

the ability to turn in upon itself and "no longer merely to know, but to know one's self; no longer merely to know, but to know that one knows." The transition from consciousness to self-consciousness was a gradual one in terms of the morphology of the brain, but psychologically a new world was born.

As a paleontologist the author's main interest has been anthropogenesis and the process of "hominisation" that took place in the paleolithic primates. This story is told with literary skill. It joins the prehomins with early *Homo sapiens* and shows how the neolithic age was prolonged into historic times and still exists in isolated regions.

Starting millions of years farther back than most authors, Teilhard describes how even in minerals there is order, a primordial emergence of organized matter, which to him represents the beginning of a global and irreversible evolution. Tangential developments are occurring in millions of morphologic relationships, but through all this complexity runs a radial development, a fundamental impetus. This is the internal as contrasted with the external organization, a rudimentary sort of consciousness contrasted with mere matter. When one passes from the inorganic to the organic, from the geosphere to the biosphere, the transition is easier to see. Other philosophical writers on evolution have expressed similar ideas: J. C. Smuts proposed that the main characteristic of the evolutionary process is to form new wholes. E. W. Sinnott calls it "directive self-regulation." J. B. S. Haldane believes that man shall ultimately find evidence of "mind" in inert matter. When all the enormous sweep of evolution is grasped, such a provincial belief as the separation of body and mind becomes unthinkable.

Teilhard takes "consciousness" in the broadest possible sense as a kind of directiveness and order. One needs some mental suppleness to accept his definition. Having accepted it, however, one realizes that what most people consider "mind" or "thought" is what he speaks of as "reflective consciousness," a far more complex form of consciousness and almost unbelievably recent. (Life probably developed on this planet about 2 billion yr. ago; it is impossible to comprehend such figures, so one must translate them into understandable terms. If one condenses these 2 billion yr. into a mental picture of 1 yr., then mammals appeared in late October, and man, with his "re-

fective consciousness," at 11:55 on the night of December 31, the last five min. of the year.

The "age of reason" began in the Pleistocene, the ice age. According to Teilhard, the brain of neolithic man was already perfect and has shown no measurable variation since then. Changes may be developing slowly in the nervous system, but since that date evolution has "overflowed its anatomical modalities" and been expressed in social development. Anatomical developments need hundreds of thousands of years; social developments occur in decades.

Pierre Teilhard was a Jesuit priest, a devout Catholic. The last chapters of his book describe his optimistic religious philosophy. He shows how man has developed personality, a level superior to individuality. He compares this social evolution to the structural evolution of the nervous system that produced a brain in which "reflective" thought was possible. When true social integration has been achieved man will have reached what he terms the "omega point." This he equates with God. Immortality is at least a collective continuation and, in that sense, is survival. This is a modern transcendentalism, based on abundant new data not available to Hegel or to Emerson.

The book in its original French must be a literary masterpiece. Even in translation the style is fine. Repetition of ideas, expressed with new facets of thought, might be considered redundant, but this is part of the art of a good teacher. In the lucid Introduction by Sir Julian Huxley one finds a brief biography of the author that explains why he was forbidden by his superiors in the Church to continue teaching and why the manuscript of this book had to be laid aside for 10 yr. and could only be published after his death. The introduction by Sir Julian will give to the hurried reader a useful abstract, but this should not deter the more scholarly from enjoying a great book. S. C.

Plans and the Structure of Behavior

George A. Miller, Eugene Galanter, and Karl H. Pribram

New York, Henry Holt & Co., 1960, pp. 226, \$5.00

This book is welcome on at least three scores: it consistently applies the same theoretical model to a diverse selection of important problems in psychology, without going into exces-

sive length or getting caught up in controversial details; the model is new and sheds new light on these problems; and the presentation is most enjoyable. It is not a comprehensive or formal treatise, but rather the outline of one to follow. It can be read as a manifesto on behalf of the cognitive approach; to sharpen the edge of their challenge, the authors line themselves up under a completely novel banner of subjective behaviorism. They accept the discipline of behaviorism, without the obligation to ignore some problems characteristic of human experience and performance because these happen to be tainted with mentalism.

Help to resolve the behavioral dilemma has come from the machine. The authors inform the reader that every day someone suggests to them that people are like computing machines. Very likely, they did not have to go beyond their own circle to hear this suggestion, but then psychologists who accept it as a plausible hypothesis are not rare exceptions. One advantage accruing from this analogy is that it admits purposive behavior without any vitalist implication. Also, computers must have instructions available for execution, and by analogy, men too must have plans. Plan is the cardinal concept in the author's theory; two others are the Image and TOTE.

TOTE stands for test-operate-test-exit and is a cybernetic alternative for the stimulus-response connection modeled on the reflex arc, which the authors reject as the fundamental pattern for the organization of behavior. Image includes all information stored by the organism about itself and its world, stored in a cumulative structure reminiscent of Bartlett's schema. "A Plan is any hierarchical process in the organism that can control the order in which a sequence of operations is to be performed." It is with Plans in this sense that the book is concerned, with the problem of basing a theory of action on a concept derived from relatively complex cognitive operations, in place of constructs borrowed from physiology or the clinical studies of individual differences. Naturally enough, the theory is most effective when it deals with such topics as language and problem solving; it is also in these contexts that the analysis is most firmly based on significant experimental data. Applied to motor skills, habits, and instincts, to psychopathological types and hypnosis, the bold and broad formulations are perhaps not quite so satisfactory. The interpretations are always ingenious and

elegant, but they inevitably neglect certain considerations that not every reader would admit as negligible, even at the level of analysis chosen by the authors. Perhaps the most serious defect of the theory is that it does not clearly state how Plans are set into operation. True, there is the hierarchical model to fall back on, and the concept of metaplans, but this can easily lead into an infinite regress. The problem of conflicting Plans has not been adequately dealt with also.

Perception does not emerge as a topic to be treated in its own right, and learning is examined principally as tested by memorizing lists of syllables or word associations. The authors' paradigm of learning neatly illustrates the hierarchical model: ordinarily, it involves "a metaplan for constructing a Plan that will guide recall." The utility of this formula for reconciling two or more otherwise disparate theories of forgetting is evident. It also nicely fits certain observations on amnesia associated with subcortical lesions, mentioned in a chapter on "some neuropsychological speculations," and would fit equally well some aphasic symptoms. The question is whether the explanation offered to account for amnesia—inability to formulate Plans for remembering—adds anything to the simple statement that there is failure in recall. That depends on whether a substitute plan imposed from outside would elicit recall that does not occur spontaneously. The authors suggest that it would, but their example quoted in support of this proposition, while not unique, is not typical. Their neuropsychological speculations are directed towards a gross anatomical localization in the brain of the two major functions of the psychological model: sequential ordering or planning and discriminating or imaging. The authors' interpretation of some examples of neuropathology, with that end in view, is ingenious and stimulating, as is the entire book, but also inevitably sketchy.

To those who believe that, in spite of its lively controversies, psychology is in need of more theoretical systems anchored in empirical data, this essay offers an important contribution to the literature. It is also recommended as the most readable presentation of a school of thought that is steadily extending its influence in this country where, for a long time, it barely survived amidst a hostile intellectual climate.

GEORGE A. TALLAND, Ph.D.