at getting his position clear both for himself and others, and the systematic changes over the years in his research programme and theoretical statements represent a progressive clarification of what is implicit in much of the earlier work. Mostly his statements are found sufficiently explicit to constitute an affront to common sense. Sensory qualities can apparently be items in perceptions when certain invariants of stimulation are attended to. By attending to the variants and changing aspects of stimulation one can experience sensations. Sensory properties could provide a constant feature of the stimulation, but if ignored and not explored these will play no part in on-going perception. Few psychologists would feel challenged by the assertion that not all perception can be analysed into component sensations, but certainly the notion that sensory qualities, which are specific to given sensory receptors, do not come into normal perception is something of an affront. To explain his position Gibson has argued for the need to make a sharp distinction between the effects of stimulation imposed on passive receptors and the results of stimulation obtained by means of the active exploratory action of perceptual systems. Common sense would suggest that the properties of environmental objects, that could elicit sensory experience, might well be used in our perceiving without either being focally attended to, or, on the other hand, being completely ignored. Perhaps we have failed to learn from Gibson the chief lesson that he has to teach, which is that we should not argue about perception in terms of what obviously must be the case. Nevertheless it seems to be likely that there would be some imposed stimulation relating to some things, whilst we are being attentive to, and obtaining stimulation from other things. Such imposed stimulation should be a rich source for leads as to where to be attentive next. The most natural way to account for how we come to move off to obtain a different supply of stimulation, in addition to that brought about by reflex adjustment to intensities or novelties of stimulation, would be to allow the sensory effects of imposed stimulation to have some sign or symbolic function. From the normal reports of most persons the perceptual world of everyday living is replete with sensory qualities, although we would not be explicitly and focally aware of most of this. Particularly is this true of visual perception. Landscapes are seen unbounded, full of colour and with impression of varying arrangements of detail. Of course Gibson is right in that we do not just see

the woods as green because we know that they should be. This may come into it but largely such colour and order of detail must be picked up in some very economical fashion and incorporated in our perceptual contact with the landscape environment. If it comes largely by imposed stimulation one could argue that the apparently representational characteristics of vision are not reconstructed but simply rest on environmental support via imposed perception filling - out the yield of exploration and obtained perception. Alternatively sensory properties uncovered by active exploration might be used without demanding any explicit attention, so that perhaps imposed stimulation might function only negatively to warn us of things in the situation which do not fit our perceptual landscape world. Either way it may be possible to avoid the either - ors of different theorists and not be forced to decide between a perceptual organisation dependent on stimulation and one imposed on it by various constructive processes. Certainly Gibson's denial of the usefulness of simple sensory experience in perception may be unhelpful. To make the positive contribution of his theory Gibson need only to have stressed the information base to perception. It is one thing to issue danger warnings about the use of terms like 'plans', 'hypotheses', 'schemata', or 'images' but quite another to rule against their usage. Gibson does the second. Is all this just a question of emphasis, or is this proscription of old concepts, an essential part of Gibson's theory? Whilst allowing for the possibility of alternative statements, Gibson would argue that we cannot continue with a patch - work of existing theories and that acceptance or rejection of his present position must be done on an all - or - nothing basis. To deny that this is necessary is not to belittle his stature as a perceptual theorist. It is unlikely that Gibson's position will be wholly accepted or wholly rejected, but many will profit by paying close attention to the complexities of stimulation and by regarding perception as being based on, or as revealing the information in stimulation. It is no exaggeration to say that Gibson's positive insights and the results of his empirical investigations are having a decisive influence on work being done in all areas of perceptual enquiry.

