Symbolic Thought and Communication from a Contextual Behavioral Science Perspective

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In the current chapter we present a brief summary of how contextual behavioral science has approached the topic of symbolic thought and communication. We begin by considering how behavioral psychology defined and studied symbolic relations prior to the seminal research of Murray Sidman (1994) and his colleagues on stimulus equivalence in the 1970s and '80s. Specifically, up until this time behavioral psychology more or less assumed that symbolic thought and communication functioned in broadly similar ways for both human and non-human species (Skinner, 1957), and *all* behavior involved the same behavioral processes (e.g., classical and operant conditioning). Skinner himself appeared to break with this view in the 1960s when he proposed the concept of instructional control in explaining human problem solving, but the symbolic nature of instructions remained ill-defined. Sidman's work in the 1970s helped bring some clarity to the symbolic nature of instructional control, and this was further developed and elaborated by the work of Steven C. Hayes in the 1980s under the rubric of Relational Frame Theory (RFT). The evolution of the ability to engage in relational framing was very much understated in the seminal volume in this area (Hayes, Barnes-Holmes, & Roche, 2001a), but more recent conceptual analyses have developed the account in this area. The current chapter aims to provide an overview of the behavior-analytic approach to human symbolic thought and communication, and its evolution, as viewed predominantly through the lens of RFT.

Verbal Behavior

In his 1957 book *Verbal Behavior*, Skinner defined language as any behavior by a speaker that is reinforced through the mediation of a listener, which in turn gives rise to multiple classes of verbal behavior. These classes included mands, echoics, textuals, transcription, dictation, intraverbals, tacts, extended tacts, and autoclitics. While these concepts have been used extensively in remedial education programs (e.g., Lovaas, 1981), Skinner's text did not generate a vibrant and productive program of basic research on human language per se. One likely reason for this is that many of the verbal operants he defined could be studied in the non-human laboratory. For example, when a rat learned to press a lever for food in an operant chamber, the lever press could be considered a type of mand, if the lever press was reinforced by an individual who was trained by a verbal community to do so (Hayes, Blackledge, & Barnes-Holmes, 2001b). Given this conceptual view, there was little motivation for behavioral researchers to study language in the *human* animal. This motivation would only emerge when key differences between human and non-human behavior were identified.

While the influence of Skinner's operant analysis of verbal behavior remained limited, even in behavioral psychology, some behavioral psychologists, including Skinner, did pursue broader features of human language. In the early years, this was focused on so-called instructional control or rule-following. Rules were first defined by Skinner (1969) as contingency-specifying stimuli. That is, *"we tend to follow rules because previous behavior in response to similar verbal stimuli has been reinforced"* (p. 148). Indeed, many studies on instructional control and rule-following emerged in the literature in the 1970s and '80s. For example, research showed that human infants only begin to show adult-like responding on schedules of reinforcement from the age of 24 months and the likely source of this developmental change could be traced to the ability to generate simple rules that could be

used to regulate one's own behavior (e.g., Bentall, Lowe, & Beasty, 1985). Researchers also demonstrated that rule-governed behavior could be insensitive to changes in reinforcement contingencies (e.g., Hayes, Brownstein, Haas, & Greenway, 1986). Although many studies on rule-governed behavior emerged in the literature, a precise functional definition of instructional control remained elusive. As noted above, Skinner defined rules as contingency specifying stimuli, but failed to define specification in functional terms. Research on derived relational responding provided this much-needed definition.

Stimulus Equivalence and Relational Frame Theory

In the early 1970s, Murray Sidman reported a behavioral effect in his research on the acquisition of basic reading skills in individuals with learning disabilities. This effect came to be known as *stimulus equivalence,* and it eventually provided the basis for a behavior-analytic account of symbolic thought and communication in humans. The basic stimulus equivalence effect involved training a series of matching responses that could easily be explained in terms of direct reinforcement contingencies, but additional *emergent* matching behaviors were frequently observed that were difficult to explain in terms of established behavioral principles. For example, a child who was taught to match a spoken word to a picture, and a spoken word to a printed word, was able to spontaneously match the printed word to the picture, without any further reinforcement (see Sidman, 1994 for a book-length treatment). Other studies, using non-human species, including "language-trained" higher-primates, repeatedly failed to demonstrate this emergent effect (e.g., Dugdale & Lowe, 2000). When stimuli became related in this way, they were said to form equivalence classes or relations. Critically, Sidman argued that the formation of such relations may provide a behavior-analytic model of symbolic or referential relations in human language. In other words, Sidman provided the first definition of semantic meaning in behavioral psychology, which suggested that it may be unique, or at least highly dominant, in humans. As we shall see subsequently, this approach to semantic

relations provided the basis for a behavioral account of specification that was previously missing in the literature on rule-governed behavior.

