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INSTRUCTIONS, RULES, AND ABSTRACTION: A MISCONSTRUED RELATION

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ABSTRACT: The concept of rule-governed behavior is often used in the analysis of problem solving, conceptualization, and thinking. Rule-governed behavior has been described as behavior that is controlled by verbally constructed and transmitted discriminative stimuli. Instructions, advice, and examples are typical instances of rules that govern behavior during acquisition in problem solving situations. Nevertheless, some problems arise in identifying instructions with rules and instructionally-controlled behavior with rule-governed behavior. In this article, I argue that instructions, as instances of constructed discriminative stimuli, are the outcome of abstract stimulus control in humans. Descriptions of contingencies and performance may result from effective performance under abstract stimulus control. Instructions, as stimulus conditions, do not necessarily reproduce the abstract contingencies under which they were constructed. Therefore, instructions and self-instructions do not control abstract behavior. Instructions shape up new effective behavior by prompting and restricting response variation. A conceptual analysis along these arguments suggests that the usefulness of the distinction between rule-governed and contingency-shaped behaviors is questionable.
Key words: abstraction, instruction, rule, description, prompting.

Although Skinner had already dealt with some issues related to complex human behavior in *Science and Human Behavior* (1953) and in *Verbal Behavior* (1957), his *An Operant Analysis of Problem Solving* (1966) was the cornerstone for the analysis of problem-solving, conceptualization, and thinking as forms of *rule-governed behavior*. In this regard, Vaughan (1989) commented that:

> A distinction was gradually drawn between behavior shaped directly by its consequences and behavior under the control of a rule. It was a distinction that not only breathed new life into the field, it unequivocally linked behavior analytic research and cognitive processes.
> . . . The research on rule-governed behavior was meant to provide an analysis, in physical terms, of at least some of the activities that preoccupy the behavior of cognitive psychologists. (p. 98)

The distinction between rule-governed and contingency-shaped behavior pursued two theoretical goals: 1) to account for the emergence of new behaviors that had not been directly followed by consequences, and 2) to include the

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behavior of the listener and the observer as prominent cases of a special class of verbal stimuli through which contingencies are abstracted and specified. Rules as discriminative stimuli were proposed to fulfill these two functions by replacing consequences with instructions, under the assumption that instructions were "normally" followed whenever they were presented. Also, rules were thought to constitute, in content as well as in form, a special class of verbal stimuli. These stimuli were assumed to constitute abstractions and specifications of the contingencies that affected behavior.

I will argue that the distinction between contingency-shaped and rule-governed behavior is misleading in that: (a) it assumes that the behavior of "constructing" and the behavior of "following" verbal discriminative stimuli are independent of the reinforcement contingencies (otherwise both kinds of behavior would be conceived as contingency-shaped); and (b) it fails to distinguish between verbal behavior that describes contingencies *after* effective performance and verbal behavior that describes contingencies for effective behavior *prior* to performance.

In his analysis of problem solving, Skinner (1966) pointed out that:

> Lower organisms discriminate without responding verbally to essential properties, and it is unlikely that man gave up the ability to do so. He simply discovered the additional value of constructing descriptive stimuli which improve his chances of success. (p. 231)

According to Skinner, problem solving involves the construction and transmission of discriminative stimuli. To the extent that they "describe essential" stimulus properties and their correlation with outcomes, such stimuli can be conceived as the result of tacting. Skinner (1957) defined tacts as verbal responses that were under the control of nonverbal properties of antecedent stimuli. He assumed that tacting-produced stimuli that specified a response and its consequence were different from the contingencies that originally established discriminative stimuli. Despite this assumption, he assumed that the variables involved in the two cases were the same:

> In constructing external stimuli to supplement or replace private changes in his behavior, a man automatically prepares for the transmission of what he has learned. . . . What he says in describing his own successful behavior (I held the base firmly in my left hand and turned the top to the right) can be changed into a useful instruction (Hold the base firmly in your left hand and turn the top to the right). The same variables are being manipulated and with some same effects on behavior. (1966, p. 232)

