

- implicit activation of word candidates during the processing of spoken words. *Journal of Memory and Language*, 34, 417-439.
- Wallace, W. P., Stewart, M. T., Shaffer, T. R., & Barry, C. R. (1998). Are false recognitions influenced by prerecognition processing? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 24, 284-298.
- Wedell, D. H., & Bockenholt, U. (1994). Contemplating single versus multiple encounters of a risky prospect. *American Journal of Psychology*, 107, 499-518.
- Werner, H. (1948). *Comparative psychology of mental development*. New York: International Universities Press.
- Winer, G. A. (1980). Class-inclusion reasoning in children: A review of the empirical literature. *Child Development*, 51, 309-328.
- Wolfe, C. (1995). Information seeking on Bayesian conditional probability problems: A fuzzy-trace theory account. *Journal of Behavioral Decision Making*, 8, 85-108.

RELATIONAL FRAME THEORY: A POST-SKINNERIAN ACCOUNT OF HUMAN LANGUAGE AND COGNITION

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I. Introduction

Language and cognition are important domains in the discipline of psychology, and they are often the primary focus in the study of psychological development. In most introductory textbooks, for example, one will find sections or chapters headed "Language Development" and "Cognitive Development." In both domains, the mainstream approach within developmental psychology has been to identify relatively invariant patterns of psychological change as they unfold during the

lifetime of the individual. Chomsky (1959) and Pinker (1991) both provide well-known examples of this approach in the area of language, and Piaget (1967) does in the area of cognition.

In contrast, behavioral psychologists tend to resist the idea of invariant sequences in language and cognitive development, and they try to show how these complex behaviors result from basic behavioral processes (e.g., Fischer, 1980). The behavioral view has had limited impact on mainstream developmental psychology. Why has behavioral psychology had such a limited role in this domain?

We believe that one major contributing factor is that behavior analysis has yet to offer a viable account of human language and cognition that appears capable of handling many of the complexities and subtleties of these two domains. Perhaps the most famous (or infamous) behavioral attempt at dealing with human language was Skinner's (1957) *Verbal Behavior*, which was self-consciously and explicitly derived from experimental work conducted almost exclusively with nonhuman species. With its emphasis on principles wrought from nonhuman research, the book was perhaps an easy target for nonbehavioral language researchers, and it was roundly condemned for failing to address the key properties of human language (e.g., Chomsky, 1959). Even within the behavioral community the book has not gone unchallenged (e.g., Hayes & Hayes, 1992; see also Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000). Specifically, some have argued that the direct-contingency account of human verbal behavior presented by Skinner could never capture the symbolic and emergent qualities that define human language and cognition.

Within behavioral psychology, a major empirical source of this challenge has been the growing literature on derived relational responding or relational framing. Our purpose in this article is to provide a behavioral approach to this literature that, we believe, forms the basis of a new account of language and cognition (see Hayes, Barnes-Holmes, & Roche, 2001, for a booklength treatment upon which this article is based). The account, Relational Frame Theory (RFT), is firmly rooted in the philosophical contextualism of behavior analysis and draws on many of the key behavior analytic concepts and principles. Nevertheless, RFT extends well beyond the direct-contingency account of human language and cognition presented by Skinner.

Relational frame theory, like any behavioral account, is inherently developmental in orientation. A behavioral perspective is focused on streams of organism-environment interactions, considered both historically and situationally, and therefore change is assumed and expected. The challenge for the behavioral theorist has more to do with constancy. Given the important role attributed to the stream of an individual's history, why would an order and progression in development be found?

Two answers are typically given. First, a child's environment, and in particular the social context, provides a great deal of teaching in an orderly way. Second, some behaviors may be more complex than others: A child cannot run before walking. Relational frame theory adopts both of these views, but what is new is

the detailed analysis of human language and cognition that specifies why some cognitive tasks are more complex than others.

In the first half of this article we address the basic features of relational frame theory. In the second half we turn our attention to a few psychological phenomena that we believe can be explained by these processes.

II. Relational Frame Theory as an Approach to Language and Cognition

From the perspective of RFT, both language and cognition are products of a core behavioral process termed *arbitrarily applicable relational responding*. In the next subsection we outline basic relational concepts and attempt to show how they may be used to interpret some of the basic properties of human language. In subsequent sections we demonstrate how the basic relational concepts of RFT may be used to analyze more complex features of language and cognition, such as analogy, metaphor, narrative, problem solving, and self-generated instructional control.

A. THE DEFINING CHARACTERISTICS OF DERIVED RELATIONAL RESPONDING

1. Definitions

Relating means to respond to one event in terms of another. Most living organisms, given the appropriate training, are capable of responding to nonarbitrary relations among the physical properties of two or more stimuli. For example, adult rhesus monkeys can be trained to select the taller of two stimuli (which differ only in terms of height) when presented stimuli of varying heights. When later presented with a previously "correct" stimulus and a novel taller stimulus, the monkeys will select the novel stimulus, indicating that they are responding based on relational rather than absolute properties of the stimuli (Harmon, Strong, & Pasnak, 1982).

When relational responding itself is abstracted and brought under the control of contextual features other than solely the formal properties of the stimuli, the behavior is defined as *arbitrarily applicable relational responding*. Such responses can be brought to bear on any stimuli encountered in the appropriate relational context. Such responding is arbitrarily applicable because in some contexts it is under the control of cues that can be modified entirely on the basis of social whim. In an educational game, for example, a child might be told that to solve a series of logical problems, "more means less, and less means more." This example illustrates how relational functions can be *applied* in a purely *arbitrary* manner.

For the behavior of relating to be abstracted, the organism must learn to discriminate between the relevant features of the task (responding to one event in terms of another based on a contextual cue) and the irrelevant features (the actual physical properties of the related objects). The explicit training of symmetrical relations between words and their referents seen in early language training is a

good example. For a young child learning to name objects, early language training consists of a wealth of name-object and object-name interactions across an extensive range of objects and names. In essence, a symmetrical relation between the object name and the object itself is being directly trained (i.e., given name of object, select object and given object, select name of object). Reinforcement for such bidirectional responding is rich in a naturally occurring language training history. This kind of symmetrical responding occurs only in certain contexts, and a variety of cues indicate the task at hand, including the use of phrases such as "what's that?" and the juxtaposition of objects and words. A core claim in RFT is that if name-object relations reliably predict object-name relations in certain contexts, this extensive training history may be brought to bear and provide a basis of *generalized* symmetrical responding. As a result, explicit training in a new name-object relation may result in a *derived* object-name relation.

If this generalized responding is possible with relations of identity it should also be possible with many other kinds of relations, and thus a generic set of terms is needed to describe and to define these performances. Arbitrarily applicable relational responding has three defining characteristics. *Mutual entailment* describes the fundamental *bidirectionality* of relational responding. Arbitrary stimulus relations are always mutual: If A is related to B, then B is related to A. If the first relation is specified, the second is entailed: thus the term "mutual entailment." Although these relations are bidirectional, they are not always symmetrical, for example, if A is *larger* than B, then B is *smaller* than A. Arbitrarily applicable relational responding is brought to bear on the situation by contextual stimuli beyond solely the physical properties of the relata themselves (to avoid confusion, the Latin term *relata* is used to describe related events since the English term, *relates*, is obscure and has much more dominant meanings). Thus, mutual entailment applies when, in a given context, A is related in a characteristic way to B, and as a result, in that context, B is related in another characteristic way to A.

Combinatorial entailment refers to a derived stimulus relation in which two or more stimulus relations (trained or derived) mutually combine. For example, combinatorial entailment applies when, in a given context, if A is related to B and A is related to C, then B and C are mutually related in that context. For example, if hot is the opposite of cold, and caliente is the opposite of cold, then a derived mutual relation between hot and caliente is entailed (in this case, caliente and hot are the same). Combinatorial entailment must be described specifically, but (unlike mutual entailment) the derived relations may be much less precise than the original relations. For example, if A is different from B and B is different from C, we cannot say what the precise relation is between A and C and between C and A. Due to its complexity and training history, combinatorial entailment will probably emerge somewhat later in language training than mutual entailment.

The term *transformation of stimulus function* is employed when the functions of a given stimulus are modified in accordance with derived relations with other

stimuli. Transformation of function is an important feature of relational responding because it enables derived relations to have psychological content. For example, if a person is trained to select stimulus B as the "opposite" of stimulus A, and if A is given a conditioned *punishing* function, such as by pairing it with a loss of points, B should have a *reinforcing* function (without this function having to be directly trained), because it is "opposite" to the punishing A stimulus (Dymond & Barnes, 1995; Roche & Barnes, 1997; Roche, Barnes-Holmes, Smeets, Barnes-Holmes, & McGeary, 2000). Derived functions of this kind have been observed with conditioned reinforcing functions (Hayes, Brownstein, Devany, Kohlenberg, & Shelby, 1987; Hayes, Kohlenberg, & Hayes, 1991), discriminative functions (Hayes et al., 1987), elicited conditioned emotional responses (Dougher, Auguston, Markham, Greenway, & Wulfert, 1994), extinction functions (Dougher et al., 1994), and self-discrimination functions (Dymond & Barnes, 1994).

The transformation of stimulus functions must come under contextual control, just as the relational response itself is controlled by context. An example would involve any two stimuli, such as the word "apple" and an actual apple, that participate in a relational class of equivalence. An apple, of course, has several stimulus functions, including perceptual functions of taste, texture, and sight. When a person says "picture an apple," most verbally able individuals would "see" an apple in the absence of the real object. In the language of RFT, this effect can be explained as follows: Actual apples have visual perceptual functions. The word "apple" and actual apples are in an arbitrarily applicable stimulus relation (in this case, an equivalence relation or "frame of coordination"). The words "picture an" are a context in which visual functions are actualized in terms of the underlying relation. In another context (e.g., "imagine tasting an ..."), other functions (e.g., taste) could be actualized. Contextual cues, therefore, not only establish and indicate the particular conditions under which relational activity occurs, they also specify which functions should be transformed (or transferred).

In the early stages of language training, many "inappropriate" functions of stimuli participating in a derived stimulus relation will likely be transformed before reinforcement contingencies are able to establish contextual control. A young child told that "Uncle George is a snake" may be frightened that Uncle George will bite or be confused because Uncle George does not look like a snake. Eventually, however, the child (through differential reinforcement from the verbal community) will learn that in the context of saying someone is an animal, the perceptual functions should not transfer to the person unless additional cues are offered (e.g., the words "looks like").

The term *relational frame* designates a specific kind of arbitrarily applicable relational responding (Hayes & Hayes, 1989) that has three sets of properties. (a) It shows the contextually controlled qualities of mutual entailment, combinatorial entailment, and transformation of stimulus functions; (b) it results from a history of relational responding relevant to the contextual cues involved; and

(c) it is not based solely on direct nonrelational training with regard to the particular stimuli of interest, nor is it based solely on nonarbitrary characteristics of either the stimuli or the relation between them. Although the term "frame" is employed, a relational frame is always an action—"framing events relationally." Arbitrarily applicable relational responding is the generic name for behavior of this kind; a relational frame is a specific type of such responding.

