guage performance and other cognitive behavior by minority-group children. These three books will be required reading for anyone who wishes an up-to-date, comprehensive view of developments in behavior therapy. Personological theorists and psychotherapists will find only the bare beginnings for a common ground.

EDWARD S. BORDIN
Department of Psychology, University of Michigan, Ann Arbor

Clinical Views of Memory

Human Memory and Its Pathology. JACQUES BARBIZET. Translated from the French by D. K. Jardine. Freeman, San Francisco, 1970. x, 198 pp. $5.

Thoughtful men have long struggled to gain a better understanding of the operation of human memory. Although it has been clear that the brain is responsible for both the processes and the contents of memory, the precise means by which experience modifies the nervous system remains one of the major mysteries of biology. Disturbances of what is called "memory" have been described for years in patients with dementing disorders and tumors and injuries involving various parts of the brain. Ablations of certain brain structures in experimental animals have long been known to alter their ability to learn or retain certain behaviors; the variety of brain structures in which the effect has been shown is impressive. Yet until recently most such observations had shed little light on the biologic relation of the brain to memory, and instead had provided comfort to the adherents of Lashley's concept of the nonspecific "mass action" of cortex. Even the principles of memory mechanisms derived from verbal and behavioral studies of intact subjects seemed to correspond to little that could be observed in the brain.

During the last 20 years several avenues of approach to the investigation of the biology of memory have opened. In 1957 Scoville and Milner observed that bilateral removal of the hippocampal regions in man seriously impaired the ability to store new memories, yet did not interfere with other cognitive functions. This serendipitous discovery gave support to the view that this aspect of memory, at least, had a discrete anatomical substrate, and for this reason that memory storage was a biologic property of brain rather than a convenient "psychological construct." In addition, the development of the computer as a model for cognitive organization, the advancement in the understanding of central neurotransmitter biochemistry, and the sophistication of techniques for the analysis of the electrical activity of the brain all gave impetus to research along the appropriate derivative lines.

Research on memory has thus fanned out in widely divergent directions. At times it has become difficult to imagine how the claims of the "worm-runners" for the transmission of "memory" via ingested RNA could have any relation to the verbal behaviorist's rules for proactive inhibition of "memory" exerted by list A on list B. And, when the family of a patient with senile dementia says that he has a "memory problem," are they referring to the same "memory" as the cyberneticist building a computer model? The difficulty in resolving these questions, and in correlating these various approaches to memory by means of an all-inclusive plan, has led most researchers to adhere as closely as possible to the narrow boundaries of their own fields in investigating memory. Thus they can avoid the frustrating problem of finding a larger conceptual schema that might place the insights of these diverse disciplines into a useful relationship.

The clinician who takes an interest in disorders of memory is not as readily able to remain a purist, considering if he chooses only the molecular aspects of memory. Patients with "memory disorders" ranging from transient inability to store new information to global dementia may present themselves for study; he will see some whose emotional states interfere with storage or recall of information, and others whose hippocampi have been destroyed by herpes simplex encephalitis. As such a clinician, Barbizet has viewed a vast range of pathologic disruptions of memory; in *Human Memory and Its Pathology* he has attempted to set down something of the breadth of the clinical spectrum that he has observed, and to put these observations into an orderly framework.

The author's approach is an inclusive one, in which he regards memory as fundamental to almost all cognitive processes. He argues that not only is factual information stored in memory, but similarly programs for the acquisition, organization, and retrieval of information must be stored. Intelligence, he concludes, is not innate but is the product of "acquiring both experience and the programs that enable us to use effectively one or more earlier experiences in our reactions to any given situation." For Barbizet, then, the province of the study of memory includes not only the *cerebral processes* by which information is acquired, stored, and retrieved, but also the *stored information itself*, some of which in turn modifies the future acquisition, storage, and retrieval of information.

This is a clinically convenient approach, since it allows the author to approach aphasias, apraxognosias, dementias, hysterical amnesias, intellectual deterioration with aging, and impairment of memory with hippocampal lesions—all as if they are disorders of memory. It is, indeed, valid and valuable that Barbizet has addressed himself to the contents as well as the mechanisms of memory, since by far the majority of research interest has favored the study of memory mechanisms; this monograph may help to right the balance.

It is disappointing, however, that while the author has drawn the bold outlines of the scope of memory, he has had far less success in defining the boundaries of its components, either from a theoretical or from a clinical standpoint. Elsewhere, Richter has been able to provide more than 20 definitions of the word "memory" as employed in "common usage," biology, information theory, neurology, and psychology. Barbizet ignores many of these nuances of meaning; yet at one point he arbitrarily refers to "very short, short, medium, long, [and] very long-term retention," without providing the rationale for five time-based divisions of memory. His clinical descriptions of syndromes that may occur with a variety of lesions of the brain are always complete and clear. Yet it is not always evident precisely which memory mechanisms have been impaired to produce a particular clinical picture, nor is it clear what steps one might take to analyze further the nature of the memory deficit.

Overall, the major value of this book is to be found in the many keen clinical observations of an experienced clinician, as well as a number of sharp insights into the functioning of memory gained from closely examining patients with derangements of memory. Once again, however, the grand design of human memory seems to have proved

elusive, although the perusal of this monograph may bring another investigation a little closer to that objective.