On this basis, verbally generated discriminative stimuli that usually take the form of rules, maxims, laws, and injunctions are assumed to function as discriminative stimuli for effective behavior. However, rules, as discriminative stimuli, must be part of a set of contingencies that involve the reinforcement of a response, the occurrence of this response, and the discriminative stimulus that is correlated with the reinforcer. The response under the control of the verbally

constructed discriminative stimulus (rule) may or may not be different from the one that is ultimately reinforced. That is, the behavior of following an instruction may or may not be the same as the instructed effective response. For example, in a matching-to-sample task, the behavior of following a rule such as "Point at a yellow circle" can be the same as the behavior of choosing a yellow circle. However, the behavior of following the rule is likely to be different from the behavior that is ultimately reinforced (viz., the problem-solving response). In a matching-to-sample task, the behavior of following the rule may consist of looking at or orienting towards the stimulus that is different from the other stimuli in the sample, while the effective response could be choosing a red triangle that is different from the sample stimulus (e.g., a green square). In this case, two questions arise. First, is the behavior of following the rule the same as the behavior that is involved in constructing the discriminative stimuli? Second, if not, is the behavior of following the rule a kind of a self-instruction for the effective behavior and the specific stimuli to be discriminated? If following the rule is a case of self-instruction, and the behavior of solving the problem differs from the behavior of following the rule, then we should distinguish them, rather than subsume them under the category of rule-governed behavior.

Skinner (1969) considered the rule itself as part of the contingencies, under the assumption that following a rule depended on previous reinforcement of responding to similar verbal stimuli:

> As a discriminative stimulus, a rule is effective as part of a set of contingencies of reinforcement. We tend to follow a rule because previous behavior in response to similar verbal stimuli has been reinforced. (p. 148)

To assume that rules govern behavior due to their previous reinforcement as verbal discriminative stimuli raises several conceptual issues. First, how can a stimulus that has not been specifically associated with a reinforcer become a discriminative stimulus that controls two classes of behavior,[1] namely, instruction-following (where the instructions function as a general class of discriminative stimuli), and behavior that consists in prompting, selecting, or facilitating further behavior that is relevant to the operation of the contingency (Ribes, 1992). Second, once the behavior of following a rule has been reinforced, is it still different from contingency-shaped behavior? And third, how and under what contingencies do rules function as verbal discriminative stimuli that consist of descriptions of

[1] The defective logic inherent in conceiving rules as discriminative stimuli results in inconsistencies such as those of Catania, Shimoff & Matthews (1989) and Zettle (1990), who finally admit that rule-governed behavior is ultimately contingency-shaped. Catania et al. conclude that "when we speak of human nonverbal behavior, we should call it rule-governed. When we speak of human verbal behavior, we should call it contingency-shaped. But, as with all rules, we should allow these to be shaped by contingencies" (p. 149). Zettle, in conceiving the formulation of rules, self-rules and following them as a special class of verbal behavior, also assumes an active role of the verbal community in prompting, discriminating and reinforcing such behaviors during acquisition and maintenance (pp. 44-45).

contingencies that specify different stimulus conditions, behaviors, and sets of consequences? Hayes and Hayes (1989) consider that constructing a rule and following it qualify as verbal behavior. With this view, the issue of rule following becomes the issue of how the listener's behavior is different from the rule-formulation that is dependent upon the speaker's behavior.

