ciplined manner. Moreover, despite Skinner's role as the archbehaviorist, his steadfast insistence that all "mentalistic" terms be renounced, I would unhesitatingly include him among those whose efforts have advanced our ability to deal with the very phenomena that Griffin asserts have fallen under reductionist taboos. Griffin recognizes the need "to avoid both of two obviously fallacious extremes: (1) the postulation of complex mental activities (such as horses capable of long-division) when simpler ones are consistent with the observed behavior of the animal . . . and (2) the conventional reductionist position that animals have no mental experiences at all, or that any they may have are hopelessly inaccessible to our investigation" (p. 72). For more than 50 years individuals such as those I mentioned have tried to steer a course between the Scylla of unbridled anthropomorphism and the Charybdis of the Cartesian reflex machine. And by and large they have been successful; more so I think than Griffin understands.

Griffin's failure to appreciate the methods and accomplishments of previous investigations of animal cognition probably accounts for the unique promise he sees in two-way communication, which he views as a kind of royal road to the animal mind. This is evident throughout the book, but most clearly in the final substantive chapter, entitled "A possible window on the minds of animals," where he advocates an approach called *participatory* investigation. By this he means a method that permits one "almost literally speaking, to talk back and forth with a communicating animal" (p. 89).

The inspiration for the method of participatory investigation is taken from recent research on the acquisition of language by chimpanzees, particularly the work of the Gardners. Because Griffin accepts the view that human mental experiences can be approached only through the use of language and introspective reports, he sees communication and "animal introspection" as a way "to detect and examine any mental experiences or conscious intentions that animals may have" (p. 105). He urges that more effort be directed toward developing physical models and social surrogates to permit man to enter more fully into the natural process of social communication with animals.

Griffin seems to miss the essential point in the work of the Gardners, Premack, Rumbaugh, and Fouts. Chimpanzees in nature do not communicate with each other via computer keyboards and displays, or by using plastic chips, or with the gestures of the American Sign Language. Animals, even as man, know more than they can tell. But we can sometimes increase the information they give us by offering technical assistance. The investigators of chimpanzee language acquisition have produced fundamental new information, not by learning to communicate like chimpanzees, but by devising flexible and subtle methods particularly suited to the investigation of cognition in these apes. The essential point is that more has been learned about chimpanzee mental processes through such methods than these animals could possibly have conveyed to each other (or to man) using their natural systems of communication.

It does not diminish their originality or importance to say that the cornerstone of these achievements is methodological, rather than conceptual. And they are built on old foundations. The idea that the investigator is in communication with his animal subjects is not new. In studies of animal cognition it is virtually essential that one be able to pose a "question" and elicit an interpretable response. The scientist "asks" the monkey to select a red object from an array of novel objects it has never seen before, after first showing it a sample of the correct color; or he moves a circle of pinecones from around the entrance of the digger wasp's burrow to a new location and "asks" whether she will home on the original site or the translocated configuration. Certainly such procedures allow us to discover something important about the animal's experiential world. I see no evidence in this of shared language or participatory investigation, to say nothing of animal introspection. And how much of our considerable knowledge of the cognitive abilities of the preverbal child is based on strictly analogous procedures?

What has been achieved may seem pale in comparison with the vision of sitting down like Dr. Doolittle for an informal and revealing chat with an animal friend. But even if this were possible, how much would necessarily remain unsaid? If we have learned one thing from the many years of effort devoted to the problem, it is that there is no "window" that will allow us to gaze directly on another mind, even that of another human being, and to see its workings clearly and to see them whole. Mind, after all, lacks "thing quality"; it is but a construct, hardly more than a label, really, for complex processes and functions that we are still far short of understanding in any creature, including ourselves. We have learned what is perhaps the hardest lesson of all: There is no royal road to mind; we are forced to approach along the only paths that are open to us, through the tortuous byways of analysis, inference, hypothesis, and reconstruction. That animals are aware can scarcely be questioned. The hows and whys and wherefores will occupy scientists for many years to come.

