

The Application of Establishing Operations

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The concept of the establishing operation, as described by Michael in this issue, provides behavior analysts with a way to analyze topics related to motivation without relying on cognitive constructs or terms. Skinner (1938, 1953, 1957) has always treated motivational variables (under the rubric of deprivation, satiation, and aversive stimulation) as independent variables in behavior analysis. Examples of this can be found throughout his writings, especially in *Verbal Behavior* (1957), in which he defines the mand as a type of verbal behavior that is controlled by motivational variables (Michael, 1988). Currently, however, establishing operations (EOs) are not well incorporated into applied behavior analysis and the treatment of human problems.

Michael points out that the neglect of the EO as a controlling variable in the analysis of behavior “leaves a gap in our understanding of operant functional relations” (p. 191). This gap can be observed, for example, in work with the developmentally disabled, for whom attempts to teach language or reduce negative behaviors fail. Often, by incorporating the EO into the behavioral analysis and intervention plan, the desired behavior change will occur. The purpose of the current paper is to use Michael’s classification system of the different types of EOs as a guideline for ways to incorporate the EO into typical functional analyses and behavior intervention programs.

Michael defines the EO as “an environmental event . . . that affects an organism by momentarily altering (a) the

reinforcing effectiveness of other events and (b) the frequency of occurrence of that part of the organism’s repertoire relevant to those events as consequences” (p. 192). There are several aspects of this definition that can be used to guide applications. First the “momentary” aspect is critical. This suggests that the reinforcing effectiveness is transient, and in order to use the EO as an independent variable, the applied behavior analyst must either *capture* or *contrive* the reinforcing effectiveness of an event.

Capturing an EO involves capitalizing on the EO as it occurs naturally in the environment, whereas contriving an EO involves manipulating some object or event that alters the value of another object or event as a form of reinforcement. Identifying and controlling EOs is often difficult, and requires special training on the part of the analyst. The analyst must first be able to tact the variables that alter the effectiveness of consequences, and then know how to manipulate them at the moment that they are strong. In addition, the analyst must be able to discriminate between a discriminative stimulus (S^D) and an EO. This can be difficult because the analyst must be able to determine if a response is due to the *availability* of reinforcement or the *effectiveness* of reinforcement (Michael, 1982). Skinner’s (1957) distinction between the tact and the mand provides several examples of these two types of control, and can be useful in acquiring this essential discrimination.

The Unconditioned Establishing Operation

There are several ways in which unconditioned establishing operations (UEOs) can be captured or contrived. UEOs such as thirst and hunger are perhaps the simplest to use, because it is the passage of time that increases the mo-

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mentary effectiveness of consequences that weaken them. These sources of control can easily be captured in the natural environment by simply waiting until the EO is strong. UEOs can also be contrived, for example, by giving someone salty chips to increase the value of liquids or by decreasing the temperature in a room to increase the value of warmth. UEOs are powerful independent variables and can be used in teaching a variety of behaviors, especially mands. These UEO effects may also be responsible for the occurrence of negative behaviors (e.g., tantrums and aggression) in nonverbal individuals. For example, when a child is thirsty, his or her whining and cup-pounding behaviors may be reinforced by quicker access to liquids.

The Transitive Conditioned Establishing Operation

The three types of conditioned EOs (CEOs) described by Michael—transitive, reflexive, and surrogate—can also be captured or contrived. Capturing a transitive CEO in the natural environment, for example, involves capitalizing on a situation in which one stimulus increases the value of a second stimulus as a reinforcer, but the second stimulus cannot be obtained without the emission of some behavior. For example, a nonverbal child sees a highly reinforcing fire truck parked outside the window. This stimulus increases the value of a second stimulus, an open door, and will evoke behavior that has resulted in doors opening in the past. A skilled trainer would observe these events and be quick to conduct a mand trial for the word “open” or “out.” Because the CEO is strong, this is the time to conduct mand training; in fact, manding cannot be easily taught if there is not a controlling EO in effect. The work of Hart and Risley (1975) on the incidental teaching model exemplifies this teaching strategy.

Transitive CEOs can also be contrived in order to conduct mand training. For example, in using this type of CEO procedure to teach mands to deaf individuals, Hall and Sundberg (1987) presented

a stimulus that increased the value of another stimulus (e.g., instant coffee without hot water). The coffee increased the value of hot water and thereby evoked behavior that had been followed by that form of reinforcement in the past. Appropriate mands were easy to teach when this EO was in effect. In fact, a number of mands were taught with this procedure, which often resulted in unprompted mands.

A surprising number of autistic and other developmentally disabled individuals remain essentially nonverbal despite years of specialized services. This transitive CEO procedure can be quite successful in generating early mands for nonverbal individuals (as can the UEO procedures). For example, a nonverbal child could be taught the mand *movie* when he or she has a strong EO for watching a video and a trainer carefully shapes the sign for “movie” by using the remote control to turn the video off and on and by presenting and fading physical, imitative, and verbal prompts. This procedure can be successful, because when the video is off it becomes possible to use the onset of the video as a form of reinforcement, and the child is likely to engage in any behavior that has produced that reinforcement in the past (typically negative behavior). The trainer can make sure that only approximations to the sign are reinforced (instead of negative behavior), thus generating a more acceptable mand. Often the negative behavior will decrease simply because the new mand replaces it. If the video is not effective as a form of reinforcement, then the procedure will not work.

