

# Establishing Operations and the Mand

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In *Verbal Behavior* Skinner identifies a small number of elementary verbal relations, one of which is the mand. Because its introduction is at first in terms of unlearned motivative variables, and because the mand's relation to prior controlling events is quite complex, its general significance has probably been underestimated. An extensive treatment of establishing operations, including the warning and the blocked-response conditioned establishing operations is provided, followed by a description of the mand in terms of such operations. The importance of the mand for language training programs is suggested, as well as the reasons why it is typically neglected in such programs.

In *Verbal Behavior* Skinner defines the mand as ". . . a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation. . . . and in contrast with other types of verbal operants . . . the response has no specified relation to a prior stimulus" (1957, pp. 35-36). In other words, with the mand what is said, written, signed, etc. is primarily determined by the motivative variable currently in effect.

## ESTABLISHING OPERATIONS

Variables such as deprivation and aversive stimulation are identified as motivative because of two quite different, but related behavioral effects: (1) They momentarily alter the reinforcing effectiveness of other events, and (2) they momentarily alter (increase or decrease) the frequency of the kind of responses that have been reinforced by those other events. (Response *frequency* here refers to number of response opportunities in which a response occurs as well as number of responses per unit of time, which makes it possible to avoid having to use the more controversial *probability* or *strength* of response.) These changes only last as long as the motivative variable is in effect and in this sense are momentary, as contrasted with the changes produced by respondent or operant conditioning or extinction (or by the

type of pairing that causes stimuli to become conditioned reinforcers or conditioned punishers). Thus water deprivation (1) momentarily increases the reinforcing effectiveness of any water that should be encountered; and (2) momentarily increases the frequency of (*evokes* is a convenient synonym) the various kinds of responses that have been reinforced with water. Painful stimulation (1) momentarily increases (in this case actually makes possible) the effectiveness of pain reduction as reinforcement, and (2) evokes the various kinds of responses that have been reinforced by pain reduction.

Keller and Schoenfeld (1950) introduced the term *establishing operation* for a variable that momentarily establishes the reinforcing effectiveness of some other object or event. Thus water deprivation momentarily establishes water as an effective form of reinforcement. The term is useful in that it can refer to any operation that has this effect (and the second effect seems always to accompany the first), whether or not the operation seems to be a form of deprivation or aversive stimulation. Salt ingestion, for example, is not easily classified as either deprivation or aversive stimulation, but is clearly an establishing operation with effects very similar to those of water deprivation. Similarly, changes in temperature above or below the optimal level establish changes in the opposite direction as effective reinforcement, and evoke behavior that has been reinforced by such changes.

The term *establishing operation* (EO) refers only to a variable's capacity to produce the two defining effects described above. Many

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stimulus changes that have these two effects have other effects as well but those are more properly identified with other terms. Thus, the onset of painful stimulation is also an *unconditioned elicitor* of smooth muscle and gland responses, and an *unconditioned punisher* for any behavior that immediately preceded the onset of the painful stimulation. These latter effects should not be confused with the motivational or establishing operation effects, even though they may often occur along with them. (For a systematic organization of the terms for respondent and operant functional relations see Michael, 1983.)

Water deprivation, painful stimulation, salt ingestion, and temperature changes probably have their reinforcer-establishing effects without any learning. In other words, we are probably *prewired* to be reinforceable by water as a function of water deprivation, or by pain reduction as a result of painful stimulation. Of course learning plays an obvious role in the development of the particular repertoires that are evoked by water deprivation or by painful stimulation—the second of the two defining effects of a motivative variable. It is convenient to refer to EOs with unlearned reinforcer-establishing effects as unconditioned establishing operations (UEOs). It is quite clear, however, that there are establishing operations whose reinforcer-establishing effects are learned, and these can be referred to as conditioned establishing operations (CEOs).

The most familiar type of CEO is the auditory or visual stimulus that is paired with painful stimulation—usually electrical shock—in an avoidance procedure, the so-called warning stimulus. In the typical procedure some arbitrary type of behavior—pressing a lever—terminates the warning stimulus and also prevents the onset of the painful stimulus. As a result of the systematic and repeated relation of the warning stimulus to the painful stimulus, the offset of the warning stimulus acquires the capacity to reinforce any response that precedes such offset, and the onset and presence of the warning stimulus then comes to evoke such responses.