The extension of Sidman's seminal work to rule-governed behavior came with Hayes and Hayes' (1989) approach to stimulus equivalence as an operant class of *arbitrarily applicable relational responding (AARR)*. According to this view, a history of reinforced relations among stimuli established particular patterns of over-arching or generalized relational operants, referred to as relational frames (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000). For example, imagine a young child who learns to point to the family dog upon hearing the word "dog" and to say "dog" when someone else points to the dog. The child might also learn to say "Rover" when asked, "What is the dog's name?" Each of these naming or relational responses would be explicitly prompted, shaped, and reinforced initially by the verbal community. Across many such exemplars, involving other stimuli in other contexts, the operant class of coordinating stimuli in this way becomes abstracted, such that direct reinforcement for all of the individual components of naming are no longer required when a novel stimulus is encountered. So, if a child was shown a picture of an aardvark and the written word, and was told its name, the child may later say "That's an aardvark" when presented with a relevant picture or the word, without any prompting or direct reinforcement for doing so. In other words, the generalized relational operant of coordinating pictures, spoken, and written words is established, and directly reinforcing a subset of the relating behaviors (spoken word-picture and spoken word-written word) "spontaneously" generates the complete set (e.g., picture-written word).

When a pattern of generalized relating is established, that class of behavior is defined as always under some form of contextual control. Contextual cues are thus seen as functioning as discriminative for different patterns of relational responding or different relational frames. The cues acquire their functions through the types of histories described above. Thus, for

example, the phrase “that is a”, as in “*That is a* dog”, would be established across exemplars as a contextual cue for the complete pattern of relational responding (e.g., coordinating the word “dog” with actual dogs). Once the relational functions of such contextual cues are established in the behavioral repertoire of a young child, the number of stimuli that may enter into such relational response classes becomes almost infinite (Hayes et al., 2001a).

The core analytic concept of the relational frame proposed by Hayes and Hayes (1989) involved three common properties: mutual entailment; combinatorial entailment; and the transformation of stimulus functions. First, mutual entailment refers to the relation between two stimuli. For example, if you are told A *is the same as* B, you will derive that B *is the same as* A. That is, the specified A *is the same as* B relation mutually entails the (symmetrical) B *is the same as* A relation. Second, combinatorial entailment refers to the relations among three or more stimuli. For example, if you are told A *is more than* B and B *is more than* C, you will derive that A *is more than* C and C *is less than* A. That is, the A-B and B-C relations combinatorially entail the A-C and C-A relations. Third, the transformation of stimulus functions refers to the “psychological content” involved in any instance of derived relational responding. For example, if A *is less than* B, and a reinforcing function is attached to A, then B will acquire a greater reinforcing function than A, even though the function was directly attached to A and not B. This general approach to human language and cognition became known as *Relational Frame Theory (RFT)*, and facilitated a behavior-analytic account of key elements of language, such as meaning, reference, and understanding (Barnes & Holmes, 1991), which led to a book-length treatment by the turn of the millennium (Hayes, et al., 2001a).

Whereas Sidman’s work on equivalence relations focused on what may be considered the most basic type of symbolic relation, RFT developed and expanded the conceptual analysis in an effort to cover the full richness and complexity of human language and

cognition in whole cloth. Equivalence relations were defined as just one type of symbolic relation with numerous other relations (defined above as relational frames) also being identified and studied from the early 1990s until the present day. These patterns of relational frames (e.g., coordination, opposition, distinction, comparison, spatial frames, temporal frames, deictic relations, and hierarchical relations) have been analyzed across numerous experimental studies, and across a variety of procedures. Some research has also explored the transformation of functions (see Hughes & Barnes-Holmes, 2016a, for a recent review). In addition, empirical evidence supported the core RFT postulate that exposure to multiple exemplars during early language development is required to establish these relational frames (see Hughes & Barnes-Holmes, 2016b). As such, the argument that relational frames may be thought of as overarching or generalized relational operants gained considerable traction.