ΠΕΡΙΛΗΨΗ

Αν επισκοπήσωμε τις έρευνες του J. J. Gibson στα τελευταία 40 χρόνια, θα διαπιστώσωμε συστηματικές αλλαγές τόσο στις θεωρητικές του απόψεις για την αντιληπτική λειτουργία όσο και στις μεθόδους τις οποίες χρησιμοποίησε για την έρευνά της. Στην πρώτη του έρευνα, την οποία πραγματοποίησε όταν ακόμη ήταν φοιτητής, χρησιμοποίησε σχήματα δύο διαστάσεων, έρεθισμούς συνηθισμένους για την ψυχολογία της εποχής εκείνης, και έδειξε ότι μόνη ή πάροδος του χρόνου δεν εξηγεί τις αλλαγές που παρουσιάζονται κατά την ανάπλασή τους, μιὰ θέση που υποστήριζαν οι ψυχολόγοι της μορφής. Ο Gibson πίστευε ότι οι αλλαγές ώφείλονταν στις αλληλεπιδράσεις μεταξύ των αντικειμένων και της μνημονικής λειτουργίας. Την άποψή του αυτή στήριζε στο γεγονός ότι ένας δεδομένος έρεθισμός δεν έχει πάντοτε την ίδια επίδραση στο άτομο που απομνημονεύει. Έδειξε σχετικά ότι σε πολλές αισθήσεις ή ψυχοφυσική αντιστοιχία μεταξύ φυσικών έρεθισμών και των ιδιοτήτων των οι οποίες γίνονται αντιληπτές από το άτομο, μεταβάλλεται. Τις μεταβολές αυτές απέδωσε ο Gibson σε μιὰ φυσική τάση για προσαρμογή σε χαρακτηριστικά των επικρατεστέρων έρεθισμών μέσα στο περιβάλλον. Με την θεώρηση αυτή κατανόηθηκαν καλύτερα πολλά ψυχικά φαινόμενα, ανάμεσα στα όποια και τα άρνητικά μετεικάσματα.

Κατά την διάρκεια του δευτέρου παγκοσμίου πολέμου ασχολήθηκε ο Gibson με προβλήματα πρακτικά. Στις έρευνές του για την αντιληπτική λειτουργία αντί άπλων εργαστηριακών έρεθισμάτων, χρησιμοποίησε έρεθίσματα περιπλοκώτερα, περισσότερο σύμφωνα με την πραγματικότητα, όπως λ.χ. ποικίλα προγράμματα εκπαίδευσης για τις ένοπλες δυνάμεις, κινηματογραφικές ταινίες για την αναγνώριση αντικειμένων και για την εκτίμηση αποστάσεων και βάθους. Τόνισε ιδιαίτερα την σημασία που έχουν για την όπτική αντίληψη ή κλιμάκωση του μεγέθους των λεπτομερειών στους φυσικούς έρεθισμούς του φωτός και οι μεταβολές των έρεθισμών που συμβαίνουν όταν ο ίδιος ο παρατηρητής βρίσκεται σε κίνηση. Ο Gibson εισάγει τις έννοιες «όπτικό πεδίο των αισθημάτων» και «όπτικός κόσμος της αντίληψης», άκριβως για να ξεχωρίση μεταξύ των στιγμιαίων αισθημάτων, όταν λ.χ. ταξιδεύη

κανείς με αυτοκίνητο, και της σταθερής αντίληψης, όταν ξέρουμε ότι πίσω από την αλλαγή υπάρχει σταθερότητα στο περιβάλλον.

Παράλληλα με τις προσπάθειές του για την εξακρίβωση ψυχοφυσικής αντιστοιχίας μεταξύ εμπειρίας και περιπλοκών ερεθισμάτων του εξωτερικού κόσμου, ο Gibson, μαζί με την σύζυγό του Eleanor, μελέτησε την πορεία της αναπτύξεως των αντιληπτικών εκείνων μηχανισμών, οι οποίοι ξεχωρίζουν σταθερές σχέσεις μέσα στην περίπλοκη ροή των ερεθισμάτων. Κατά τον Gibson, οι σταθερές σχέσεις ξεχωρίζονται άμεσα μέσα στην διαδοχή των ερεθισμάτων, χωρίς την μεσολάβηση της μνημονικής λειτουργίας. Σύμφωνα με την κλασική θεωρία της αντίληψης, κάθε όμαλη αντιληπτική εμπειρία στηρίζεται στον μηχανισμό του συνειρμού και στην ύπαρξη μνημονικών ίχνων. Σύμφωνα με τον Gibson, η αντιληπτική εμπειρία προκύπτει από τις πληροφορίες οι οποίες περιέχονται ήδη στα ερεθίσματα του εξωτερικού κόσμου. Έτσι η τάξη, η δομή, οι σταθερές σχέσεις ενυπάρχουν μέσα στους περίπλοκους εξωτερικούς ερεθισμούς και είναι άμεσα προσιτές στον οργανισμό. Κατά την τελευταία δεκαετία ο Gibson ασχολήθηκε με έρευνες της άπτικής λειτουργίας, στις οποίες είδε την αφή ως λειτουργία με χαρακτήρα ενεργητικό. Τα δεδομένα που συνέλεξε δείχνουν ότι οι σταθερές σχέσεις, οι οποίες καθορίζουν σημαντικές ιδιότητες των αντικειμένων, διαπιστώνονται με την ενεργητική άπτική διερεύνηση της διαδοχής των ερεθισμάτων και όχι με την άπλη παθητική «έντύπωση» της τάξεως ανάμεσα στα στατικά ερεθίσματα που δέχεται ο οργανισμός σε μία δεδομένη στιγμή.