2. Types of Relational Frames

Stimulus events can be related to one another in a variety of ways. These different relations are kinds of relational frames. The *frame of coordination* is perhaps the most common type of relational responding. This frame incorporates the relation of identity, sameness, or similarity. Naming is an example of the frame of coordination at its simplest. This relational frame is probably the first to be abstracted sufficiently to enable its application to become arbitrary, in part because it is the only relation in which derived and trained relations are the same, regardless of the size of the stimulus network. A frame of coordination is involved in an *equivalence class*: a set of three or more stimuli mutually related via frames of coordination (e.g., an actual apple, and the spoken and printed word "apple").

Another family of relational frames is that of *opposition*. In natural language use, this kind of relational responding involves an abstracted dimension along which events can be ordered and distinguished in equal ways from a reference point. Along the verbally abstracted dimension of temperature, for example, cool is the opposite of warm, and cold is the opposite of hot. The specific relational frame of opposition typically (but not necessarily) implicates the relevant dimension (e.g., "pretty is the opposite of ugly" is relevant to appearance). Opposition should emerge after coordination because the combinatorially entailed relation in frames of opposition includes frames of coordination (e.g., if hot is the opposite of freezing and cold is the opposite of hot, then cold is the same as freezing).

Distinction involves responding to one event in terms of its differences from another, typically also along a particular dimension. Like a frame of opposition, this frame implies that responses to one event are unlikely to be appropriate in the case of the other, but unlike opposition, the nature of an appropriate response is typically not defined. If I am told only, for example, "this is not warm water," I do not know whether the water is ice cold or boiling hot.

The family of *comparative* relational frames is involved whenever one event is responded to in terms of a quantitative or qualitative relation along a specified dimension with another event. Many specific subtypes of comparison exist (e.g., bigger/smaller, faster/slower, better/worse). Although each subtype may require its own history, the family resemblance may allow the more rapid learning of successive members. The different members of this family of relations are defined in part by the dimensions along which the relation applies (e.g., size, attractiveness, speed). Comparative frames may be made more specific by

quantification of the dimension along which a comparative relation is made. For example, the statement "A is twice as fast as B and B is twice as fast as C" allows a precise specification of the relation within all three pairs of elements in the network.

Hierarchical relations or hierarchical class memberships have the same diode-like quality of frames of comparison, but the combinatorially entailed relations differ. For example, if Bob is the father of Dave and Barb, then Dave and Barb are known to be siblings. If Bob is taller than both Dave and Barb, however, the relative heights of Dave and Barb are unknown. Hierarchical relations are essential to many forms of verbal abstraction. Other families of relations include *spatial* relations such as over/under and front/back, *temporal* relations such as before/after, and *causal/contingency frames* such as "if . . . then."

Deictic relations are those that specify a relation in terms of the perspective of the speaker such as left/right; I/you (and all of its correlates, such as "mine"); here/there; and now/then (see Barnes & Roche, 1997; Hayes, 1984). Some relations may or may not be deictic, such as front/back or above/below, depending on the perspective applied. For example, the sentence "The back door of my house is in front of me" contains both a spatial and deictic form of "front/back." Deictic relations seem to be a particularly important family of relational frames that may be critical for perspective-taking. An example is the three frames of I and YOU, HERE and THERE, and NOW and THEN (by convention we will place relational terms in all capitals when a device is needed to avoid reading the terms normally). These frames are unlike the others mentioned previously in that they do not appear to have any formal or nonarbitrary counterparts. Coordination, for instance, is based on formal identity or sameness, and "bigger than" is based on relative size. Temporal frames are particularly verbal in that they are based on the nonarbitrary experience of change, but the dimensional nature of that experience (past, present, future) must be verbally constructed. Frames that depend on perspective cannot be traced to formal dimensions in the environment at all; instead, the relationship between the individual and other events serves as the constant variable upon which these frames are based.

Various relational frames can be combined into relational networks, which in turn can be related to other relational networks. For example, if one equivalence class is the opposite of another equivalence class, then each member of the first class should be the opposite of all members of the second and vice versa. These relations can continue to expand to virtually any level of complexity. For example, many relations surround a given word, such as "car." It is part of many hierarchical classes, such as the class "noun" and the class "vehicles." Other terms are in a hierarchical relation with it, such as "windshield" and "wheel." It enters into many comparisons: "it is faster than a snail, bigger than a breadbox, heavier than a book." It is the same as "automobile," but different from a "house." The participation of the word "car" in these relations is part of the training required for

the verbal community to use the stimulus "car" in the way that it does. This complexity is managed by contextual control, and thus not all derived relations are psychologically present to the same degree when the word is used.

3. Defining Verbal Events

According to relational frame theory verbal behavior is the action of framing events relationally. Speakers speak with meaning when they frame events relationally in the act of producing sequences of stimuli. If the same formal stimuli are produced but not because the speaker has framed events relationally (e.g., when a parrot repeats what was said), then according to RFT, no verbal behavior is involved. Listeners listen with understanding when they frame events relationally (and in that sense the listener can understand both the person and the parrot). Verbal stimuli are not the products of speakers in a formal or topographical way; rather, they are stimuli that have their effects because they participate in relational frames.

B. MULTIPLE STIMULUS RELATIONS AND THE TRANSFORMATION OF FUNCTIONS IN HUMAN LANGUAGE

The relational frame approach to language contains an apparent paradox. The concept of derived stimulus relations is simple at the level of process, and yet it gives rise to amazingly complex human performances. In other words, only the result of deriving stimulus relations is complex, not the process itself. Indeed, highly complex patterns of responding have already been demonstrated in a range of laboratory studies of relational framing activity (e.g., Barnes & Keenan, 1993; Dymond & Barnes, 1995, 1996; Roche & Barnes, 1996, 1997; Roche et al., 2000; Steele & Hayes, 1991). Relational frame theory applies this complexity directly to some of the more challenging aspects of the study of language and cognition.

Relational frame theory provides a naturalistic, functional-analytic approach to verbal behavior. Words and symbols participate in relational networks, and the relational frames that participate in these networks help to establish the meaning or psychological functions of the network for the language user. The simple sentence "This is a cup" illustrates three points about this network. First, the word "cup" participates in a frame of coordination with the actual cup to which the speaker is referring. Second, the phrase "This is a" may participate in a frame of coordination with other contextual cues that control the frame of coordination itself (e.g., "same as," "goes with," "equivalent to"). Third, the word sequence in the sentence establishes grammatical relational frames, so that the listener responds appropriately to the statement. For instance, the phrase "This is a cup" is not the same as the question "Is this a cup?" The same words are used in each sentence, but the two sentences will typically have different effects upon the listener. In certain contexts, the spoken word "cup" may function in exactly the same way as either "This is a cup" or "Is this a cup?" The function of the single word "cup" in this example will

be determined by a range of possible contextual cues, such as the conversational context in which the word is uttered, the facial expression of the speaker, the vocal inflection, and so forth. From the perspective of RFT, single words, grunts, raised eyebrows, a frown, or virtually any discrete event may function as part of a relational network if the historical and current context supports the relevant relational (and thus verbal) functions.

1. Complete and Coherent Networks

The concept of a relational network provides a way to approach the organization of larger language units in everyday terms, such as sentences, paragraphs, chapters, stories, and trilogies. Relational networks can be more or less complete. By "complete" we mean the degree to which the events in the network, and the network itself, serve as a context for relational activity. At the lowest level, a network is complete if terms (serving as contextual cues) set the occasion for relational activity necessary to specify a relation between all of the events in the network. This level corresponds closely to the commonsense notion of a sentence, and thus one could say that, in terms of RFT, the lowest level of a complete relational network is a sentence (a similar view can be found in Place, 1998).

According to this view, a sentence does not have to make sense to be classified as a sentence, but it does have to form a complete network in the sense just described. This view easily incorporates distinctions between complete sentences, meaningful sentences, nonsense sentences, and nonsentences. For example, the statement "This cup is a..." would normally be defined as an incomplete sentence. According to RFT, it is also an incomplete network because the contextual cue "is a" evokes a relational response that cannot be completed (because the frame of coordination is to be applied to the cup and something that as yet remains unspecified). A point worth remembering is that meaningful networks are generally complete, but they need not be in a formal sense.

The relational frame theory of language thus described can also account for nonsense sentences, which virtually by definition have never occurred. The famous nonsense sentence "Colorless green ideas sleep furiously" provides one example. In the language of RFT, this sentence is a complete relational network, because the syntactical structure and the terms themselves serve appropriate relational functions. In other words, clear hierarchical relations can be found between "colorless," "green," and "ideas" and between "furiously" and the function word "sleep." However, the relational network is nonsense because it is composed of relations that are almost never found in the relational networks that operate in the natural language community, and thus few functions are transformed through the network (except, perhaps, in the context of poetry). For instance, "colorless" and "green" would normally participate in frames of opposition or difference, but in the foregoing nonsense sentence "colorless" is an attribute of the color "green." Sentences without a contextual function are purely arbitrary or meaningless, but

if they provide both a proper relational context and fulfillment of that relational response they are complete.

Compare the above-mentioned example with the nonsense "Jockstrap, monkey, dishwasher." Although verbal events are presented in this example, neither the sentence itself nor the larger verbal context provides contextual cues that would specify the relations to be derived from the words (i.e., we do not know what the relation is between the monkey and the dishwasher). In RFT terms, this is a nonsense sentence because it is not a complete relational network. By adding contextual cues to specify relations among the words, however, the nonsense may become a meaningful sentence. For example, "A Jockstrap IS A monkey IN A dishwasher" is a coherent network because the relations among the terms are specified, and thus relations among all of the elements can be derived. Similarly, the three words can become a coherent network by placing before them a sentence that describes how they are related, such as "List your three favorite possessions."

From this perspective, we can also consider the completeness of larger units of language. A network can be complete in a local sense, but not in a larger sense, because previous verbal material or the general verbal context specifies that a larger relational network is being formed. This network requires certain features to be complete. Suppose a parent says to a young child: "Let me tell you a story. Once upon a time there was a king who went on a quest to find a magical ring." If the parent then says nothing more, a child with even preschool verbal abilities will quickly demand "tell me the rest of the story!" In this case, the child's history with the larger relational networks called "stories" combine with cues, such as the parent's first sentence or the first phrase of the second sentence, to establish a relational function. "There was a king who went on a quest to find a magical ring" is a complete sentence because a relational context at that level is fulfilled, but it is not a complete story because the larger relational network should specify how the quest turned out. In this particular case, it does not.

C. RELATIONS AMONG RELATIONS: ANALOGIES, METAPHORS, AND STORIES

Relational frame theory can take the foregoing analysis further in tackling more complex verbal styles such as analogy, metaphor, stories, allegory, anecdote, parable, humor, and the everyday use of examples. Indeed, the analysis of analogy, metaphor, and parable is believed by some to be an important test of any theory of language and cognition (Ortony, 1993).

