Establishing Operations: Another Step Toward a Functional Taxonomy of Environmental Events

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In "Establishing Operations," Michael (this issue) presents a strong case for distinguishing (i.e., classifying) a group of operant antecedent events he calls establishing operations (EOs). This is not the first time Michael has made the case for considering establishing operations in behavior theory. In fact, it has been 10 years since his first major treatment of the subject (Michael, 1982). That article appeared in the *Journal of the Experimental Analysis of Behavior*, and even though it has been fairly widely cited, those who read it were probably relatively few in number. Now, the larger behavior-analytic community has the opportunity to read an updated, revised, and, frankly, more readable treatment of the subject. Michael's analysis of establishing operations is significant for a science of behavior in several ways. First, by identifying a class of environmental operations with unique functions, Michael contributes to the experimental and theoretical endeavors to discover the independent variables of which behavior is a function. Second, the classification of certain operant antecedent events as establishing operations permits behavior analysts to make some finer discriminations between EOs and other antecedent events such as discriminative stimuli (S^Ds) and unconditioned and conditioned elicitors. And, finally, Michael's analysis of establishing operations brings within the purview of behavior analysis the area of psychology traditionally referred to as motivation.

Throughout his article, Michael makes reference to a variety of environmental events, in addition to EOs. This reflects his consistent approach over the years to the understanding of behavioral and environmental events and their interrelations by classifying them according to such characteristics as behavior type, provenance, and behavioral function. Thus, it would not be inappropriate to describe Michael as a taxonomist of behavior. By being almost singularly responsible for distinguishing events called establishing operations, Michael has further subdivided the behavioral functions of environmental events, thus permitting a more accurate classification.

BASIC UNITS OF ANALYSIS AND FUNCTIONAL TAXONOMY

Classification in behavior analysis, or in any science for that matter, is not possible if basic units of analysis have not been identified. One of the most important tasks of any science to discover such basic units, because "A well-defined unit clarifies the way phenomena are conceptualized and thereby guides research and theory" (Zeiler, 1986, p. 1). The units of modern behavior analysis were first described by Skinner (1935), who defined stimuli and responses, not as independent structural units but as functional classes. Skinner defined stimulus and response classes by their effects on one another. The result was that a basic functional unit of the analysis of operant behavior was born, and was called, generically, a contingency of reinforcement. One consequence of this discovery for the science of behavior was that it enabled environmental events to be identified and classified according to their behavioral functions.

Michael (1990) has previously provided the foundation for a formalized taxonomy of environmental events and operations. In this system, events are classified according to (a) their behavioral type, that is, whether they are re-

spondent or operant; (b) their provenance, that is, whether they are phylogenic or ontogenic; and (c) their functions, that is, whether they are evocative or function altering. Accordingly, Michael classifies EOs as operant events (although the operations themselves might also have simultaneous respondent effects) that can be either unconditioned or conditioned. In these respects, EOs are similar to other operant events, for example, reinforcers. However, it is with respect to their functions that EOs become distinct from other events. Like S^Ds, they alter the momentary frequency of behavior, but unlike S^Ds, EOs also alter the momentary effectiveness of consequences.

Behavioral Functions of Environmental Events

Behavior analysts have historically distinguished between the immediate versus the more enduring effects of environmental events on behavior (e.g., Catania, 1984; Reynolds, 1975; Skinner, 1938, 1953; Thompson & Lubinsky, 1986). Similarly, Michael (1983, 1986) has classified environmental operations according to whether they alter the momentary frequency of behavior or whether they produce a more lasting effect. Michael has used the term *evoke* to denote the former, and Schlinger and Blakely (1987) have used the term *function altering* to denote the latter. More recently, Michael (1990) has used both concepts to classify the behavioral functions of environmental operations. For example, respondent operations that evoke behavior without any learning history are called *unconditioned elicitors* (UEs), whereas respondent operations that evoke behavior due to a learning history (i.e., respondent conditioning) are called *conditioned elicitors* (CEs). On the other hand, when certain stimuli without any learning history are correlated with neutral stimuli such that the function of the neutral stimuli is altered, the former are called *unconditioned conditioners* (UCs).

