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BEHAVIOR-ANALYTIC APPROACHES TO SELF-AWARENESS

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The current paper provides an overview of behavior-analytic approaches to self-awareness. Skinner (1974) argued that the phenomenon of self-awareness is produced, in large part, by those social contingencies that reinforce discrimination of the organism's own behavior. This view of self-awareness is supported by a range of empirical studies that successfully established self-discrimination performances in both nonhuman and human subjects. Recent developments in basic, applied, and conceptual analyses are currently extending Skinner's behavior-analytic definition of self-awareness. The current paper focuses on a relational frame interpretation of human self-discrimination.

The experimental analysis of behavior, as one of the many subdisciplines within psychology, is often seen as being largely unconcerned with the issue of self or self-awareness (see Skinner, 1974, p. 4). Strangely enough, however, radical behaviorism, the philosophical foundation of behavior analysis, includes many references to, and conceptual analyses of, "self-awareness" (e.g., Chiesa, 1994; Hineline, 1983, 1992; Skinner, 1953, 1974). The aim of the current paper is to provide an overview of the behavior-analytic approach to self-awareness. We will outline both early and more recent behavior-analytic definitions of self-awareness, and we will also consider a range of studies that have experimentally analyzed the phenomenon of self-awareness from a behavior-analytic perspective.

We will begin a behavioral analysis of "self-awareness" by examining the socially agreed or conventional definitions of the terms "self" and "self-awareness" found in the Concise Oxford Dictionary of Current English (1991). This dictionary defines "self" as "a person's or thing's individuality or essence" and as the "object of introspection or reflexive action (the consciousness of self)." In this way, "self" is not necessarily a

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uniquely human experience. Futhermore, the definitions do not imply that the actual private event of "self" is physical or material.

By looking up the term "self-aware," we find "conscious of one's character, feelings, motives etc." which also includes a reference to self-awareness as a noun. "Conscious" is defined as "aware of one's surroundings and identity," including "knowing with others or in oneself." The similarities between these definitions (of "self-aware" and "conscious") become even more apparent if we consider that the definition given to "consciousness" includes the term "awareness." Consciousness is "the state of being conscious" and the "totality of a person's thoughts and feelings" (see also Natsoulas, 1978).

These dictionary definitions of "self" and "self-awareness" indicate that when the lay person speaks of self, self-awareness, or consciousness he or she is referring to events that are not publicly observable. Furthermore, these terms are often used to refer to objects or events that are either explicitly or implicitly incorporeal in substance (i.e., self, self-awareness, and consciousness are not physical "things"; see for example, Hayes, 1984).

The present paper will briefly review the existing behavior-analytic approaches to self-awareness before outlining a new approach that draws upon recent research and conceptual analyses in the area of derived stimulus relations.

Behavior-Analytic Approaches to Self-Awareness

According to Skinner (1974):

> There is a difference between behaving and reporting that one is behaving or reporting the causes of one's behavior. In arranging conditions under which a person describes the public or private world in which he lives, a community generates that very special form of behavior called knowing. (pp. 34-35)

In this way, "self-knowledge is of social origin," because "It is only when a person's private world becomes important to others that it is made important to him" (Skinner, 1974, p. 35). Questions such as "How are you?" and "What are you doing?" help to establish the ability to respond discriminatively to one's own behavior, and they provide the verbal community with access to what an individual "sees" and has "seen" (Skinner, 1953, 1974). Thus self-awareness is defined in behavioral terms as discrimination of one's own behavior. In fact, many classes of complex human behavior may be explained behavior-analytically by appealing to the prevailing social contingencies (see, for example, Guerin, 1992, 1994; Lloyd, 1994a, 1994b; and Street, 1994).

Nonhuman Research

This behavioral definition of self-awareness has been examined empirically with nonhumans. Researchers have sought to demonstrate

responding that is under the control of the subject's own behavior (i.e., responding to one's own responding). The majority of studies have employed both reinforcement schedules and conditional discrimination tasks in which the subject's own behavior on a schedule task forms the basis for a conditional discrimination. For example, in a study by Lattal (1975) pigeons responded according to either a Differential-Reinforcement-of-Low rate (DRL) or Differential Reinforcement-of-Other behavior (DRO) schedule. This produced a conditional discrimination task in which the correct choice was defined by the reinforcement contingency that preceded it (i.e., subjects learned to peck a red key if they had previously pecked for reinforcement [DRL] and to peck a green key if they had not pecked for reinforcement [DRO]). In effect, responding on the conditional discrimination task represented a self-report of the subject's own behavior on the previous schedule task. Other studies with pigeons have used duration of interresponse times (IRTs) (Reynolds, 1966; Shimp, 1983), different fixed-ratio (FR) values (Pliskoff & Goldiamond, 1966), temporal intervals (Reynolds & Catania, 1962), and run lengths (Shimp, 1982) as discriminative events. These studies have provided a successful nonhuman analogue of Skinner's definition of self-awareness.