Generativity and Complexity of Human Language

The seminal text on RFT also used the basic operant unit of the relational frame to provide functional-analytic accounts of specific domains of human language and cognition, and rule-governed behavior was one of these domains. According to RFT, a rule or instruction may be considered a network of relational frames typically involving coordination and temporal relations with contextual cues that transform specific behavioral functions. Take the simple instruction, for example, “If the light is green then go”. This rule involves frames of coordination between the words “light”, “green”, and “go” and the actual events to which they refer. In this sense, the technical definition of the frame of coordination, outlined above, provides the functional-analytic definition of “specification” that was missing from earlier accounts of rules or instructions. In addition, the words “if” and “then” serve as contextual cues for establishing a temporal relation between the green light and the act of going (i.e., first green light then go). The relational network thus transforms the functions of the green light

itself, such that it now controls the act of "going" whenever an individual who was presented with the rule observes the green light being switched on.

Additional conceptual developments generated experimental and applied analyses of verbal rules or instructions in terms of complex relational networks composed of multiple relational frames, analogical and metaphorical reasoning in terms of relating relational frames, and problem solving in terms of increasingly complex forms of contextual control over relational framing itself. To illustrate, consider the example of an analogy, *pear is to peach as cat is to dog*. In this example, there are two relations coordinated through class membership (controlled by the cue *is to*) and a coordination relation that links the two coordination relations (controlled by the cue *as*). From an RFT point of view, analogical reasoning thus involves the same psychological process involved in relational framing more generally (i.e., AARR), but applied to framing itself (see Stewart & Barnes-Holmes, 2001a).

RFT research has also focused, both conceptually and empirically, on the role of human language in perspective-taking. For instance, for RFT, basic perspective-taking involves three deictic relations: the interpersonal relations I-YOU, spatial relations HERE-THERE, and temporal relations NOW-THEN (Barnes-Holmes, 2001). The core postulate here is that as children learn to respond in accordance with these relations, it allows them to locate the self in time and space and in relation to others. Imagine a very young child who is asked "What did you have for lunch today?" while they are eating the evening meal with their family. If the child responded simply by referring to what a sibling is currently having for dinner, they may well be corrected with "No, that's what your brother is eating now, but what did you eat earlier today?" In effect, this kind of on-going refinement of the three deictic relations allows the child to respond appropriately to questions about their own behavior in relation to others, as it occurs in specific times and specific places (McHugh, Barnes-Holmes, & Barnes-Holmes, 2004).

At this point we could continue, providing many examples of ways in which RFT has been used to provide functional accounts and approaches to various domains in psychology, including intelligence, implicit cognition, prejudice, etc. (Hughes & Barnes-Holmes, 2016b). At a more general level, however, it may be useful to consider a recent framework that has been proposed which highlights the potential that RFT has to take a simple human ability called AARR and to construct increasingly complex analyses of the ability to engage in symbolic thought and communication. Specifically, researchers have recently offered what they describe as a multi-dimensional, multi-level (MDML) framework for analyzing AARR. According to this framework, AARR may be conceptualized as developing in a broad sense from mutual entailment, to simple networks involved in frames, to more complex networks involved in rules and instructions, to the relating of relations and relational networks involved in analogical reasoning, and finally to relating relational networks. The framework also conceptualizes each of these levels as having multiple dimensions: *derivation, complexity, coherence,* and *flexibility* (Barnes-Holmes, Barnes-Holmes, Hussey, & Luciano, 2016).