In operant conditioning, classification of events by function has seemed to be a relatively straightforward enterprise.

Most behavior analysts have been trained to classify operant events according to a three-term contingency, namely an S^D, the operant class, and the reinforcing (or punishing) consequence. One implication of this constrained choice is that all operant antecedent operations will be classified as S^Ds. Thus, antecedent stimuli will be classified as S^Ds not necessarily because of their function but rather because of certain formal properties (e.g., that they precede the operant behavior in question). As Michael points out, such a strategy will result in an entire class of behaviorally necessary events—establishing operations—being ignored, both experimentally and theoretically. One of the most important functions of Michael's article for behavior analysts is that it separates antecedent events with discriminative functions from those with motivative functions.

Michael clearly demonstrates how it is easy to confuse discriminative with motivational effects of stimuli. Not only do S^Ds and EOs resemble each other in their evocative effect on operant behavior, but the history that produces that evocative effect is also similar. With both types of events, behavior is reinforced in their presence. For example, lever pressing is reinforced (and reinforceable) only after the rat is deprived of food, that is, in the presence of food deprivation, and only when a light is on. The critical difference between S^Ds and EOs, and the difference that Michael repeats throughout his article, is that whereas the behavior must also be extinguished in the absence of the S^Ds, the counterpart with the EO is not possible. In other words, in the absence of food deprivation it is not possible to extinguish lever pressing, because lever pressing is not reinforceable by food. Michael refers to this latter situation as a behaviorally neutral event. This difference between EOs and S^Ds is subtle but is extremely important in classifying the behavioral functions of environmental events.

One implication of Michael's distinction between EOs and S^Ds is that certain antecedent events (e.g., those called aversive stimuli) that have previously been

misclassified as S^Ds will now have to be reclassified as EOs. A second implication of the distinction between EOs and S^Ds is that behavior analysts will now have to rethink the basic units of behavior. Instead of the basic unit of analysis being the two-term contingency between behavior and consequences, it must now be a three-term contingency, between an EO, an operant class, and a consequent class. (The discriminative unit, then, is expanded to a four-term relation.) This must be so because the EO is necessary (a) to establish the reinforcing effectiveness of the consequence—the so-called reinforcer-establishing effect of EOs—and (b) to evoke the behavior, thus demonstrating that operant conditioning has occurred. This latter effect may be referred to as *motivational control,* because it resembles the similar effect of S^Ds on behavior referred to as stimulus control. In both cases, when we speak of EOs or S^Ds "controlling" behavior, we are referring to their evocative effects on behavior.

THE IMPORTANCE OF IDENTIFYING ESTABLISHING OPERATIONS

It could be said that motivational variables have been largely taken for granted by behavior analysts (Schlinger, 1992), even though Skinner (1953) seemed to have appreciated at least their evocative effect when he wrote that

the frequency of response which results from reinforcement depends upon the degree of deprivation at the time the response is observed. Even though we have conditioned a pigeon to stretch its neck, it does not do this if it is not hungry. We have, therefore, a new sort of control over its behavior: in order to get the pigeon to stretch its neck, we simply make it hungry. (p. 68)

Behavior analysts may take the EO for granted because, methodologically, experimenters must always manipulate some EO in order to condition behavior, and then manipulate it again at a later time to demonstrate the conditioning effects. However, in their analyses, behavior analysts rarely describe the evocative relation between the EO and the operant, which is established by the reinforcement contingency. Reynolds (1975) acknowl-

edged this "technological" use of EOs when he wrote that

The practitioner of operant conditioning scarcely mentions motivation, since it has come to refer only to those conditions that render a given event reinforcing at a given time. Since the emphasis in operant conditioning is on the effects of reinforcement, these motivational conditions have become mere technological details. (pp. 139–140)

Michael reminds us, however, that EOs are not simply technological details but rather are controlling variables in their own right. Michael's present article once again encourages behavior analysts to recognize the reinforcer- (or punisher-) establishing *and* evocative functions of motivational operations, to distinguish EOs from discriminative stimuli, and, thus, to acknowledge the rightful place of EOs in behavior-analytic theory.

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