Parrott (1987) has pointed out the logical problems involved in the distinction between rule-governed and contingency-shaped behavior. She has noted that we must consider the listener's behavior of solving the problem of reference, in order to account for the effectiveness of verbal stimuli presented as rule-instructions:

> Much complex behavior cannot be accounted for by appeal to a history of contingency shaping. Hence contingency-shaped behavior comes to be differentiated from a new class—rule governance. Rule governance, in essence, is behavior occurring under the control of verbal stimuli. In short, it is the behavior of the listener. . . . One solution to this problem would have been to provide a more complete analysis of the behaviors of the listener, including the acts of listening and understanding. . . . Instead, rules are assumed to have a special characteristic of reference: they are said to *describe* contingencies. Accordingly, behavior occurring under the control of a rule is analyzed as doing what the rule tells one to do. It is here that a problem arises. Rules are not only rules, they are verbal stimuli; and if verbal stimuli are not regarded as having a referential character in the context of verbal behavior, how is it that they can have this character in the context of rule governance? Skinner does not resolve this controversy. (pp. 275-276)

I contend that at least two different kinds of "understanding" take place. On the one hand, "rules" are constructed as verbal stimuli that describe contingencies. On the other hand, "rules" are transmitted as instructions to be followed in order to cope with a set of already specified contingencies. In the first case, effective performance is needed to construct the "rule" in the first place (Ryle, 1949). The verbal description of the prevailing contingencies is the *outcome* of this understanding, which entails being a listener and an observer of one's own effective behavior. Successful instances of behavior function as components of a regularity that defines the problem-solving situation. In the second case, effective performance is expected to follow from the cueing and restrictions provided by the demonstration and/or instructions on how to solve a specific problem in a given situation.

On Rules and Rule-Governed Behavior

"Rule" is a term that has a diversity of meanings and uses (e.g., Hayes & Hayes, 1989; Reese, 1989). In ordinary language, the term "rule" typically refers to a guide for practical action. A guide for practical action usually consists of instructions, descriptions, advice, and indications of consequences for various courses of action. Rules are presented as verbal behavior ("do this," "don't do that," "turn always left," "stop when the red light is on," etc.), and other sorts of signals and demonstrations. Far from being separate from behavior, rules constitute

the common outcome of a shared practice or behavior in a cultural environment. Formal rules are statements about *constructed* stimuli and, thus, are behavioral outcomes and products. Rules are identified from regular practices, and are identified through the observation of regular practices, for which they can be regarded as cultural practices (Barker, 1989; Wittgenstein, 1953).

As products of verbal behavior, rules describe the functioning and organization of contingencies. Verbal behavior itself acts as a rule only when it describes conditions that are different from the particular ones being currently encountered. In this sense, formulating a rule involves self-reference, even if the rule is transmitted in the form of instructions by another individual.

Behaviorally, the relevant issue is to identify conditions in which an individual constructs "rules" as the result of his or her own behavior. This behavior is different from "rule-following" when it adjusts to common practices. An individual learns a rule through demonstrations when, for example, he or she does something according to a procedure that presumably leads to some outcome. Therefore, outcomes are the criteria through which we can assure that a rule has been followed. The function of a rule can be described to an individual only after training. Hence, understanding a rule cannot go beyond the explications about how to proceed to obtain an outcome (Wittgenstein, 1987, pp. 39, 63; pp. 267, 14, 271-280, 23, 31).

As contingency prescriptions, rules can be inferred from the instances of a particular class of discriminative or discriminat*ing* (as opposed to discriminat*ed*) behavior, that is, behavior that produces stimulus changes versus behavior controlled by stimulus changes. Moreover, to say that a certain behavior follows or conforms to a rule is in itself verbal behavior that involves, in itself, effective responding to functional relations between antecedent stimuli, responses, and consequences. However, we would expect only some effective performances to fulfill the criteria specified by a putative rule. At least three requirements must be satisfied in order to identify some given behavior as rule-following.