Ο Gibson τονίζει ολοένα και περισσότερο ότι οι θεωρητικοί της αντιληπτικής λειτουργίας πρέπει να εγκαταλείψουν την προσπάθεια περιγραφής της λειτουργίας αυτής ως λειτουργίας η οποία σχηματίζει αντίγραφα των αντικειμένων και των γεγονότων του εξωτερικού κόσμου με σύνθεση μεμονωμένων δεδομένων των αισθητηρίων οργάνων. Οι φυσικοί ερεθισμοί, υποστηρίζει ο Gibson, έχουν κατ' ανάγκη κάποια δομή. Την δομή αυτή ακριβώς επιζητούν να αποκαλύψουν οι αισθήσεις μας, οι οποίες ενεργούν ως αντιληπτικά συστήματα. Γι' αυτά γίνεται λόγος στο βιβλίο του *The senses as Perceptual Systems* (1968). Η αντίληψη, επομένως, ανακαλύπτει, δέν συνθέτει την δομή του εξωτερικού κόσμου. Αν δοῦμε με το ανατρεπτικό πρίσμα της θεωρίας του Gibson τα κλασικά προβλήματα της ψυχολογίας της αντίληψης, πολλά από αυτά χάνουν την σπουδαιότητά τους, για να δώσουν την θέση τους σε καινούργια προβλήματα. Έτσι, δέν θα πρέπει να υπάρχει γενικό πρόβλημα σχετικό με την αντίληψη των σταθερών ιδιοτήτων των αντικειμένων, διότι, σύμφωνα με τον Gibson, οι ιδιότητες αυτές ανακαλύπτονται εξ αιτίας ακριβώς της αλλαγής των ερεθισμών. Οι αλλαγές αυτές δίνουν την δυνατότητα στον οργανισμό να ανακαλύψει το σταθερό μέσα στην ροή. Ένα πρόβλημα που δημιουργείται τώρα είναι να δοθῆ ἑξήγηση των αποκλίσεων από την τέλεια αντιληπτική

σταθερότητα. Σχετικό ακόμη με το πρόβλημα τουτο είναι και το πρόβλημα του μεγέθους της ασάφειας στην αντιληπτική λειτουργία, το οποίο έχει τονισθή κατά τόν Gibson υπερβολικά, χωρίς σοβαρούς λόγους. Πιστεύει ότι η ασάφεια δέν είναι παράγων σημαντικός στην καθημερινή μας ζωή, διότι ο παρατηρητής έχει έπαρκῃ χρόνο στην διάθεσή του για νά έρευνήση τὸ περιβάλλον με τις αἰσθήσεις του και, ἔτσι, νά έξακριβώση καλύτερα τήν φύση τῶν έρεθισμῶν. Ἡ ἔμφαση πού δίνει στην προοδευτική βελτίωση τῆς ικανότητας τοῦ ὀργανισμοῦ νά διακρίνη και νά διαφοροποιῇ τὰ έρεθίσματα τοῦ έξωτερικοῦ κόσμου με τὸ πέρασμα τοῦ χρόνου, αὐτὸ πού οἱ ψυχολόγοι ὀνομάζουν αντιληπτική μάθηση, δικαιολογεῖται ἀπὸ τὰ δεδομένα τῶν έρευνῶν τοῦ Gibson. Δημιουργήθηκαν ὁμως ἀμφιβολίες ἀνάμεσα στοὺς ψυχολόγους τῆς ἀντιλήψεως κατὰ πόσο θὰ πρέπη ἡ ἴδια ἔμφαση νά δοθῇ σέ ὅλες τις περιπτώσεις ἀντιληπτικῆς μαθήσεως.