1. Analogy

Analogical abilities are commonly used as a metric of intelligent behavior (Sternberg, 1977) and to predict academic success (e.g., in the Graduate Record Examination), and they are believed to be prominent in scientific and mathematical abilities (e.g., Polya, 1954) and problem solving more generally (e.g., Brown, 1989).

Lipkens (1992) offered a relational frame account of analogy, in which analogy was said to involve two relational networks. In this view, two networks are deemed to be analogous (i.e., related analogically) if the trained or derived relations in one network are placed in a frame of coordination with the trained or derived relations in the other network (for empirical evidence see Barnes, Hegarty, & Smeets, 1997; Lipkens, 1992). A relevant example is as follows. A person is directly trained in a given context to relate A to B in a particular way and to relate C to D in the same way. The trained relation between A and B in this instance is analogous to the trained relation between C and D. For example, after being taught that A is opposite to B and C is opposite to D, an analogous relation can be derived between the relation "A is opposite to B" and the relation "C is opposite to D."

At the simplest level of analogy, we can describe a derived analogous relation between derived relations of mutual entailment. That is, given the same trained relation between A and B and between C and D, the relation of mutual entailment between B and A is analogous to the relation of mutual entailment between D and C. For example, after being taught that A is opposite to B and C is opposite to D, an analogous relation can be derived between the relation "B is opposite to A" and the relation "D is opposite to C."

At a more complex level, with more than one relation in each system, derived analogous relations between derived relations of combinatorial entailment can also occur. An illustrative example is as follows. The relations of combinatorial entailment between A and C are analogous to the relations of combinatorial entailment between D and F. At the same time the relations between C and A are analogous to the relations between F and D. A person, for example, may be directly trained that A is the same as B and B is the opposite of C and also that D is the same as E and E is the opposite of F. This person might well derive an analogy between the relations "C is the opposite of A" and "F is the opposite of D" and vice versa (i.e., "A is the opposite of C" and the relation "D is the opposite of F").

As we have described previously (see Section II.A.1), the transformation of stimulus functions is the characteristic that gives arbitrarily applicable relational responding its psychological significance. In terms of analogy, therefore, we can also extend this notion to include a transfer of function of one relation to another relation.

2. Metaphor

In this subsection, we consider the more complex process of metaphor. As noted earlier, analogy does not require nonarbitrary relations among the stimuli used (although such relations are often involved). Unlike analogy, however, metaphor must involve forms of relational control based in part on the verbally abstracted nonarbitrary properties of some events in the relational network. The following metaphor, for example, is often used in clinical practice, "Struggling with anxiety is like struggling in quicksand." This metaphor is used to enable the client to see

that struggling with anxiety (i.e., trying really hard to escape feelings of anxiety) serves only to make the anxiety worse in the same way that struggling in quicksand serves only to make you sink more quickly.

The relational network suggested by this example might be denoted as follows: "anxiety" (A) is to "psychological struggle" (B) as "quicksand" (C) is to "physical struggle" (D). What distinguishes this metaphorical example from the analogical examples described previously is that the relational network involves a formal relation between two apparently very different events. This formal relation is important because it transforms the functions of the related events for the listener. Specifically, deriving a relation between anxiety and quicksand could help the listener to discriminate that struggling in either case leads to formally similar effects. The functions of "anxiety" are therefore said to be transformed, and the anxious client might derive important cause/effect relations between these events, such as "struggling with anxiety will only make my situation worse." In this way, the original anxiety problem may be altered in view of the new relational network.

3. Storytelling

Relational frame theory approaches an understanding of storytelling in a manner similar to metaphor. Stories are generally less complex than metaphors primarily because stories carefully establish the relational network in one domain rather than relying as much on the existing verbal relations of the listener. Stories are built out, piece by piece, sometimes over many hundreds of pages or hours of telling. After they are built, they can readily be applied metaphorically. For example, a biblical story is used metaphorically every time someone is called a "Good Samaritan" (of course, this phrase may be used without knowledge of its biblical origin). This process difference between stories and metaphors is not absolute, because any story relies on unstated contextual and verbal features to be understood. In fact, no story is truly built *ab initio*, because all language requires a larger context. The story of the "Good Samaritan," for example, is much better understood when it is made clear how much the Samaritans loathed the Jews. Nevertheless, stories are usually less demanding of a listener in that the listener will be brought along, step by step.

Stories are cognitively simpler than metaphors for another reason. They contain or develop many nonarbitrary formal properties within the domain of the story via derived stimulus relations and the transformation of stimulus functions that they enable. Even a very young child will attend for a long time to a good story because the development of the relational network in the story itself establishes intense, coherent, and direct stimulus functions. In a good story, the child can "imagine" the prince and the princess, or the scary dragon, or the evil witch. These functions cohere with the story. Because of this property, stories are said to be "concrete"; lacking this property, analogies and metaphors are relatively "abstract."

That is, stories have reinforcing value based merely on the properties of developing complex relational networks and transforming emotional and other psychological functions in terms of these relations. More informally, such relational responding allows the listener to experience events that would be reinforcing had they actually occurred (e.g., defeating the scary dragon and winning the love of the princess). Contacting the value of analogy and metaphor appears to require more complex and subtle forms of relational responding than that involved in following a simple or obvious story.

4. Humor

A humorous story or joke involves stimulus networks which themselves serve as contextual cues for specific kinds of relations. In a "shaggy-dog" story, for example, the tale appears to go on endlessly. Although cues are provided that would lead the listener to respond to the telling as if it were a story (i.e., with a beginning, middle, and end), the story is told in excruciating detail with constant asides and irrelevant tangents, until the listener realizes that the story has no end, it is not truly about anything, and that in itself is the joke.

A slightly different process is basic to many other forms of humor in which the relational networks are complete, meaningful, and coherent, but they are incongruous. One of several types of incongruity can be observed in humor in which the story appears to be congruous until the punch line. Salient cues are provided that lead the listener to predict that the network is being completed in a particular fashion. The story involves a particular topic, approached in a particular way—or so it seems until the punch line. Suddenly and unexpectedly (thus the metaphor of a "punch"), the network collapses into incoherence, only to re-form an instant later in an unusual and often ridiculous and incongruent way. It becomes obvious that the listener "should have seen it coming" (i.e., that the dominant cues should not have been relied upon so thoroughly).

According to RFT, riddles and word puzzles rely on the same verbal properties as humor. In both cases, the contextual features needed to solve a riddle are subtle or nondominant. The difference is that the network achieved and the process of achieving it are more clever than incongruous. For example, "if you saw a basketball team chasing a baseball team, what time must it be?" Answer: "Five after nine." The number of players on a team is a nondominant feature, but it is made relevant by the request to supply a time, since times are usually stated as numbers, and with a few nonnumerical words such as "until" or "after." The relation between "chasing" and "after" supports the solution process further. The ability to solve riddles and word puzzles has long been taken to be a sign of learning, intelligence, or creativity. This apparent relationship makes sense if one thinks of the process of puzzle solution as having to do with both the degree of elaboration of relational networks, and the subtlety and flexibility of contextual control over relational responding.

5. Conclusions

The RFT account of analogy, metaphor, stories, and humor consists of relating networks of stimulus relations. This process is a critical attribute of the RFT account of language, because it appears to explain two important hallmarks that underpin the generativity, richness, and complexity of language, as commonly described. First, the ability to relate networks of stimulus relations is extraordinarily efficient and generative. Hundreds or thousands of existing stimulus relations in one domain can be brought suddenly to bear on another domain and can generate a myriad of derived relations as a result. Second, relating relations is essential in the establishment of abstract verbal terms, precisely because what is meant must be abstracted from a larger set of phenomena. From the perspective of RFT, relating relational networks to relational networks may also lie at the heart of what is commonly referred to as "remembering." Someone who is remembering is essentially telling a story. According to RFT, elaborated networks can be retained well because the entire network can often be derived when some of the trained or derived relations have become weak.

D. THINKING, PROBLEM SOLVING, AND PRAGMATIC VERBAL ANALYSIS

1. Pragmatic Verbal Analysis: The Nonarbitrary Application of Relational Frames

Truly nonarbitrary stimulus relations are hard to distinguish from verbal relations that are applied to the nonarbitrary world. An illustrative example is as follows. Two clear cups with milk are placed side by side. They are identical in shape but one is physically larger than the other. A child who is asked "which one has more?" points to the larger of the two cups. Although the pointing may look like a nonverbal event, we do not know if it is verbal or not. We would predict, for example, that a well-trained nonhuman with the relevant history with different-sized objects and the nonarbitrary stimulus relation between these particular two objects, would be able to accomplish this type of task.

However, according to RFT, a given act that could be nonverbal (as would be the case with the nonhuman subject), is not necessarily so. Even in this simple example, the child may be applying a relational frame. Specifically, selecting the larger cup in this instance would be deemed to be verbal if the behavior is in a class with behaviors that are controlled in other contexts by arbitrary contextual cues. If so, we would say that the act of relating the two cups is an arbitrarily applicable relational response that is not arbitrarily applied in this instance. When relational frames are applied nonarbitrarily, the relevant history involves both arbitrary training and nonarbitrary features of the environment. This type of verbal behavior is called *pragmatic verbal analysis* in RFT; this phrase thus refers to a form of verbal analysis of the nonarbitrary world that involves acting upon the world verbally and having the world serve verbal functions as a result.

According to RFT, the majority of what is considered nonarbitrary in human affairs is in fact verbally involved as a result of pragmatic verbal analysis. Any physical dimension that one can speak about meaningfully and can understand is, in RFT terms, functioning verbally for these speakers and listeners.

The nonarbitrary environment can, therefore, become involved in arbitrarily applicable relational responding in two ways. First, nonarbitrary features or relations may set the occasion for verbal relations, but they do not themselves enter into relational frames. For example, a very young child might point reliably to the larger of two toys when asked "which one is bigger," without the word "bigger" participating in relational frames with the relevant formal dimension or other words. The same child would, for example, be unable to answer questions such as "what is another word for bigger." The functions of the physical environment (i.e., "bigger than") that were responsible for the relational responses are not transformed, and thus cannot themselves be defined as verbal.

Second, nonarbitrary features can set the occasion for relational responding of a particular kind because the features themselves are functioning verbally. In that case, the nonverbal environment actually becomes verbal to a degree, and verbal relations act upon it. Let us return to the preceding example. The larger of the two cups containing milk described now has extremely thick sides, such that only a thin strand of milk can be seen extending down the center of the cup. In other contexts the child has placed "milk" and "heavy" into a relational frame of "difference" (i.e., "milk is not heavy"). Subsequently, the child is given the choice of the two cups again and is asked "which one has more milk?" and later "which one is more heavy." If the child points to the small cup in answer to the first question and the large cup in answer to the second, we may begin to conclude that the child's original performance was regulated by verbally abstracted nonarbitrary features of the choice situation.

