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Stimulus Equivalence and the Symbolic Control of Behavior

Equivalencia de estímulos y el control simbólico de la conducta

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ABSTRACT

Six subjects formed two three-member equivalence classes following conditional discrimination training in a matching-to-sample procedure using nonsense syllables as stimulii. For three subjects, a stimulus from each equivalence class was then given a distinct discriminative function. For the remaining three subjects, a stimulus from each equivalence class was given a conditioned reinforcing function. Six additional subjects served as controls. Three received the discriminative control training and three the conditioned reinforcement training, but none received the conditional discrimination training required to form the equivalence class. Following training, testing was done using an element of the equivalence classes related symmetrically and transitively to the element used in the discriminative or reinforcement training. For the equivalence subjects, but not the control subjects, discriminative control and conditioned reinforcement effects transferred to other members of the equivalence classes. This transfer of discriminative and reinforcing functions across members of equivalence classes may provide a more complete account of some types of generalization and maintenance. In addition, stimulus equivalence and related phenomena may help explain the control exerted by symbolic stimuli such as in rule-governed behavior.

DESCRIPTORS: equivalence classes, discriminative control, conditioned reinforcement.

RESUMEN

Seis sujetos formaron dos clases equivalentes de tres miembros, mediante entrenamiento en discriminación condicional con un procedimiento de igualación de la muestra

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en que se emplearon sílabas sin sentido como estímulos. Para tres de los sujetos, a un estímulo de cada clase equivalente se le dio una función discriminativa diferente. Para el resto de los sujetos, a un estímulo de cada clase equivalente se le dio una función de reforzador condicionado. Seis sujetos adicionales funcionaron como controles; tres de ellos recibieron entrenamiento en control discriminativo, y tres entrenamiento en reforzamiento condicionado, pero ninguno de ellos tuvo el entrenamiento en discriminación condicional requerido para formar clases equivalentes. Después del entrenamiento, se probó con un elemento de las clases equivalentes, relacionado simétrica y transitivamente al elemento empleado en el entrenamiento discriminativo o de reforzamiento. Los sujetos entrenados en equivalencia, a diferencia de los control, si transfirieron los efectos del control discriminativo y del reforzamiento condicionado, a otros miembros de las clases de equivalencia. Esta transferencia de las funciones discriminativas y reforzantes a través de los miembros de las clases equivalentes, puede proporcionar una explicación más completa de algunos tipos de generalización y mantenimiento. Además, la equivalencia de los estímulos y los fenómenos a ella relacionados, pueden ayudar a explicar el control ejercido por estímulos simbólicos como en la conducta gobernada por reglas.

DESCRIPTORES: clases equivalentes, control discriminativo, reforzamiento condicional.

When normal humans are taught a series of related conditional discriminations, the stimuli often become related to each other in untrained ways (e.g., Sidman, Cresson, & Willson-Morris, 1974). For example, when a person is taught to match A to B and then A to C, it is likely that the person will be able to match B to A, C to A, B to C, and C to B without additional training. This is termed "stimulus equivalence", and the stimuli are said to have formed "equivalence class".

The study of stimulus equivalence may constitute the beginnings of a behavior analytic approach to symbolic or verbal stimuli (Devany, Hayes, & Nelson, 1986; Hayes, 1986; Sidman & Tailby, 1982). Language researchers have long maintained that an essential characteristic of language is the bidirectionality of symbol-referent relations and speaker-listener functions (Hoskins, 1960). The relation between the word and the referent is necessarily bidirectional: If a word "stands for" a referent, then it is always also true that the referent "is called" the word. Such a symmetrical relation is not characteristic of normal processes of discriminative control. However, symmetrical or bidirectional responding is a defining property of stimulus equivalence. Thus, relations between elements of equivalence classes may provide a working model of relations between symbols and referents.

