MODELING THE FORMATION AND USE OF CONCEPTS, PERCEPTS, AND RULES

WALTER REITMAN
UNIVERSITY OF MICHIGAN

1. Introduction

In his fascinating recent investigation of "The Structure of Scientific Revolutions," Thomas S. Kuhn [5] argues that scientific research has two phases. There is "normal science," characterized by work within a shared conceptual and evaluative paradigm or framework; and there is "revolutionary science," involving efforts to develop new and more adequate frameworks. Each such framework comprises assumptions about how one works, what one works towards, what the important questions of the field are, and so on.

Work now going on in psychology under such rubrics as computer simulation, heuristic programming, and information processing or dynamic modeling constitutes an effort to introduce a new paradigm into that field. Basic to the paradigm is conceptualization of psychological activity in terms of structures and processes more or less analogous to certain classes of complex computer data structures and programs. Miller, Galanter, and Pribram [6], for example, take "image" and "plan" as their basic concepts, and in the work we consider here psychological propositions are stated in actual computer programs.

The origins of this paradigm can be traced at least to Turing [23], who tried to make a case for computers as complex information processing systems capable in principle of intellectual activity in the same sense that humans are. Five years later, Selfridge [16] and Dinneen [1] published descriptions of a system actually capable of very limited pattern recognition (discriminating *A*'s from *O*'s). Shortly thereafter, Newell, Shaw, and Simon [9] reported their Logic Theorist, a program capable of proving theorems in elementary symbolic logic, and in ways that seemed to them to parallel the kinds of activity going on in human problem solvers attempting the same kind of tasks. This, furthermore, was deliberate. The Logic Theorist was designed to incorporate strategies, procedures, rules, and heuristics that had been observed on a more or less informal basis in human subjects. The next large step was the General Problem Solver program, again the work of Newell, Shaw, and Simon [10]. This system was designed to handle a *variety* of problems rather than being limited to logic or to any other single domain. Not quite so general as its name suggests, it none-