Κατὰ τόν Gibson, ὅλα τὰ προβλήματα μποροῦν νά λυθοῦν κατ' ἀρχήν, ἂν οἱ ψυχολόγοι προσπαθήσουν νά ἀνακαλύψουν τήν έξάρτηση τῆς ἀντιλήψεως ἀπὸ τὰ έρεθίσματα. Ἡ ἀποστροφή του πρὸς τὸ πρότυπο τῆς ἀπλῆς προσλήψεως εἰκόνων ἀπὸ τὸ έξωτερικὸ περιβάλλον ἔγινε αἰτία νά χάση τήν ἐμπιστοσύνη του σέ ἔννοιες ὅπως «νοερὴ ἀναπαράσταση» ἢ «νοερὸ σχῆμα». Κι ὁμως οἱ ἔννοιες αὐτὲς θεωροῦνται χρήσιμες ἀπὸ τοὺς ψυχολόγους, ὅταν αὐτοὶ περιγράφουν πῶς ἀντιλαμβανόμαστε γνωστὰ ἀντικείμενα ἢ νέα πράγματα. Πρέπει, ἐπομένως, νά δείξη ὁ Gibson, με εἰδικές έρευνες, ὅτι τὸ πρόβλημα τῆς οἰκονομίας στην ἀντίληψη και τῆς εὐχέρειας στην ταύτιση νέων ἀντικειμένων μπορεῖ νά ἀντιμετωπισθῇ καλύτερα με τήν δική του θεωρητικὴ θέση.

Ἡ ἀποψη τοῦ Gibson, ὅτι σήμερα δέν ἔχομε ἀνάγκη στην ψυχολογία ἀπὸ κάποια πληρέστερη θεωρία τῆς ἀντιλήψεως ἢ ἀπὸ νέες μεθόδους έρευνας, ἀλλὰ ἀπὸ κατάλληλες μαθηματικὲς ἔννοιες με τις ὁποῖες θὰ μπορούσαμε νά περιγράψωμε τοὺς περίπλοκους έρεθισμοὺς τοῦ περιβάλλοντος, εἶναι κάπως ὑπερβολική. Πιθανώτατα τήν αἰσιόδοξη αὐτὴ θέση του ὑποστηρίζουν τὰ ἀποτελέσματα ὀρισμένων νέων έρευνῶν του στην ἄπτική ἀντίληψη, τὰ ὁποῖα δείχνουν ὅτι εἶναι δυνατὴ ἡ πρόβλεψη τῶν ἐμπειριῶν ἀτόμων πού λαμβάνουν μέρος ὡς ὑποκείμενα σέ τέτοιες έρευνες. Παρὰ τοὺς διαδοχικοὺς ἄπτικοὺς έρεθισμοὺς ἢ ἐνεργὸς ἄπτική ἀντίληψη μένει στην οὐσία ἡ ἴδια. "Ὅμως έρευνες συνθετικὲς στην αἴσθηση τῆς ἀφῆς δέν ἔχουν ἀκόμη πραγματοποιηθῇ. "Ἐτσι, θὰ μπορούσε κανεῖς, στηριζόμενος στην κοινὴ λογική, νά ὑποστηρίξει ὅτι, ὅταν τὸ ἄτομο ψαύη ἓνα ἀντικείμενο, δέν ἐπιχειρεῖ νά ἀνακαλύψῃ σταθερὲς ιδιότητες στοὺς έρεθισμοὺς, ἀλλὰ ὅτι ἐλέγχει κάποιαν «ὑπόθεσή» του σχετικὴ με τὸ ἀντικείμενο πού ψαύει. "Ἐνα πρᾶγμα εἶναι νά δεχόμεστε με κάποια δυσπιστία ὄρους κάπως ἀσαφεῖς ὅπως «νοερὲς εἰκόνες», «προσδιοριστικὲς τάσεις», «έρεθίσματα με νόημα», και ἄλλο πρᾶγμα νά ἀποκλείωμε τήν χρήση τους, ὅπως κάνει ὁ Gibson. Κατ' αὐτόν, στην ἄμεση ἐπαφή με κάποιο ἀντι-

κείμενο, για πρώτη φορά, δὲν παρεμβαίνει ἡ μνημονικὴ λειτουργία. Τὰ ἀντιληπτικὰ συστήματα, ὑποστηρίζει ἀκόμη, ἐργάζονται ἔτσι, ὥστε σὲ κάθε ἐπανάληψη παρομοίων ἐρεθισμῶν ἐπιτυγχάνουν καλύτερη προσαρμογή. Μὲ ἄλλα λόγια, ἡ θέση του εἶναι ὅτι, ἐφ' ὅσον πρόκειται νὰ εἴμαστε ἀσαφεῖς, ἄς εἴμαστε ἀσαφεῖς χωρὶς τὴν βοήθεια τῶν παραδουσιακῶν ἐξηγήσεων.