Although most of the behavioral studies on self-awareness in nonhumans have been concerned with the discriminative properties of responding on various reinforcement schedules, other research has emphasized self-awareness in terms of "self-recognition." In a typical demonstration of "mirror self-recognition," nonhumans with extensive experience with mirrors can often use a mirror to locate a spot on their bodies that cannot be seen directly (see Gallup, 1982; Mitchell, 1993). Such performances have been taken as evidence for the existence of an "essential cognitive category for processing mirrored information about the self" (Gallup, 1982, p. 240). However, of all the species studied only chimpanzees and orangutans have readily demonstrated mirror self-recognition (Gallup, 1982). For example, Gallup (1977) gave a crab-eating macaque 5 months or over 2,400 hours of exposure to a mirror (i.e., the mirror was present in the animal's home cage), and yet he failed to find any evidence for self-directed behavior. In fact, the macaque reacted to the mirror as if it were another individual and engaged in a variety of social responses.

The idea that self-recognition is a species-specific phenomenon that requires an essential cognitive category was challenged, however, by Epstein, Lanza, and Skinner (1981). Epstein et al. (1981) *trained* pigeons, across four phases, to locate colored paper dots on their body using a mirror. On test trials, birds were fitted with bibs that "made it impossible for the bird to see the dot directly" (p. 695) without the aid of the mirror. The researchers recorded the number of "dot-directed responses" made by the pigeons and argued that such evidence of self-awareness could be attributed, not to a "self-concept," but to a specifiable history of reinforcement. Although further attempts to

replicate the Epstein et al. (1981) study have proven unsuccessful (see Gallup, 1985, p. 418; Thompson & Contie, 1994; cf. Epstein, 1985a, 1985b), the general approach adopted by these researchers is representative of a behavior-analytic approach to self-awareness, in that they attempted to identify the history of behavioral interactions that give rise to instances of what we normally consider self-aware behavior.

Human Research

Correspondence training. The relationship between what persons say they will do and what they do, and between what they do and what they later say is often described in the behavior-analytic literature as "correspondence between verbal and nonverbal behavior" (see Paniagua, 1990). "Correspondence training techniques" are employed in a wide variety of situations in order to study the development of accurate self-reporting in young children (e.g., de Freitas Ribeiro, 1989; Risley & Hart, 1968). Correspondence training typically involves three phases (Paniagua, 1990, pp. 107-108), but it is the reinforcement of verbal-nonverbal relationships that is most relevant to an understanding of self-awareness. In this phase, correspondence is required between either doing in the past and reporting about doing (i.e., do-report), or reporting on future behavior and later doing (i.e., report-do). For instance, Risley and Hart (1968) reinforced children's reports about past behavior (e.g., "I played with blocks") *only* if they had actually played with blocks in the preceding free-play period. Most studies, whether concerned with report-do (e.g., Ward & Stare, 1990; Wilson, Rusch, & Lee, 1992) or do-report correspondence (e.g., de Freitas Riberio, 1989; Risley & Hart, 1968) have reported high levels of agreement between verbal and nonverbal behavior (see Lloyd, 1994a, 1994b; Paniagua, 1990).

Occasionally, verbal prompts are required to aid children's correspondence between their verbal and nonverbal behavior. For example, Paniagua and Baer (1982) prompted children who did not name the nonverbal (i.e., play) behavior in the initial sessions of do-report training with "did you play with blocks in your special play room?" When prompts are used they are usually introduced in the early stages of training and are then removed as correspondence is reinforced (e.g., Experimenter: "Did you play with blocks?"; Child: "I played with blocks."; [reinforcer is presented]). Various other studies have employed prompts to establish the desired verbal behavior in variations of the report-do correspondence procedure. We shall now consider three such procedures in some detail.

In the procedure that Paniagua (1990) calls "reinforcement set-up upon report," "the reinforcer is shown to the child after the report (the set-up condition), and later delivered contingently upon behavior corresponding to the report (the reinforcement of report-do correspondence condition"; p. 114). For example, Israel and O'Leary (1973) presented snacks to children contingently upon reporting the target nonverbal behavior (e.g., "I'm going to play with puzzles"). Those

children who made the appropriate report and then engaged in the nonverbal behavior (playing with puzzles) were allowed to consume the snacks. In cases where the subject did not emit the target verbal behavior, prompts were often used (e.g., "Say that you will play with puzzles"). Interestingly, a version of the reinforcement set-up upon report procedure is often employed by researchers in training conditional discrimination tasks in young children (see for example, Schenk, 1995).