In simple terms, *derivation* refers to how well practiced a particular instance of AARR has become. Specifically, the first time an AARR is emitted, derivation will be high, but across repeated instances of that class, level of derivation will fall. *Complexity* refers to the level of detail or density of a particular pattern of AARR. As a very simple example, an AARR involving mutual entailment alone is less complex than an AARR involving combinatorial entailment. *Coherence* refers to the extent to which an AARR is generally predictable based on prior histories of reinforcement. For example, the statement "A mouse is larger than an elephant" would typically be seen as lacking coherence with the relational networks that operate in the wider verbal community. Note, however, that such a statement may be seen as coherent in certain contexts (e.g., when playing a game of 'everything is opposite'). *Flexibility* refers to the extent to which a given instance of AARR may be

modified by current contextual variables. Imagine a young child who is asked to respond with the wrong answer to the question “Which is bigger, a mouse or an elephant?” The easier this is achieved, the more flexible the AARR.

A detailed treatment of the MDML is beyond the scope of the current chapter. The critical point to appreciate, however, is that RFT may be used to generate a conceptual framework that begins with a very simple or basic scientific unit of analysis, the mutually entailed relational response. From an RFT perspective, this unit is not synonymous with naming in a traditional analysis of symbolic meaning and communication, but it is seen to be intrinsic to it in a psychological analysis of naming as an act in context. In other words, the concept of mutual entailment strips bare the informal concept of naming, leaving nothing but the raw relational properties of the psychological or behavioral process. What the MDML adds to this conceptual analysis is a framework for considering what appear to be the key dimensions along which mutual entailment as a behavioral process may vary (e.g., mutually entailed responding may vary in terms of coherence, flexibility, complexity, and derivation). In addition, the MDML emphasizes that more complex units of analysis may evolve from mutual entailment, such as the simple relational networks involved in relational frames, more complex networks involving combinations of frames, the relating of relational frames to relational frames, and ultimately the relating of entire complex relational networks to other complex relational networks. And in each case, these different levels of AARR may vary along the four dimensions listed above, and perhaps others that remain to be identified.

When RFT is viewed through the lens of the MDML, the potential power that it may have to analyze the complexities and dynamics of human symbolic thought and communication quickly become apparent. In much the same way that mutual entailment provides a purely relational approach to understanding naming as a language process, the concepts of frames, networks, relating relations, and relating relational networks provide

purely relational analyses of increasingly complex human language phenomena. As outlined above, for example, the concept of relating relations appears to be relevant to, if not synonymous with, analogical reasoning. Similarly, relating relational networks may be relevant to the telling and understanding of complex stories (Stewart & Barnes-Holmes, 2001b).

At this point, it must be acknowledged that the MDML is a relatively new development in the RFT literature, but it does coincide with another relatively new development in the theory, which aims to situate this behavioral approach to human language and cognition within the broader discipline of evolutionary science. As we will outline below, for example, considerable attention has been given recently to how the human propensity for cooperation may have been instrumental in the evolution of mutual entailment as the core or most basic unit of human symbolic thought and communication.

RFT and Evolutionary Science

As a behavioral account of human language and cognition, RFT has traditionally focused on the learning experiences that occur within the lifetime of the individual. This focus is understandable because the theory has very much been driven by a pragmatic concern with predicting and influencing human language and cognition itself in clinical, educational, and wider social settings. On balance, it has always been recognized that the ability to acquire the relational operants identified by RFT with relative ease is likely to have emerged from a particular evolutionary history, but until recently work in this area has been limited (Hayes & Sanford, 2014; Wilson, Hayes, Biglan, & Embry, 2014).

On the one hand, it appears that language required a massive evolutionary leap, and considerable attention has been devoted to explaining the potential relationship between the many examples of non-human communication (e.g., mating calls, the honey bee dance, facial expressions in primates) and the richness and complexity of human language (see Hauser, et

al., 2014). On the other hand, if the focus is on the ability to AARR, rather than the ill-defined concept of human language, the scientific challenge appears more manageable. Specifically, it seems wise to start with the relatively simple question 'How did the behavior of mutual entailment (under contextual control) emerge so strongly in the human species?' If we can answer this question, perhaps more complex questions about the full richness of human symbolic thought and communication may be addressed, in part, through explaining how mutual entailment facilitates combinatorial entailment, the growth of more complex relational responding, and so forth.