The warning stimulus should be considered a CEO rather than an  $S^D$  for the response that has terminated it just as a pain-

ful stimulus should be considered a UEO rather than an  $S^D$  for the response that has terminated it. This point can be most easily made by reference to a typical laboratory shock-escape procedure. The response which turns the shock off (often a lever press) is clearly evoked by the shock onset, and the controlling relation is also clearly operant rather than respondent since it was developed through the use of shock offset as a reinforcing consequence. These two facts might seem to qualify the shock as a discriminative stimulus for the response that terminates the shock, but it differs in two important ways from a discriminative stimulus.

In the first place, a discriminative stimulus, or  $S^D$ , is a stimulus condition that has been correlated with the *availability* of a type of consequence given a type of behavior. Painful stimulation is *not* correlated with the availability of the reinforcing event that it establishes—in this case, the termination of painful stimulation. Being in pain is not systematically correlated with being able to remove pain, sad but true, except in the sense that if there were no pain there would be no pain to remove. In other words, the presence of pain is a necessary, but not a sufficient condition for its removal, just as food or water deprivation is necessary but not sufficient for food or water reinforcement. The stimulation associated with being food deprived—to the degree that there is any stimulation—is not also differentially associated with the availability of food. Just because an organism is hungry doesn't mean that food is likely to be available, as would be pointed out by many currently hungry organisms. Likewise with painful stimulation: It is not differentially correlated with the availability of some way to reduce the pain. An  $S^D$ , on the other hand, is a stimulus condition whose presence-absence must by definition be correlated with the availability of the relevant consequence given the relevant response.

Secondly, in the absence of shock, there is no analog to the extinction responding that occurs in the absence of an  $S^D$ . When shock is absent, the failure of the lever press to terminate the "nonpresent" shock is in no sense extinction responding. In a typical laboratory discrimination procedure with light-on as  $S^D$  and light off as  $S^\Delta$  the

organism's responses in the light-off condition fail to produce an event, food for example, which would clearly be reinforcing if it were received. In shock-escape the absence of shock is much more like the absence of food deprivation than like the absence of the light.

The argument for the CEO status of the warning stimulus in an avoidance procedure is identical in all respects to the argument for considering painful stimulation to be a UEO rather than an  $S^D$  for the response that terminates it. The only difference between them is that the warning CEO *acquires* its reinforcer-establishing capacity whereas that of the UEO is unlearned.

To state the relation in most general terms, any form of aversive stimulation, whether unlearned or learned, will momentarily increase the reinforcing effectiveness of its removal or attenuation, and momentarily increase the frequency of any behavior that has preceded such removal or attenuation. Likewise, we must suppose that any form of improvement<sup>1</sup> will also momentarily increase the punishing effectiveness of its removal or attenuation, and momentarily decrease the frequency of any behavior that has preceded such removal or attenuation (although this situation has not been subjected to laboratory investigation).

Another type of CEO, also likely to be mistaken for an  $S^D$ , is related to the fact that the conditioned reinforcing effectiveness of many stimulus changes is itself correlated with the presence-absence of other stimulus conditions. This relation is sometimes referred to as a context effect, in that the function of stimulus events as conditioned reinforcers is dependent on the context in which they occur. Said another way, the reinforcing effectiveness of many objects or events is conditional upon the status of other stimulus conditions. Now, when these other conditions assume the proper value, the object or event becomes an effective form of reinforcement, and behavior which has been followed by that object or event becomes more frequent—is evoked. But in this case the relevant stimulus change does not evoke

the behavior because of a relation with the availability of the object or event, which may have been readily available before the stimulus change occurred, but because it causes the object or event to assume reinforcing value. In other words, it evokes the response as an establishing operation rather than as a discriminative stimulus.