The connection between stimulus equivalence and verbal behavior is supported by several findings. First, the formation of equivalence classes has been readily demonstrated in human subjects using a wide variety of materials (e. g., Dixon, 1976; Dixon & Spradlin, 1976; Vanbiervlet, 1977; Wetherby, Karlan, & Spradlin, 1983), but it has not yet been shown in infrahumans, such as pigeons (e.g., Kendall, 1983) or even higher primates (D'Amato, Salmon, Loukas, & Tomie, 1985; Sidman, Rauzin, Lazar, Cunningham, Tailby,

& Carrigan, 1982). With proper training this species boundary may yet be crossed, but the difficulty in demonstrating equivalence in other animals compared to the ease with which it is shown in humans in suggestive. Second, retarded children who lack spontaneous speech (or sign) do no readily demonstrate stimulus equivalence, while normal children (as young as two years old) and speech-productive retarded children of similar mental age do (Devany et al., 1986). Finally, very young children do not demonstrate stimulus equivalence as frequently as do older children, but they may do so when taught to name the stimulus relations involved in the underlying conditional discriminations (Lowe, 1986).

If the stimulus equivalence paradigm can contribute to an analysis of symbolic stimuli, we would expect the control over behavior exerted by stimuli participating in equivalence classes to parallel the control that verbal stimuli exert over behavior. For example, suppose the spoken word and written words "men" and "boys", and pictures of males participated in the same class ("males"). After a child learns to enter the "men's room", he may also be able to approach the room with a drawing of a man on the door without explicit training to do so. As a parallel, after an equivalence class (ABC) is formed, if one member (A) becomes discriminative for a response, then B and C should become discriminative for the same response. To use another example, a person may learn that the French word for "good" is "bon" and the Spanish word for "bon" is "bueno" If "good" functions as a conditioned reinforcer, it seems likely that "bueno" will now also function as a reinforcer, without any additional training or pairing of "bueno" with other events. As a parallel, if one member of an equivalence class becomes a conditioned reinforcer, all members may do so to some degree.

The present experiment was designed to test these two possibilities. Although no published study has examined the transfer of reinforcement effects through participation in an equivalence class, the issue of the transfer of discriminative control has been examined (Lazar, 1977). In this study, three normal adult subjects were taught an ordering task; they were taught to touch first one item and then another in a visual array. Such training created two classes: the "firsts" and the "seconds". A stimulus item (either a "first" or "second") then served as a sample and novel visual stimuli served as comparisons in a matching-to-sample task. After this second component of training, the ordering task was again presented, using the comparison stimuli from the matching-to-sample task in the ordering task. Two of the three subjects first pointed to comparison stimuli that had been matched with "firsts" and then pointed to comparison stimuli that had been matched with "seconds".

Lazar's work seems relevant to our understanding of how we come to emit grammatical yet novel word sequences. It does not, however, unambiguously address the transfer of functional control through participation in equivalence classes. In this procedure, the stimuli used as samples in the matching-to-sample training had already been established as "firsts" or "seconds". This means that stimuli exerting discriminative control over sequential responding were *directly* paired with the comparison stimuli which were later tested for transfer of control over sequential responding. Although the training did produce equivalence classes, the transfer of control obtained could have occurred due to this direct pairing, the formation of stimulus compounds, or symmetry alone (without transitivity). In short, stimulus equivalence was not unambiguously responsible for the transfer effects seen.

A more powerful demonstration of transfer of control would be to give a function to a member of an equivalence class and then to test the transfer of stimuli at least one node (Fields, Fath, & Verhave, 1984) removed from the training stimuli and both symmetrically and transitively related to the training stimuli. Transfer of functional control ocurring under these conditions would clearly be attributable to participation in the equivalence class. This was the strategy followed in the present study.

Method

Subjects and Setting

Twelve introductory psychology students (4 males and 8 females) participated for course credit. Sessions were held in a small room with the subjects seated across a small table from the experimenter. Data were collected in individual single sessions which lasted from one to two hours.

General Experimental Design

The were four phases to the experiment. In the conditional discrimination training (Phase 1), subjects were taught a series of conditional discriminations. In the equivalence test (Phase 2), subjects were tested to determine if equivalence classes had formed as a result of training. In the function-training (Phase 3), one member of each of two equivalence classes was established either as a discriminative stimulus or as a conditioned reinforcer. Finally, in the transfer of control test (Phase 4), other members of the classes were tested to determine if they had acquired the relevant (discriminative or reinforcing) function. Six experimental subjects participated in all four phases while six control subjects participated only in Phases 3 and 4. This was done to rule out stimulus similarity, stimulus attractiveness, or other non-arbitrary aspects of the stimuli as the source of any transfer of function obtained.