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The Science of Values

Values in Education and Society. NORMAN T. FEATHER. Free Press (Macmillan), New York, and Collier Macmillan, London, 1975. xvi, 350 pp. $14.95.

A few decades ago scientists were sure of themselves. Increasing scientific knowledge was almost synonymous with enhancing the good of mankind. Then, increasingly, scientists began to fear the possible use of their discoveries. Psychologists as scientists were late to join the circle of fear. After all, their science was the one that could deal scientifically both with fear and with the human beings in whose hands the potentially dreadful applications of science lay. The confident hope that many psychologists felt in the 1950's has given way to increasing concern, especially in areas such as social psychology, where the study of men's motives, values, and actions is seen by some to be bogged down in an antiquated set of simplistic assumptions borrowed from a philosophy of science of a bygone age.

A central intellectual problem of our time is whether the study of man's behavior can help resolve conflicting values of groups that can lead to the destruction of all mankind. Can the influence of values on behavior be clarified to a point, for instance, where the increasing knowledge of genetics can be used for the good of mankind? In short, the value of science is questionable without an adequate science of values.

The science of values received a shot in the arm recently with the development of a new technique for measuring values. Milton Rokeach, a man well known for his work on attitudes and values and *The Open and Closed Mind* (1960), has given us a technique that is short and simple. His evidence suggests that it is tapping

relatively stable, enduring qualities of human beings that intervene between cultural, societal, and personal experience on the antecedent side and social attitudes and ideologies and social behavior on the consequent side.

Probably the most extensive use of the technique other than Rokeach's own work is that reported by Norman Feather in *Values in Education and Society*. Feather's book is a report of a program of studies concerned, among other things, with how values are conceptualized and measured, how they influence educational choice and adjustment, how they change, how they differ between generations and between cultures, and how they are manifested in juvenile offenders and student activists. Some of these topics are extensions of Rokeach's pioneering work and might be seen as no more than a slight extrapolation of it. They stand in their own right if for no other reason than that the data represent an entirely new population, the majority having been collected in Australia, where Feather is on the faculty of Flinders University.

Feather makes no startling revisions of Rokeach's position and accepts the measurement technique as given. Thus he parallels Rokeach in using values primarily as labels for human qualities or end-states found preferable by people and not as concepts to assess the worth of objects. Individual values are enduring beliefs, and a person's individual values become organized into his value systems. The organization is only partly reflected in the measurement, which is capable of assessing only relative importance to the individual because the subject is simply asked to rank the values in ordinal position of their "importance to YOU, as guiding principles in YOUR life" (Rokeach, *The Nature of Human Values*, p. 27). Two major categories of values are distinguished and are separately ordered by the subject; namely, instrumental values (defined as modes of conduct such as honesty, courage, and responsibility) and terminal values (defined as end-states of existence such as inner harmony, freedom, and equality). Apparently the organizing aspects for terminal values derive either from their personal (inner harmony) or from their social (equality) focus. Instrumental values have moral or interpersonal focus (responsibility) or are concerned with competence and self-actualization with a personal focus (being capable or logical). After mentioning these foci Feather makes little use of them. Although he notes that instrumental and terminal value systems are separate but "functionally connected," he does little to show the connection or its import in the many studies he reports.

In his introduction Feather suggests that his studies might be seen as studies of "cognitive ecology," that is, of "the effects of disjunction between personal and actual or perceived environmental value systems" (p. xiii). Value discrepancy theory (the theory concerning such disjunctions) is central to the studies reported in roughly the first half of the book. These studies were conducted in educational settings. Stressing the general theoretical framework, Feather says (p. 271), "Our stance has differed from Rokeach's." The main theoretical aim was to test hypotheses concerning the effects of value discrepancies on behavior. Feather has, for instance, shown that university students tend to choose programs of studies the values attributed to which match their own value systems and that among secondary school students satisfaction with school increases as a function of value match. Since value discrepancies might be reduced by a change of personal values over time, Feather looked at the impact of schooling on values. Although he found some evidence of change, he reports a study of university impact that showed a "virtual absence of any change that could be attributed to the impact of the university per se" (p. 279).