For example, two people are walking together and one sees something that must be written down so that it will not be forgotten—a store name, an address, etc. The would-be writer, however, does not have a pencil so requests one from the other person, who readily provides it. It might seem reasonable to consider the stimulus responsible for the request to have been an  $S^D$  for that request, but this is not correct. The immediate reinforcement for requests of this type has clearly been receipt of the thing requested, in this case a pencil; but the stimulus that evoked the request did not do so because it was an especially favorable situation for obtaining pencils—the companion would have provided the pencil whenever requested—but rather because it resulted in the increased reinforcing effectiveness of pencils. That is, it did not evoke the request as an  $S^D$  because of a correlation with the availability of pencils, but rather as a CEO because of a correlation with the reinforcing effectiveness of pencils.

This type of CEO often seems to be a stimulus event that functions as an  $S^D$  for a type of behavior which is in some sense blocked—cannot occur—until some other object or event becomes available. The stimulus event then also functions as a CEO with respect to the behavior that has been reinforced by obtaining this other object or event. Perhaps this type of CEO could be usefully referred to as a *blocked-response CEO*. (This is the establishing stimulus, or  $S^E$ , described in Michael, 1982. In that paper EO referred to unconditioned establishing operations and  $S^E$  to the blocked-response conditioned establishing operation. It now seems better to use UEO and CEO, with the latter referring to any of the several kinds of CEO. EO can now refer to any type of motivative variable, unlearned or learned.)

In addition to the warning and the blocked-response CEOs there may be other kinds, but these two would seem to be the main ones relevant to the mand, to which we shall now return.

<sup>1</sup>There is no good opposite for *aversive stimulation*. *Reinforcing stimulation* refers too specifically (as well it should) to the increase in future frequency of behavior that has preceded the stimulation. *Appetitive* is still too closely related to food.

### THE MAND

With this more extended treatment of motivative variables it becomes possible to supplement Skinner's mand definition in several directions. First, it might seem attractive to avoid dealing with establishing operations entirely and simply relate the mand to its history of reinforcement: ". . . a verbal operant in which the response is reinforced by a characteristic consequence" (1957, p. 35). But history of reinforcement only explains the origin of the functional unit involving  $S^D$ , EO, and R; not why the response occurs on a particular occasion. In other words, if a child says *water* as a mand, the explanation of that instance of behavior cannot consist simply in the statement that such responses were reinforced with water in the past, without adding that an EO related to water (for example water deprivation) was in effect at the time the response occurred. The layman would say that the child knew how to ask for water when thirsty (had the relevant history of reinforcement) and did so at that time because of being thirsty at that time (the relevant EO was in effect). Skinner expresses this general point when he says that the mand is under the functional control of relevant conditions of deprivation and aversive stimulation (1957, p. 35), which brings us to the next point.

It is clear that the terms *deprivation and aversive stimulation* are not broad enough to cover all of the variables that control the mand. Deprivation seems to be an operation that is primarily relevant to unconditioned establishing operations or UEOs, and although aversive stimulation can include any operation that can be considered a form of worsening, the blocked-response CEO is not covered by either term, nor are UEOs such as salt ingestion, temperature changes, and some others. Of course one might try to consider the blocked-response CEO to be a form of deprivation in the sense that something is absent, but again such absence is not the precipitating cause of the relevant behavior. In the previous example it was not the absence of pencils that evoked the request, or there should have been requests for all the other things that were absent. One might also try to bring the blocked-response CEO into the aversive stimulus category, in the sense that it is aversive to need something and not to have it, but this, too, seems to

stretch ordinary usage. The obvious solution is to define the mand as a type of verbal operant where the response is determined by a prior EO, as contrasted with the other verbal operants where it is determined by a prior  $S^D$ .

In Skinner's statement that the response has no specified relation to a prior stimulus, *response* is not as appropriate as *response form*, and *stimulus* should be replaced by *discriminative stimulus*. He is saying that with the mand, unlike all of the other elementary verbal relations, what it is that is actually said, written, signed (as in the sign language of the deaf), etc. is not determined by a prior *discriminative* stimulus. This does not mean (1) that the frequency of occurrence of a mand is unrelated to prior discriminative stimuli, nor does it mean (2) that the *form* of the response is not determined by prior stimuli functioning in some other way than as discriminative stimuli—namely as establishing operations.