Stimulus Materials: Training and Equivalence Testing Stimuli

The stimuli consisted of three-letter nonsense syllables selected from a list of syllables with very low associative value (Nobel, 1961). The stimuli were typed in capital letters on 5 x 7 index cards. The sample stimulus was presented in the top center of each card. The two comparisons were presented two inches below the sample, approximately an inch from either edge of the card. Each card contained the stimuli for one trial. Across trials, the left-right positions of the two comparison stimuli were randomly varied.

The nonsense syllables were randomly assigned to roles as sample or comparison stimuli (the stimuli used are shown in Table 1). Two sets of stimuli were used in training. *A1* and *A2* served as samples. *B1, B2, C1* and *C2* were used as comparisons.

Table 1

Stimuli Used in the Experiment

A1 = ZUF	A2 = YOJ
B1 = CEJ	B2 = VUG
C1 = XAW	C2 = KIJ

Training and testing trials

Train (selection of comparisons with consonant numbers reinforced):

A1 ↘ B1 B2	A2 ↘ B1 B2
A1 ↘ C1 C2	A2 ↘ C1 C2

Test:

B1 C1 C2	B2 C1 C2

Phase 1: Conditional Discrimination Training

At the beginning of the session the experimenter said:

This is an experiment in human learning. In this experiment, you will be shown various nonsense syllables, and will be asked questions about them. During some parts of the experiment, I will tell you whether your responses are correct or incorrect. During other parts of the experiment, I will not give you feedback at all, but after the experiment is over we will count your correct responses during these parts and you can earn up to two dollars for correct responding. Do you have any questions?

The amount earned by each correct response was not specified so that subjects could not determine the number of no-feedback trials. At the end of the experiment, all subjects were given two dollars and were told they had done well regardless of their actual performance.

During the conditional discrimination training, the subjects were presented with a card containing a sample (*A1* or *A2*) and two comparisons (*B1* and *B2* or *C1* and *C2*). The card was held in front of the subject and the subject was instructed: "Touch the syllable on the table and then sample stimulus was covered with a blank index card. The subject then responded. If the response was correct, the experimenter said "correct" and if the response was incorrect, the experimenter said "incorrect".

The order of training and the trained relations are presented in Table 1. When *A1* was the sample, *B1* and *C1* were correct. When *A2* was the sample, *B2* and *C2* were correct. Thus, subjects were trained on four tasks (*A1-B1, A2-B2, A1-C1, A2-C2*). Each task was presented until the subject met a mastery criterion of ten consecutive correct responses. Training began with the *A1-B1* task. Once the subject met the mastery criterion, the next (e.g., *A2-B2*) was then presented. When all four tasks had been mastered, the tasks were randomly mixed and presented until the mastery criterion was met. If the criterion was not met in twenty trials, additional training on the individual unmixed tasks was given. When the subject again met the mastery criterion on each of the individual tasks, the mixed set was presented once more. This cycle continued until the subject met the mastery criterion on the mixed set.

Phase 2: Equivalence Testing

Before the text was administered, the subject was told that no feedback would be provided. Ten test trials were administered to determine if two equivalence classes (*A1, B1, C1* and *A2, B2, C2*) had formed. The same procedures and materials were used with the exception that either *B1* or *B2* served as the sample stimuli and *C1* and *C2* served as comparisons.

If the two equivalence classes had formed, then in the presence of *B1*, comparison *C1* would be selected and in the presence of *B2*, comparison *C2* would be selected. If the subject responded in this manner on at least 9 of the test trials, the next phase began. If responding did not meet this criterion, Phase 1 training was reinstated. Subjects were not told that they were returning to an earlier phase and no comment was made about their performance in Phase 2. Following retraining and mastery of the Phase 1 tasks, Phase 2 was re-administered.

Phase 3: Function Training

Experimental subjects (1-6) and control subjects (7-12) were randomly assigned to either the stimulus control training or conditioned reinforcement training groups.

Phase 3: Stimulus Control Training. At the beginning, the experimenter said: "Youd will be shown some nonsense syllables. One means to clap, and one means to wave. I will show them to you, and you just experiment with whether to clap or wave, and I will let you know if you are correct or incorrect". Subjects were not told which stimulus occasioned which response. The stimuli (syllable *B1* and syllable *B2*) were typed on 5 x 7 inch index cards. When the subject was presented with the *B1* stimulus, clapping was followed by the statement, "correct" by the experimenter. When the *B2* stimulus was presented, waving was followed by "correct". Incorrect responses were ignored. The stimuli were presented in random order. After the subject emitted ten consecutive correct responses, Phase 4 was begun.