First, the specific, physical stimulus properties that can acquire a discriminative function should vary within the particular contingency situation under consideration. This is the case of matching-to-sample, where the specific color or shape of a comparison stimulus has a discriminative function insofar as it matches a property of the sample stimulus. Under an identity-matching criterion, a red triangle has a discriminative function only if it is the sample stimulus. If under that same criterion the sample stimulus changes to a green square, then the red triangle looses its discriminative function. The matching-to-sample procedure thus differs from the standard one in which differential reinforcement depends on the very same stimulus property throughout the contingency situation under consideration (e.g., color or shape). In the matching-to-sample procedure, then, discriminative stimuli have relational properties, whereas in the standard differential-reinforcement procedure discriminative stimuli have absolute properties, *within the same contingency situation*. My main claim here is that rule-governed behavior is behavior that occurs under contingency situations that are

more akin to a matching-to-sample than to a standard differential-reinforcement situation.

Second, to be effective, the putative rule-governed behavior should be the result of abstract stimulus control that emerges from an interaction with matching-to-sample kind of contingencies (Goldiamond, 1966). Abstraction, then, can be viewed as the outcome of discriminating *relational functional properties* (e.g., "larger than"). Abstraction is not the cause of effective behavior with respect to relational stimulus properties. Rather, it is the result of interacting effectively with stimuli that share certain properties.

Third, verbal descriptions of functional contingencies may be an additional outcome of abstraction themselves. In effect, verbal descriptions can be viewed as stimuli that are constructed by effective behavior that emerge from abstract stimulus control. To that extent, verbal descriptions can take the form of rules that identify the procedure to be followed to produce the required outcomes.

The above requirements lead to a conceptual distinction between three kinds of behavior, namely, (a) behavior under non-abstract stimulus control (i.e., behavior that results from differential reinforcement of absolute stimulus properties), (b) behavior under abstract stimulus control (i.e., behavior that results from differential reinforcement of relational stimulus properties), and (c) behavior that describes the contingencies under which (b) arose. Only (b) qualifies as rule-following behavior, while (c) qualifies as rule-description behavior. The behavior of describing the contingencies under which (c) arises roughly corresponds to what philosophers would call "knowing that." In contrast, rule-following (as well as any other contingency-shaped) behavior roughly corresponds to what philosophers would call "knowing how," in so far as it involves effective performance that is shaped by contingencies (in this case, matching-to-sample kind of contingencies). Of course, from a standard behavioral perspective, all "knowing that" (as well as any other kind of behavior) is viewed as ultimately being the result of "knowing how." In fact, one could qualify "knowing that" as "knowing how to describe functional relations between antecedents, responses, and consequences" and, hence, as contingency-shaped behavior. Still, a behavioral distinction between "knowing that" and "knowing how" is in order, to the extent that they refer to different kinds of behaviors under the control of different kinds of contingencies.

Effective performance does not necessarily lead to the emergence of verbal descriptions. An individual may know how to behave in certain ways and yet be unable to describe his or her own performance and the conditions under which it is effective. Also, learning can certainly be facilitated through instructions that describe effective performance and contingencies. However, effective performance on the learner's part does not necessarily duplicate the original conditions that gave rise to the instructions in the first place. Instructions, in Skinner's words, involve the "transmission" of rules by an individual in order to improve or facilitate another individual's learning. The behavior of following the rule is not a mirror of the descriptions that emerged from performance when the rule was constructed. Rule-following behavior and descriptions may seem alike, but they are under the control of different variables and have different functions.

Instructions and Rules

When rules become institutionalized, they require some kind of social agreement among those who follow them. Without shared common practices and outcome criteria, a rule could not be followed (Wittgenstein, 1987). In this sense, rules constitute abstract references to individual performance that adjusts to such practices and criteria. Therefore, strictly speaking, "rule" is not a psychological term, in spite of its referring to behavior contingencies. To resort to a rule-concept confounds different logical and empirical levels of observation and description, as when instructions, as formal statements, are taken as instances of rules.

