institutions that have so severely limited the accomplishments of the profession. One hopes that the historian of the next half century will be able to record a more constructive joining of plan and action than we have yet achieved.

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Processing Sensory Information

Principles of Perceptual Learning and Development. ELEANOR J. GIBSON. Appleton-Century-Crofts, New York, 1969. x + 538 pp., illus. $8.50. Century Psychology Series.

It will not be possible to teach or even discuss the topic of perception for many years to come without bringing in the name of Gibson. James J. Gibson made a major theoretical statement about the nature of the perceptual process in his book *The Senses Considered as Perceptual Systems* in 1966 (Houghton Mifflin); and now Eleanor J. Gibson has produced a book about perceptual development, a book which is much broader in scope than her husband's and clearly intended for use as a textbook, but which just as clearly makes its own theoretical contribution. This book will have many uses, not all of them confined to the special aspect of perception denoted by the title.

After an introductory chapter defining the subject of perceptual learning and a chapter on the traditional theories of perception—Helmholtz, Titchener, William James, and the Gestalt school—the author devotes two chapters to contemporary theories of two major varieties: Cognitive theories are those that emphasize various internal processes such as hypotheses, inferences, and attitudes; in this category she places Brunswik's probabilistic cue learning theory, the transactionalism of Ames, Cantril, and Ittelson, and the schema theories of Bartlett and Vernon, as well as the theories of Piaget and Bruner. Response-oriented theories are those that emphasize the role of more overt responses in the perceptual process; among these are the motor copy theories (and she includes Hebb and J. G. Taylor along with the Soviet theories) and the discrimination theories such as those that emphasize the acquired distinctiveness of cues. She considers both the cognitive and the response-oriented theories to be enrichment theories in that the organism is presumed to add something to the stimulus input, something that makes the stimulus more meaningful and possibly more complex. Whatever the rightness of her classifications (and certainly there will be some objections from those classified), these early chapters provide an excellent survey of the diversity of theories of perception, one that will be useful in any study of that subject.

The next four chapters are devoted to the development of her own theoretical position, which she terms differentiation theory, in contrast to the enrichment theories. For her, differentiation theory is unequivocally stimulus-oriented, for what is learned is the nature of the stimulus, its properties, its distinctive features, its invariants. In the learning process abstraction, selective attention, and filtering or rejection of unwanted information all play a large role. While such experimental techniques as the use of verbal labels may improve perceptual discrimination, they do so not by enriching the stimulus through an associative process but by providing information to the experimental subject concerning pertinent distinctive features or higher-order properties of the stimulus. This theoretical position puts Gibson comfortably within the current information-processing approaches to the study of perception, in that she is concerned with the organism's role in obtaining information about the environment and then doing something about it. But the doing something about it definitely is not itself perception: it is only a consequence of a process.

The rest of the book deals with various aspects of perceptual development, and the topics range widely from the development of the aspects of perception that the author considers most important (perception of objects, space, events, representations, and coded stimuli) and that are most directly pertinent to her own theoretical position, to topics much less easily encompassed in it, such as phylogenesis of perception and even imprinting. When she is dealing with the latter topics, or for example with distortions of the visual field with special lenses, the exposition has less a feeling of flow. Yet it is to her credit that she chose to write a book on perceptual development, and did not confine herself to those aspects of that subject that easily fit the information-processing approach she favors. The result is a first-rate text and reference book.

Gibson does not herself use the term information processing in describing her point of view. I have used it because her theory does comfortably fit into current notions about information processing (the four chapters outlining her own theory can easily be used in a course on information processing). But I have used the term also to contrast the point of view Eleanor Gibson elaborates with the one James Gibson has stated. Clearly the two Gibsons think much more alike than differently, but both the similarities and the differences so epitomize some general problems in the study of perception that a bit of comment on this point is worth while. They agree entirely that perception is about the world out there; they are both realists in the epistemological sense. Both are critical realists, arguing not that the world is known in a simple isomorphic fashion but rather that its properties must be deduced, possibly inferred, from complex information-seeking activities of the organism. In line with this position, they also agree that the role of the overt response in an experiment on perception is as an indicant of a process, and is not itself the process. In fact, for both of them this is a rather important point.

Where are the differences? James Gibson is very much concerned with understanding perception as knowing of the world, as cognition in its literal sense. In fact, he has more than once been heard to say that perception is synonymous with cognition. Thus for him it is reasonable to ask, for example, what the nature of depth perception is. It is not enough to know that one depth can be discriminated from another; rather, a single perceptual experience directly leads to the experience of depth, and it is worth asking what the nature of that experience is. For such questions even phenomenal report is at times a necessary experimental procedure. Eleanor Gibson, on the other hand, has emphasized an approach to perception much more in the tradition of discrimination learning, a tradition which has always depended on overt discriminative responses. Thus she defines the difference between perceptual skills in terms of the experimental response required. To illustrate, a detection experiment is one that requires a response indicating presence or absence; thus energy detection and determination of whether a target letter held in memory exists in a given display of letters are both called detection processes, an association that I find

somewhat uncomfortable. Responses as indicants of discrimination are indeed important in Eleanor Gibson's thinking, and even though it is the stimulus that is learned, we (the scientists, that is) must learn about the learning by paying close attention to the nature of the discriminative response used by the experimental subject.