Phase 3: Conditioned Reinforcement Training. Each subject was given a shuffled pack of 5 x 7 inch index cards. On each was printed one of two nonsense syllables. These were unfamiliar nonsense syllables not used in earlier training. The experimenter said:

Please sort these nonsense syllables into these cups. One belongs in the cup on the right, and the other belongs in the cup on the left. You experiment with what belongs where, and I will let you know if you are correct or incorrect.

For each syllable, placement in the left or right bin arbitrarily had been designated as correct before the training began. When a card was placed in the correct bin, the experimenter help up a card on which the *B1* syllable was printed and then said "good". Similarly, when an incorrect response was made, the experimenter held up a card on which the *B2* syllable was printed and then said "no". This continued until twenty consecutive cards had been sorted correctly.

A new sorting task was then presented using another deck of cards, each containing one of two unfamiliar nonsense syllables. When the subject made a correct response, the experimenter held up the card upon which the *B1* syllable was printed and said nothing. When the subject made an incorrect response, the experimenter held up the card upon which the *B2* syllable was printed and said nothing. This continued until twenty consecutive cards had been sorted correctly.

This entire training sequence was then repeated. A third deck of cards was presented and *B1* and *B2* were once again paired with "good" and "no", respectively. In task four, only *B1* and *B2* were used as consequences.

Phase 4: Transfer of Control Testing

Following the Phase 3 training, subjects were tested to see if the trained functions had transferred to untrained members of those equivalence classes. The stimuli used in the testing (*C1* or *C2*) were related to those used in training (*B1* or *C2*) in a manner requiring both symmetry (e.g., *C1-A1*) and transitivity (e.g., *C1-A1-B1*).

Phase 4: Stimulus-Control Transfer Test. Subjects were told that no feedback was available. Ten trials were presented. On five trials, a printed card containing the *C1* syllable was presented; on the remaining five trials, a printed card containing the *C2* stimulus was presented. The stimulus cards were presented in random order and the subject's response (either a wave or a clap as no subjects failed to respond in either of these two ways) was recorded.

Phase 4: Conditioned Reinforcement Transfer Test. Subjects were told no feedback was availabe. A new sorting task involving two new nonsense syllables was used. Ten card were presented. The subjects were instructed to sort the cards into the bins; once again the "correct" bin for each stimulus was chosen arbitrarily. Following a correct response, a card upon which the *C1* syllable was printed was presented. No vocalizations were made by the experimenter. Following an incorrect response, a card upon which the *C2* syllable was printed was presend.

Reliability

Training and testing data were collected on a trial-by-trial basis by the experimenter using pre-coded data sheets. Reliability data were collected by a second observer who sat behind the subject, facing the experimenter with a clear view of the stimulus materials. These subjects (two in the stimulus control condition and one in the conditioned reinforcement condition) were monitored. Reliability was calculated by the formula Agreement/(Agreements + Disagreements). An "agreement" was defined as a concurrence between the experimenter and the reliability checker on the emission of the response (left-right, or wave-clap). Interobserver agreement ranged rom 97% to 100%.

RESULTS

Conditional Discrimination Training and Equivalence Testing

The experimental subjects all demonstrated the formation of equivalence classes. There was considerable variability among the subjects in the number of conditional discrimination trials and equivalence tests required to establish equivalence classes. These data are summarized in Table 2. The number of conditional discrimination trials required ranged from 58 (Subject 1) to 236 (Subject 4) with a mean of 127.3 trials.

The number of equivalence tests administered ranged from one (Subject 6) to five (Subject 3) with a mean of 2.8 tests.

Transfer of control data. The experimental subjects all demonstrated the transfer of the trained function to untrained elements of the equivalence classes. Control subjects did not.