A prevalent assumption in behavior analysis is that instructions constitute instances of rules (e.g., Baron & Galizio, 1983; Buskist & Miller, 1986; Cerutti, 1989; Zettle & Hayes, 1982). Under this assumption, instructions are viewed as verbal discriminative stimuli that specify responses and contingencies in problem-solving situations that involve schedule-controlled performance or conditional-discrimination tasks. However, instructions do not function as rules if the latter, as described here, are understood as involving stimulus control that arises from regularities across different situations and stimulus objects. The kind of stimulus control that facilitates the emergence of "rules" as behavioral outcomes corresponds to what Skinner (1957) and Goldiamond (1966) called "abstracting."

Abstract stimulus control was analyzed by Skinner (1957) as a special case of tacting. A discriminated verbal operant is said to *abstract* whenever the response occurs in the presence of a certain stimulus property, regardless of variations in other properties. The stimulus property in question may be absolute (a particular color, shape, etc.) or relational ("darker than," "larger than," "similar to," etc.). According to Skinner (1957), abstract stimulus control is not an extension of the tact, as the generic tact, but a *restriction* "which sharpens stimulus control and opposes the process of extension" (1957, p. 107). This conception is different from the one put forward by Catania and Cerutti (1986), who state that "when responding is under the control of a single property of stimuli, we speak of abstraction" (p. 196). This definition of abstraction, however, does not distinguish between training with respect to a single isolated property, on the one hand, and discriminating a constant property from variable properties in the training situation, on the other.

Goldiamond (1966), in reference to matching-to-sample, stressed the difference between a "rule" as an outcome of progressive abstraction under particular contingencies, and a "rule" as an instruction:

> The instruction or rule for operation is distinguished from the abstraction or concept by whether it is taught before the training session, or emerges after, and as a result of, the training session. Otherwise, they seem to be identical. . . . (p. 194)

An example may help to clarify the distinction between constructing rules as a result of responding to relational contingencies and following instructions. In a matching-to-sample task, the individual must choose one of several comparison

stimuli in order to obtain reinforcement. The correct comparison stimulus (i.e., the discriminative stimulus) is the one that shares a given property with the sample stimulus. Effective matching behavior is an outcome of correct responding to the relevant relations, as well as incorrect responding to any irrelevant relation between the sample and any of the comparison stimuli. Effective matching performance implies that the subject is responding not to absolute properties of a constant discriminative stimulus, but to the *relational* properties of variable sample and comparison stimuli.

In the presence of such performance, one could say that the individual has "identified the rule for solving the task." In the case of humans, verbal descriptions of their own effective behavior may certainly be a by-product of the matching-to-sample contingencies. However, the contingencies that result in such a description are very different from those in which the subject is instructed about the matching criterion. The crucial difference is that instructions, by telling an individual how to respond correctly, eliminate the individual's exposure to the contingencies for responding incorrectly. In this manner, instructions favor an individual's exposure only to one aspect of the matching-to-sample contingencies, namely, that aspect having to do with responding correctly, that is, responding to the relevant relational properties. In contrast, the behavior of describing contingencies that have been experienced is behavior that has been shaped by contingencies for responding correctly as well as contingencies for responding incorrectly, that is, for responding to the irrelevant relational properties. Instructed individuals typically do not experience the latter contingencies.

The standard concept of rule-governed behavior, then, is misleading in that it allows for an interpretation according to which the behavior of following a rule is functionally equivalent to the behavior of formulating or constructing a rule. The standard concept is misleading also in that it favors the confounding of rules with instructions and, hence, the collapsing of different kinds of contingencies into one kind. When an individual constructs a rule after having been exposed to certain contingencies, he or she typically specifies what his or her particular experience was under such contingencies. This experience includes sometimes having responded correctly and sometimes having responded incorrectly. In contrast, an individual whose behavior is guided by instructions has not experienced (nor does he or she need to experience) the particular contingencies that gave rise to the instructions in the first place, especially those for responding incorrectly. In fact, prior to the instructions, the individual does not need to have experienced any of the contingencies described by the instruction. In this manner, instructions protect, so to speak, the individual from being exposed to certain contingencies (viz., contingencies for responding incorrectly). This, I believe, introduces a functional distinction between constructing a rule after experiencing certain particular contingencies, and following a rule prior to such experience. This difference is not implied by the standard notion of a rule.

