TEACHING DERIVED RELATIONAL RESPONDING TO YOUNG CHILDREN

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Although it employs a relatively small array of behavioral concepts and processes, Relational Frame Theory provides an account of how some of the most complex verbal events can be understood behaviorally and may be established systematically. In the current paper, the findings from a research agenda that has clear and widespread implications for educational practice are summarized. This exciting research initiative consists of studies in which both simple and relatively complex forms of derived relational responding have been targeted for assessment and remediation using interventions driven by Relational Frame Theory. A key theme running throughout the diverse content covered in this research program is the role of a basic understanding of relational responding in the teaching of critical cognitive or verbal repertoires in children. The article argues that identifying the core relational units involved in these cognitive skills, and targeting their fluid and flexible development with appropriate training, will lead to significant improvements in the methods used in many educational settings.

INTRODUCTION OR STUDYING LANGUAGE AND COGNITION FROM A BEHAVIOURAL PERSPECTIVE

The study of language and cognition constitute core and interconnected areas in the history and literature of developmental psychology (Bee, 2000). This emphasis emerged not only from the critical role played by these skills in human development overall, but because of their pivotal place in mainstream and special educational contexts. The traditional behavioral account of language has been based almost entirely on Skinner's Verbal Behavior (1957), and its application to programs of language intervention has been widespread (Sundberg & Michael, 2001).

In stark contrast, behavioral researchers have devoted little or no attention to issues of cognition as behavior per se, from either basic research or applied perspectives, and Skinner's analysis of verbal behavior appeared to do little to stimulate behavioral interests in these phenomena. In recent years, however, behavioral researchers, particularly those working under the rubric of Relational Frame Theory (RFT), have adopted what has been referred to as a post-Skinnerian account of verbal behavior that addresses human language and cognition equally and similarly (Hayes, Barnes-Holmes, & Roche, 2001).

According to RFT, arbitrarily applicable relational responding is the core process involved in human language and cognitive abilities from the simplest act of naming a toy to the understanding of the most complex and intricate trilogy. In the first half of the current paper, the core features of RFT are described, and these form the conceptual basis of the empirical work and evidence described in the latter part of the article. In Part 2, a research program containing a series of studies driven by RFT in which complex repertoires of arbitrarily applicable relational responses were established in populations including young normally developing and autistic children are reviewed. The paper overall argues that as well as offering a coherent behavioral and functional account of human verbal and cognitive processes, RFT offers the possibility of harnessing these processes in programs for teaching and remediating deficits in language and cognition (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2001).

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PART 1

RELATIONAL FRAME THEORY

Defining Arbitrarily Applicable Relational Responding

The process of relating may be simply defined as responding to one event in terms of another. For example, rhesus monkeys may be trained to respond relationally to, and thereby select, the taller of two stimuli (Harmon, Strong, & Pasnak, 1982; Reese, 1968). According to RFT, this type of relational response is controlled entirely by the nonarbitrary or formal properties of the stimuli (i.e., one stimulus is actually physically taller than the other), and as such it is not a verbal process. In contrast, RFT argues that arbitrarily applicable relational responding is a verbal process, because it is under the control of contextual features beyond the formal properties of the related stimuli or events. For illustrative purposes, consider the following example.

If you are told that a one euro coin is worth more than a fifty cent coin, then as a verbally-sophisticated individual you would be able to derive that the fifty cent coin is worth less than the one euro coin. However, if you actually examined both coins, you would see that the fifty cent coin is in fact larger than the one euro coin. In this case, therefore, the more-than and less-than relations as stated between the two coins are arbitrarily applied because they are not based on physical features of the related stimuli (indeed they are the opposite). In fact, RFT argues that arbitrarily applicable relational responses may be brought to bear on any stimuli presented in an appropriate context (Hayes, Fox, Gifford, Wilson, Barnes-Holmes & Healy, 2001). Consider another example of a children's game in which the participants are instructed to "Let's pretend that big is small and small is big." In this simple example, the relational functions of big and small are applied arbitrarily, and again they are the reverse of the actual physical properties of the stimuli to be related.

In learning to play games such as in the previous example, the relational performances of children even at a relatively early age must come under appropriate forms of contextual control. This type of control is necessary if they are to discriminate correctly between the features of the task relevant on a particular occasion (i.e., responding relationally to events in the presence of appropriate contextual cues), and those features that are irrelevant (e.g., responding to the physical properties of the stimuli). According to RFT, the relevant history that gives rise to this type of discrimination commences in the very earliest natural language training when bidirectional stimulus relations between words and objects are established.

