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Distinguished dissident

James J. Gibson and the

Psychology of Perception

by Edward S. Reed

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E.H. Gombrich

"There are some 20,000 psychologists in this country alone [in 1966], nearly all of whom seem to be busily applying psychology to problems of life and personality. They seem to feel, many of them, that all we need to do is consolidate our scientific gains. Their self-confidence astonishes me. For these gains seem to me puny, and scientific psychology seems to me ill-founded. At any time the whole psychological applecart might be upset. Let them beware!"

Such an utterance would not normally endear its author to his professional colleagues, but I find it hard to imagine anyone being angry with "Jimmy" Gibson. True, as an outsider, lacking all formal training in his field, I had and have no stake in the honor of the guild, but I was all the more happy to learn from Edward Reed's biography that even Gibson's academic critics testified to his "great personal warmth" and passion for the truth.

Reed's book is evidently a labor of love. It tells the story of a "distinguished dissident" who felt reluctantly compelled by the evidence he encountered in his research to question views that had been taken for granted for centuries. Naturally, in the course of this intellectual odyssey Gibson's statements became more and more antagonistic. Opening the book we frequently encounter emphatic assertions about what perception is *not*: "Perception is not to be explained as a construction of the mind." It is "an act, not a response, an act of attention, not a triggered impression, an achievement, not a reflex." Not a "guessing game," but "a search for meanings." These challenging statements, however, are invariably part of an argument based on rigorous reasoning and careful experiments. "A strenuous effort has been made" - Gibson wrote in the first of his books - "to keep the propositions of this book explicit enough to be potentially incorrect." Consciously or unconsciously endorsing Karl Popper's methodology, he also wrote: "The construction of a theory is most valuable when the theory is 'vulnerable,' when future experiments can but do not disprove it."

Despite these incessant efforts to make himself clear, which led to much rewriting, Reed tells us that

the implications of Gibson's revolution have only rarely been understood. Perhaps he can console himself with Goethe's paradoxical reflection: "In a way we only learn from books we do not understand, the author of a book we do understand would have to learn from us." Admittedly there are books we do not understand but which we only use as a source of a new and possibly impressive vocabulary. Gibson introduced very few novel terms. The difficulties he presents and the profits he offers are of a different kind. What he asks us mainly to do is to *unlearn*. Our entire education has been geared to making us distrust our senses and slightly to look down on those who confuse their subjective experiences with objective facts.

Yet Gibson wants to persuade us that this whole dualistic philosophy stands in need of renewed analysis. It is not for nothing that Edward Reed and Rebecca Jones chose for their edition of selected essays by Gibson the title *Reasons for Realism* (1982). Gibson wants us to go back to square one and to start again from the indubitable fact that we, like any other animal, do successfully interact with our environment, what biologists now call our ecological niche, "by looking, listening, sensing, and moving. Instead of making this fact the starting point of their investigations psychologists had actually tried to prevent their subjects from gaining awareness of their surroundings. They thought to investigate vision by artificially reducing it to its alleged elements, not permitting their subjects to move their heads, exposing them to brief flashes of nonsense figures on a screen or to various ingeniously arranged line drawings which have little in common with the sights of the real world.

Gibson was well versed in these techniques and so it may have been doubly fortunate that during his wartime work he was confronted with a problem that did not lend itself to this type of investigation. He was advising on the training of pilots confronted with the difficult task of landing a fast plane on the deck of an aircraft carrier. It was in this context that he came to reject the traditional account of vision as an interpretation by the brain of the image on the retina. What matters to the pilot in his orientation is not the static picture but the *flow of information* received by the eye in the context of the permanent structure of our environment - the earth below, the sky above, and the horizon in-between provide the anchorage for this performance. There is a vital difference, moreover, between the sky and the ground; the ground is normally textured and the appearance of this texture changes with the distance. We know where we are as we move through the world, because even a featureless landscape will exhibit those gradients of apparent density which assist orientation.