Ὁ Gibson δὲν κατηγορεῖται συνήθως γιὰ ἀσάφεια. Οἱ συστηματικὲς ἀλλαγὲς στὰ ἐρευνητικὰ του προγράμματα καὶ στὶς θεωρητικὲς του ἀπόψεις, μὲ τὸ πέρασμα τῶν χρόνων, ἀντανακλοῦν μιὰ συστηματικὴ προοδευτικὴ διασάφηση ἰδεῶν του ποὺ ἤδη ἐνυπάρχουν στὶς παλαιότερες ἐργασίες του. Ἐπὶ πλεόν, οἱ πρόσφατες ριζοσπαστικὲς θέσεις του εἶναι ἀρκετὰ σαφεῖς. Προσπάθησε νὰ κατατάξῃ τὶς ἐμπειρίες ποὺ δίνουν τὰ αἰσθητήρια καὶ νὰ τὶς περιγράψῃ ὡς ἀποτελέσματα ἐρεθισμάτων, τὰ ὁποῖα εἴτε ἐπιβάλλονται στὰ αἰσθητήρια ὄργανα εἴτε ἐπιζητοῦνται ἐνεργητικῶς ἀπὸ αὐτά. Τόνισε ἀκόμη ὁ Gibson τὴν σημασία τῆς μυϊκῆς αἰσθήσεως τοῦ σώματος, ἡ ὁποία μᾶς πληροφορεῖ γιὰ τὴν θέση ἢ τὴν ἀλλαγὴ τῆς θέσεως τῶν μελῶν του μέσα στὸν χῶρο. Ἡ σαφήνεια τῶν ἀπόψεών του καὶ ὁ αὐστηρὸς χαρακτήρας τῆς ταξινομήσεως ποὺ κάνει γιὰ τὶς αἰσθητήριες ἐμπειρίες ζημιώνεται ἀπὸ τὴν γνώμη του, ὅτι τὰ διερευνητικὰ συστήματα πρέπει νὰ ἔχουν κάποιον αὐτοέλεγχο. Τοῦτο σημαίνει ὅτι δέχονται ταυτόχρονα ἐρεθισμοὺς καὶ ἀπὸ τὸ ἐξωτερικὸ περιβάλλον καὶ ἀπὸ τοὺς μῦς τοῦ σώματος.

Ἴσως ὁ Gibson μᾶς διδάσκει ὅτι δὲν πρέπει νὰ μιλοῦμε γιὰ τὴν ἀντιληπτικὴ λειτουργία κατὰ τρόπο ὁ ὁποῖος δὲν προσθέτει τίποτε στὴν γνώση μας. Φαίνεται, ἐν τούτοις, πιθανὸ ὅτι θὰ πρέπει νὰ ἐπιβάλλονται στὰ αἰσθητήριά μας ἐρεθίσματα ἀπὸ ὠρισμένα πράγματα τὴν ὥρα ποὺ προσέχομε καὶ δεχόμαστε ἐρεθίσματα ἀπὸ ἄλλα πράγματα. Οἱ ἐρεθισμοὶ οἱ ὁποῖοι ἐπιβάλλονται στὰ αἰσθητήριά μας πρέπει νὰ ἀποτελοῦν πλούσια πηγὴ πληροφοριῶν σχετικὰ μὲ τὸν ἐπόμενο στόχο τῆς προσοχῆς μας. Ὁ φυσικώτερος τρόπος γιὰ νὰ περιγράψωμε τί συμβαίνει, πέρα ἀπὸ τὶς ἀνακλαστικὲς προσαρμογὲς σὲ ἔντονους ἢ νέους ἐρεθισμοὺς, εἶναι νὰ ποῦμε ὅτι τὰ ἐρεθίσματα τὰ ὁποῖα ἐπιβάλλονται στὰ αἰσθητήρια ἔχουν κάποια συμβολικὴ ἀξία. Ἐφ' ὅσον τὰ πράγματα εἶναι ἔτσι, ἡ ἄρνηση τῆς ἀξίας τῶν ἀπλῶν αἰσθητηρίων ἐμπειριῶν γιὰ τὴν ἀντιληπτικὴ λειτουργία δὲν εἶναι καθόλου ἐποικοδομητικὴ.