Table 2

Training Supplied to Subjects in Both Conditions

	Stimulus Control Group			*Conditioned Reinforcement Group*		
Subject Number	1	2	3	4	5	6
Total Number of Training Trials	58	102	189	236	70	106
Number of Times Equivalence Tested	2	3	5	4	2	1

The data for the stimulus control subjects are presented in Table 3. All of the subjects receiving equivalence training demonstrated the transfer of functional control to untrained members of the equivalence classes. Responding predicted on the basis of transfer was designated "correct." Correct responding on the clap-wave task ranged from 80% (Subject 3) to 100% (Subject 1) and averaged 90% across the three subjects. Correct responding was 0% for each of the control subjects (7-9). Thus, non-arbitrary aspects of the stimuli could not accoun for the effects seen in Subjects 1-3.

Table 3

Transfer of Control from B to C Stimuli (in Same equivalence Class)

Conditioned Reinforcement Test				
Experimental	Subjects	Control	Subjects	
S4	90%	S10	0%	
S5	100%	S11	0%	
S6	100%	S12	100%	(Task 1)
			0%	(Task 2)
Stimulus Control Test				
Experimental	Subjects	Control	Subjects	
S1	100%	S7	0%	
S2	90%	S8	0%	
S3	80%	S9	0%	

The data for the conditioned reinforcemente subjects are also presented in Table 3. All of the subjects receiving equivalence training demonstrated transfer of the reinforcing function to an untrained element of the equivalence class. Correct responding on the sorting task ranged from 90% (Subject 4) to 100% (Subjects 5 and 6), and averaged 97% across subjects. Correct responding in the control group ranged from 0% (Subjects 10 and 11) to 100% (Subject 12) and averaged 33%. Immediately following the Phase 4 task, Subject 12 was given a second sorting task. Again *C1* and *C2* were used as consequences for correct and incorrect responses. On this task, Subject 12 failed to emit any correct responses. It seems unikely, then, tha the results seen in Subjects 4-6 are due to non-arbitrary features of the *C1* and *C2* stimuli.

DISCUSSION

The present study was designed to determine if functions given to an element of an equivalence class will transfer to other elements of the class without explicit training. The data show that they will. After subjects had mastered a series of conditional discriminations and formed two equivalence classes, one member of each class was given either a discriminative or a conditioned reinforcement function through subsequent training. Once this function was established, other members of the equivalence class acquired the function without additional training or experience. Control conditions showed that these effects were not due to non-arbitrary aspects of the stimuli used.

Unlike earlier work (Lazar, 1977), the present effects seem unambiguously due to stimulus equivalence. Schematically, Lazar (1977) trained discriminative effects to what in this study were the *A1* and *A2* stimuli. Because *A1-C1* and *A2-C2* pairings were among those explicitly trained, transfer of control from *A1* or *A2* to *C1* or *C2* could be based on these directly reinforced pairings, not equivalence per se. In this study, the *B1* and *B2* stimuli were used in the Phase 3 training while *C1* and *C2* were used in the transfer test (Phase 4). There were no reinforced *B1-C1* or *B2-C2* pairings in the conditioned reinforcement or discriminative training. Instead, *B1* was related to *C1* only because *B1* was related to *A1* (through symmetry in the explicitly trained A1-B1 relation) and *A1* was explicitly trained to *C1*. Thus, the transfer effects seen required both symmetry and transitivity.

It could be argued that the demonstration of stimulus equivalence itself necessarily involves a transfer of discriminative control. Suppose, for example, that stimulus Z is added to class W, X, Y by explicit Y-Z training. Control by the W-Z or X-Z relation could be viewed as a transfer of the discriminative control of Y over Z to W and X. While this is true, it is not yet clear that the phenomenon of stimulus equivalence should be conceptualized in the language of simple discriminative control (Catania, 1983; Sidman, 1986). Further, the present study showed that control over other kinds of responses, not just stimulus-stimulus relations, can be transferred within an equivalence class. Thus, the present demonstration appears to document the transfer of discriminative control through stimulus equivalence beyond that implied by the equivalence phenomenon itself. Furthermore, no previously published study has shown the transfer of reinforcement functions through equivalence classes.

