

A Review of *Animal Behavior*

Noam Chomsky

A great many linguists and philosophers concerned with language have expressed the hope that their studies might ultimately be embedded in a framework provided by behaviorist psychology, and that refractory areas of investigation, particularly those in which meaning is involved, will in this way be opened up to fruitful exploration. Since this volume is the first large-scale attempt to incorporate the major aspects of linguistic behavior within a behaviorist framework, it merits and will undoubtedly receive careful attention. Skinner is noted for his contributions to the study of animal behavior. The book under review is the product of study of linguistic behavior extending over more than twenty years. Earlier versions of it have been fairly widely circulated, and there are quite a few references in the psychological literature to its major ideas.

The problem to which this book is addressed is that of giving a "functional analysis" of verbal behavior. By functional analysis, Skinner means identification of the variables that control this behavior and specification of how they interact to determine a particular verbal response. Furthermore, the controlling variables are to be described completely in terms of such notions as stimulus, reinforcement, deprivation, which have been given a reasonably clear meaning in animal experimentation. In other words, the goal of the book is to provide a way to predict and control verbal behavior by observing and manipulating the physical environment of the speaker.

Skinner feels that recent advances in the laboratory study of animal behavior permit us to approach this problem with a certain optimism, since "the basic processes and relations which

give verbal behavior its special characteristics are now fairly well understood ... the results [of this experimental work] have been surprisingly free of species restrictions. Recent work has shown that the methods can be extended to human behavior without serious modification" (3).1

It is important to see clearly just what it is in Skinner's program and claims that makes them appear so bold and remarkable, It is not primarily the fact that he has set functional analysis as his problem, or that he limits himself to study of observables, i.e., input-output relations. What is so surprising is the particular limitations he has imposed on the way in which the observables of behavior are to be studied, and, above all, the particularly simple nature of the function which, he claims, describes the causation of behavior. One would naturally expect that prediction of the behavior of a complex organism (or machine) would require, in addition to information about external stimulation, knowledge of the internal structure of the organism, the ways in which it processes input information and organizes its own behavior. These characteristics of the organism are in general a complicated product of inborn structure, the genetically determined course of maturation, and past experience. Insofar as independent neurophysiological evidence is not available, it is obvious that inferences concerning the structure of the organism are based on observation of behavior and outside events. Nevertheless, one's estimate of the relative importance of external factors and internal structure in the determination of behavior will have an important effect on the direction of research on linguistic (or any other) behavior, and on the kinds of analogies from animal behavior studies that will be considered relevant or suggestive.

Putting it differently, anyone who sets himself the problem of analyzing the causation of behavior will (in the absence of independent neurophysiological evidence) concern himself with the only data available, namely the record of inputs to the organism and the organism's present response, and will try to describe the function specifying the response in terms of the history of

inputs. This is nothing more than the definition of his problem. There are no possible grounds for argument here, if one accepts the problem as legitimate, though Skinner has often advanced and defended this definition of a problem as if it were a thesis which other investigators reject. The differences that arise between those who affirm and those who deny the importance of the specific "contribution of the organism" to learning and performance concern the particular character and complexity of this function, and the kinds of observations and research necessary for arriving at a precise specification of it. If the contribution of the organism is complex, the only hope of predicting behavior even in a gross way will be through a very indirect program of research that begins by studying the detailed character of the behavior itself and the particular capacities of the organism involved.

Skinner's thesis is that external factors consisting of present stimulation and the history of reinforcement (in particular, the frequency, arrangement, and withholding of reinforcing stimuli) are of overwhelming importance, and that the general principles revealed in laboratory studies of these phenomena provide the basis for understanding the complexities of verbal behavior. He confidently and repeatedly voices his claim to have demonstrated that the contribution of the speaker is quite trivial and elementary, and that precise prediction of verbal behavior involves only specification of the few external factors that he has isolated experimentally with lower organisms.

Careful study of this book (and of the research on which it draws) reveals, however, that these astonishing claims are far from justified. It indicates, furthermore, that the insights that have been achieved in the laboratories of the reinforcement theorist, though quite genuine, can be applied to complex human behavior only in the most gross and superficial way, and that speculative attempts to discuss linguistic behavior in these terms alone omit from consideration factors of fundamental importance that are, no doubt, amenable to scientific study, although their specific character cannot at present be precisely formulated. Since Skinner's work is the

most extensive attempt to accommodate human behavior involving higher mental faculties within a strict behaviorist schema of the type that has attracted many linguists and philosophers, as well as psychologists, a detailed documentation is of independent interest. The magnitude of the failure of this attempt to account for verbal behavior serves as a kind of measure of the importance of the factors omitted from consideration, and an indication of how little is really known about this remarkably complex phenomenon.