In their on-going natural language interactions, young children encounter a multitude of exemplars of name-object and object-name relations. For example, when shown the object teddy, the caregiver will utter the word "teddy" (i.e., the object-name relation -- teddy → "teddy" -- is explicitly trained) and reinforcement will be provided when the child orients towards the teddy. Similarly, the primary caregiver may say "Juice" and reinforcement will be provided when the child orients towards the object containing juice (i.e., once again an object-name relation is explicitly trained). Similarly, a caregiver may explicitly train name-object relations. For example, the caregiver may ask the child "Where's the teddy" and reinforcement will provided for orienting towards the teddy. Given this history of explicit training with both name-object and object-name relations, it is likely that the child will begin to derive additional object-name and name-object relations without explicit training. For example, when shown the juice container and asked "What's this", the child may utter "juice" (i.e., the object-name relation emerges without explicit training). In other words, young children are explicitly trained in many object-name and name-object relations, and many more bidirectional relations emerge for free (i.e., they are derived). According to RFT, this type of naming history establishes that in certain contexts bidirectional relations such as name-object relations reliably predict the derivation of object-name relations and vice versa. In relational terms, therefore, the skill that emerges from this history is a type of generalized bidirectional responding that can be applied to almost any objects and names. For instance, if the child is now trained in a completely novel name-object relation (e.g., "snow" → actual snow) this will likely result in the derived object-name relation (e.g., in the presence of snow the child may be asked "What's this?" → and she/he will say "snow"). In the language of RFT, the training history in bidirectional stimulus relations is brought to bear on the novel stimulus (snow) by the presence of specific contextual cues (e.g., "What's this?") that control responding in accordance with the bidirectional relations between the current object and its name and vice versa. The arbitrariness of the bidirectional relations between words and their referents is particularly obvious because in most cases words or names do not bear any formal resemblance to the actual objects to which they refer (i.e., the word "snow" is nothing like actual snow).

The bidirectional relations between words and their referents are always based on an arbitrary relation of sameness (i.e., the word "means the same as" the object and the object "is" the word). However, unlike Sidman's concept of symmetry, RFT does not assume that all bidirectional stimulus relations must be symmetrical (Sidman, 1994). For example, if A is bigger than B, then B is smaller than, and not the same as, A. Relational Frame Theory employs the term mutual entailment to describe the arbitrary bidirectional relations between two stimuli or events, and, as described previously, mutually entailed relations come under contextual control. For example, if in a given context, A is related in a

characteristic way to B, then in the same context, B will be related in a characteristic way to A.

Relational Frame Theory also employs the term combinatorial entailment to describe the derived stimulus relation in which two or more relations mutually combine. For example, if you are instructed that A is less than B and B is less than C, then you will readily derive that A is less than C and that C is more than A. Because of the increasing number of relations involved, it seems likely that combinatorial entailed relations emerge after (and thus should be trained after) mutually entailed relations, and there is some limited empirical evidence in this regard (Barnes-Holmes, 2001 – see below).

According to RFT, mutual and combinatorial entailment are two defining features of arbitrarily applicable relational responding, and describe the arbitrary derived relations between two or more stimuli or events. From this perspective, however, a third feature must be specified in order to describe the changes that occur in the functions of a given stimulus as a result of its participation in derived relations with other stimuli. The concept employed by RFT for this purpose is referred to as the transfer or transformation of functions. Consider the following example. If a child is presented with two identical boxes and is told that box A is better than box B. Then the child is likely to be less excited at the prospect of receiving box B than box A by virtue of the better-worse relations between the two stimuli, even though the child has no direct experience of dealing with either of the boxes (Roche & Barnes, 1997; Roche, Barnes-Holmes, Smeets, Barnes-Holmes, & McGeady, 2000). According to RFT, the functions of B have been transformed by virtue of the worse-than relation with A, such that B will now elicit less approach functions than A.

Just as mutual and combinatorial entailment come under contextual control, so too does the transformation of stimulus functions. Consider, for example, the many perceptual functions of milk, including its creamy taste, its smooth texture, and it's white color. If you are asked to "Think of a cold glass of milk", then many of these perceptual features will become psychologically present. According to RFT, this psychological event occurs because the words "cold glass of milk" and an actual cold glass of milk participate in a relational frame of coordination (i.e., the word "is" the object). In addition, the words "think of" provide a context in which many of the perceptual functions are elicited based on the relational frame. If, for example, you were asked to "imagine dropping a cold glass of milk", then other functions (e.g., auditory functions) might be elicited. This example illustrates the fact that contextual cues not only control the type of relational frame involved, but also control the transformation of functions that are enabled by the frame in question.