It is a poignant fact brought out in Reed's biography that Gibson's vital contribution to our understanding of flying was rewarded, after the war, by his security clearance being withdrawn during the McCarthy period. His uncompromising championship of free speech had made him suspect, though the Office of Naval Research was less paranoid and continued to support his experiments. Reed's chapter on Gibson's brief sally into social psychology makes interesting but tantalizing reading. It appears that it squared with his perceptual research in coming down on the side of realism. His very interest in the effects of propaganda and indoctrination had convinced him of the old adage that you cannot fool all the people all the time - a fact which the great dictators might have done well to ponder.

Reed suggests that Gibson's disillusionment with his colleagues in the field of social psychology contributed to his increasing concentration on perception. His first book, *The Perception of the Visual World* (1950), already presents a bold challenge to traditional views, but it still makes a distinction between the "visual world" (the real world of our environment) and the "visual field" (that flat expanse that psychologists had taught us to regard as the basic constituent of sight). Under one

name or another this visual field was also basic for the theory of painting, notably of Impressionism. Having profited much from consulting Gibson's first book I was doubly struck by the fact that its author was soon ready to jettison this distinction. In one of the lively exchanges in which he liked to engage, he subsequently suggested that it was the visual field, not the visual world, that was a construct. I am still happy to have spotted what in *Art and Illusion* I described as "this bold reversal of the traditional way of putting things" and that I tried to spell out its consequences at the conclusion of my chapter on the "Analysis of Vision in Art." But for Gibson this radical separation from tradition obviously meant that he had to write another book, which he was to call *The Senses Considered as Perceptual Systems* (1966).

The questions that Gibson here asks differ indeed quite radically from the ones that his colleagues were used to investigating. The senses must have evolved in order to enable living organisms to cope with their environment. They all contribute to making us aware of the world, though we rarely are able to tell how they achieve this. How many people even know that their sense of balance depends on the stimulation of minute hairs in the inner ear? In an experiment of impressive simplicity Gibson demonstrated the achievements of touch which are rarely open to introspection. We can easily tell the shape of a cookie-form without being able to say which part of our hand or finger has been stimulated by its surface. The distinction Gibson here emphasizes is the one between "imposed" and "obtained" information. Having been hard of hearing for much of his life he must have had much experience of the problem confronted by any wearer of a hearing aid, who finds it most difficult at first to distinguish irrelevant noise from information. Listening means to ignore the noise, and the same is true of the other senses. "An eye," he wrote, "is an organ for exploring an optic array"; it serves this purpose admirably by picking up the information offered by the ambient light about the invariance of objects.

In his earlier book Gibson had stressed that the eye responded not to individual stimuli but to gradients of stimuli. He now generalized on this finding by studying the flow of information reaching the moving observer from a solid object. He explained that the transformations it undergoes transformations which can be conveniently studied by watching the changing shadows of a rotating object on a screen - uniquely specify one shape and one shape only.

To put it more concretely: we have been told that a rectangular table top viewed from the side projects a trapezoid image on the retina of a stationary eye. This is true, but rarely relevant. What is relevant is that the sequence of variously shaped projections that arise as we change our position mathematically corresponds exclusively to the invariant rectangular shape of the table top and that this is what we really perceive as we move around in the room. We therefore perceive it directly as we also perceive our own position, in relation to the table. Perception in this sense is inseparable from what Gibson calls "proprioception." Moreover, we also are aware of what Gibson calls the "affordance" of the table top, its potential usefulness for depositing things or, maybe, as a platform from which to address a crowd. This, too, in Gibson's view has not to be inferred; it is also perceived directly. Both animals and man make contact with the world by exploring it for affordances.

In joint studies with his wife, Eleanor, Gibson stressed that the ability to pick up the information offered by the ambient light of the environment is not learned; it is always present. What has to be learned is the refinement of this ability, through becoming aware of distinctions and nuances such as perhaps the slipperiness or fragility of a particular table top. Maybe a furniture dealer will be able to tell us much about the advantage and disadvantage of certain types of polished surfaces, but he, like anybody else, will not attend to the gyrations of the image on the retina as he examines the

table.

What Gibson advocated so strongly therefore was a shift of orientation in the psychologist's concerns. Instead of trying to concentrate on the elements of our subjective experience, we should trust our immediate reaction.

