Book Reviews

Similarities and Discontinuities

Cognitive Processes of Nonhuman Primates. A symposium, Pittsburgh, March 1970. LEONARD E. JARRARD, Ed. Academic Press, New York, 1971. xii, 188 pp., illus. $9.50.

In what ways are the cognitive capacities of human and nonhuman primates similar and in what ways are they different? This question provided the central theme of this symposium.

Several of the contributors emphasize the similarities. Thus, Weiskrantz attempts to resolve the apparent discrepancy between effects of medial temporal lesions in humans and in monkeys. In man, bilateral ablation of the temporal lobe involving the hippocampus produces a profound anterograde memory loss, which has been interpreted as a failure to place new experiences in long-term memory storage. Attempts to reproduce such effects in animals have been largely fruitless; perseverative or disinhibitory effects have been the most frequent outcome. Whereas others have tried to reinterpret the animal data or design new experiments with animals, Weiskrantz and his collaborators have adopted a different strategy—that of further analyzing the amnestic syndrome of patients with Korsakoff's psychosis (believed to involve pathology and memory defects similar to those produced by the bilateral hippocampal ablations). On the basis of his findings on retention of verbal and nonverbal material in these patients, Weiskrantz suggests that they are particularly prone to perseverative tendencies, which produce abnormally strong interference with memory. Thus, he concludes, there may be a close resemblance between the disorders produced by medial temporal lesions in monkey and in man.

Jarrard and Moise take a somewhat different approach. Arguing that a prerequisite for comparison of memory mechanisms in monkeys and man is the use of comparable testing procedures, these investigators have used the performance of monkeys in a delayed matching-to-sample task as a measure of short-term memory. They found that short-term memory in monkeys, measured in this way, is sensitive to the same variables that have been found to influence it in humans: length of delay (monkeys show memory decay curves like those found with humans), the presence and duration of distracting activities interpolated between the sample stimulus and the recognition task, and number of repetitions of the sample stimulus, as well as other factors, apparently influence memory in monkeys in the same ways as they do in humans. These results are encouraging for those who look for similarities in the mnemonic processes of human and nonhuman primates, especially since the task used by Jarrard and Moise is comparable to human short-term memory tasks only in a very general way, and certainly not with regard to many procedural variables, as the authors admit.

Rather than developing a new test of animal memory that is applicable to humans, Miles has compared the performance of humans and various nonhuman species on a frequently used, almost standard "monkey" test, the delayed-response test. His results show that adult humans, older and younger children, rhesus monkeys, squirrel monkeys, cats, and rats can be ordered along a scale of decreasing proficiency in delayed-response performance. Miles interprets his results as indicating the "outstanding" and qualitatively distinct performance of humans in this situation. According to Miles, this superiority is evident despite the fact that the delayed-response test provides no special advantage to humans; it is assumed to represent a noncognitive task in which language abilities would play no decisive role. It is questionable, however, whether there is any behavioral task to which humans would fail to apply cognitive abilities, and even more questionable that rehearsal strategies could not be employed in this situation. Useful information on this point could have been obtained simply by asking subjects how they stored the information. Moreover, one could argue that Miles has in fact demonstrated only a quantitative difference between the performance of humans and nonhumans and that evidence for qualitative differences could be obtained only by demonstrating that performance is sensitive to different variables in humans and in nonhumans.

Perhaps the best and certainly the most dramatic evidence to date for an essential continuity of cognitive processes between subhuman and human primates is the finding that chimpanzees can be taught language. Indeed, there are now two reports of this feat, one by the Gardners, the other by Premack, who authors one of the chapters in this book. Premack does not speculate unduly about the possible phylogeny of language or the limits of chimpanzee cognitive capacity, as others might be tempted to do in a symposium of this sort. Rather, he describes the methodology of his language training program and the successes and failures encountered in applying his procedures to Sarah, a five-year-old female chimpanzee. Premack's approach consists of formulating a list of behaviors that satisfy the requirements of use of language (that is, exemplars of language) and a list of corresponding training methods intended to produce the requisite behaviors. With such a list of definitions, according to Premack, one can investigate not only the question Can an ape learn language?, but also the more general question What is language? This frankly operational approach is combined with a modest appraisal of the experiment's accomplishments; Premack makes it clear that this experiment is simply a pilot study, that controls are lacking and for this reason it is difficult to assess the relative efficacy or the necessity of various procedures. In describing the stages Sarah went through in learning to use pieces of plastic as words, Premack stresses the use of nouns and adjectives as exemplars of language attainment. Much less emphasis is placed on structural aspects of sentences, matters which linguists place high on the list of language exemplars; in fact, they often treat these aspects as evidence for neural/cognitive structures unique in man. It remains for future research to determine whether and to what extent apes can learn grammatical rules. At present, it is clear that one very central prop supporting the idea of man's uniqueness has been pulled out or at least considerably weakened as a result of Premack's

research and that of the Gardners.