Why this difference, James Gibson emphasizing direct cognition, and Eleanor Gibson emphasizing discriminative perception? Certainly it is in line with their backgrounds, one having come from a partly introspectionist training at Princeton, the other from a stimulus-response tradition at Yale. But more than that, it reflects the inherent limitations the student of development must accept in studying perception in either animals or children, particularly preverbal children. It is essentially impossible to find out how a child or an animal knows the world; but it is quite easy (relatively speaking) to find out whether an organism can discriminate aspects of the world, and the discrimination learning procedures are the ones to use. With adults, capable of accepting complex instructions and of giving verifiable complex responses, we can learn much more about the nature of knowing, about perception as cognition.

So Eleanor Gibson is emphasizing a point of view entirely appropriate to her subject matter, but one that is perhaps still methodologically limited. Nevertheless, her thinking about the nature of perceptual development has gone far beyond any such limitations, and we are indebted to her for an excellent addition to the study of perception and its development.

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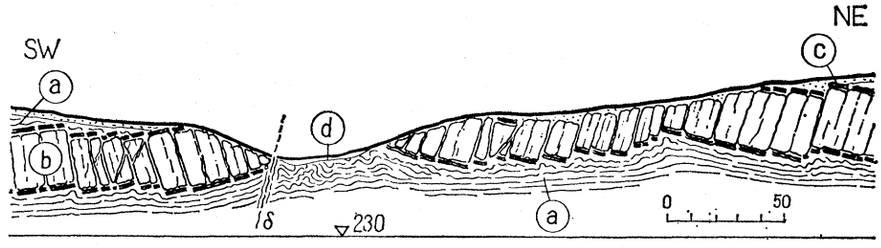
Instabilities

Landslides and Their Control. QUIDO ZÁRUBA and VOJTECH MENCL. Elsevier, New York, and Academia, Prague, 1969. x + 206 pp., illus. $14.50.

This book is organized about a fourfold geological classification of landslides, to wit: superficial slides; slides in weak rocks; slides in solid rocks; and other types. Superficial slides include creep of debris, sheet slides, earth flows, and debris flows. Slides in weak rocks are divided into those on cylindrical shear surfaces, those on ancient slide surfaces, and those caused by bulging or squeezing of soft layers. Solid rock slides are those controlled by geological structure, slides associated with the long-term deformation of mountain slopes, and rock falls. Under the fourth category are solifluction phenomena, quick clay slides, and subaqueous slides. One of the most interesting chapters gives geological examples of every type, including many totally new to this reviewer.



Squeezing out of marly shales on the valley bottom of the Lucina River near Ostrava, Czechoslovakia. *a*, marly shales (Lower Cretaceous); *b*, teschenite; *c*, contact metamorphosed slates; *d*, disturbed shale beds in the valley bottom. [From *Landslides and Their Control*]

Since slides are geomorphic features, terms expressing the stage and degree of development are useful. Thus the authors refer to *active*, *dormant*, and *fossil* slides. Dormant slides are those for which the basic causes persist, so that there is a possibility of renewed movement. Fossil slides, in contrast, cannot revive under present climatic conditions. The degrees of development of landslides are defined as *initial*, *advanced*, or *exhausted*, according to the relative degree of cracking and of emptying of the head area. In the initial stages, the factor of safety can be estimated from the degree of development. Slides may be active, fossil, or dormant in any of the three degrees of development.

The type of slides in weak rocks caused by bulging or squeezing up of soft layers is illustrated by fig. 5-36, reproduced here, which shows a slide associated with a "valley anticline"—an anticline caused by upward bulging of shale accompanying unloading by erosion. This process is accompanied by a tension cracking in the more rigid strata in the valley sides. A very similar occurrence in Dallas, Texas, accompanied the collapse of an excavation several years ago.

The authors do not pretend to present a highly technical work with the latest refinements in analysis and corrective measures, but they are careful to give extensive references on these subjects and to provide a review of the basic phenomena which will be helpful to those who have not closely followed these areas. Almost no attention has been paid in landslide literature to the measurement of stresses accompanying landsliding. The authors give examples of their own stress measurements in slides using rock-mechanics methods; they point out that these methods are well suited in view of the small deformation moduli and therefore relatively large displacements that accompany the release of strain when stress measurements are carried out in clays and weak rocks. The book also reviews various methods of stabilizing slides, giving examples from practice. These methods include excavation, drainage, plantings of vegetation, construction of retaining walls and similar structures, the use of rock bolts, stabilization of slopes by piles and hardening of soils by grouting and electrical techniques, and finally the rupture of the slip surface by blasting.

In summary, the book is a complete study of the enormously interesting subject of landslides, including not only those slides produced in the natural terrain and considered as geologic phenomena but those produced by man and his activities as well. It is very well written from both the geological and the engineering point of view and is thorough in both fields to a degree seldom achieved in a single work.

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Troposphere and Stratosphere

Climate of the Free Atmosphere. D. F. REX, Ed. Elsevier, New York, 1969. x + 450 pp., illus. $52.50. World Survey of Climatology, vol. 4.

In the 15-volume series *World Survey of Climatology*, 3 volumes are devoted to "general climatology," 11 to regional climatologies, and 1 to the climate of the "free atmosphere."

The editor of the present volume has