2. Verbal Abstraction of Stimuli

From the perspective of RFT, the freedom from co-occurring stimulus properties (e.g., nonarbitrary features of the environment) increases enormously because stimulus attributes participate in networks of relational frames and in particular hierarchical relations such as "attribute of" or "part of." This outcome in turn allows verbally abstracted attributes to enter into other verbal relations or to serve as verbal relational cues. The importance of hierarchical relations to abstraction is emphasized explicitly in a range of early preschool activities. A Sesame Street task, for example, presents to a child four objects, three of which are identical, and asks the child "one of these things does not belong; can you tell which thing is not like the others?" Tasks such as these train identity matching and exclusion, and they support the development of frames of coordination and of distinction. A more complex task can be constructed in which all four objects are different, but three share a common attribute. This kind of training builds on the earlier training

by adding a hierarchical relation and using it as a relational cue for the derivation of frames of coordination among the three similar objects. From the perspective of RFT, this procedure amounts to a kind of relational abstraction training and should greatly enhance the impact of verbal relations on the ability to abstract features of the environment.

As verbal humans interact with their environment, events gain an ever increasing number of verbal functions of this kind. Specifically, pragmatic verbal analysis supports more complex forms of interaction with the natural environment that are "purposive" or "intentional" in the verbal sense of these terms (see section II.A.3). In other words, patterns of verbal behavior are sequenced to produce certain consequences as verbally conceived. The distinction between different forms of pragmatic verbal analysis comes from the precise use to which this verbal analytic process is put. Thinking and problem solving serve as useful examples of these verbal processes.

3. Thinking

Thinking involves the purposeful action of pragmatic verbal analysis and thus is both situated in the practical environment and controlled by direct or verbally constructed consequences. The term "thinking" tends to be used when the specific performances involved are not already established. Thinking is reflective in the sense that verbal responses are often made to verbal and nonverbal responses in the process. That is, steps are taken in the verbal analysis of a situation that serve as the occasion for additional verbal analyses. The term is more likely to be invoked (though not always) when the verbal activities involved are private, that is, observable only by the agent that performs them.

Relational frame theory thus defines thinking in a verbal sense as a reflective behavioral sequence, often private, of pragmatic verbal analysis that transforms the functions of the environment to lead to novel, productive acts. In this definition, thinking is said to transform the environment, but this transformation of stimulus functions is not random. It is an action controlled by its consequences, both verbal and nonverbal, in a situation in which relatively novel productions are required. In essence, this definition treats thinking as a particular kind of verbal problem solving, a related topic to which we now turn.

4. Problem Solving

Relational frame theory offers an account of problem solving similar to that provided for thinking. In behavioral terms, we can think of having a problem as lacking the behavior that occasions available reinforcement (Skinner, 1953) or as the presentation of situations in which behavioral obstacles are to be avoided or removed (see Reese, 1994, for an excellent analysis of various traditional models of problem solving). From a relational frame perspective, verbal problem solving can be defined as framing events relationally under the antecedent and consequential

control of an apparent absence of effective actions. Stated another way, the absence of effective actions is an antecedent for relational activity that is itself oriented toward the establishment of such actions.

Problem solving so defined is usually (but not always) a form of pragmatic verbal analysis. Some problems are almost entirely verbal, for example, solving an abstract mathematical or logical problem. Problems of this nature often begin and remain verbal and arbitrary. Most problems, however, involve the stimulus functions of the nonarbitrary environment. In these cases, verbal problem solving can be said to be pragmatic verbal analysis that changes the behavioral functions of the environment under the antecedent and consequential control of an apparent absence of effective action.

According to this definition, all forms of problem solving involve detection of a problem state, namely, the absence of effective action in a given situation. However, problem-solving strategies differ in the degree to which the problem solution is verbally discriminated. For example, *strategic problem solving* is said to occur when solutions have been identified verbally. In other words, the desired goal or purpose has been placed in a relational frame and can be compared to various verbal networks that specify the current situation and the steps that need to be taken to reach the verbally constructed goal. This activity is inherently metaphorical in the sense described in Section II.C.2, because entire sets of derived stimulus relations are being related to one another on the basis of physical properties, dimensions, or relations and their transformation.

Valuative problem solving, in contrast, applies when the lack of effective action is verbally accessible, but not to a degree that would constitute effective action. This type of problem solving involves the use of relational frames to contact possible outcomes to select from among them. In major life decisions, such as employment and marriage, the problem may be more about the selection among possible consequences as it is the means of reaching consequences that are selected. Faced with problems of this kind, a list of pros and cons may be constructed, formally or informally, to try to abstract features of the situation that might be contacted. In this case the "contact" is through the transformation of stimulus functions through a network of derived stimulus relations.

5. The Utility of Pragmatic Verbal Analysis

Pragmatic verbal analysis is an important part of verbal behavior because it is useful for many reasons. First, it enables us to delay and reduce the possibility of impulsive actions, because of the intrusion of functions that are transformed and the increased predictability of temporally extended consequences. Second, it enables us to deal with problems before they are experienced and thus to work out verbal solutions. Third, it allows us to develop overarching or general verbal strategies that are particularly useful in instances of ambiguity. Fourth, pragmatic verbal analysis can be applied to one's own behavior. In the case of problem-solving

strategies, for example, responding to one's responses may contribute to evaluating the success or failure of behavioral efforts. Fifth, by far the most important adaptive function of pragmatic verbal analysis is the construction of verbal rules that allow for stimulus and response functions to be augmented or diminished, for possible outcomes to be detected, and for lengthy behavioral sequences to be performed with regard to those possible consequences. This issue is discussed in the next section.

E. UNDERSTANDING AND VERBAL REGULATION

From the perspective of relational frame theory, pragmatic verbal analysis and relational networks facilitate verbal understanding and verbal regulation, in part by the construction of verbal rules. Relational frame theory considers an analysis of rules and rule-governed behavior as important for establishing a technical definition of understanding and verbal control.

1. Understanding Verbal Events

According to RFT, words and other events (e.g., facial expressions) function as verbal stimuli because they participate in relational frames. Verbally governed behavior is simply behavior governed by verbal stimuli. A listener's "understanding" is synonymous with the set of derived and specified relations that results for the listener from verbal stimuli. The important point is that the functional source of stimulus control is the feature that defines the listener's performance as verbally governed, rather than the form of the behavior or the form or social source of its antecedent. Hayes and Hayes (1989) simply defined rule-governed behavior as "behavior controlled by antecedent verbal stimuli" (see also Zettle & Hayes, 1982).

Verbal antecedents that are complex have the commonsense connotations of the term "rule" and for that reason are more likely to be called "rules" than "stimuli." Hayes, Gifford, and Hayes (1998) provide the following example. A person says, "I'm going on vacation in two weeks and will be gone for a month. If you water and mow my lawn each week that I am gone, the following month I will pay you \$100." This is a thoroughly specified contingency. It alters the functions of calendar time, the grass, and the implements needed to water and mow the lawn. It specifies all the major elements of a contingency: a temporal antecedent, a topographical form and the context within which it should occur, and the nature and delay of a consequence. The contingencies that are specified could not be effective through direct training, in part because greatly delayed consequences are simply not effective in the absence of verbal rules.

According to RFT, understanding this rule requires first the examination of the specific relational frames and the cues that occasioned them, and then it requires the functions of the events that are transformed in terms of these relations and

the cues that occasioned these transformations. Several core relational frames seem necessary for understanding this rule. Coordination exists between some of the terms (e.g., grass) and classes of physical events. Before-after relational frames, made more specific by numerical temporal terms, are used to specify a temporal antecedent and a consequence (e.g., begin mowing *after* 2 weeks). If-then relational frames are used to specify the contingent relations (e.g., *if* you mow and water weekly for 4 weeks, *then* you will receive \$100). Terms like "mow" alter the behavioral functions of the grass, and the transformation of stimulus functions provides these actions and contexts with some of the features of the specified consequence (e.g., approach). Clearly, many rules are more complex than this example. However, in the language of RFT, complex rules are not different at the level of process—they are simply examples of more complex relational networks and transformations of function.

As the listener follows a rule, the coordination between the original relational network as understood and the relations sustained among the specified events when the rule is followed provide an ongoing source of control over behavior. Stated loosely, the person following a rule can detect that the rule is being followed (or not), because what is being done corresponds (or not) with the rule. This monitoring does not require that the rule itself be restated, although it often is restated. Rather, the elements specified in the rule are actualized in a particular manner, and these events themselves form a relational network that corresponds (or not) to the original relational network. If the person exposed to the lawn-mowing rule in the example described above mows the lawn two and a half weeks after the rule was provided, he or she, as the listener, will be able to detect that the rule is being followed, based on a verbal comparison between what was done and what was asked.

Whenever a frame of coordination between two such networks serves as a source of control over behavior, in RFT terms the behavior can be defined as rule-governed. Most complex examples of verbal control, in which intricate verbal sequences control the behavior of listeners across large temporal gaps, seem to have this feature. However, when verbal antecedents are much simpler, and when correspondence between the rule and relevant behavior is not part of the source of behavioral control, RFT would adopt the simple concept of "verbal stimulus" rather than the concept of a "rule." In RFT, a clear distinction is made between nonverbal and verbal regulation. Rule-governed behavior is a subset of verbal regulation. The term becomes more likely to be used when the verbal antecedent is a relational network or a comparison of such networks, and especially when comparison between a verbal antecedent and the verbal construction of ongoing events is part of the source of control over behavioral regulation. Rule governance is also more likely to be used when the nonarbitrary features of the environment are abstracted and transformed and when the verbal network is generally applicable.

2. Verbal Regulation and Rule Following

Although the newly acquired verbal functions of the previously nonverbal environment allow a rule to control behavior in contexts that are sometimes radically different from those in which the rule was presented, actual verbal regulation of overt behavior does not always occur. In other words, for a number of reasons, rules may not be followed even when they are understood (in what follows, we assume that any consequence specified in a rule functions as either a reinforcer or punisher for the listener). Relational frame theory approaches this issue by analyzing the contextual features and content of an instance of rule following. First, a particular instance of not following a rule may be due to *insufficient control by nonverbal contingencies* (e.g., the behavior proscribed by the rule may not be present in the behavioral repertoire). Second, the extent of rule following may depend on the *credibility of the speaker*, one of whom (e.g., a policeman) may be more likely to produce verbal formulas that are predictive than others. Credibility can be acquired directly or verbally, and generalization of credibility from one speaker to another can be through formal or relational means. Speakers who are said to be intelligent, for example, will likely be more effective in producing rule following because these very verbal relations are seemingly predictive of rules that are accurate. Third, rule following also depends in part on the speaker's *authority and ability to mediate reinforcement*. For compliance in particular, the capacity to mediate consequences to the listener will predict rule following (e.g., young children will often follow rules provided by parents, but not by babysitters). Fourth, the *plausibility of the message* will also determine whether or not the message is followed (cf., Hovland, Lumsdaine, & Sheffield, 1949). Plausibility is undermined by the emergence of relations of distinction and opposition between the stated rule and other current and relevant relational networks actualized by the terms in the rule. Nowadays, an average listener will have been exposed to many previous rules of the form, "Cigarette smoking causes cancer" from highly credible sources (e.g., national medical leaders). Because "smoke" and "cigarettes" participate in frames of coordination or hierarchical class membership with words such as "cancer," "heart disease," and so forth, the frame of coordination specified in the rule "Smoke more cigarettes and you will live a longer and healthier life" cannot occur without a radical change in the existing relational network. Fifty years ago the case was different: stimulus networks were being elaborated, not contradicted. Given the protracted history of exposure to the earlier rules, they are more likely to be followed than the implausible rule.