In the immediate reinforcement of intermediate behavior procedure, "a correspondence between a report of future behavior and corresponding intermediate behaviors is emphasized" (Paniagua, 1990, p. 114). For example, in the study by Paniagua and Baer (1982), children's reports about future nonverbal behavior (e.g., "I'll paint") were followed by intermediate behaviors (e.g., preparing paints and paper). Each intermediate behavior was immediately reinforced, regardless of the occurrence or nonoccurence of the nonverbal (painting) behavior. Again, prompts are often used to establish the verbal behavior prior to nonverbal intermediate behaviors.

In the reinforcement set-up upon intermediate behavior procedure, "a correspondence between reporting and the target (nonverbal) behavior is required for the delivery of the reinforcer, but the reinforcer is placed in the child's presence after the emission of a set of intermediate behaviors instead of placing it after the child's report" (Paniagua, 1990, p. 116). For example, Paniagua and Baer (1982) reinforced each intermediate behavior with a token, and after emission of the last intermediate behavior (e.g., placing a container of blocks on the floor), the tokens were exchanged for a toy which was presented to the subject contingent upon report-intermediate behavior-do correspondence. Prompts are, again, often used to establish the verbal behavior in the report-do sequence.

We have outlined in some detail the various procedural aspects of correspondence training techniques in order to highlight the complex behavioral interactions involved in reporting one's own (verbal or nonverbal) behavior. Overall, the objective of these procedures is direct correspondence between verbal and nonverbal behavior or between verbal behavior and intermediate behavior that makes the occurrence of the nonverbal behavior more likely. In effect, these studies provide an example of Skinner's (1974, pp. 34-35) behavioral definition of self-awareness, in that the experimental procedures reinforce successive approximations to the desired outcome (i.e., an accurate report of one's own behavior, future or past) through the asking of questions (i.e., prompts) by others (see also Street, 1994).

Verbal self-reports. Correspondence training techniques, as outlined by Paniagua (1990), clearly involve explicit training in order to achieve correspondence between verbal and nonverbal behavior. These procedures are entirely consistent with Skinner's behavior-analytic account of self-reporting and self-awareness. The use of *untrained*

verbal self-reports, such as those obtained with questionnaires, attitude scales, clinical interviews and assessments however, present certain difficulties for behavior analysis.

Despite the widespread use of verbal self-reports, often as the primary source of data in nonbehavioral areas of psychology, behavior analysis has tended to focus until recently on (a) responses by nonhumans that share at least some of the functional characteristics of human self-reports (see section on nonhuman research above), or (b) self-reports of, for example, drug sensation (Overton, 1987) and reinforcement contingencies (Catania, Matthews, & Shimoff, 1982; Matthews, Catania, & Shimoff, 1985). In the study by Matthews et al. (1985) for instance, subjects earned money by button-pressing according to multiple random-interval random-ratio schedules. Following each exposure to the pair of schedules, subjects were required to write statements about the contingencies or the appropriate way to press the buttons. The experimenters shaped correct statements by reinforcing successive approximations. Results indicated that when subjects were trained to describe performances, their button-pressing generally was consistent with the descriptions. When subjects were trained to describe the contingencies, however, responding occasionally varied from the descriptions. These and other data have highlighted the distinction between verbal and nonverbal, or rule-governed and contingency-shaped behavior (see Hineline & Wanchisen, 1989).

Some behavior analysts are reluctant either to examine self-reports or to incorporate subjects' self-reports of experimental contingencies in their research, even anecdotally. Much of the reluctance can be attributed to the theoretical and pragmatic difficulties inherent in interpreting uncorroborated or subjective self-reports (see Hayes, 1986; Perone, 1988). In effect, the self-report is often viewed as a highly unreliable, indirect measure of a subject's nonverbal behavior, and thus behavior analysts have either used them very cautiously or not at all (see Barnes & Keenan, 1993a, pp. 518-519). However, Critchfield (1993) points out:

> An alternative approach is to view the verbal self-report - a response presumably under discriminative control of characteristics or actions of the person making the report - as behavior subject to the same fundamental influences as any other. (p. 495)

Thus, self-reports, like any other behavior, should be the focus of an experimental analysis (see also Street, 1994, p. 146).

This approach has had some success. A number of related studies by Critchfield and colleagues (Critchfield, 1993, 1994; Critchfield & Perone, 1990a, 1990b, 1993) represent a landmark in the behavioral analysis of human self-reports. The general approach adopted by Critchfield and colleagues involves restricting both the target behavior

(e.g., a delayed-matching-to sample [DMTS] task) and the number of possible self-reports (e.g., pressing "yes" or "no" buttons in answer to a computer-generated query) in order to ensure precise experimental control. In a typical experiment subjects are required, after each DMTS trial, to report whether the last response was successful or unsuccessful in meeting a particular contingency. The contingencies manipulated and/or measured in a range of studies by Critchfield and colleagues include the number of elements in a compound sample stimulus, speed and accuracy of self-report, the number of sample and comparison stimuli, as well as factors contributing to self-report bias such as signal-frequency, discriminability and time pressure on the reported performance (see also Lane & Critchfield, 1996).