The studies discussed above have a theoretical impetus and also account for the word "education" in the title of the book. "Mapping of values" is the term used by Feather to characterize the studies reported in the later chapters of the book, and it is these chapters that take up the topic of "society." The goal of the research reported in them was primarily to stockpile value profiles of different groups for later comparisons. "Similarities and differences in value priorities were . . . noted between males and females, parents and children, different income groups, student activists and non-activists, delinquents and non-delinquents, Australians and Americans, Australians and indigenous people of Papua, New Guinea, and Australians and migrant groups—Ukranians and Latvians—assimilating to Australian society" (p. 277).

Although Feather has extended the use of the value scale in many areas, he has not done much to follow up two of Rokeach's most fascinating, indeed almost startling findings, namely the data showing long-term changes in values as a function of very brief "self-confrontation" with value discrepancies, and the data supporting Rokeach's two-value model of political ideology. Despite Feather's claim that his stance differs from Rokeach's, both writers appeal to a value discrepancy theory. Whereas Feather looks for discrepancies between the values of students and those of their educational institutions, Rokeach makes people aware of discrepancies in their own outlook (self-confrontation) and reports long-term effects of very brief confrontations which deserve to be followed up.

Rokeach's two-value model of political ideology singled out *freedom* and *equality*, and he hypothesized that socialism would be high on both values, capitalism high on freedom and low on equality, communism high on equality and low on freedom, and fascism low on both. A content analysis of the writings of Hitler, Lenin, Goldwater, and various socialist writers produced strong support for the model. Again, these tantalizing data tempt one to further use of the two-value model. Yet Feather only alludes to them in a discussion of conservatism (p. 136), where he reports weak evidence for a single conservatism factor and suggests that "it may be more useful to relate social attitudes and behavior to small sets of values" based on "underlying theory" (p. 137). He does not seem tempted by Rokeach's analysis emphasizing freedom and equality. He does note that the student activists he studied were very high on both values, but he regards these as "only two values among several that differentiated activists from controls" (p. 167).

I have couched my discussion of the science of values in the context of broad concern with the value of science. I have couched my discussion of Feather's book in the context of the more innovative work of his predecessor Rokeach. Clearly this step-down procedure leaves Feather's work looking rather pale. Let's face it, his book is not very exciting reading and seems to hold out little hope for a big breakthrough that will save mankind. Feather's book is often tedious, as near the end where he reviews possible extensions of his work and its relation to other concepts without presenting anything new. The "mapping of values" was guided almost entirely by what was possible (groups and cultures that were available) rather than by any compelling logic of comparison. As a result the list of highly prized values for each group holds few surprises. Even the studies in the educational settings that were tied together by a theoretical thread may be criticized by saying that the thread is thin indeed.

One could demand perfection and ask

for more theoretical meaning in the choice of cultures to map. One type of choice that would draw more attention would be to measure values of prominently competing cultures (Israelis and Arabs, perhaps). The question arises, however, whether attention is a good criterion of scientific meaning. On the other hand, one could ask for a more rigorous tie between theory and the data on educational choice. Such a demand would ask of Feather more than most psychological theories have accomplished. The point is that Feather's book may seem insignificant in the face of world problems but it represents where we are in psychology and takes a step beyond. It represents what has been called "normal science." In present parlance that phrase is often taken to mean dull and mediocre. Thomas Kuhn, however, used it to mean "research firmly based upon one or more past scientific achievements" (*The Structure of Scientific Revolutions*, p. 10), and Feather's book is certainly that. Kuhn has set us to look for new and exciting paradigms at every turn of a book cover. Feather's work does not present one, but he need not apologize for that. Progress in science (between revolutions, of course) usually occurs slowly, cumulatively, in "mopping up" and even "mapping out" operations. When carefully done, as Feather's work is, such research does not have to read like a novel to be useful.

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Giraffa camelopardalis

The Giraffe. Its Biology, Behavior, and Ecology. ANNE INNIS DAGG and J. BRISTOL FOSTER. Van Nostrand Reinhold, New York, 1976. xiv, 210 pp., illus. $13.95.