3. Verbal Communication

Thus far we have tended to focus on the verbal behavior of the listener, but a complete analysis of understanding and verbal regulation requires that these be considered in the wider context of verbal communication (i.e., communication that involves relational frames). More specifically, we need to address the relationship

between speakers and listeners. Speaking with meaning and listening with understanding both involve arbitrarily applicable derived relational responding. Verbal communication from the speaker's point of view becomes verbally purposive (e.g., involving if-then relational frames) by being used to produce verbally known effects in a listener (i.e., the effects participate in relational frames). A salesperson, for instance, might adjust his or her sales pitch depending on the relational frames in which the listener participates (e.g., a prospective buyer who participates in a frame of coordination with "friendly"). In effect, the distinctions among types of verbal communication have to do with the specific purposes, contexts, and listeners involved. A parent teaching a child to talk will behave differently from a teacher teaching a child to do math or a lover trying to establish an intimate relationship. The type of communication used will differ profoundly if the listeners participate in frames of coordination or hierarchy with terms such as friendly, intelligent, psychotic, mean, stupid, and so on. Of course, such verbal repertoires need not necessarily be coordinated, and for young children they are almost certainly not (i.e., children have to learn how to manipulate listeners purposively by responding in accordance with relational frames).

F. SELF AND SELF-DIRECTED RULES

To provide a relational frame analysis of self-directed rules, we need first to address the concept of self.

1. The Concept of Self

Derived relational responding makes verbal self-knowledge important and useful (Hayes & Gifford, 1997; Hayes & Wilson, 1993). Verbal reports of one's own behavior or of the contingencies controlling it can alter the functions of both. The temporal delays experienced by a young child provide an example. Self-instructions can reduce the effect of temporal delays as a young child develops (Bentall & Lowe, 1987). A child, for example, who is able to place "waiting" into a conditional (if-then) relational frame with "getting more" will probably, via the frame of opposition, place "not waiting" in an if-then frame with "getting less." Getting a reward after not waiting may now be less reinforcing because by derivation of a relation, the consequence received after not waiting will be in a comparative relational frame with the verbally known alternative that would have been received had the child waited. If put into verbal form, this process could be expressed as something like "this is no good—this is less than I would have gotten." Of course, the child does not necessarily have to say such a thing for the behavior of waiting to occur, although about the time that relational responding is sufficiently strong to have these effects, statements of this kind will also be likely. From the perspective of RFT, the relational (cognitive) processes that allow children to regulate their own impulsive responding in this way are:

- a. Coordination and temporal/causal relations, at a minimum,
- b. the transformation of stimulus functions in terms of these relations which allows uncontacted "consequences" to have stimulus functions,
- c. a sufficient history of rule following that has previously led to successful contact with verbally constructed consequences,
- d. comparative relational responding that can lead to the next item, that is,
- e. the reduction in the relative value of immediate, small, contacted consequences over larger, delayed, verbally contacted ones via a transformation of stimulus functions, and
- f. rule following based on this verbal comparison.

From the perspective of RFT, only verbal self-knowledge of this kind will enable the individual to predict and control his or her own behavior because it leads to self-rule following. The downside of this same relational process is that derived relational responding also makes verbal self-knowledge emotional and difficult (Hayes & Gifford, 1997; Hayes & Wilson, 1993). For example, persons who have experienced a traumatic event seem to reexperience the aversiveness of the event in reporting it. This effect is not surprising because the verbal report can carry with it some of the functions of the original trauma. Without verbal relations, this effect would not occur.

2. Perspective-Taking

According to RFT, perspective-taking frames appear to be essential in the verbal construction of self. Three of these frames are of particular importance: the frames of I and You, Here and There, and Now and Then (Barnes & Roche, 1997; Hayes, 1984). As argued in section II.A.2, these frames are unlike most of the other relational frames in that they do not appear to have formal or nonarbitrary counterparts. The physical properties involved in these frames are abstracted only in the context of relational frames. Abstraction of an individual's perspective on the world, and that of others, requires a combination of a sufficiently well-developed relational repertoire and an extensive history of multiple exemplars that take advantage of that repertoire. Each time someone is asked a question such as, "How are you?" the physical environment and its formal properties will likely be different. The only constant across all such questions is the relational properties of I versus You, Here versus There, and Now versus Then. These properties appear to be abstracted through learning to talk about one's own perspective in relation to other perspectives. For example, I is always from this perspective *here*, not from someone else's perspective *there*.

The establishment of these three relational frames gives rise to responding to a range of relational networks as follows:

I-HERE-NOW	YOU-HERE-NOW	I-HERE-THEN	YOU-HERE-THEN
I-THERE-NOW	YOU-THERE-NOW	I-THERE-THEN	YOU-THERE-THEN

In everyday discourse, many phrases may be constructed from these eight relational networks; "I am here now, but you were here then" or "You were there then, but I'm here now" or "You and I are both here now, but I was here then." In actual conversation, of course, the phrases would often include or substitute words coordinated with particular individuals, places, and times. The actual words that function as relational cues are not important (as is the case for all relational framing), the generalized relational activity (similar to what psycholinguists might speak of as "deep structure") is what matters. Thus, the English speaking community probably normally establishes perspective-taking relational functions in words such I, YOU, HERE, THERE, NOW, and THEN.

3. The Three Selves

In combination with an elaborated relational repertoire, RFT would argue that perspective-taking can establish three types of self: (a) self as the content of verbal relations, (b) self as an ongoing process of verbal relations, and (c) self as the context of verbal relations (Hayes, 1995). Stated another way, verbal relations can lead to a conceptualized self, a knowing self, and a transcendent or conscious self.

a. Self as Content—The Conceptualized Self. Perspective-taking frames allow each of us to derive relations between our ongoing unified stream of behavior and a panoply of categorical concepts. We can evaluate, interpret, predict, explain, rationalize, and otherwise interact verbally with our own behavior. As soon as we can interact with ourselves verbally (in terms of the frames of I-YOU, HERE-THERE, and NOW-THEN), we begin to form a "conceptualized self." In constructing a conceptualized self, most of us try verbally to make sense of ourselves, and to put our own histories and tendencies into a coherent relational network. In short, self as content refers to the descriptive and evaluative relational networks that we construct HERE and NOW when talking about I or ME (or the behaviors of I or ME) located THERE and THEN. A middle-aged man might say (HERE and NOW), for example, that he (I) is a really bad son because he did not visit his mother before she died (THERE and THEN), but his sister (YOU or not I) is a good daughter because she visited regularly.

b. Self as Verbal Process—The Knowing Self. To understand the second type of self, we need to focus on the training that goes on in forming frames of coordination between the fuzzy set of bodily sensations, behavioral predispositions, thoughts, and environmental situations and on a name for an "emotion." Furthermore, we need to address the training involved in learning to talk about these frames of coordination in terms of the perspective-taking frames (e.g., "Oh no, I have that pounding feeling again in my chest [HERE and NOW]—I'm going to panic" [THERE and THEN]). According to RFT, humans will have emotions that nonverbal organisms do not have, because emotions are in large part

verbally constructed through complex relational networks (e.g., anxiety is not simply fear). From this perspective, therefore, human emotion generally can be viewed as a complex set of events related together through perhaps complex relational networks.

c. Self as Context—The Transcendent Self. The third aspect of self is perhaps the most difficult to explain. As indicated earlier, once the perspective-taking frames are established in the behavior of a particular person they become an inherent property of most verbal events for that person. Whenever the person talks to someone else, the talking will be from the perspective of I located HERE and NOW about events that occurred THERE and THEN. This inherent property of verbal events serves an important social and communicative function. If I ask you what you did yesterday, for example, I have to be able to trust that the report that is made is from a perspective or point of view that is consistent and predictable. In other words, the speaker is *always* I (not YOU), located HERE and NOW, and what is spoken about is always located THERE and THEN. Self as context refers to the I who is always doing the discriminating (located HERE and NOW). If I ask many, many questions of a person, the only thing that will be consistent is not the content of the answer, but the context from which the answer occurs. "I, HERE and NOW" is the self that is left behind when all the content differences are subtracted out. For this reason, this sense of perspective or self as a place from which things occur does not change once it emerges (around the age of 3 years).

A noteworthy point is that in describing these three senses of the term "self," we have focused only on the psychological "self" from the point of view of the person of interest. Clearly, the term self has many other senses, including self as a biological organism and self as an integrated behavioral repertoire, to name but two, although these selves do not appear to be *psychological* selves.

4. Self-Directed Rules

Having analyzed the self, we are now ready to deal with the issue of self-rules. In section II.D.5, we argued that applying pragmatic verbal analysis to one's own behavior is useful for permitting greater self-control and for allowing an individual to evaluate the success or failure of behavioral efforts. The most important adaptive function of pragmatic verbal analysis, however, is the construction of verbal rules that allow functions to be augmented or diminished, possible outcomes to be detected, and lengthy behavioral sequences to be performed with regard to those possible consequences. From the perspective of RFT, this is the point at which self-directed rules enter the picture.

5. Self-Directed Rules and Problem Solving

According to RFT, the average verbally sophisticated human produces vast numbers of self-directed rules during each day, some simple and perhaps facile, such

as "I must go home and feed the cat," and some more complex and fundamental, such as "I must do something meaningful with my life, and so I must make the right decision now about which career I should choose to follow, but in doing so I should be careful not to sacrifice my personal interests and intimate relationships to that career."

The cat-feeding self-rule is relatively simple. The problem is purely strategic because the outcome is specified, and presuming that all of the terms in the network possess relatively precise behavioral functions, the problem devolves into a simple matter of when and how to get home, whether cat food is available there, and so on. Such limited strategic problems involve self-rules, but the role of the self per se is limited. A spouse could just as readily specify the steps to be taken: "Take the car home on your lunch break and feed the cat, using the cat food in the refrigerator." The issues of self enter into the self-rule in this case primarily in the form of the conditions under which the self-rule is generated and of the larger patterns of behavior in which the specific problem participates. For example, the person may have noticed a feeling of guilt that the cat was home hungry; perhaps the cat was purchased to help the children learn to care for others and not feeding the cat properly would present a bad model to the children. Such neglect might conflict with the person's self-beliefs, such as "I'm a kind person." Such factors would involve the self in several ways. At the level of process, becoming verbally aware of thoughts about the cat, of feelings of guilt about the cat, or of values regarding child rearing is part of the ongoing process of self-knowledge. Actually going home to feed the cat may involve a conceptualized self ("I am never cruel to animals"). If the present analysis is correct, both of these forms of self-knowledge are dependent upon the contextual clarity that this self is known from a given perspective or point of view.