The proposed functional distinction separates between two cases to which the term "rule" is typically (although equivocally) applied. In one case, an individual formulates and eventually follows a rule, after having experienced certain

contingencies (which, as I have proposed, are better viewed as being of the matching-to-sample kind). Under such contingencies, the individual was exposed to relevant *as well as* irrelevant properties, thus progressively restricting the individual's range of responding. In this case, the rule in question constitutes a description of previous experience, a description that is formulated by the individual who experienced the contingencies being described. In a second case, an individual is simply instructed to follow a rule, under the assumption that he or she has not experienced the kinds of contingencies that gave rise to the rule in the first place. In fact, instructing an individual to follow a rule is usually motivated by such an assumption. Indeed, the aim of an instruction is to *simplify* the individual's learning process by preventing him or her from responding incorrectly. In this case, the individual's range of responding is restricted *a priori*, before having experienced any of the contingencies that are described by the rule. In this case, the rule becomes functionally, *for the individual who follows it*, an instruction, a prompt of sorts, rather than a description of contingencies. To be sure, an individual who follows a rule will eventually experience certain contingencies. In this sense, rule-following behavior can be seen as contingency-shaped, or rather "prompted-shaped," given that responding correctly was initially prompted by instruction. However, such contingencies will comprise only those for responding correctly. The individual who follows the rule may never experience the contingencies for responding incorrectly, although they had to be experienced by the person who formulated the rule in question as a description of previous experience. We thus obtain a functional distinction between descriptions and instructions. I propose to reserve the term "rule" for verbal descriptions of previously experienced contingencies, and the term "instruction" for those cases of rule-following behavior in which the individual has not experienced the contingencies that gave rise to the rule in the first place.

Abstraction, as an *a posteriori*, progressive restriction of responding that is shaped by matching-to-sample contingencies, may involve verbal and nonverbal responses. Also, *a priori* response restriction (through a prompting-shaping, or instructional procedure) may occur under the presence of verbal and nonverbal stimuli. An abstraction may develop as the outcome of direct contingencies. After experiencing these contingencies, and in the case of humans, abstraction may take the form of a verbal description of those contingencies. In fact, a verbal description of successful behavior and the relevant contingencies is the only way that a rule can be formulated and applied to different situations, either as a self-instruction or as an instruction given to another individual. Once a rule is formulated, verbal behavior functions to provide stimuli that restrict and direct relevant behavior to particular contingencies. To say that a rule is a discriminative verbal stimulus that alters or specifies a three-term contingency (SD-R-SR) fails to distinguish functionally between the behavior of formulating rules and the behavior of following instructions. The study by Epstein, Lanza, and Skinner (1980) on symbolic communication between two pigeons is an example of the confounding of these two functional steps in stimulus control. Although the behavior of one of the pigeons might be considered as constructing discriminative stimuli for the

second animal, this interpretation is questioned by the fact that the pigeons could not switch roles in the interaction.

When an individual is being trained to solve a discrimination problem by following instructions, the range of relevant behaviors is considerably reduced. Instructions abbreviate the process of response selection through consequences by restricting the number and type of possible successful behaviors. The terms "instructing" and "instruction" are closely related to human teaching and learning. Their meaning, similarly to that of "rule," entails the notion of directed or supervised practice. Nevertheless, the verbal nature of instructions and instructing raises special problems, as compared to teaching procedures that are based on supervised practice. Instructions are typically regarded as a special class of teaching procedures in that they explicitly specify what to do, how to do it, and sometimes when to do it. Instructions thus verbally direct the behavior of the instructed subject in ways that optimize the conditions under which he or she behaves. In this manner, instructing restricts the range of responses and reduces the time required for effective performance under a specified contingency. On this basis, instructing can be conceived as a special case of prompting-shaping in which the relevant, expected behavior is initially prompted by the instructions. Once such behavior occurs for the first time, it makes contact only with those contingencies that are scheduled for emitting it. In this sense, instructions selectively expose the individual to a partial set of contingencies, relative to those that gave rise to the instructions in the first place (Galizio, 1979).