I experienced this bias during a visit to the Gibsons' hospitable house in Ithaca, when he took up an issue of *Scientific American* that had on its cover a demonstration of transparency that delighted him, various colored shapes apparently lying one below the other. When I remarked that the sequence of shapes could be variously interpreted according to which of the shapes were seen as opaque and which as transparent, he looked at me sternly and said: "You *think* too much." I was relieved to find in Reed's book that the Gibsons were fully conversant with this ambiguity of static displays but such displays had ceased to interest him. Their intellectual analysis could only bring us to "the slippery slope that leads from subjectivism to solipsism." Interested as Gibson was in the achievements of veridical perception he had no time for the study of perceptual errors. I also remember him making fun of Helmholtz's report that he believed as a child that men working on top of a steeple must be little dolls. He was sure that the great scientist had merely transformed his childhood experience from hindsight. He *must* have seen what was there. I wonder how he would have reacted to an experience related by Voltaire, who writes in Chapter VI of his *Eléments de la philosophie de Newton* that he once looked out through a narrow window at a distant building when he saw what he took to be a row of small statues crowning the roof; suddenly one of the figures moved and thereafter he saw them as people, people of "normal size." Voltaire adhered to the old distinction between "seeing" and "knowing," insisting on the influence of the one on the other. For Gibson this idea (familiar to every art teacher) was another heresy:

The old idea that perception is determined partly from the outside and partly from the inside is nothing hut a muddle of thought If perception is essentially an act of attention, as I maintain, and is not to be confused with imagination, hallucination, or dreaming, then the perceiver does not *contribute* anything to the act of perception, he simply *performs* the act.

But can we not also attend to the products of our imagination? It is here that some of us will find Gibson's determined realism problematic. Not that he ignored these phenomena altogether. He devoted a splendid chapter of his second book to "The Causes of Deficient Perception," a discussion to which Reed pays perhaps insufficient attention. He can do so, because Gibson himself was always a trifle reluctant to attend to these unwelcome disturbances. It was precisely because he aimed at making his position both clear and vulnerable that he resisted any attempt at watering down his radical realism. This uncompromising stance was to find expression in his last book, *The Ecological Approach to Visual Perception* (1979).

I treasure the memory of the aging scientist hard at work on his final opus. Having retired from his chair at Cornell University he had automatically lost his office but was granted a minute space, virtually in the corridors of the department in Uris Hall, where he sat uncomplainingly at a small table with his pile of penciled notes, as eager as ever to test his views against other approaches. Those who have studied this final statement - and the book does not permit skipping and skimming - will agree with Reed's verdict that "*The Ecological Approach* is fiercely independent and proudly so. It is a masterpiece of organization and exposition Few, if any, of the novel issues are resolved, but an astonishing number of new ideas and suggestions are put forth."

Among these still unresolved issues I would count the problems that I so often debated with Gibson,

the problems raised by the existence of naturalistic images. Reed devotes a long chapter to "the slow process through which Gibson extricated himself from the lure of the image" and what he calls "his eventual success at distinguishing image from information in vision, as well as the implications of that distinction." It is a chapter that will be read with profit by anybody concerned with these matters, but it takes us only part of the way. Reed is certainly to be applauded when he warns us against too freely identifying pictures with reality. A study of the perception of faces, he reminds us, will too often "turn out to be a study of how we see pictured faces." Touché. He is also right in his reasoned rejection of the semiotic interpretation of representation. But the positive recommendation to regard pictures in terms of information, which he takes over from Gibson, leaves many questions unanswered. To be sure it can be liberating to regard all pictorial styles as attempts to convey information of invariants, because this will eliminate the need to regard the so-called "conceptual image" found in the drawings of children and in many other pictorial conventions as standing somehow close to the bottom of the evolutionary ladder. But this approach becomes somewhat artificial when applied to the development of Western realism.

It is a common mistake (and one that Gibson himself had made in his first book) to equate perspective structure with a static viewpoint or even with a still picture. This is simply wrong. Gibson's ecological approach requires treating all forms of stasis as limits, as special cases of flow. A static picture of a table, for example, collapses the perspective and invariant structure.... The changing perspectives are unavailable in the static case, as are the alterations of occlusion.... Perspective neither adds depth to flat surfaces nor even provides an illusion of realism. If a picture displays the perspective of a scene it puts the viewer into the scene, but that is all."