Different Types of Relational Frames

Relational Frame Theory employs the generic term relational frame to describe particular patterns of arbitrarily applicable relational responding (Hayes & Hayes, 1989), and a number of relational frames have thus far been identified in the RFT literature (Hayes, Fox, Gifford, Wilson, Barnes-Holmes & Healy, 2001). These patterns include the relational frames of coordination, opposition, distinction, comparison, hierarchy, and perspective-taking. The relational frame of coordination, as in the example above, is perhaps the most commonly known pattern of relational responding and involves relations of identity or sameness. The bidirectional relations in naming are a clear example of the frame of coordination, and it is likely that this is one of the first relational frames to be established naturally in a child's verbal repertoire, or should be the first to be established educationally.

The relational frame of opposition appears to be more complex and requires the abstraction of a particular dimension along which stimuli or events can be distinguished and ordered in equal ways from a reference point. With the frame of opposition, the relevant dimension is often implied. For example, if you are told that 'cold is the opposite of hot' then the dimension of temperature is clearly implied. According to RFT, it is likely that the frame of opposition will emerge, or should be taught later than the frame of coordination. This is because the combinatorially entailed relations within frames of opposition are frames of coordination. For instance, if cold is the opposite of hot, and cold is the opposite of warm, then hot and warm are the same (i.e., they are coordinated and not opposite). There currently exists some empirical evidence of this relationship between the frames of coordination and opposition in RFT research with young children (Barnes-Holmes, 2001, see below).

Relational frames of distinction involve responding to the differences among stimuli, also

along a particular dimension. However, in these frames, the relevant dimension is rarely implied. For example, if you are told only that "This student is not working too hard", then you cannot determine whether the student is working hard or not at all. Furthermore, combinatorially entailed difference relations are unspecified. For instance, if you are told that A is different to B, and B is different to C, then you cannot determine the relations between A and C (i.e., A and C may be different or they may be the same).

Relational frames of comparison involve responding to events in terms of a quantitative or qualitative relation again along a specified dimension. Because there are many particular types of frames of comparison, then there are many dimensions along which the events can be compared. For example, if I say that 'an elephant is bigger than a lion and a lion is bigger than a mouse', then the stimuli can be compared along the dimension of size, and you can derive that 'the elephant is bigger than the mouse and the mouse is smaller than the elephant.' However, I could also tell you that 'A lion is faster than an elephant and an elephant is faster than a mouse', in which case the same stimuli can be compared along the dimension of speed, and you can derive that 'the lion is faster than the mouse and the mouse is slower than the lion.' Comparative relations can be made even more specific by quantifying the dimension of comparison. For instance, if I now told you that 'An elephant is three times the size of a lion and a lion is three times the size of a mouse', you could derive that the elephant is exactly six times bigger than the mouse and that the mouse is six times smaller than the elephant.

One other important family of relational frames that has been identified in the RFT literature is the perspective-taking or deictic frames (Barnes-Holmes, Hayes, & Dymond, 2001). The three deictic frames that appear to be critical to the development of perspective-taking are the frames of I and YOU, HERE and THERE, and NOW and THEN. In the language of RFT, taking the perspective of the self or another involves responding in accordance with deictic relations. For example, taking the perspective of the self involves responding from I located HERE and NOW with respect to events located THERE and THEN. According to RFT, perspective-taking involves a high level of relational complexity and may share significant overlap with the skills of understanding false belief and deception (see below).

Only a brief summary of some of the core RFT concepts has been presented thus far, although these concepts could be elaborated further and additional concepts contained within the nomenclature of the theory could also be discussed. For example, RFT also describes the relating of relations and the relating of relational networks to relational networks. These complex relational skills are believed to be important to the development of, and instruction in, analogical reasoning, metaphorical talk, story telling, and humor (Stewart, Barnes-Holmes, Hayes, & Lipkens, 2001). However, all of these issues are beyond the scope of the current article and the reader is referred to Hayes, Barnes-Holmes, and Roche (2001) for a book-length account of the theory. The most important point to be emphasized at this time is that from the perspective of RFT, deriving relations underpins developmental and educational achievement and a small number of psychological processes are sufficient to yield the full gamut of cognitive skills.