In what follows we have adopted exactly this strategy. Of course, what we offer must remain wildly speculative, but the aim here is to *begin* a meaningful dialog with experts in other domains, and in particular evolutionary science, rather than seek to provide some final answer to what is an incredibly complex question (i.e., How did human symbolic thought and communication evolve?). Wilson (2007) summarized human evolution as the "three C's": cognition, culture, and cooperation. Although all three of these are embedded within early renditions of RFT, it appears that cooperation was somewhat underplayed.

According to the first book-length treatment of RFT, Hayes et al. (2001) suggested that mutual entailment in a listener could improve avoidance of predators even if entailment was not present as part of a speaking repertoire. In addition, it was suggested that this small difference could give rise to a group of listeners who were then capable of reinforcing mutually entailed responses in a speaking repertoire. This account, of course, relies on the evolution of mutual entailment as an adaptation of cognition in listeners, which then spreads to speakers and throughout the culture, thereby leading to increased social cooperation. In contrast to this account, Hayes and Sanford (2014) have recently suggested that it is more evolutionarily viable to suppose that cooperation came first. Indeed, as Hayes and Sanford point out, there is a vast amount of empirical data to support the idea that cooperation was

established by multilevel selection of cooperation itself, because it offered advantages for human group competition, which occurred alongside the cultural suppression of individual selfishness.

From this perspective, cooperation that originally began with pointing and grunting, for example, provided humans with highly important behavioral skills, such as, social referencing and joint attention, which have been recognized as important behavioral pre-cursors for the psychological development of AARR in the lifetime of the individual (see Pelaez, 2009). Critically, these pre-cursors increase the likelihood that cooperation will be reinforced, as is the case with young children. For example, if a young child says "eh" while looking at and trying to reach for a toy, the mother will reinforce this cooperation by giving the toy to the child. Hayes and Sanford (2014) conclude: "The entire exchange will build cooperation, perspective taking, and joint attention as patterns that are maintained within the group because it is a functionally useful communication exchange. If we unpack this highly likely sequence it means that in the context of high levels of cooperation, and adequate skills in joint attention, social referencing, and perspective taking, *any characteristic vocalization in the presence of a desired object would likely lead to reinforced instances of symmetry or mutual entailment"* (p. 122). And once mutual entailment evolves, extended cooperation further facilitates the adaptation of the species, by allowing for more complex adaptations of this functional unit, such as combinatorial entailment. Ultimately, increasing complexity in AARR would likely facilitate the use of symbols and the ability to problem-solve in the natural and social environment. According to this more recent RFT account of the evolution of AARR, cooperation leads to more useful forms of cognition, rather than cognition leading to more useful forms of cooperation.

Once the basic unit of AARR is established, it allows for the evolution of more complex relational operant units, such as relational networks, the relating of relations (e.g.,

analogy and metaphor), and the relating of entire relational networks to other relational networks (e.g., extracting common themes from different narratives). In effect, this set of relational abilities evolved into complex forms of communication and problem-solving in only a few thousand years. Indeed, it could be argued that the ability to AARR is a defining characteristic of the human species, and allows us to predict and influence our environment in increasingly sophisticated and powerful ways. From this perspective, once AARR evolves, the natural environment becomes thick and rich with stimuli that are symbolic, rather than direct-acting, as they appear to be for non-human species. For example, symbolic stimuli can be used to form new meanings and to construct new realities detached from direct experience (e.g., fiction, poetry, metaphor). As such, the transmission of behaviors, from one individual to another and from one generation to the next, is increased dramatically. This ultimately leads to greater variation in behavior and the potential for the acquisition of new behaviors that serve to increase survival at multiple levels -- individuals, groups, and species.

Summary and Conclusions

In adopting the RFT approach we have outlined here, the question is not how human language evolved, but rather how mutual entailment as the basic unit of AARR evolved in the first instance, and then how more complex units of AARR likely evolved from mutual entailment, thus allowing for the emergence of grammar and syntax, complex rule-following, analogy, metaphor, and story-telling. This approach could be seen as a gross oversimplification of the processes involved in the evolution of human language, but if we cannot explain how a simple behavior such as mutual entailment evolved, there seems little hope in explaining the evolution of human language in whole cloth. As noted above, the foregoing remains highly speculative, but is does serve to highlight potentially important areas of overlap between evolution science and contextual behavioral science. It is our hope that the current chapter helps to facilitate a fruitful dialog in this regard.

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