Signal detection analysis (Green & Swets, 1966) conducted on the results of one of these studies indicated that, when success was frequent, subjects tended to exhibit a bias for reporting success, and when success became less frequent, bias in turn became less pronounced, even to the extent where at extremely low success levels some subjects were biased towards reporting failure (Critchfield, 1993). These data appear to have important implications for an experimental approach to that aspect of self-awareness commonly described as "self-evaluation." For example, cultural differences in self-evaluation biases (Stevenson, Chen, & Lee, 1993) suggest that self-evaluation is, to some degree, environmentally determined, and thus "any viable theory of behavioral self-regulation would have to take into account the results of research on the situational determinants of self-evaluation" (Critchfield, 1994, p. 247). Clearly, the systematic investigation of variables and conditions controlling verbal self-reports, as exemplified in the research conducted by Critchfield and colleagues, should facilitate the use of such reports in obtaining reliable data, and may also contribute to a behavioral understanding of those phenomena traditionally considered to be outside the purview of behavior analysis, such as memory (see Critchfield & Perone, 1993; Nelson, 1984).

Self-Awareness - Further Developments

The foregoing indicates that behavior analysts have investigated a range of phenomena that are relevant to self-awareness, at least according to Skinner's definition. Nevertheless, we argue that there may be more to self-awareness than simply responding to one's own behavior as discriminative stimuli. Our view is that human verbal behavior significantly alters or changes the basic type of stimulus control observed when nonhumans demonstrate self-discrimination (e.g., Lattal, 1979; Shimp, 1983). To appreciate fully our position on human self-discrimination we must first consider some of the important aspects of the stimulus equivalence research program, and the relational frame account of verbal behavior (a detailed account of this position can be found in, for example, Barnes, 1994, 1996; Barnes & Roche, 1996;

Hayes, 1991, 1994; Hayes & Hayes, 1989, 1992; Hayes & Wilson, 1993, 1996; Lipkens, Hayes, & Hayes, 1993).

Stimulus Equivalence, Transfer of Function, and Relational Frame Theory

Although nonhuman studies have shown that subjects' own behavior may function as discriminative stimuli, recent developments in stimulus equivalence research have indicated that certain properties of human discrimination, in general, are not readily predicted by the traditional concept of discriminative control. Specifically, when verbally-able humans are trained on a series of conditional discriminations, the stimuli often become related to each other in untrained or derived ways. For example, when a subject is taught to match Stimulus A to Stimulus B and then to match A to C, it is likely that the subject will also match B to A, C to A (symmetry), B to C, and C to B (combined symmetry and transitivity) without further training. Following such a derived performance, the stimuli are said to participate in an equivalence relation (Barnes, 1994; Sidman & Tailby, 1982). Perhaps what is most interesting about equivalence relations is that the test outcomes are not readily predicted by the traditional concept of conditional discrimination because neither B nor C has a direct history of differential reinforcement with regard to the other, and therefore neither stimulus should control selection of the other.

Interestingly, other novel or derived performances have also been generated using stimulus equivalence procedures. For example, when a simple discriminative function is trained to one stimulus in an equivalence relation, the function will often transfer to the other stimuli in that relation, without further reinforcement. This transfer of function effect through equivalence relations has been demonstrated with discriminative (Barnes & Keenan, 1993b; Barnes, Browne, Smeets, & Roche, 1995; deRose, McIlvane, Dube, Galpin, & Stoddard, 1988; Gatch & Osborne, 1989; Kohlenberg, Hayes, & Hayes, 1991; Wulfert & Hayes, 1988), consequential (Hayes, Devany, Kohlenberg, Brownstein, & Shelby, 1987; Hayes, Kohlenberg, & Hayes, 1991), and respondent stimulus functions (Dougher, Auguston, Markham, Greenway, & Wulfert, 1994; Roche & Barnes, in press). In the study conducted by Hayes et al. (1987), for example, adults were first trained in four matching-to-sample tasks (i.e., if Sample A1, select Comparison B1 and not B2; if A2, select B2 and not B1; if A1, select Comparison C1 and not C2; if A2, select C2 and not C1). Subjects were then tested for the formation of two equivalence relations (A1-B1-C1, A2-B2-C2). Next, a stimulus from each equivalence relation was given a distinct, simple discriminative function; in the presence of B1 clapping was reinforced, and in the presence of B2 waving was reinforced. During testing, the discriminative functions assigned to the B1 and B2 stimuli were seen to transfer through equivalence to the C1 and C2 stimuli, in the absence of differential consequences for either clapping or waving (i.e., B1→clap transferred to C1→clap, and B2→wave transferred to C2→wave).