PART 2

TEACHING DERIVED RELATIONAL RESPONDING

There are two core assumptions made by the RFT approach to the teaching of repertoires of derived relational responding, and to education more generally. First, verbal relational skills form the basis of a range of cognitive abilities that correlate with educational achievement (Barnes-Holmes, et al., 2001). Second, multiple-exemplar training is a critical feature for the establishment of these cognitive skills, and for the development of flexibility therein. In the following part of the current article, the findings from an on-going program of RFT research that provides clear evidence of the successful establishment of repertoires of derived relational responding are presented. This exciting research initiative consists of studies in which both simple and complex forms of derived relational responding were targeted for assessment and remediation using interventions indicated by RFT. A key theme running throughout the diverse content areas covered in this research program is the role of a basic understanding of relational responses in establishing critical cognitive skills in children. The current paper argues that identifying the core relational units involved in these cognitive skills, and targeting their fluid and

flexible development with appropriate training, will lead to significant improvements in the methods used in many educational settings.

Facilitating Derived Transformations of Function in Accordance with Symmetry

One of the first studies in the on-going program of RFT developmental/educational research that attempted to analyze the development of relational responding in young children involved a systematic analysis of the role of multiple-exemplar training in facilitating derived transformations of function in accordance with symmetry (Barnes-Holmes, Barnes-Holmes, Roche, & Smeets, 2001, b). Sixteen young normally developing children aged four to five years old participated across three experiments and were first trained in a conditional discrimination task involving the explicit training of action-object relations. That is, for example, when the experimenter waved, choosing a toy car was reinforced (i.e., the relation wave-car was explicitly trained), and when the experimenter clapped, choosing a doll was reinforced (i.e., the relation clap-doll was also trained). The children were then immediately tested (in the absence of feedback) for the derived symmetrical object-action relations. Specifically, when the experimenter presented the car, the child was required to wave (i.e., the target derived relation was car-wave), and when the experimenter presented the doll, the child was required to clap (i.e., the derived relation was doll-clap).

In spite of the simplicity of the task, eleven of the sixteen children failed to demonstrate the target derived performances on their first exposure to the symmetry test. In order to remediate these deficits, a multiple-baseline design was employed to introduce explicit training of the target symmetrical object-action relations for those children who failed the symmetry test. That is, after failing the first test, some children were reexposed to the original conditional discrimination training followed by the symmetry test trials, whereas other children received explicit training of the target object-action symmetry relations (i.e., feedback now consequated the symmetry test trials). Both sets of children were thereafter exposed to another session of training and testing involving a novel set of stimuli. In other words, the children who received explicit object-action training received one exemplar of training and were then tested on another. Within the multiple baseline design, some children were exposed to several sessions of standard conditional discrimination training and testing with novel sets of stimuli prior to receiving the explicit symmetry training in order to determine whether these children would improve in the absence of explicit object-action training across exemplars.

The results of the three experiments overall indicated that for all eleven children who failed the first symmetry test, explicit symmetry training effectively established the derived transformations of function in accordance with symmetry. Furthermore, the majority of children required only one exemplar of training in order to demonstrate the derived performances on a novel set of stimuli. Interestingly, in a number of related studies the same researchers employed an alternative naming intervention (similar to that which is commonly used in educational settings), and found this to be much less effective than the multiple-exemplar training in establishing the derived symmetry test performances (Barnes-Holmes, Barnes-Holmes, Roche, & Smeets, 2001, a).

One important limitation of these studies, however, arose from the fact that only a limited number of exemplars was required for the participants to demonstrate the target derived performances. The researchers acknowledged that this outcome suggested that the exemplar training simply activated an already existing repertoire of symmetrical or relational responses, and indeed the age and levels of verbal ability of the children supported this conclusion. The following studies addressed this concern.

Teaching Derived Manding

In a more recent study Murphy, Barnes-Holmes, and Barnes-Holmes (2003) attempted to establish derived manding via relational frames in young normally-developing and autistic children. This study consisted of three experimental phases, namely, mand training; conditional discrimination training; and testing for a derived transfer of mand functions. During mand training, each child was trained to use two stimulus cards (A1 and A2 – each of which displayed a different abstract symbol) to mand for a pink token and a yellow token, respectively. In order to establish a 'state of deprivation', participants were exposed to a task that required them to mand for the appropriate number of either pink or yellow tokens. That is, the participant was presented with a token mat that contained a

number of pink and/or yellow tokens. On each trial, either pink or yellow tokens were missing. Thus, in order to complete a mand training trial, the participant had to mand for only those tokens (i.e., pink or yellow) that were required to complete the missing set. Thus, if a participant manded for a token that was not needed (i.e. that color set was complete on that trial), the trial was recorded as incorrect.