One potentially fruitful approach to the analysis of cognitive processes is Harlow's error-factor theory, which he originally applied to the formation of learning sets. One of the few investigators who has carried on this method of analysis is Meyer, who reports his findings on the relationship between the learning of habits and of concepts by monkeys. These findings, according to Meyer, suggest that monkeys can learn and unlearn concepts (rule learning) without any apparent change in the way they learn particular habits. This view suggests that as cognitive processes for handling complex information develop the mechanisms governing habits remain stable. Meyer goes further and claims on the basis of an experiment by Betllinger *et al.* that habits, when retained, can suppress learning sets, although it is not entirely clear whether set suppression or simply interference with a particular habit has been demonstrated in this study. Meyer concludes by speculating that humans, to the extent that they show behavioral rigidity, are probably prone to similar suppression of concepts by habits. Support for this view comes from Maier's findings that insightful learning of new principles for solving problems can be impeded by old habits.

In one of his two contributions to this symposium, Harry Harlow, together with M. K. Harlow, Schiltz, and Mohr, presents data on learning abilities of monkeys raised in normal, enriched, or socially deprived environments. These findings indicate that manipulation of early social environment has no consistent effect on the learning of tasks ranging in complexity from simple discrimination learning to learning the oddity principle. Harlow and his co-authors take to task those investigators who have reported apparent adverse or facilitating effects of rearing conditions on later learning, and point out the importance of adaptation to the test situation, the interfering effects of emotional reactions, and several other factors carelessly dealt with or ignored in past studies. Harlow apparently feels quite strongly about these problems, for he contributes, along with J. P. Gluck, another chapter in which, after a critical review of the literature in this area, it is concluded that because of failure to control the factors mentioned previously inferences about the impact of early experience on later learning are unwarranted. The message is clearly stated: those who look to the animal literature for an understanding of factors controlling human learning and for guidance in forming social policy had better look carefully.

The disparity between approaches taken in these papers is matched by that of the viewpoints expressed by the two discussants. Gregg, a psychologist, approaches cognition from the computer-modeling point of view. He concludes that cognitive control occurs when an internal event selectively directs attention to particular environmental stimuli so that different stimuli generate switching operations as a function of internal states. This idea is very similar to those expressed by Sutherland and others in dealing with selective attention in animal discrimination learning. According to Gregg, if cognition is described in terms of a computer-modeled system involving elementary information processing, expressed as instructions, then cognitive processes in monkeys (the learning of rules in learning set) and in man are fundamentally the same; they both involve perceptual or attention-getting rules. Stimulus-response theorists, starting from quite different assumptions, have also attempted to understand complex problem-solving behavior of animals and humans in terms of a unified theory. One can only hope that an information-processing approach will be more successful.

By contrast, Geschwind, a neurologist, begins his analysis with the fact that the human cerebral hemispheres are unique among mammals in that they show functional and anatomical asymmetry. He points out that the dominant role of the left hemisphere with regard to language is clearly seen in cases of cerebral disconnection. Geschwind holds the view that language involves the ability to form cross-modal associations, which in turn depends upon the functions of a higher-order association area in the region of the angular gyrus. Since it is now known that chimps can learn language, he must show that this region has common features in the chimp and human brain. He must also demonstrate that it is impossible for primates with an undeveloped angular gyrus (a definition is needed here) to learn language. Since it is impossible to prove the null hypothesis, Geschwind's theory, at least in its present form, is at best difficult to test.

The editor of this volume states in the preface that "many who attended the symposium left with a clearer understanding of similarities and differences that exist in complex behavior of human and non-human primates." This claim may come as something of a surprise to the reader, who more likely would be struck by the paucity of data bearing on these issues. It is evident from what has been said that the contributors to this volume are concerned with different problems, have different conceptual frameworks, and use different experimental methods, all of which makes it difficult to interrelate their contributions. From a distant perspective, it is difficult to make out any trends emerging in the analysis of cognitive processes in primates. In fact, it appears that the study of cognition in nonhuman primates is proceeding at a slower pace than it did in the past, when such investigators as Harlow and before him Nissen, Klüver, Yerkes, Tinklepaugh, and others opened up the field. Present investigators of primate behavior seem to be more interested in social and emotional behavior or sensory processes than in cognition. It appears that a resurgence of interest in this area will have to come about before we have a clearer understanding of similarities and differences between the complex behaviors of human and nonhuman primates.

CHARLES M. BUTTER
Neuroscience Laboratories,
University of Michigan, Ann Arbor

Continuing Reviews

Current Topics in Experimental Endocrinology. Vol. 1. L. MARTINI and V. H. T. JAMES, Eds. Academic Press, New York, 1971. xiv, 294 pp., illus. $16.50.

Since this is the first volume of what is intended to be a continuing series, it is of interest to note its orientation as outlined in the editors' preface. "The purpose of this series is to provide readers with a continuing and critical review of the field [of endocrinology]. The invited authors have been offered the opportunity to discuss their field critically from a personal standpoint rather than to provide an extensive reference list. . . ."

In fact, can this series justify itself and stake out an area that is not already occupied by *Recent Progress in Hormone Research*, produced annually by the same publisher, and by the frequent endocrinologic treatises in *Annual Re-*