According to relational frame theory, stimulus equivalence and the transfer of function are both considered to be examples of the *same* behavioral process of arbitrarily applicable relational responding (see Dymond & Barnes, 1994, pp. 263-264). In effect, emergent performances such as equivalence and derived transfer are normally produced, in part, by the subject's history of arbitrarily applicable relational responding that is brought to bear by various contextual cues on the matching-to-sample test (see Barnes, 1994, 1996; Barnes & Holmes, 1991; Barnes & Roche, 1996; Hayes, 1991, 1994; Hayes & Hayes, 1989). From this perspective, learning to name objects and events in the world represents one of the earliest and most important forms of arbitrarily applicable relational responding. For instance, parents often utter the name of an object in the presence of their young child and then reinforce any orienting response that occurs towards the named object. This interaction may be described as, hear Name A→ look at Object B. Parents also often present an object to their young child and then model and reinforce an appropriate "tact" (Skinner, 1957). This interaction may be described as see Object B→hear and say Name A (see Barnes, 1994, for a detailed discussion). Initially, each interaction may require explicit reinforcement for it to become firmly established in the behavioral repertoire of the child, but after a number of name-object and object-name exemplars have been trained, derived "naming" may be possible. Suppose, for example, a child with this naming history is told "This is your shoe." Contextual cues, such as the word "is" and the naming context more generally, may establish symmetrical responding between the name and the object. Without further training, for example, the child will now point to the shoe when asked "Where is your shoe?" (Name A→Object B) and will utter "shoe" when presented with the shoe and asked "What is this?" (Object B→Name A).

Arbitrarily applicable relational responding may be brought to bear on any stimuli, given appropriate contextual cues. Relational frame theory therefore explains equivalence and derived transfer in terms of a training history applicable to a given situation. For example, when a young child is taught a number of name-object and object-name relations and is then exposed to a matching-to-sample procedure, contextual cues provided by this procedure may be discriminative for equivalence responding. In fact, the matching-to-sample format itself may be a particularly powerful contextual cue for equivalence responding insofar as it is often used in preschool education exercises to teach picture-to-word equivalences (see Barnes, 1994, and Barnes & Roche, 1996, for detailed discussions).

Relational frame theory views stimulus equivalence and derived transfer as having important implications for a behavior analysis of human language. Consider the following example. Suppose that a young child who visits a "dentist" (Stimulus A) experiences a painful tooth extraction. The child may then learn at school that an "orthodontist" (Stimulus B) is a type of dentist. Later, on hearing of a projected visit to

an "orthodontist," the child may show signs of anxiety despite having had no direct experience with an orthodontist. This transfer of function effect is based on the behavioral function of A and the derived relation between A and B. In effect, the child does not need to experience the possibly aversive consequences of attending an orthodontist, in order to show signs of anxiety.

This dentist example illustrates one of the core assumptions of the relational frame account of verbal events. *That is, a stimulus is rendered verbal by its participation in an equivalence or other type of derived relation* (see Hayes & Hayes, 1989, 1992; Hayes & Wilson, 1993, pp. 286-289). In effect, we define a behavioral event as verbal when it involves, at least to some degree, a transfer of functions in accordance with arbitrarily applicable relations. As we shall see, this functional definition of verbal events has important implications for the experimental and conceptual analysis of human self-discrimination and self-awareness.

Verbal Self-Discrimination

Recent research at the University College Cork laboratory has set about examining the transfer of self-discrimination response functions through equivalence and other derived relations (Dymond & Barnes, 1994, 1995, 1996). In one study (Dymond & Barnes, 1994) subjects were first trained in six matching-to-sample tasks (i.e., if A1 select B1, A1-C1, A2-B2, A2-C2, A3-B3, A3-C3) and were then tested for the formation of three equivalence relations (i.e., A1-B1-C1, A2-B2-C2, A3-B3-C3). Following a successful equivalence test, subjects were trained to emit two self-discrimination responses on two time-based schedules of reinforcement; if subjects did not emit an operant response, choosing one stimulus (B1) was reinforced, and if they did emit one or more responses choosing another stimulus (B2) was reinforced. Finally, subjects were tested for a transfer of these self-discrimination response functions through derived equivalence relations (i.e., no response = choose C1, and one or more responses = choose C2). All four experimental subjects demonstrated the predicted formation of three equivalence relations and the transfer of self-discrimination response functions through two of these relations. This study was the first to demonstrate the derived transfer effect with self-discrimination response functions.