With regard to the first point, as Skinner points out (1957, p. 52) prior stimuli are not irrelevant to the actual occurrence of the mand response form. Consider the mand *water* where the response form is determined by water deprivation. Saying *water* in the absence of an appropriate audience, or under circumstances where water has never been available has typically undergone extinction, and thus even under water deprivation the response will not ordinarily occur until appropriate circumstances are in effect. The audience or the circumstances are clearly functioning as  $S^D$ s, but not in the sense of determining the form of the response. The EO contributes to an increase in the momentary frequency of *water* as a response form, but  $S^D$ s related to past reinforcement of such a response form also contribute. In commonsense terms, the deprivation produces some tendency to ask for water, but such asking will not occur under circumstances where it has been systematically unsuccessful in the past. On the other hand, even in circumstances where the mand *water* has always been reinforced, the response form would not occur unless an EO related to water reinforcement was in effect. This is what Skinner means by the statement that with the mand ". . . the response has no specified relation to a prior stimulus" but it seems somewhat more precise to say that

with the mand the *form* of the response is not determined by a prior *discriminative* stimulus.

Now with respect to the second point, prior stimuli functioning as EOs may well determine the form of the mand response. UEOs such as painful stimulation and temperature changes are certainly prior stimuli, and even more common, both warning CEOs and blocked-response CEOs are prior stimuli, and are clearly the determinants of response form in the mand relation. A revised description of the mand and its contrast with other verbal operants, then, is as follows: The mand is a type of verbal operant in which a particular response form is reinforced by a characteristic consequence and is therefore under the functional control of the establishing operation relevant to that consequence. In the mand the response form has no specified relation to a prior discriminative stimulus. The other elementary verbal operants (tact, echoic, etc.) consist of response forms that are reinforced by generalized conditioned reinforcement (Skinner, 1957, pp. 53-54) but in the presence of characteristic discriminative stimuli, and are therefore under the functional control of those discriminative stimuli. Ideally these other verbal operants have no specified relation to any establishing operation (but see Chapter 6 of *Verbal Behavior*).

### PRACTICAL IMPLICATIONS

Considering only mands controlled by UEOs, one could easily underestimate the ubiquity of the mand. When mands related to the warning CEOs and to the blocked-response CEOs are added in, however, it is reasonable to assume that about half of the adult's ordinary daily verbal interaction consists of mands. In addition to the mands for objects and actions there are the mands for S<sup>D</sup>s and CEOs—that is, for information—that constitute such a large share of what we say to others. Much of the verbal behavior controlled by other ongoing verbal behavior in the same speaker, autoclitic verbal behavior is also a type of mand, but due to the complexity of this relation it cannot be dealt with in a paper of the present scope (for more on the autoclitic mand see Skinner, 1957, pp. 311-367, but especially, pp. 321-330; also Peterson, 1978, pp. 177-180).

Underestimation of the mand's importance in our speculative analysis of everyday

language is of little practical significance. Normal children and adults do not need much professional support for their mands, since the mand is the type of verbal behavior that directly benefits the speaker. If anything, a more common concern is to induce those who mand too much to be more considerate of the needs of others.

Of much more practical significance is the relative neglect of the mand in language training programs for the developmentally disabled. Such programs devote very little time to the mand, in favor of training the tact relation and what is referred to as receptive language. There are several reasons for this neglect, in addition to general ignorance of Skinner's analysis of verbal behavior. First, acquiring a verbal repertoire is seen by many in the speech and language area as *learning the meanings of words*. It is assumed that when such meanings have been acquired the words can then be *used* in various ways with no further training. From this perspective receptive language training is clearly one of the easiest ways to teach such meanings, and tact training is probably next. Based on experience with normal children and adults, once a person has learned what an object is called (by learning to point to it when given its name, or to say the name when the object is shown) it is reasonable to assume that when the object becomes important the learner will be able to ask for it without further training.