The career choice rule is more complex. From the perspective of RFT, it involves the frames of IF-THEN, I-YOU, HERE-THERE, and NOW-THEN: IF right decision (HERE and NOW), THEN I will be fulfilled in my career and personal life (THERE and THEN). In this rule, however, some of the terms in the relational network do not possess precisely controlled behavioral functions and the outcome of the problem-solving activity is not known—for example, what exactly is the "right decision," and what would the speaker define as "something meaningful"? As a result, this rule generates a type of evaluative problem, with strategic problems to be solved once an outcome goal is clearer.

The problem that emerges from the complex rule is evaluative, because additional relational framing is needed to contact possible outcomes, so as to select among them. For example, a list of pros and cons may be constructed to try to abstract features of the situation that might be contacted (e.g., "in thinking about my future career, being a doctor would be well paid, but the hours are often long and unsociable"). Iterative and metaphorical processes may also be employed to amplify the behavioral effects of different verbally constructed futures (e.g., "if

being a doctor was an animal, what animal would it be?"). No matter how the person attempts to solve this evaluative problem, the difficulties involved may be better understood in terms of the three selves outlined in Section II.F.3.

If the person simply chooses a career based largely on *self as content*, little or no contact is being made verbally with many of the important consequences of that decision. The person in the earlier example may decide to train to be a doctor because she or he thinks "doctors are good people and so becoming a doctor will make me a good person." In this case, the verbal construction of self (as content) as a good person dominates the decision, rather than the verbally constructed future of what being a doctor would actually be like. As a result, the person may well find later that he or she does not like being a doctor, thus having wasted many years training. A decision based solely on *self as process* might also be problematic. In this case, the person might verbally construct a career as a doctor and decide that "I feel like I would enjoy it." If the decision is made on this basis alone, the person may start training to be a doctor and then give up "impulsively" if at some point being a doctor no longer feels good. In short, when a person makes a "good decision," all three types of self seem likely to play a role. *Self as context* broadens the scope of the stimulus control, so that neither self as content nor self as process obtains absolute control over the final decision. In effect, self as context provides a psychological space in which the person can contact self as content (e.g., I have good eyesight and a steady hand, so I might make a good surgeon), and self as process (e.g., I really enjoy reading medical textbooks, so I might enjoy being a doctor). In this sense, a more balanced decision can be made in which a broader range of relevant issues are factored into the final choice.

6. Verbal Communication Revisited: The Verbal Other

In early childhood, as verbal relations are just forming, the action of the listener as it impacts on that of the speaker is not verbally known from the point of view of the speaker. Over time, however, as verbal behavior develops, the listener as verbally constructed by the speaker provides relational cues and serves relational functions for the speaker, along with other contextual features of the communicative episode (e.g., the purpose of the communication). The actual behavior of the listener is also verbally construed, and in extended interactions these verbal relations enter into the ongoing verbal construction of the listener. All these verbal actions participate in the regulation of the behavior of the speaker.

Perspective-taking leads to both the development of the self and an elaboration of the verbal other. Perspective-taking can establish three types of verbal other: (a) other as verbal relations about the stable content of the other, (b) other as verbal relations about the ongoing process of the other, and (c) other as verbal relations about the context of verbal relations in the other. Stated another way, verbal relations can lead to a conceptualized other, a knowing other, and a transcendent or conscious other.

The conceptualized other is the normal verbal construction of the listener. In most verbal interactions, the conceptualized other serves, to some degree, as a relational cue for the speaker's behavior. The knowing other is more fluid because it is based on a moment to moment construction of reactions of the other. This sense of the other emerges in many conversations, especially with friends or others who are willing to share their reactions openly, or with those who one knows well enough to "read" their expressions and gestures. This fluidity is relevant even to public speakers, who are said to be able to "read" their audiences. A sense of the transcendent other is relatively uncommon, occurring most often in religious, intimate, or therapeutic relations. This sense occurs when the speaker is psychologically connected to the listener as a purely conscious person. In this aspect, the speaker and listener are one, because "HERE and NOW" is imputed to be a singular event (i.e., one cannot be HERE and NOW, simultaneously, at different times and places). Perhaps for this reason, the sense of self as context is associated with a sense of the transcendent other—the two go hand in hand.

7. Summary

In Sections II.A–F, we outlined the defining features of relational frame theory at the level of process. Globally, RFT stands on three pillars: relational frames, relational networks, and abstraction from and transformation of the nonarbitrary environment. Each of these pillars is implicit in the others and all are developing simultaneously, but what is barely seen at one level becomes dominant at another. Archetypal examples of these three pillars are naming, storytelling, and problem solving, respectively.

In the rest of this article, we will attempt to explore some of the implications of relational frame theory for development and education (for its implications for other areas, including social behavior, psychopathology, and spirituality, see Hayes et al., 2001). Although substantial empirical evidence supports the major points made in the first part of this article, the same cannot be said for the next part, which is more interpretive and speculative. As a pragmatic theory, if RFT cannot lead to interesting and useful outcomes in important domains of human concern obviously relevant to human language and cognition, then it is functionally false. Nevertheless, the specific ways that relational frame theory might be applied vary and must be worked out over time. Thus, our aim here is simply to show that it is plausible that RFT might lead to new things in important domains and to suggest possible research avenues to explore.

G. PSYCHOLOGICAL DEVELOPMENT

From the perspective of RFT, relational frames enter into virtually all developmental changes and become a defining feature of complex human behavior and psychological maturity. In the current section, we present RFT analyses of

the broad categories normally found in the traditional developmental literature: cognitive, language and emotional development.

1. Cognitive Development: Intelligence

According to RFT, a small number of psychological processes are sufficient to yield the full gamut of cognitive skills (deductive reasoning, inductive reasoning, analogy, etc.). Across various intelligence tests, certain main verbal factors appear to be relatively consistent, including vocabulary, reading comprehension, the use of analogies, and verbal problem solving. In the language of RFT, the traditionally distinct verbal and numerical intelligences are both verbal, although they are distinct in several meaningful ways. We will consider each of these types of intelligence in turn.

a. Verbal Intelligence. Vocabulary is the primary factor in verbal intelligence. According to RFT, vocabulary is the context in which relational frames originally emerge and from which elaborated networks of verbal content develop, incorporating every relational frame in common use. Thus, persons with a highly elaborated vocabulary will tend also to have highly elaborated relational repertoires. Consequently, a task such as learning to spell is far less relationally rich than learning word meanings; not surprisingly, therefore, spelling performance correlates less with overall levels of intellectual behavior than does vocabulary, even though both tasks involve verbal material.

Other more complex aspects of verbal intelligence, such as reading comprehension and the use of analogies and metaphors, require that an individual relate relational networks with flexibility and relative ease. Specifically, these aspects require the learner to elaborate entire networks of stimulus relations quickly and to bring them under increasingly subtle forms of contextual control, to transform stimulus functions through entire networks, and to abstract features of the natural environment that will support and sustain relational responding. Although these relational performances are largely abstract, they are dependent on a great deal of verbal content, and a natural developmental transition is based on acquisition of that content.

All these relational abilities come together in verbal problem solving, thereby emphasizing the verbal abstraction of features in the environment and the transformation of the functions of the environment. According to RFT, verbal problem solving should be strongly correlated with other forms of relational responding, and indeed that correlation is typically obtained. From the perspective of RFT, therefore, the "global g" that underlies many intelligence tests may not be some innate biological readiness, but rather it may be the core acquisition of relational responding.

b. Numerical Intelligence. Number-series problems are a common component of tests of numerical intelligence (e.g., "1, 7, 13, 19, 25, ... What is the next number

in this series?"). According to RFT, a history of arbitrarily applicable relational responding is necessary before this type of problem can be solved correctly. The proper relational performance is acquired by presenting a child multiple exemplars of given problem types (e.g., with solutions based on other relations, such as "plus 7" instead of "plus 6" as in the answer to the example). In mathematics, the range of quantitative comparative relations is large, but the set of core relational skills is not. Mathematical relations are highly precise and focused, and the contextual control over relational performances is highly specified; thus mathematical relations depend to a relatively limited extent on verbal content.

Higher mathematics, however, has more of the features of abstract verbal skills because the contextual cues controlling the numerical relational response become more subtle and the range of specific responses becomes more varied. Nevertheless, higher mathematical skills differ from content-dominated verbal skills, because the relational frames involved are essentially "empty" and almost completely arbitrary. The quality of arbitrariness at a higher level of analysis forms a barrier to successful acquisition of mathematical relations for most children, but it removes barriers of another kind. Once mathematical relations come under abstract and arbitrary contextual control, amplification and elaboration of these skills is not dependent on significant verbal content. This relative freedom from verbal knowledge may explain why mathematics is one of those few areas (along with music, logic, or art) in which child prodigies periodically appear. These areas require highly developed abstract relational abilities, not content knowledge about real-world domains. Child prodigies in history, chemistry, or psychology, for example, do not appear because the importance of the arduously acquired content of relational networks in these areas is too great.