It also appears that this early mand training and the use of the EO as an independent variable facilitate the later development of tact and intraverbal training in at least two ways. First, a successful mand training program with a previously nonverbal individual often changes the individual’s willingness to participate in training sessions. He or she is now successful, and trainers are paired with reinforcement rather than punishment. Second, the EO can be used as an additional independent variable in teaching

tacts and intraverbals (multiple control). Once a specific response form is acquired, procedures to break free from EO control and bring the response solely under S^D control can be implemented (Carroll & Hesse, 1987; Skinner, 1957; Sundberg, 1987).

The Reflexive Conditioned Establishing Operation

There are several possible applications of the reflexive CEO. In this type of CEO "any stimulus condition whose presence or absence has been positively correlated with the presence or absence of any form of worsening will function as a CEO in establishing its own termination as effective reinforcement and in evoking any behavior that has been so reinforced" (Michael, p. 203). For example, many developmentally disabled individuals have acquired strong repertoires of escape and avoidance behaviors (e.g., tantrums, aggression, self-injurious behavior, and self-stimulation). These behaviors often reliably occur when attempts are made to teach language and other skills. It may be that verbal stimuli presented to the individual function like a reflexive CEO, in that these stimuli are warning stimuli indicating that more bad things are coming, and behaviors that have terminated similar stimuli in the past occur immediately. The offset of the warning stimulus (the teacher backing off) will immediately reinforce any behavior that precedes such offset (Michael, 1988). Aggression, self-stimulation, and other negative behaviors are often immediately reinforced because they precede the termination of the warning stimulus. Reducing these behaviors requires extinguishing the behaviors by not terminating the teaching situation and by removing or desensitizing the warning stimulus. For example, if a child engages in aggression when "what is that?" is presented, it may be useful to change the stimulus to something different (e.g., "This is a . . .") while carefully ensuring success when this new stimulus is presented by use of prompts, interspersal

techniques, and strong forms of reinforcement.

The Surrogate Conditioned Establishing Operation

The surrogate CEO, in which a stimulus is correlated with a UEO, is relevant to analyses of emotional behavior. For example, stimuli correlated with punishment may evoke emotional behavior as a CEO rather than as an S^D. For example, a child may engage in a high rate of crying upon entering a dentist's office because that particular room has been previously paired with painful stimuli. The previously neutral stimulus (the room) now may evoke behavior (e.g., severe tantrums) that terminates that stimulus (the child is taken out of the room). The room is a CEO rather than an S^D (or a conditioned elicitor) because it increases the reinforcing effectiveness of terminating the stimulus rather than being a stimulus related to the availability of termination. There could be many other negative behaviors that are caused, in part, by the surrogate CEO, such as shyness or self-injurious behavior. Reducing such negative behavior requires extinction of the behavior and teaching the individual to remove the CEO with more acceptable response forms.

Additional Applications of Establishing Operations

There are many other examples in applied behavior analysis to illustrate how establishing operations can improve our effectiveness. In education, for example, there are probably several ways in which a teacher could use EOs to evoke more effective behavior from students, such as using problem-solving games. In addition, if EOs that compete with learning (e.g., sleep deprivation, video games) can be identified and controlled, then students may benefit. EOs also play an important role in many clinical interventions (e.g., marital problems, sexual dysfunctions, and depression may be related to EOs). The failure to recognize the role of the EO in controlling human behavior could also result in incomplete

behavioral assessments. In fact, EOs probably play a significant role in all of applied behavior analysis (e.g., behavioral medicine, behavioral gerontology, correction behavior analysis, business and industry), and a complete functional analysis should include EOs. Therefore, it seems appropriate that the common three-term contingency (stimulus–response–consequence) be expanded to a four-term contingency (establishing operations–stimulus–response–consequence).

Research

Research on the EO is just beginning, and lags far behind research on other behavioral principles. Other principles have received decades of experimental attention, and still continue to be the focus of basic empirical research. Relatively little is known about the EO and its parameters, and how it interacts with other principles of behavior. However, there is a growing body of literature on the EO, both on verbal (e.g., Hall & Sundberg, 1987; Lamarre & Holland, 1985; Sigafos, Reichle, Doss, Hall, & Pettitt, 1990; Sundberg, San Juan, Dawdy, & Arguelles, 1990) and nonverbal behavior (e.g., McPherson & Osborne, 1988; Pierce, Epling, & Boer, 1986). There are many research questions relevant to the EO, such as the relation between punishment and EOs, the relation between respondent behaviors and EOs, the role of the EO in blocking the establishment of discriminative stimulus control, and the role of the EO in the multiple control of behavior (for additional research topics, see Sundberg, 1991).

Conclusion

The EO is a powerful independent variable and can be manipulated to change a variety of human behaviors. It is possible that further research on the EO could lead to many theoretical and practical improvements in behavior analysis. Michael's classification system

of the different types of EOs serves as a guide for research, and for ways to incorporate the EO into typical functional analyses and behavior intervention programs. Michael's refinement of the EO concept will facilitate this important development in our field.

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