As mentioned previously, we define a behavioral event as verbal when it involves, at least to some degree, a transfer of functions in accordance with arbitrarily applicable relations. Thus, we define a transfer of self-discrimination response functions in accordance with such relations as an instance of *verbally* discriminating oneself. This relational frame view of verbal events and self-discrimination suggests that, in human self-awareness, the person is "not simply behaving with regard to his behavior, but is also behaving *verbally* with regard to his behavior" (Hayes & Wilson, 1993, p. 297, [emphasis added]). A

nonhuman, while it has learned to respond to responding, is merely performing a discrimination in which the original response (i.e., pecking according to a DRO or DRL schedule) was discriminative for the second (i.e., choosing between red and green keys; see Hineline & Wanchisen, 1989, p. 234). The difference thus becomes a functional one; verbal organisms are often controlled by the participation of verbal events in equivalence and other relations and the various functions (e.g., "good," "bad") that can attach to them, whereas nonverbal organisms clearly are not (i.e., there is no evidence from the nonhuman literature that a choice following an aversive stimulus will itself become aversive).

Making a distinction between verbal and nonverbal self-discrimination may have important implications for our understanding of human self-awareness and perhaps even the origins of certain human emotional problems. Consider, for example, a young girl who is constantly harangued by her parents and told that she is "a nuisance," "bad," and "nothing but trouble." When this girl interacts with the verbal community these critical remarks may come to participate in equivalence relations and other more general negative self-discriminations will emerge. That is, the child may respond to "a nuisance" as equivalent to "I'm clumsy and get in the way," "bad" as equivalent to "everything I do is wrong," and "nothing but trouble" as equivalent to "no one loves me." This form of equivalence responding may result in the self-discrimination "I'm useless and no one loves me" and cause the young woman to distrust anyone who shows her intimacy or love in future relationships without ever experiencing a prolonged and intimate relationship. In effect, the woman's avoidance of emotional intimacy is verbally constructed (e.g., "No one could want me because I'm not worth it"). The reader is reminded that in this example no reference is made to a mentalistic domain that plays a central or explanatory role in the development of the woman's negative "self-worth." This behavioral view therefore differs from many nonbehavioral accounts, in that the woman's emotional avoidance is attributed to a specifiable history of reinforcement and not to an ill-defined mentalistic realm in which the concept of self is somehow miraculously embedded.

Relations Other Than Equivalence

So far we have focused only on equivalence relations. Relational frame theory, however, incorporates patterns of derived behavior that cannot readily be categorized as equivalence responding (see Steele & Hayes, 1991). In one recent study, we expanded upon our treatment of a transfer of self-discrimination response functions through equivalence by exploring a transformation of functions in accordance with sameness (i.e., equivalence) and comparison (Dymond & Barnes, 1995).

In this study, four experimental subjects were pretrained in accordance with sameness, more-than, and less-than relations (more-than and less-than relations are subcategories of the relational frame of comparison). Responding in accordance with sameness was trained

using procedures similar to those employed by Steele and Hayes (e.g., subjects were trained to pick a short line comparison given a short line sample in the presence of the SAME contextual cue). Responding in accordance with more-than and less-than relations was trained using comparisons that were either more than or less than the sample along some physical dimension. For example, subjects were trained to pick a two star comparison in the presence of a three star sample given the LESS-THAN cue, and to pick a six star comparison in the presence of the three star sample given the MORE-THAN cue. After the subjects had been successfully pretrained, they were trained in six arbitrary relations using the three contextual cues. The four critical relations were: SAME/A1-B1, SAME/A1-C1, LESS-THAN/A1-B2, MORE-THAN/A1-C2. Subjects were then tested for seven derived relations, the following three relations being the most important: SAME/B1-C1, MORE-THAN/B1-C2, LESS-THAN/B1-B2 (see Figure 1).

In order to establish derived self-discrimination response functions in accordance with sameness, more-than, and less-than relations, three response functions were required. Subjects were trained, therefore, using three complex schedules of reinforcement to produce three

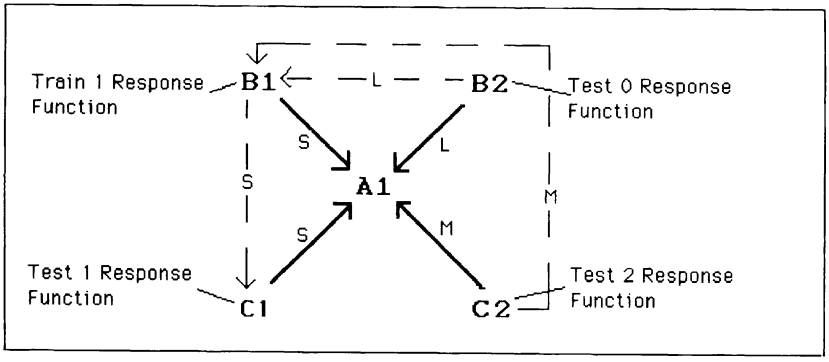

Figure 1. Schematic representation of the most crucial trained (solid lines) and tested (dashed lines) relations. Letters S, M, and L indicate the arbitrarily applicable relations of sameness, more than, and less than. The diagram also shows that a one-response function was trained using the B1 stimulus, and tests examined the transformation of the trained self-discrimination response function in accordance with the relations of sameness (C1, one response), more than (C2, two responses), and less than (B2, no response). (adapted from Dymond & Barnes, 1995; copyright 1995 by the Society for the Experimental Analysis of Behavior, Inc.).