2. Language Development

Relational frame theory analyses can be used to account for a number of specific linguistic features that characterize language development. We will briefly consider each of these in turn.

a. Production of Novel Utterances. Children from a young age show productivity in their language acquisition, in terms of producing novel utterances and dealing effectively with novel words (e.g., Berko, 1958). According to RFT, some element of relational framing is involved in the production of novel nonsense words, facilitating the production of large numbers of derived stimulus relations, which have not been established explicitly.

b. Speech Errors. Language development is characterized by certain types of speech errors, including the use of incorrect prepositions in conjunction with verbs—"can I have any reading *behind* dinner" (example from Pinker, 1990). Relational frame theory would account for this phenomenon by suggesting that children develop somewhat loosely constrained relational frames in the early stages of

language development. For instance, prepositions denoting temporal events (e.g., before or after) and spatial events (e.g., in front of or behind) are of the same family of comparative relations and may initially participate in a more general relational frame. Due to the loosely constrained nature of these relational frames, errors of the type cited here are likely to occur. As language skills are shaped up through ongoing interactions with the verbal community, these relational frames become increasingly refined so that prepositions denoting temporal events, for example, such as "before" and "after" come to participate in more specific temporal relational frames of comparison, and in turn enter into relational frames of difference with prepositions denoting spatial comparatives, such as "behind" and "in front of" (see Barnes & Roche, 1997). Thus, the relevant relational frame will be brought to bear by the context of a particular sentence. This process of contextual refinement of relational frames into elaborate networks of relations will result in the gradual elimination of so-called "conceptual errors" in sentence construction. Furthermore, once relational frames are acquired, two of the main consequences that maintain them are sense making and coherence. From the perspective of RFT, therefore, children do not require consistent feedback on grammatically incorrect sentences for grammatically correct adult speech to develop.

c. Comprehension versus Production. Comprehension precedes production at all stages of language acquisition. Many words (e.g., "no") are understood well before they are produced, and as adults we understand many more words than we use. According to RFT, relational framing is as readily established for a listener as it is for a speaker. In one example, a child sees Daddy and is told "that's Daddy." At a subsequent point, the child's orienting toward Daddy upon hearing the name may instantiate mutual entailment and could be rewarded in the same way as if the child had said the word "Daddy." If a child is told at a later point "This is an orange, and an orange is a type of fruit," he or she may now be able to get oranges when asked to "go get some fruit." As these relational repertoires of coordination and hierarchy begin to combine, both kinds of performances help establish a relational response, and responses in one domain will generalize to the other. Furthermore, the acquisition of meaning for hearing single instances is not surprising once relational frames have been acquired.

d. U-Shaped Development. One of the key features observed in the development of grammar in young children is its U-shaped development (see Pinker, 1999). This is a characteristic of certain aspects of natural language acquisition, whereby initially good performance is replaced by incorrect performance, and then final good performance is achieved. The acquisition of the irregular past tense of the verb "eat" provides an example. Across time many children use the past-tense forms "he ate it"—"he eated it"—"he ate it" in that order. According to RFT, grammatical errors come in part from overgeneralization and inappropriate contextual

control over relational frames and the transformation of functions through them. High-frequency verbs, which are undoubtedly learned before low-frequency verbs, tend to have irregular past-tense forms (go—went, see—saw, eat—ate, etc.), and therefore the frame of coordination for each high-frequency verb is applied to a specific past-tense verb. Later, the child learns the regular form (-ed) but due to inappropriate contextual control this regular form is also coordinated with the irregular verbs. This inappropriate contextual control oversimplifies conventional (grammatical) relational networks, but eventually the appropriate forms of contextual control are established. For example, the frames of coordination within which the verbs participate (i.e., the verb meanings) come to function as contextual cues. Thus the frame of coordination between some verbs and irregular past-tense forms are reestablished, whereas all other verbs continue to participate in a frame of coordination with the regular past-tense form. Thus, errors may not occur, then begin to occur, and then fade away because relational processes may gradually emerge which make errors possible, but then fade as these processes come under better refinement and control. In short, U-shaped development is observed as the child's speech shifts from being based on minimal forms of relational framing, to relatively limited forms of relational framing, and then finally to complex forms of framing activity.

3. Emotional Development

For RFT, healthy emotional development involves learning relational networks that contain emotional terms, and learning to respond in accordance with them in ways that overlap significantly with similar networks operating in the wider verbal community. A relational frame analysis of understanding the emotions of self and others relies heavily upon the concept of the three selves described in section II.F.3.

a. Understanding the Emotions of the Self. According to RFT, as limited forms of relational framing are established in the behavioral repertoire of the young child, the bidirectional transfer of functions between self as content and self as process begin to emerge. An example of a transfer of functions from content to process might occur when a young child is told that a family relative has died and that the child should be "sad." As a result, the child might actually experience some of the psychological properties of sadness that otherwise would not have occurred without the content statement, "When a relative dies I should be sad."

According to RFT, emotional self-regulation involves the application of pragmatic verbal analysis to emotional states. A relatively simple relational network that a child might construct as a means of dealing with fear of the dark provides an example, "If I am afraid of the dark, then I'll close my eyes and pretend I'm at the seaside." According to RFT, particular classes of pragmatic verbal analysis will either strengthen or weaken depending upon how successful they are in producing appropriate forms of emotional control (e.g., reducing fear when alone in

the dark). In addition to regulating their own emotional states, children also have to learn to regulate displays of their emotions (Miller & Sperry, 1987). Relational frame theory would define emotional display rules as a class of self-directed rule control. This rule control will have been established by rules provided by significant others with well-worn phrases such as "Big boys don't cry." Obviously, the ability to control emotional expression will likely increase with the development of more complex forms of relational framing activity. This advanced form of relational framing with respect to emotions brings us to what some researchers have described as emotional intelligence.

b. Emotional Intelligence. According to RFT, emotional intelligence begins with simple elicited imitation, such as a child crying when she or he sees another child crying (i.e., global empathy; see Hoffman, 1982). At a more complex level, an increasing number of emotional terms coordinate with emotional states and increased development in the perspective-taking frames (i.e., egocentric empathy and empathy for another's feelings). At a more complex level still, the child is capable of complex forms of relational framing in which she or he can create a complex relational network (i.e., a mininarrative) concerning the events in another's life and then coordinate that relational network with an emotional term or other network (i.e., empathy for another's life condition).

H. EDUCATION

Hayes (1994) argued that overarching relational skills can be taught, and that the subsequent improvement in relational responding should lead to improved abilities in areas of cognition such as language and intelligence. Relational frame theory explicitly emphasizes the role of multiple-exemplar training in the teaching of relational skills. Examples are given in the following subsections. As will be seen, according to RFT, identifying the core behavioral units involved in cognitive skills, however simple or complex, and targeting them with appropriate multiple-exemplar training, should lead to significant improvements in the methods used in many educational settings.

1. Mainstream Education

According to RFT, explicit training with multiple exemplars is required for a child to abstract any relational frame sufficiently to allow the child to apply it arbitrarily to almost any event. Multiple-exemplar training is an inherent component of normal educational practice. Much of education involves presenting children clusters of tasks that are grouped by content (adding two numbers together, identifying the adverb in numerous sentences, etc.). From the perspective of RFT, relational skills are incidentally trained in these tasks, even though these practices were not designed specifically for this purpose. Relational frame theory is more concerned

with the cognitive skills that are being abstracted rather than with the content of the material on which this abstraction is based. Concern for these core psychological processes lies at the heart of RFT, and one of its key research aims is to harness these skills in the form of effective interventions that will bring about improved educational achievement. The RFT approach to education, therefore, is twofold. First, relational skills lie at the heart of a wide range of cognitive abilities that form the basis of educational achievement. Second, multiple-exemplar training is critical to the effective education of these cognitive skills.

Some evidence has already been obtained to support the principle that multiple-exemplar training plays a vital role in simple forms of derived relational responding such as the transformation of functions in accordance with symmetry (Barnes-Holmes, Barnes-Holmes, Roche, & Smeets, 2001a). Other evidence supports the role of multiple-exemplar training in complex forms of derived relational responding, such as responding in accordance with the relational frames of more-than, less-than, and opposite (Barnes-Holmes, Barnes-Holmes, Roche, & Smeets, 2001b). This research may have important implications for how we teach cognitive abilities to young children in the course of normal educational practice. For example, a great many early mathematical tasks involve numerous exemplars of responding in accordance with items that are the same as, more than, or less than each other ("If these two coins look the same, but this one is worth more than this one, which coin would you choose?"). The more than/less than study referred to here, for example, demonstrated that for a number of children, training in the relational frame of "same" facilitated responding in accordance with opposite. These findings might significantly improve the focus and success of common educational practice, for example, by training children to respond in accordance with same before commencing training in the more complex relations of more than and less than. A number of other possibly important research questions emerge. What are the key relational frames that underpin specific areas of educational achievement, such as reading or arithmetic? Does multiple-exemplar training in nonarbitrary relations facilitate or hinder arbitrarily applicable relational responding? What is the minimum number of exemplars required for effective application of a particular relational frame? As long as these and many other important research questions remain, we will continue to wonder why education works and how it can be improved.

2. Special Education

Relational frame theory may have a useful contribution to make to special education, for example, with developmentally delayed populations. Cognitive perspective-taking, commonly referred to as "Theory of Mind," is an essential feature of remedial educational programs for autistic children (Howlin, Baron-Cohen, & Hadwin, 1999). From the perspective of RFT, these special educational practices incidentally employ multiple exemplars that establish or facilitate relational

skills. According to RFT, cognitive perspective-taking involves increasingly complex contextual control of the relational frames of I-YOU, HERE-THERE, and NOW-THEN, and various combinations of these frames. According to RFT, a more effective means of establishing these repertoires would be to target these relational frames directly and thereby focus explicitly on the largely verbal nature of these skills.

In one RFT research program, interventions consisting of training in the three perspective taking frames established repertoires of cognitive perspective-taking *ab initio* in young children (Barnes-Holmes, Barnes-Holmes, Roche, & Smeets, 2001c). This finding has important implications for special education with autistic children. In this study, for example, the I-YOU perspective-taking frame appears to be an essential prerequisite to the HERE-THERE frame. These findings might contribute to the education of autistic children in that they suggest that these children should be trained to respond to the I-YOU frame before commencing training in the more complex relations of HERE-THERE and NOW-THEN. Deficiency in cognitive perspective-taking is a critical obstacle that impedes both the educational progress and the quality of life generally for autistic populations, and therefore warrants intense empirical and educational attention.

3. Higher Level Education: Logic

Relational frame theory predicts that multiple-exemplar training should be useful in establishing the most highly complex forms of relational responding, in areas such as logic and abstract mathematics. According to RFT, logic is essentially a relational activity that involves the derived transformation of functions in accordance with multiple stimulus relations. Let us consider deduction and, in particular, focus on the errors that nonlogicians often make when confronted with examples of reasoning with conditionals.

When faced with tasks or examples that require reasoning with conditionals, individuals usually make one of four deductions. First, individuals will often correctly make the *modus ponens* deduction: If there is a square then there is a circle; there is a square; therefore, there is a circle. Second, many individuals often fail to make the *modus tollens* deduction: If there is a square then there is a circle; there is not a circle; therefore, there is not a square (many report that nothing follows; see Evans, 1982; Wason & Johnson-Laird, 1972). Third, *denying the antecedent* is another logical error that people often make when reasoning with conditionals: If there is a square then there is a circle; there is not a square; therefore, there is not a circle (logically, there could be circle). Fourth, *affirming the consequent* is another logical error commonly made: If there is a square then there is a circle; there is a circle; therefore, there is a square (logically, there may not be a square).

From a relational frame perspective, these examples of logical and illogical reasoning may be explained, in large part, by focusing on the verbal histories that established the functions of the contextual cues contained within the premises and

conclusions. The two cues that seem most relevant for RFT are the words "if" and "then," and the key question concerns the relational functions that have been established for these words in the history of the reasoner. According to RFT, *if* and *then* often function as contextual cues that cause a listener to respond to the term that directly follows "then" as *completely dependent* upon the term that directly follows "if," although according to strict logic the dependency is not complete. For example, a child might be told by a parent: "if you tidy your room, then you will get some chocolate," implying that getting chocolate depends entirely on tidying the room. Parents would not normally use this *if-then* statement to indicate that the child might get the chocolate even if the room is not tidied, although according to strict logic, this possibility is implied by the *if-then* statement (see the third deduction). Similarly, parents would not wish to imply that eating chocolate might occur in the absence of a tidied room, although this again is implied according to strict logic (see the fourth deduction). These types of errors in strict logic, therefore, are entirely predictable given the common history to which most of us have been exposed.