A monograph that assembles for the first time all that has been published about the biology of any large mammal must be a welcome book. This is doubly true when the animal is as extraordinary and important as the giraffe. Yet, as with most of the world's more spectacular mammals, the new research that is reported stands out against a background of past neglect. Anne Dagg and Bristol Foster are themselves responsible for much of the new work that is summarized in their book. Dagg first studied giraffes in the eastern Transvaal, and Foster studied them in the Nairobi National Park and its hinterland in Kenya; with D. Backhaus, who studied giraffes in Zaire, they were pioneers of fieldwork on this species.

The most important new work that the authors present has to do with behavior and ecology. This information, heretofore unpublished, is marshaled in three chapters. The account of individual activities consists mainly of an analysis of the time allocated to various activities, particularly feeding. The chapter on social grouping and activities is intriguing but inconclusive. It seems that giraffes are very variable and lax in their associations. Companions separate and reunite at long time intervals. Moreover, although individuals may be widely dispersed they can often, presumably, still see one another over great distances. Difficulties in the concept of a social group are raised. Foster's work is notable for his ingenuity in compiling a catalog of photographs of all the giraffes he saw and then gaining past records of individuals (all identifiable from their unique coat patterns) from old photographs and even from old postcards for tourists. His oldest record was of a bull and two adult females taken in 1948; the bull would have been at least 27 years old when seen in 1968. Clearly, once individuals have established themselves they stay in an area for a lifetime, but their home ranges can be very large. The chapter on reproduction and population structure gives particularly full data on births and mother-calf relationships, but what can at present be constructed about the population dynamics of the giraffe is very incomplete because of the rather atypical environment of Nairobi National Park and the fact that the group of giraffes studied in South Africa were on pastoral ranges.

If the book has shortcomings it is basically because our knowledge of the giraffe is still elementary. The authors have gathered a bibliography of over 700 papers, but much is speculation or opinion, and in discussing the biology of the giraffe they have often to resort to saying that some naturalists think this while others think that. This style is a little incongruous with the precise information interspersed concerning, for example, the dosages of drugs required to immobilize a giraffe.

Recently new work on the behavior of the giraffe has been conducted in the Serengeti in Tanzania, and intensive work continues there. The exhaustive account in this book, however, will provide the foundation for any new understanding of this species. Not only does the animal capture the imagination, but the fact that it is the only species that can exploit the high canopy and that it will browse a wide spectrum of the foliage makes it a herbivore of potentially great economic value.

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Biomechanics

Mechanical Design in Organisms. S. A. WAINWRIGHT, W. D. BIGGS, J. D. CURREY, and J. M. GOSLINE. Halsted (Wiley), New York, 1976. xii, 424 pp., illus. $19.50.

This is an interesting, important, and useful book. The authors end it with the statement that biomechanics represents a "useful point of view," and the volume makes that point convincingly. The book is strongest in its phenomenological descriptions of strength of materials, which introduce concepts such as viscoelasticity and the statistics of polymer chains, and in the exposition of the properties of biological materials. It is least detailed in its treatment of what is called ecological mechanics, but it does document that biomechanical approaches are now possible and may lead to important results when more intensively pursued.

The materials discussed are those used for support, and include both simple and compound substances, such as bone and collagen, silk and lignin, chitin and elastin; these are dealt with under the headings of tensile, pliant, and rigid materials, and the properties of individual fibers and crystals are analyzed as well as those of the composite structures. The book stresses that biological materials are unlikely to react in the simple fashion often depicted for the sake of convenience in biological textbooks. Consequently, there is continuous and refreshing emphasis on the limiting assumptions of the several tests. Conversely, the authors emphasize the problem of applying engineering approaches to biological systems.

This kind of treatment has long been desirable but has only recently become feasible (the majority of the references cited are later than 1960). It furnishes methods and data that may facilitate both ecological interpretations and reconstructions from the fossil record. It is particularly nice to find so many documentations of how competing influences keep organisms from achieving optimized adaptations for one particular set of living conditions, or how a particular tissue such as bone may show quite different stress responses in different parts