performances: (a) no response, (b) one response only, and (c) two responses only. It was predicted that, if the derived sameness, more-than, and less-than relations had been established (i.e., B1 is the same as C1, B2 is less than B1, and C2 is more than B1), and choosing Stimulus B1 after making one response had been reinforced, it is possible that a subject, without further training, would then choose: (a) C1 following 'one response' (i.e., C1 acquires the *same* function as B1),

(b) B2 following 'no response' (i.e., B2 acquires a response function that is *less than* the B1 function), and (c) C2 following 'two responses' (i.e., C2 acquires a response function that is *more than* the B1 function; see Figure 1). The reader should note that we used the term *transformation* of functions to describe this effect instead of *transfer*, because the explicitly trained 'one response' function of B1 does not transfer to B2 and C2 (i.e., B2 and C2 do not acquire 'one response' functions), but rather the 'one response' function of B1 *transforms* the functions of B2 and C2 in accordance with more-than and less-than relations. In total, all four pretrained subjects demonstrated the predicted transformation of self-discrimination response functions (i.e., no response, choose B2; respond once, choose C1; respond twice, choose C2; see Dymond & Barnes, 1995). This study was the first to demonstrate a transformation of functions in accordance with the arbitrarily applicable relations of sameness, more than, and less than (see also Dymond & Barnes, 1996, for a demonstration of responding in accordance with the derived relations of sameness and opposition).

Applied Implications

Relational frames such as comparison may have important implications for an understanding of the development of self-discriminations that emerge from socially based comparisons, which appear to be an important source of unhappiness for many individuals. In other words, self-discriminations such as "he's better than me," "I'm worse than her," "I wish I was as good as him," may emerge, in part, through their participation in a variety of relational networks that are established and maintained by the verbal community.

Take, for instance, a young boy who is frequently exposed to comments by his parents and teachers comparing him to his brother. For example, he may be repeatedly told that his brother is "*better than* him at sports," that his grades at school are poor *in comparison to* his brother, and he will often be asked by parents and teachers alike, "why aren't you *more like* your brother." In later adulthood, these verbal criticisms may help to generate more general self-criticisms, in which the young man compares his performance with that of others, as always *less than* satisfactory. Hence, he may "drop out" of college, quit numerous jobs, and avoid long-term personal relationships because he verbally constructs a future in which his performance in these areas will never equal the "expectations of others." Again, it is important to note that, in the relational frame account presented here the explanation for the young man's behavior is not attributed to a mentalistic self. Instead, the verbal descriptions presented by his parents and teachers, and the transformation of self-discriminations that later emerged from these negative verbal descriptions, form the basis of the current behavior-analytic interpretation.

Self as Context: Implications for Spirituality and Therapy

A behavior-analytic account of self based on relational frame theory extends the basic idea of self-discrimination as the basis for self-awareness. The fact that functions may transform in accordance with arbitrarily applicable relations means that our self-discriminations can become increasingly removed from the explicit history of reinforcement that typically establishes self-discrimination in nonhumans. Interestingly, relational frame theory might also help to provide a behavior-analytic interpretation of the more mystical or spiritual aspects of self-awareness that are typically seen to be outside the purview of natural science.

One of the most important types of relational framing activities that a child is taught by the verbal community is to discriminate his or her own perspective as separate from that of others. According to Hayes (1984), this relational activity emerges when a child is taught not only to discriminate her own behavior (i.e., to see that she sees), but to discriminate her own behavior from a consistent locus or perspective (i.e., the child sees that she *always* sees from her own perspective).

> First, words such as "here" and "there" are acquired which do not refer to a specific thing but to a relation to the child's point of view. For example, "there" is always anywhere else but "here" and "here" is always "from this locus or point of view". Second, children are taught to distinguish their perspective from that of others. Young children have a hard time with the issue of perspective. For example, young children seated across from a doll will, when asked, report that the doll sees what they are seeing. Gradually, however a sense of perspective emerges. A child learns what he or she sees is seen from a perspective. Similarly, a young child, asked what she had for breakfast, may respond with what her brother actually ate, but an older child will not make such a mistake. Through correction, ("No, that is what your brother ate. What did *you* eat?") a child must learn to see seeing from a consistent locus... Suppose a child can give correct answers to the question "what did you *x*?" where "*x*" is a wide variety of events such as eat, feel, watch, and so on. The events constantly change. In our terms, the seeing and the seeing seeing change. Only the locus does not. Thus, one consistency between the word "you" in such questions and behavior is not seeing or seeing seeing but the behavior of seeing that you see from a particular locus or perspective. Thus, in some real sense, "you" *are* the perspective. (Hayes, 1984, pp. 102-103)