DAVID A. DRACHMAN
Department of Neurology, Northwestern University Medical School, Chicago, Illinois

Subjective Phenomena

Image Formation and Cognition. MARDI JON HOROWITZ. Appleton-Century-Crofts, New York, 1970. xvi, 352 pp., illus. $12.50.

The psychology of cognition has undergone some major reorientations in the last five to ten years, and this book is an important and timely contribution to that active field. Mental imaging—the subjective equivalent of looking and listening—has its equivalents for such experiences as taste, smell, touch, and pain, and images of these various kinds play an important part in thinking, remembering, and fantasy, all concerns of the cognitive psychologist. Horowitz, writing as a psychiatrist, shows imagery to be important also in the practical sphere of dealing with patients, and examines its various forms in their relation to symptoms, treatment, and prognosis.

A new and original examination of the problem of classifying the various phenomena of imagery begins the book. Horowitz deals ably with hallucinations, dreams, and the half-awake (hypnagogic) state and the strange intrusions of dreamlike imagery that some people experience while falling asleep. He discusses the body image—the conception a person has of his own body as a spatial object and of its shape, position, and orientation to surroundings—and offers interesting clinical evidence of disturbances of the body image that may occur in the hypnagogic state or under drug or anesthetic influence. Other phenomena dealt with are synesthesia, with its intersensory blendings of imagery and perception (such as the shape and color imagery some people have on hearing music); "flashbacks" (reexperienced images after drug-induced states); "dream scintillations" (successions of images that intrude in full wakefulness); and *déjá vu*. There is an up-to-date account of experiments involving sensory deprivation and hallucinogenic drugs, and a strong chapter on the influence of the brain in image formation.

Some basically important issues about differences in imagery arise in relation to work with psychiatric patients. For example, it might be assumed that the psychotic patient with auditory hallucination is in other ways primarily an auditory imager. Horowitz shows that the opposite is probably the case; his discussion recalled a low-powered visual imager, not a patient, who once said to the present reviewer, "I've had visual images once or twice, and they nearly frightened me out of my wits." In the wide variations of imagery within the realm of the normal we can find much to comfort the anxious parent, and the author is alert to this need. This book should be read by those psychologists who remain even today introspectively illiterate because of the shadow of an out-of-date form of behaviorism that proscribed introspection; by psychiatrists who wish to understand more of the psychology of imagery and perception; and by those lay to both disciplines who wish to learn more about the subjective mental life of their spouses, their children, and themselves. Differences between individuals can be considerable.

Some minor criticisms may be made of this important and otherwise scholarly book. There is on occasion a hint of resort to the use of imaginary examples; these (known to psychologists as "fantastic anecdotes") are dangerous in exposition and irrelevant to proof. One leading English investigator of such phenomena as synesthesia, Magdalene D. Vernon (p. 70), would doubtless prefer to be cited as "she" rather than "he." Investigators from the side of psychology may be cautious about whether phenomena reported by Iskower, and heavily loaded with theoretical interpretation of a psychoanalytic kind, justify the status given them by the label "the Isakower phenomenon." Finally, it seems a pity that an investigator of the author's caliber should make use of that esthetically barbarous and linguistically impossible term "psychedelic," whose unfortunate associations have often embarrassed rather than helped serious research on the effects of hallucinogenic drugs on imagery.

These are very trivial criticisms, of a comma-spotting kind. The book is an absorbing one, distinguished by originality, theoretical reorientation, and valid inference in relation to available evidence. After a first reading, the reviewer had to borrow it back repeatedly from colleagues working in the same field who proved deeply interested in the intellectual news it contains. He awaits the author's next book with more than usual impatience.

PETER MCKELLAR
Department of Psychology, University of Otago, Dunedin, New Zealand

Perception and Depiction

Optics, Painting, and Photography. M. H. PIRENNE. Cambridge University Press, New York, 1970. xxiv, 200 pp., illus. $13.50.

Artists, experimental psychologists, and philosophers have long been concerned with the puzzling fact that a flat object (a picture) can in some sense substitute for an arrangement of very different objects in three dimensions. As a first step in explanation, we note that any picture and any tridimensional scene that present the eye with the same array of light can thereby substitute one for the other.

Understanding this aspect of the perception of pictorial representation rests, therefore, on some knowledge of physical and anatomical optics. The first seven chapters (about half) of Pirenne's book examine the anatomy of the eye and the geometry of image formation; a discussion of light, linear perspective, and central projection culminates in a description of the painted ceiling of the nave of St. Ignazio. In this painting, Pozzo's painstaking use of the geometry of central projection presents to the eye of an observer, if he stands at one particular point on the floor, an array that is almost identical to that which would have been produced if the church had an additional story with a much higher ceiling and with figures floating in midair. From that viewing point, reportedly, a nearly perfect *trompe l'oeil* is achieved. From off-center viewing points, the depicted scene reportedly appears deformed (nonrectangular), just as one would expect, because the array of light then reaching the eye is what it would receive from the distorted tridimensional arrangement.

Such perceived distortions in a depicted scene should, according to this principle, occur whenever the picture is viewed from any position other than the central projection point: The perspective picture of an object is itself