The force of Skinner's argument lies in the enormous wealth and range of examples for which he proposes a functional analysis. The only way to evaluate the success of his program and the correctness of his basic assumptions about verbal behavior is to review these examples in detail and to determine the precise character of the concepts in terms of which the functional analysis is presented. Section 2 of this review describes the experimental context with respect to which these concepts are originally defined. Sections 3 and 4 deal with the basic concepts -- stimulus, response, and reinforcement, Sections 6 to 10 with the new descriptive machinery developed specifically for the description of verbal behavior. In Section 5 we consider the status of the fundamental claim, drawn from the laboratory, which serves as the basis for the analogic guesses about human behavior that have been proposed by many psychologists. The final section (Section 11) will consider some ways in which further linguistic work may play a part in clarifying some of these problems

Although this book makes no direct reference to experimental work, it can be understood only in terms of the general framework that Skinner has developed for the description of behavior. Skinner divides the responses of the animal into two main categories. Respondents are purely reflex responses elicited by particular stimuli. Operants are emitted responses, for which no obvious stimulus can be discovered. Skinner has been concerned primarily with operant behavior. The experimental arrangement that he introduced consists basically of a box with a bar attached to one wall in such a way that when the bar is pressed, a food pellet is dropped

into a tray (and the bar press is recorded). A rat placed in the box will soon press the bar, releasing a pellet into the tray. This state of affairs, resulting from the bar press, increases the strength of the bar-pressing operant. The food pellet is called a reinforcer; the event, a reinforcing event. The strength of an operant is defined by Skinner in terms of the rate of response during extinction (i.e, after the last reinforcement and before return to the pre-conditioning rate).

Suppose that release of the pellet is conditional on the flashing of a light. Then the rat will come to press the bar only when the light flashes. This is called stimulus discrimination. The response is called a discriminated operant and the light is called the occasion for its emission: this is to be distinguished from elicitation of a response by a stimulus in the case of the respondent.² Suppose that the apparatus is so arranged that bar-pressing of only a certain character (e.g., duration) will release the pellet. The rat will then come to press the bar in the required way. This process is called response differentiation. By successive slight changes in the conditions under which the response will be reinforced, it is possible to shape the response of a rat or a pigeon in very surprising ways in a very short time, so that rather complex behavior can be produced by a process of successive approximation.

A stimulus can become reinforcing by repeated association with an already reinforcing stimulus. Such a stimulus is called a secondary reinforcer. Like many contemporary behaviorists, Skinner considers money, approval, and the like to be secondary reinforcers which have become reinforcing because of their association with food, etc.³ Secondary reinforcers can be generalized by associating them with a variety of different primary reinforcers.

Another variable that can affect the rate of the bar-pressing operant is drive, which Skinner defines operationally in terms of hours of deprivation. His major scientific book, *Behavior of Organisms*, is a study of the effects of food-deprivation and conditioning on the strength of the

bar-pressing response of healthy mature rats. Probably Skinner's most original contribution to animal behavior studies has been his investigation of the effects of intermittent reinforcement, arranged in various different ways, presented in *Behavior of Organisms* and extended (with pecking of pigeons as the operant under investigation) in the recent *Schedules of Reinforcement* by Ferster and Skinner (1957). It is apparently these studies that Skinner has in mind when he refers to the recent advances in the study of animal behavior.⁴

The notions stimulus, response, reinforcement are relatively well defined with respect to the bar-pressing experiments and others similarly restricted. Before we can extend them to real-life behavior, however, certain difficulties must be faced. We must decide, first of all, whether any physical event to which the organism is capable of reacting is to be called a stimulus on a given occasion, or only one to which the organism in fact reacts; and correspondingly, we must decide whether any part of behavior is to be called a response, or only one connected with stimuli in lawful ways. Questions of this sort pose something of a dilemma for the experimental psychologist. If he accepts the broad definitions, characterizing any physical event impinging on the organism as a stimulus and any part of the organism's behavior as a response, he must conclude that behavior has not been demonstrated to be lawful. In the present state of our knowledge, we must attribute an overwhelming influence on actual behavior to ill-defined factors of attention, set, volition, and caprice. If we accept the narrower definitions, then behavior is lawful by definition (if it consists of responses); but this fact is of limited significance, since most of what the animal does will simply not be considered behavior. Hence, the psychologist either must admit that behavior is not lawful (or that he cannot at present show that it is -- not at all a damaging admission for a developing science), or must restrict his attention to those highly limited areas in which it is lawful (e.g., with adequate controls, bar-pressing in rats; lawfulness of the observed behavior provides, for Skinner, an implicit definition of a good experiment).

Skinner does not consistently adopt either course. He utilizes the experimental results as evidence for the scientific character of his system of behavior, and analogic guesses (formulated in terms of a metaphoric extension of the technical vocabulary of the laboratory) as evidence for its scope. This creates the illusion of a rigorous scientific theory with a very broad scope, although in fact the terms used in the description of real-life and of laboratory behavior may be mere homonyms, with at most a vague similarity of meaning. To substantiate this evaluation, a critical account of his book must show that with a literal reading (where the terms of the descriptive system have something like the technical meanings given in Skinner's definitions) the book covers almost no aspect of linguistic behavior, and that with a metaphoric reading, it is no more scientific than the traditional approaches to this subject matter, and rarely as clear and careful.