Ὅλα ὅσα μᾶς λέγει ὁ Gibson εἶναι ἄραγε νέοι τρόποι θεώρησης παλαιῶν προβλημάτων ἢ μήπως τονίζονται ἐντονώτερα πράγματα ποὺ μᾶς εἶναι ἤδη γνωστά; Ὁ ἴδιος πιστεύει ὅτι δὲν εἶναι σωστὸ νὰ ὑπάρχη ἡ σημερινὴ πληθώρα ἐπὶ μέρους θεωριῶν γιὰ τὴν ἀντιληπτικὴ λειτουργία καὶ ὅτι ἡ δική του θεώρηση ἢ πρέπει νὰ γίνῃ δεκτὴ ὅπως ἔχει ἢ νὰ ἀπορριφθῇ. Μὲ τὴν θέση του αὐτὴ δὲν εἶναι δυνατόν νὰ συμφωνήσωμε, μολονότι ἡ διαφωνία μας δὲν μειώνει καθόλου τὴν ἀξία τοῦ Gibson ὡς θεωρητικοῦ τῆς ἀντιλήψεως. Εἶναι ἀπίθανο ὅτι ἡ θεωρία του ἢ θὰ γίνῃ δεκτὴ ὅπως διατυπώθηκε ἀπὸ αὐτὸν ἢ θὰ ἀπορριφθῇ τελείως.

Τὸ πιὸ πιθανὸ εἶναι ὅτι ὅσοι ψυχολόγοι ἐρευνοῦν τὴν περιοχὴ τῆς ἀντιληπτικῆς λειτουργίας θὰ κερδίσουν πολλὰ ἂν προσέξουν περισσότερο τὴν περιπλοκότητα τῶν ἐρεθισμῶν καὶ ἂν δοῦν τὴν ἀντίληψη ὡς λειτουργία ποὺ βασίζεται στὶς πληροφορίες τῶν ἐρεθισμῶν ἢ ποὺ ἀνακαλύπτει πληροφορίες μέσα σ' αὐτούς. Δὲν θὰ εἶναι ὑπερβολὴ ἂν λεχθῆ ὅτι τόσο οἱ θετικὲς ἐνοράσεις τοῦ Gibson ὅσο καὶ τὰ ἀποτελέσματα τῶν ἐμπειρικῶν του ἐρευνῶν ἔχουν ἀποφασιστικὴ ἐπίδραση στὶς ἐργασίες ποὺ γίνονται σήμερα σὲ ὅλες τὶς περιοχὰς τῆς ψυχολογίας τῆς ἀντιλήψεως.

REFERENCES:

- GIBSON, ELEANOR J., & WALK, R. D. (1960) The «visual cliff», *Scient. Amer.*, 202, 64-71.
- GIBSON, J. (1937) Adaptation and negative after effect, *Psychol. Rev.*, 44, 222-244.
- (1950) *The Perception of the Visual World*, Boston, Mass., Houghton Mifflin.
- (1959) Perception as a function of stimulation, in KOCH, S., *Psychology: a Study of a Science*, Vol. I, New York, McGraw-Hill.
- (1965) Constancy and invariance in perception, in KEPES, G., *The Nature and Art of Motion*, N. York, Braziller, pp. 60-70.
- (1968) *The Senses as Perceptual Systems*, London, Allen & Unwin.
- GIBSON, J. J. and CROOKS, L. E. (1938) A theoretical field-analysis of automobile-driving. *Amer. J. Psychol.*, 51, 458-471.
- HELD, R. (1965) Object and Effigy, in KEPES, G., *Structure in Art and in Science*, N. York, Braziller, pp. 42-54.
- MICHOTTE, A., THINES, G., and CRABBE, G., (1967) Les complements amodaux des structures perceptives. *Studia Psychologica*, Louvain Publications Universitaires de Louvain.
- SCHIFF, W. (1965) Perception of impending collision: a study of visually directed avoidant behaviour, *Psychol. Monogr.*, 1965, 79, Whole No. 604.