Of course, not all reasoners produce the typical errors associated with the latter three previously described deductions. To explain this outcome, RFT would again look to the verbal history and current context of the reasoner. The verbal history of a sophisticated reasoner may have established multiple relational functions for the cues "if" and "then," such that in some sentences these cues establish a relation of complete dependency, and in other sentences they do not. The nature of the relational functions that are actualized within a particular instance of reasoning will, therefore, determine whether or not the reasoner reasons correctly. For example, persons who have a common history will have the common (mis)understanding of "if-then" and therefore should use it in dealing with conditionals in everyday contexts. However, if they have also been trained in formal logic, they should use the formal meaning of "if-then" in dealing with conditionals that are posed as logical problems, that is, presented in the context of logic.

III. Conclusion

Based on a relatively small array of psychological and behavioral processes, RFT allows even fairly complex verbal events, such as metaphor and humor, to be approached behaviorally. From this perspective most human actions are verbal or cognitive in part, as the functions of the nonarbitrary environment are transformed by way of derived stimulus relations. This property means that traditional behavioral interpretations of virtually all complex forms of human behavior must be reworked. Therefore, RFT is appropriately characterized as a post-Skinnerian behavior analytic theory. If RFT is correct, many important topics in behavioral psychology will need to be reworked substantially, including the nature of verbal

behavior and of cognition, the nature of self, the nature and role of self-knowledge, the nature of problem solving, the nature of intelligence, and the focus of education.

Behavioral psychologists may or may not be willing to take steps of this kind, even though the empirical basis for the approach we are presenting came from behavioral psychology. The fact remains that behavioral approaches to language and cognition have not been very successful empirically, however. We believe that RFT offers a coherent alternative worth exploring.

REFERENCES

- Barnes, D., Hegarty, N., & Smeets, P. M. (1997). Relating equivalence relations to equivalence relations: A relational framing model of complex human functioning. *The Analysis of Verbal Behavior*, 14, 57-83.
- Barnes, D., & Keenan, M. (1993). Concurrent activities and instructed human fixed-interval performance. *Journal of the Experimental Analysis of Behavior*, 59, 501-520.
- Barnes, D., & Roche, B. (1997). A behavior-analytic approach to behavioral reflexivity. *The Psychological Record*, 47, 543-572.
- Barnes-Holmes, D., Barnes-Holmes, Y., & Cullinan, V. (2000). Relational frame theory and Skinner's Verbal Behavior: A possible synthesis. *The Behavior Analyst*, 23, 69-84.
- Barnes-Holmes, Y., Barnes-Holmes, D., Roche, B., & Smeets, P. M. (2001a). Exemplar training and a derived transformation of function in accordance with symmetry. *The Psychological Record*. In press.
- Barnes-Holmes, Y., Barnes-Holmes, D., Roche, B., & Smeets, P. M. (2001b). Testing and training relational responding in accordance with "more-than," "less-than," and opposite in young children. In preparation.
- Barnes-Holmes, Y., Barnes-Holmes, D., Roche, B., & Smeets, P. M. (2001c). Analyzing the development of complex perspective-taking in young children. In preparation.
- Bentall, R. P., & Lowe, C. F. (1987). The role of verbal behavior in human learning. III. Instructional effects in children. *Journal of the Experimental Analysis of Behavior*, 47, 177-190.
- Berko, J. (1958). The child's learning of English morphology. *Word*, 14, 150-177.
- Brown, A. L. (1989). Analogical learning and transfer: What develops? In S. Vosniadou and A. Ortony (Eds.), *Similarity and analogical reasoning* (pp. 369-412). Cambridge, England: Cambridge University Press.
- Chomsky, N. (1959). A review of B. F. Skinner's *Verbal Behavior*. *Language*, 35, 26-58.
- Dougher, M. J., Auguston, E. M., Markham, M. R., Greenway, D. E., & Wulfert, E. (1994). The transfer of respondent eliciting and extinction functions through stimulus equivalence classes. *Journal of the Experimental Analysis of Behavior*, 62, 331-351.
- Dymond, S., & Barnes, D. (1994). A transfer of self-discrimination response functions through equivalence relations. *Journal of the Experimental Analysis of Behavior*, 62, 251-267.
- Dymond, S., & Barnes, D. (1995). A transformation of self-discrimination response functions in accordance with the arbitrarily applicable relations of sameness, more-than, and less-than. *Journal of the Experimental Analysis of Behavior*, 64, 163-184.
- Dymond, S., & Barnes, D. (1996). A transformation of self-discrimination response functions in accordance with the arbitrarily applicable relations of sameness and opposition. *The Psychological Record*, 46, 271-300.
- Evans, J., & St. B. T. (1982). *The psychology of deductive reasoning*. London: Routledge and Kegan Paul.
- Fischer, K. W. (1980). A theory of cognitive development: The control and construction of hierarchies of skills. *Psychological Review*, 87, 477-531.
- Harmon, K., Strong, R., & Pashak, R. (1982). Relational responses in tests of transposition with rhesus monkeys. *Learning and Motivation*, 13 (4), 495-504.
- Hayes, S. C. (1984). Making sense of spirituality. *Behaviorism*, 12, 99-110.
- Hayes, S. C. (1994). Relational frame theory: A functional approach to verbal events. In S. C. Hayes, L. J. Hayes, M. Sato, and K. Ono (Eds.), *Behavior analysis of language and cognition* (pp. 9-30). Reno, NV: Context Press.
- Hayes, S. C. (1995). Knowing selves. *The Behavior Therapist*, 18, 94-96.
- Hayes, S. C., Barnes-Holmes, D., & Roche, B. (2001). *Relational Frame Theory: A post-Skinnerian account of language and cognition*. New York: Plenum Press.
- Hayes, S. C., Brownstein, A. J., Devany, J. M., Kohlenberg, B. S., & Shelby, J. (1987). Stimulus equivalence and the symbolic control of behavior. *Mexican Journal of Behavior Analysis*, 13, 361-374.
- Hayes, S. C., & Gifford, E. V. (1997). The trouble with language: Experiential avoidance, rules, and the nature of verbal events. *Psychological Science*, 8, 170-173.
- Hayes, S. C., Gifford, E. V., & Hayes, G. J. (1998). Moral behavior and the development of verbal regulation. *The Behavior Analyst*, 21, 253-279.
- Hayes, S. C., & Hayes, L. J. (1989). The verbal action of the listener as a basis for rule-governance. In S. C. Hayes (Ed.), *Rule-governed behavior: Cognition, contingencies, and instructional control* (pp. 153-190). New York: Plenum.
- Hayes, S. C., & Hayes, L. J. (1992). Verbal relations and the evolution of behavior analysis. *American Psychologist*, 47, 1383-1395.
- Hayes, S. C., Kohlenberg, B. K., & Hayes, L. J. (1991). The transfer of specific and general consequential functions through simple and conditional equivalence classes. *Journal of the Experimental Analysis of Behavior*, 56, 119-137.
- Hayes, S. C., & Wilson, K. G. (1993). Some applied implications of a contemporary behavior-analytic account of verbal events. *The Behavior Analyst*, 16, 283-301.
- Hoffman, M. L. (1982). Development of prosocial motivation: Empathy and guilt. In N. Eisenberg (Ed.), *The development of prosocial behavior* (pp. 281-314). New York: Academic Press.
- Hovland, C. L., Lumsdaine, A. A., & Sheffield, F. D. (1949). *Experiments on mass communication*. Princeton, NJ: Princeton University Press.
- Howlin, P., Baron-Cohen, S., & Hadwin, J. (1999). *Teaching children with autism to mind-read: A practical guide*. Chichester: Wiley.
- Lipkens, G. (1992). Analogical reasoning as arbitrarily applicable relational responding. Unpublished manuscript, University of Nevada, Reno.
- Miller, P. J., & Sperry, L. L. (1987). The socialization of anger and aggression. *Merrill-Palmer Quarterly*, 33, 1-31.
- Ortony, A. (1993). *Metaphor and thought*. Cambridge, England: Cambridge University Press.
- Piaget, J. (1967). *Six psychological studies*. New York: Vintage.
- Pinker, S. (1990). Language acquisition. In D. N. Osherson and H. Lasnik (Eds.), *An invitation to cognitive science, Vol. 1. Language* (pp. 199-241). Cambridge, MA: MIT Press.
- Pinker, S. (1991). Rules of language. *Science*, 253, 530-535.
- Pinker, S. (1999). *Words and Rules: The Ingredients of Language*. New York: Basic Books.
- Place, U. T. (1998). Sentence and sentence structure in the analysis of verbal behavior. *Analysis of Verbal Behavior*, 15, 131-133.
- Polya, G. (1954). *Mathematics and plausible reasoning: Volume 1, Induction and analogy in mathematics*. Princeton, NJ: Princeton University Press.
- Reese, H. W. (1994). Cognitive and behavioral approaches to problem solving. In S. C. Hayes, L. J. Hayes, M. Sato, and K. Ono (Eds.), *Behavior analysis of language and cognition* (pp. 197-258). Reno, NV: Context Press.
- Roche, B., & Barnes, D. (1996). Arbitrarily applicable relational responding and sexual categorization: A critical test of the derived difference relation. *The Psychological Record*, 46, 451-475.

- Roche, B., & Barnes, D. (1997). A transformation of respondently conditioned function in accordance with arbitrarily applicable relations. *Journal of the Experimental Analysis of Behavior*, 67, 275-301.
- Roche, B., Barnes-Holmes, D., Smeets, P. M., Barnes-Holmes, Y., & McGeady, S. (2000). Contextual control over the derived transformation of discriminative and sexual arousal functions. *The Psychological Record*, 50, 267-292.
- Skinner, B. F. (1953). *Science and human behavior*. New York: Free Press.
- Skinner, B. F. (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.
- Steele, D. L., & Hayes, S. C. (1991). Stimulus equivalence and arbitrarily applicable relational responding. *Journal of the Experimental Analysis of Behavior*, 56, 519-555.
- Sternberg, R. J. (1977). *Intelligence, information processing, and analogical reasoning: The componential analysis of human abilities*. Hillsdale, NJ: Erlbaum.
- Wason, P. C., & Johnson-Laird, P. N. (1972). *Psychology of reasoning: Structure and content*. Cambridge, MA: Harvard University Press.
- Zettle, R. D., & Hayes, S. C. (1982). Rule-governed behavior: A potential theoretical framework for cognitive-behavior therapy. In P. C. Kendall (Ed.), *Advances in cognitive-behavioral research and therapy* (pp. 73-118). New York: Academic Press.

THE CONTINUITY OF DEPRESSION ACROSS THE ADOLESCENT TRANSITION

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REFERENCES

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