Equivalence, of course, is only an outcome concept. It does not explain the process that established it. Sidman (1986) has suggested that equivalence emerges from conditional discriminations in humans. This, however, does not seem to be an adequate explanation for three reasons. First, it does not explain why non-humans do not readily show equivalence class formation even though they do show ready acquisition of conditional discriminations. Second, it does not explain why only some humans show the effect. Finally, if mere conditional discriminations in humans were sufficient to establish equivalence classes, and if the data in the present study obtain, then any chain involving conditional discriminations would paralyze the individual. In a chain, Al may occasion a response to B1 over B2. But, if Sidman is correct, a human would then treat A1 and B1 as members of a equivalence class. B1 would then occasion a response to A1 and the normal sequence of responses in a chain would collapse as the individual would cycle pathologically between the elements of the chain. Thus, for equivalence to work *equivalencing itself must be under conditional control.* This is the essence of an alternative explanation of equivalence that explains it as due to the learned acquisition of control by abstract, arbitrarily applicable relations such as sameness, oppositeness, and so on (Hayes, 1986).

It may be argued that present results were the result of subtle cuing from the experimenter. This is possible, but unlikely. We have recently obtained similar results with such procedures even when they are entirely computerized (Wulfert, Hayes, & Shull, 1987). Similarly, it may be suggested thath these results are the result of complex verbal mediation. This is quite possible, although its theoretical import depends upon how one conceptualizes "verbal mediation" itself. Furthermore, equivalence has been shown in children as young as 25 months (e.g., Devany et al., 1986). Whether transfer of functional control would be seen in such young children is as yet unknown. If it ocurrs, however, it would be difficult to explain transfer of control on the basis of a highly elaborated verbal repertoire.

The method used in this study may have a strategic role to play in the study of stimulus equivalence. It has been noted that the acquisition of equivalence classes often requires more than mastery of the underlying conditional discriminations. The curious "acquisition-like" trend during non-reinforced equivalence testing trials suggests that the equivalence test itself helps establish the class (cf., Sidman et al, 1985; Saunders, Spradlin, & Wachter, 1986). This pattern has been shown even when the equivalence testing occurs in a single block at the end of training (Devany et al, 1986).

It is logically troublesome, however, to claim that the equivalence test per se establishes equivalence because the only way to demonstrate the existence of a class is to test for it. It is a hypothesis that seems refractory to empirical test. The method used here may provide an alternative means of testing for the formation of equivalence classes without conducting a formal or explicit equivalence test. Transfer of functions in a manner that requires symmetry and transitivity provides strong independent evidence for the existence of equivalence classes. The transfer of control test may be useful in analyzing certain issues in stimulus equivalence such as the role of formal equivalence testing in the formation of equivalence classes.

The results may have important implications for the analysis of symbolic control and generalization (Spradlin & Saunders, 1984). The growing literature on rule-governed behavior (e.g., Baron & Galizio, 1983; Hayes, in press) suggests that behavior under verbal control may differ from other behavior. The present results may begin to provide an account of the difference. It has already been shown that extraordinarily elaborate networks of stimulus relations can be established in equivalence training (e.g., Sidman et al., 1985) and the various classes may themselves be brought under conditional control (e.g., Faniello, Sidman, & DeRose, 1986). If experiences with individual class elements affect all class members and if classes are themselves conditionally controlled, then instances of generalization may occur that have a degree of scope and precision that could not readily occur otherwise. For example, a phobic person may see a graphic description of a plane crash on television and may then avoid riding in the family car because the pictures of the plane are in a class with the word "plane" and the word "plane" is (under some contextual conditions) in a class called "transportation vehicles" and this class contains the word "car". Further, the transfer of functions across a class may allow social events or statements to function as reinforcing or punishing consequences without any direct pairings with reinforcers or punishers in an individual's history. Together, these effects may allows us to acquire behavior that could never be learned directly.

Control by symbolic or verbal stimuli thus may differ from other kinds of stimulus control in the bi-directional flow of the effects of experience and in the extreme degree of precision, scope, and indirectness permitted by conditionally controlled networks of arbitrary symbolic stimuli. As illustrated in the example of the phobic, however, the effects may not always be beneficial or desirable. Symbolic control may establish an unhealthy degree of insensitivity to direct contingencies (cf., Hayes, Brownstein, Hass, & Greenway, 1986; Catania, Shimoff, & Matthews, in press), excessive control by social contingencies (e.g., Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986), improper comparisons of a person's directly experienced environment to a symbolically established ideal (cf., Ellis, 1977; Freud, 1956; Rogers, 1961) and similar unhappy effects. In the interest of advancing human functioning, it seems important to learn both how to establish and how to moderate control by symbolic stimuli. The transfer of behavioral control through stimulus equivalence may provide the beginnings of a working model of symbolic control amenable to behavior analytic research.

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