Given the importance that Gibson's theory attaches to "proprioception," this "all" is not all that little. But as a matter of fact the realistic painter has additional resources not mentioned in this context: the uniform fall of light and the direction of the shadows which sometimes allow us to plot the relative position of objects in a scene. Speaking of his proposed terms Gibson writes characteristically, "May they never shackle thought as the old terms and concepts have!" Is this not a case in point? Gibson shared with Nelson Goodman a reluctance to speak of representations in terms of resemblance or likeness, but why should I not be allowed to say that the peaches displayed on a table in a still life look precisely like peaches? And is it not more natural to say that the snow-covered Dent Blanche in Switzerland is so called because it looks like a white tooth rather than to say that it gives us information about white teeth (which it does not)? And is it not still correct to say that the painter wishing to represent the mountain will have to match his painting with the *appearance* of the peak from a given station point?

I urged long ago that in this and similar cases Gibson's assertion that we do not really see the individual aspects of things but their invariants perceived in the round is easily refutable. We may in fact be greatly surprised to see what the same peak looks like when seen from another valley. I was happy to note that Gibson conceded this point to me during our last meeting and happier still that he expressed his agreement in writing. He was kind enough to send me the copy of a letter he wrote to Professor Topper of the University of Winnipeg on January 3, 1978, the year before his death. Responding to a note in the journal *Leonardo* edited by Frank Malina he wrote:

Your interpretation of what I mean by the *invariants* of an object is correct. It's not easy to grasp, and if Frank Malina doesn't have it straight I can hardly blame him. Ernst Gombrich comes to Cornell every now and then and listens to me carefully, so he has it clear enough too. His criticism therefore (as I have now decided) is just. Prodded by your *Note*, I shall pull back somewhat. The "chronological priority of the perception of invariant features before perspective features," as you

correctly put it, applies only to *objects one can walk around*, not to *mountains you can't walk around* (or celestial objects of any sort).

Given the chance by Frank Malina, I shall say so. I hope he will publish your *Note* and let me add to it.

To the best of my knowledge Gibson never got around to discussing the implications of my criticism. Naturally it leaves his account of our interaction with the immediate environment intact, but it suggests that vision reaches far beyond this environment. Whether we are painters or merely nature lovers, we have a right to examine and admire the distant view without wanting to become aware of affordances or indeed of our exact position in relation to these vistas. Enjoying the magic of a sunset we cannot be concerned with invariants. We may respond to its beauty, and this response can also be evoked by a painting, which may arouse a mood rather than a potential for active exploration. Gibson was right in drawing our attention to this latter function and purpose of our senses, but his account may still have to be supplemented by doing justice to the undoubted emotional effects of seeing, effects which may also be wrongly considered to be purely subjective.

Gibson's sole outlook, as Reed emphasizes, kept him apart from the line of approach that developed in his lifetime, the approach of "input and output" stimulated by computer research. He was no doubt right in stressing that we are not automata to be triggered by external forces. It is all the more noteworthy that the pioneer of computational theories, David Marr, in his posthumous book *Vision* (1982) paid a special tribute to Gibson.

In perception, perhaps the nearest anyone came to the level of computational theory was Gibson (1966). However, although some aspects of his thinking were on the right lines, he did not understand properly what information processing was, which led him to seriously underestimate the complexity of the information-processing problems involved in vision and the consequent subtlety that is necessary in approaching them.

No doubt Gibson would have agreed. If he aimed at simple formulations, it was, as we know, because these could most easily be discussed and criticized. He never claimed to have fathomed the full complexity of human perception. On the contrary, he considered an awareness of these complexities the first requirement and he never ceased to regret the absence of this awareness. In a sentence that Reed places at the head of his book he wrote:

Psychology, or at least American psychology, is a second rate discipline. The main reason is that it does not *stand in awe* of its subject matter. Psychologists have too little respect for psychology.

Come to think of it, the same strictures may apply to other fields, for instance to art history (and not only in America).