Instructions, then, have different functional properties when they constitute descriptions that are provided by an individual who experienced the full set of contingencies, and when they constitute indications, prescriptions, or advice given to an individual who did not experience the contingencies in question. In the first case, descriptions involve verbal behavior that emerges as a by-product from a stimulus-control process of progressive abstraction. In a different situation, these descriptions may function either as self-instructions or instructions that are given to others. In the second case, instructions constitute verbal behavior that prompts at the outset verbal or nonverbal behavior. This latter behavior becomes immediately effective by making contact only with those contingencies that are scheduled for responding correctly. Rule-governed behavior should be identified only with an individual's behavior of verbally describing his or her own previous experience and acting (through self-instruction) in accordance to the corresponding descriptions. The behavior of following instructions without having experienced the full set of contingencies that gave rise to the instructions in the first place does not qualify as rule-governed behavior.

Descriptions, Instructions, and Self-Instructions

Abstracting behavior is effective behavior that emerges from contingencies that involve responding in the same manner to variable stimulus properties and/or responding differentially to the same stimulus property. In the case of humans, such behavior may emerge from an interaction with abstract stimulus control (of

the matching-to-sample kind), under the facilitating role of instructions. In this case, abstracting behavior is not a mere functional "transcription" of instructional information. To be sure, false or misleading instructions can interfere with the emergence of abstract behavior and even with the emergence of successful performance involving non-abstract problems (DeGrandpre & Buskist, 1991; Ribes & Martinez, 1990; Martinez & Ribes, 1996). This effect has been usually described as "insensitivity to contingencies," rather than as a case of antagonistic shaping and scheduling operations, where instructions prompt performance that does not fulfill the requirements for reinforcement. However, sustained exposure to the contingencies does make performance progressively more effective. Contingencies thus have the effect of shifting performance from the response restrictions prompted by the instructions to those required by the contingencies, in spite of the initial presence of misleading instructions.

When abstract behavior emerges after problem-solving, abstract contingencies (as well as successful performance) may be described by the individual who solved the problem. Such descriptions, however, are not a necessary outcome of successful abstract behavior. In fact, they tend to be inaccurate with respect to actual performance and problem-solving criteria. Rather, descriptions tend to reflect more accurately the interview situation and experimental parameters (Critchfield & Perone, 1990; Shimoff, 1986). Conditions that foster the emergence of descriptions of successful abstract behavior have to be analyzed in carefully designed experiments. These descriptions are related to theoretical notions such as the abstract tact (Skinner, 1957), contingency substitutional behavior (Ribes, 1991), and contingency specifying stimuli (Schlinger & Blakely, 1987), but there is little empirical research regarding conditions and variables influencing their emergence and functions.

I have argued that instructionally-controlled behavior is not rule-governed behavior even when performance is successful and when instructions are similar to the descriptions generated by successful abstract behavior. Rules, as descriptions, are outcomes of contingencies. When provided as information about contingencies, rules work as verbal prompts that abbreviate the time and effort that are required by a full shaping process. Instructions are always transmitted descriptions and, although they may be identical in form, they are different in function. Descriptions are the *outcome* of a training process whereas instructions are the *beginning* of a training process. Does this distinction hold when the individual who describes and the individual who is instructed are one and the same? That is, does the proposed distinction hold in cases of self-instruction?

It seems reasonable to assume that an individual who has learned a successful abstract performance and has formulated the corresponding descriptions might use them as self-instructions in a different problem-solving situation. Do self-instructions based upon abstract contingency descriptions (rules) still function as instructions when they are used in solving a new problem by the same individual?