In summary, the child's interaction with the verbal community establishes the relational frames of "Here and There" and "Now and Then," and the child is taught to discriminate "herself" as always located in the same position in the relational frames (i.e., she is always *here* and *now* and not *there* and *then*) (see Figure 2). This type of relational framing thus generates a perspective, or context, of self from which all

things and events are experienced. "Everything I did as an eight year old" is markedly different, in content, from "everything I do now," even though the locus or perspective from which "I" emanates is still the same. According to Hayes (1984, p. 104): "*What* you see will change radically - your body will age, your thoughts will change - but the locus or context of self-knowledge will not and cannot." "I" is thus the location or perspective that is left behind when all of the content is removed. This process, we would argue, is critical to a behavioral interpretation of the mystical or spiritual experience.

Hayes (1995), in a relational frame account of the concept of self, distinguishes three "knowing selves" that humans experience directly, the most important of which, for present purposes, is 'self as context.' As we have already mentioned, "I" is the immutable location or point of view

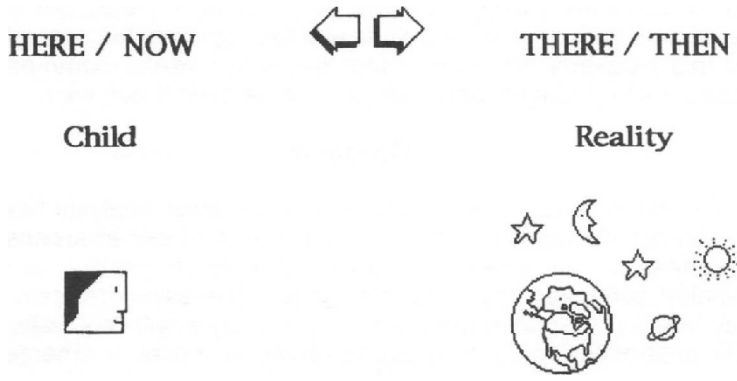

Figure 2. Schematic representation of responding in accordance with the relational frames of Here and There, and Now and Then. A child learns that he or she is always located Here and Now, and "external" reality is always located There and Then. See text for details.

from which humans report all events and as such the self forms the context for the ongoing process of verbal knowing. Hayes argues that a sense of transcendence results from a situation in which the derived stimulus functions due to relational frames are greatly reduced. In effect, this transcendental quality involves verbally discriminating the contents of one's awareness but not evaluating, conceptualizing, or comparing those events. If we stop labeling and categorizing the contents of our experience, we are left with only the undivided experiential whole; the perspective or 'self as context' from which all things are experienced. This is the very essence of the mystical experience.

Interestingly, this relational frame interpretation has important pragmatic implications for therapeutic techniques employed by behavior therapists. One of the goals of the behavior-analytically based therapy, Acceptance and Commitment Therapy (ACT) for example, is to

encourage clients to discriminate between the context of their experience (the "I") and the actual content of the experiences (thoughts, emotions, evaluations etc.) (see Hayes, Strosahl, & Wilson, in press; Hayes & Wilson, 1994, for a detailed description of ACT). One of the techniques used in ACT requires clients to adopt a particular verbal style in which, "the type of verbal event is named, rather than simply stating the content of that event." (Hayes & Wilson, 1994, p. 294). For example, clients may be taught to say "I'm having the thought that I can't go to the job interview," rather than "I can't go to the job interview." This way of talking can also include evaluative aspects such as, "I'm having the evaluation that I'm a worthless person, as opposed to simply saying, "I'm worthless." Therapeutic techniques such as this help undermine the assumption established by the verbal community that thoughts and feelings are the literal causes of behavior, and thus can be used as reasons or causes for emotional avoidance (e.g., "I was so anxious that I had to leave the party."). In other words, ACT helps the client to discriminate their negative thoughts and feelings from the context of self, and this weakens the control that the wider verbal community has established for thoughts and feelings over the client's behavior.

Conclusion

The current paper clearly shows that behavior analysts have been and still are concerned with the phenomenon of self-awareness. Self-awareness begins when behavior itself is discriminated via socially mediated contingencies of reinforcement. The transformation of self-discrimination response functions in accordance with equivalence and other arbitrarily applicable relations allows for novel or emergent self-discriminations. The behavior analytic treatment of self-awareness helps provide a functional account of spirituality and has important implications for behavior therapy. The behavior analytic, naturalistic approach to studying self-awareness clearly provides a fertile ground for further empirical and conceptual analyses.

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