It is clear that this does not happen with low functioning individuals, many of whom have had a good deal of receptive language and tact training but are said to lack a functional language repertoire, which is then explained in terms of their general intellectual deficit. They can often point to several kinds of objects when the name is spoken, and they can sometimes even say the name when the object is shown, but have no tendency to request the object when it is clear from other evidence that it would be an effective form of reinforcement for them. This point was dramatically made in a study by Hall and Sundberg (1987). Two subjects were taught to perform a sequence of activities (without responding verbally in any way) which culminated in the production of something that was known to be effective as reinforcement. For example, both subjects were taught to make a cup of soup using a

package of instant soup, a bowl, hot water, and a spoon, with the last step being consuming the soup. In a different setting the same subjects were taught to tact all of the objects used in the other setting, but not in the process of producing and consuming the reinforcer. Then when again attempting to produce the reinforcer, but the sequence could not be completed because a critical object was missing (the hot water in the case of making soup), the subjects had no tendency to mand the missing object, although they tacted the object in the other setting. When the same subjects were next taught to mand the missing objects by either duplic or tact prompting, they readily learned to do so, and fairly soon acquired a more general tendency to mand other things when they became effective as reinforcement even though they had only been formally taught to tact those things. This suggests that a little bit of mand training might have dramatic effects with respect to the development of functional language.

Another reason for the neglect of mand training, even by those who might well appreciate its significance, is that the trainer must contrive appropriate EOs, or take advantage of those that develop naturally. Contriving a variety of effective EOs for the learner seems at first glance much more difficult than providing a variety of objects (usually pictures of objects) to be named or pointed at. And relying on naturally occurring EOs in a language training setting will not usually result in sufficient variety, although the variety can be increased by providing language training under other circumstances not instituted for that purpose. The procedure called *incidental teaching* (Hart & Risley, 1975) makes some use of this latter approach, in that verbal prompts for mands are provided whenever the learner needs help in obtaining some kind of reinforcement during any training or care-giving activities. Although it might appear difficult to contrive EOs in the artificial setting of a language training program an understanding of the blocked-response CEO should make it easier. In general, where some known form of effective reinforcement cannot be obtained without some additional object or action, that object or action becomes the basis for a reinforceable mand. This strategy is well illustrated in the Hall and

Sundberg study mentioned above, and could be a major part of any language training program.

Mand training may also be neglected because it is not well appreciated that it is the only type of verbal behavior which directly benefits the learner. Receptive and tact repertoires permit the learner to follow directions given by others, and to provide information to others. Of course such directions and such information may well be to the long range advantage of the learner, but long range advantage is seldom effective as reinforcement. There is some evidence (Carroll & Hesse, 1987; Stafford, Sundberg, & Braam, 1988) that mand training makes other aspects of language training more effective. The EO and specific consequences can be used in combination with other variables (nonverbal stimuli, verbal prompts, etc.) to help evoke a verbal response, and then faded out once the response is strong. A student who can successfully mand for, and receive, specific reinforcement is often much more willing to participate in training sessions. Receptive, tact, and intraverbal trials can also be interspersed with mand trials, and language training becomes much more like typical verbal interactions, rather than the standard situation where the trainer does all the manding (e.g., "What's that?" "Touch red.") and the student simply complies.

A final point concerning the importance of mand training with the low functioning developmentally disabled client is that it will often lead to a considerable reduction in the frequency of various kinds of inappropriate behavior—crying, aggressive behavior, loud unintelligible vocal responses, etc. As Sundberg (1987) points out, much of this behavior is actually under the control of some strong EO, but the behavior is either insufficiently specific for the trainer or caregiver to comply, or compliance does occur which functions as continued reinforcement for the inappropriate behavior. An appropriate mand response, if generally successful will displace the inappropriate behavior, and the client can then function more normally.

The neglect of mand training is naturally paralleled by a neglect of the mand in language assessment procedures. This would be expected to result often in assessments that credit the client with better language skills than are actually available. The relative

lack of functional language would then be the basis for underestimating the client's actual potential for language performance. A more detailed treatment of language assessment from the perspective of Skinner's analysis of verbal behavior is available in Sundberg (1983).

### CONCLUSION

Skinner's analysis of language is a major behavioral breakthrough, with many theoretical and practical implications. Its advantage over traditional language theory is especially clear in its identification of elementary verbal relations, and its implications for teaching and learning these relations. Because of the mand's introduction in terms of unlearned motivative variables, and because its relation to prior controlling events is quite complex, its general significance has probably been considerably underestimated. A more extensive treatment of establishing operations and a description of the mand relation in such terms will, I hope, prevent such a mistake, as well as lead to a more appropriate emphasis on the mand in language training programs for subjects who do not develop normal language.

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