Using Skinner's terminology, a self-instruction may be a softened mand (self-interrogation) or a tact to future events (if this is . . . then . . .). In both cases, the effect of a self-instruction is to direct responding towards certain properties in the

situation, restricting the variation of possible functional behaviors. Self-instructing, then, does not seem to differ from instructing in general. Self-instructing consists of a self-regulated shaping based on the individual's history of interaction with a particular class of contingencies. Thus, self-instructions may facilitate (or interfere) with relevant effective behaviors in a new problem situation, to the extent that instructions increase the likelihood of the relevant responses.

Self-instructions may occur under two conditions. First, when the problem to be solved is the same as, or very similar to, previous ones. In this case, if the individual has already learned to solve the problem, self-instructions should be construed as prompts (i.e., as supplementary stimuli that increase the likelihood of already existing behavior, see Skinner, 1957), rather than as discriminative stimuli. This situation is a case of routine application, and would not qualify as rule-governed behavior. Second, when the problem is novel. In this case, in order to solve the problem without the need to emit all of the possible behaviors, it is necessary to deploy abstract behavior that has been acquired after learning a different problem. Nevertheless, abstract behavior in the form of self-instructions only abbreviates the process of learning the new effective behavior. As mentioned before, self-instructions narrow down the possible stimulus properties, event-relations, and response features, but do not provide the solution in advance, before responding. Self-instructions guide but do not produce effective behavior. Self-instructions promote the emergence of new abstract behavior, and tentatively of rule-type descriptions. However, functionally speaking, self-instructions are not descriptions. Rules are abstracted descriptions, but when they are applied to a situation that fits the rule, they function as self-instructions.

Skinner (1988) admitted that "*problem solving is part of the problem of the First Instance*" (p. 255). The notion of rule-governed behavior is useful only to explain the emergence of novel responding. Because a new response that is effective in solving a problem is immediately followed by consequences, any response subsequent to the novel response is, by definition, contingency-shaped. But this condition applies to any operant behavior, since consequences generally follow a first response that, by definition, is new in the situation. Since all operant behavior is emitted, any new response in a given situation appears without previous reinforcement. The first occurrence allows for the selection of responses by consequences, but the origin of the first response is independent of the current reinforcement contingency (Staddon & Simmelhag, 1971). The origin of operant responses has to do with an unknown reinforcement history, with unidentified respondent stimulus control, and with setting factors related to motivational variables in the organism and in the environment.

It can be seen from the foregoing that novelty, as related to rule-governed behavior, is not a feature of added discriminative stimuli that supplement the likelihood of problem-solving behavior. Rather, it is a characteristic of descriptive verbal behavior that emerges as an additional outcome of successful responding. In abstract stimulus control situations, novelty is an attribute of emerging abstract verbal descriptions, not of the effective problem-solving responses. For instance, after learning a matching-to-sample task according to an oddity criterion, the

possibility of describing one's effective behavior in terms of oddity is a *consequence* of learning the task, and this novel behavior can be used as a self-instruction in order to solve a transfer test with new matching-to-sample stimulus arrangements that involve oddity.

Response variation in a new situation is reorganized as "original" problem-solving behavior by (a) the prompting effects of instructions, (b) the relative probability of previously learned responses, and (c) the interaction with ongoing consequences. When novel effective responding is prompted by instructional stimuli, it may involve the transfer of previous successful behavior.

In abstracting, behavior acquires generality regarding particular contingencies. Abstracting may be achieved without the further emergence of verbal descriptions of effective performance and relevant contingencies. Nevertheless, descriptions are essential to transmit contingencies as instructions or verbal information. Descriptions, functioning as instructions, may facilitate and generalize learning, although descriptions can never replace effective contingencies. Descriptions may be necessary to transmit (to teach) what has been learned as an abstraction (or a simple routine), and may facilitate learning such an abstraction (or simple routine), but they are certainly not sufficient.

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