After successfully completing mand training, each participant was explicitly trained in two conditional discriminations in the context of a matching-to-sample task. During this training, the children were taught to relate the symbol on the A1 stimulus card to a second symbol (B1), and to relate B1 to a third symbol (C1). The participants were also trained to relate the A2 symbol to a B2 stimulus, and B2 to a C2 stimulus. In this way, two relational frames of coordination (or two equivalence classes) were established (A1-B1-C1 and A2-B2-C2). According to RFT, the critical test of derivation involved determining if the children would spontaneously use the two C stimuli to mand for the appropriate colored tokens. That is, would the yellow manding function of A1 transfer via the frame of coordination to C1, and would the pink manding function similarly transfer from A2 to C2?

The results of the Murphy et al. study indicated that the three normally developing children and two of the autistic children readily demonstrated the target derived transfer of mand functions on the first test. The remaining autistic child who failed the test was then exposed to explicit exemplar training on the derived transfer of mand functions. Specifically, after failing the test, the child was immediately exposed to the test trials but this time corrective feedback was provided. In total, the child required five exemplars of explicit derived mand training before successfully demonstrating a derived transfer of mand functions on a novel set of stimuli in the absence of corrective feedback. The data indicated that the improvement in derived manding was gradual across exemplars, and thus suggests that a genuinely novel relational repertoire was established ab initio in the behavior of this child.

This study provided a useful example of how RFT-based concepts and an emphasis on exemplar training, can influence more traditional behavioral approaches to the teaching of verbal behavior (for a more conceptual account of this issue see Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000). The data obtained with the autistic child who repeatedly failed to demonstrate the derived transfer of mand functions indicated that directly trained and derived manding may be functionally distinct verbal abilities, and that the latter may require extensive training in order to become firmly established in a child's repertoire.

Establishing the Relational Frames of More-Than, Less-Than, and Opposite

Across two recent studies, RFT researchers attempted to establish even more complex patterns of derived relational responding ab initio in the repertoires of a group of young normally developing children (Barnes-Holmes, 2001). In the first study, a basic problem-solving task was developed to test and train derived relations in accordance with the relational frames of more-than and less-than, and in the second study a similar problem-solving task was developed to test and train responding in accordance with the frame of opposition. The basic task employed across both studies involved presenting each child with a number of identically sized laminated paper circles. Throughout the studies, the circles were referred to as "coins" because the task involved choosing one or more of the circles on the basis of their relative stated value. On each trial, the Experimenter described specific more-than, less-than relations (Experiment 1) or opposite relations (Experiment 2) among the coins in terms of value. These relations, of course, were arbitrary, because the coins were actually identical in size and thus the scenario resembled training with real money. Based on the stated comparative relations, the child was then asked to pick the coin (s) that would buy as many sweets as possible (i.e., which would buy the most). In both studies, the target more-than, less-than, and opposite relations were first tested during a series of baseline tests, on which all children completely failed to demonstrate the target performances at levels greater than chance. The children were then trained explicitly (using corrective feedback) and the derived relations were subsequently tested on novel stimulus sets. Hence, numerous sets of coins were employed as multiple exemplars for training the more-than, less-than, and opposite relations and testing the appropriate derived relations.

During the more-less study, the child may have been presented with three coins (A, B, and C) and instructed as follows: "If this coin (Experimenter points to the first coin -- A) buys less sweets than this

coin (Experimenter points to coin B), and this coin (Experimenter points to B again) buys less sweets than this coin (Experimenter points to coin C): which would you choose to buy as many sweets as possible?" In this case, a correct response consisted of the child selecting coin C because it buys more than both coins A and B. Three normally developing children each required 30-40 experimental sessions before successfully demonstrating responding in accordance with the target arbitrary relations of more-than and less-than on a novel set of three coins. In the final test sessions, the children also showed highly flexible relational performances in that they could respond correctly: (1) when the Experimenter pointed to the coins in any direction (i.e., from left to right or vice versa, and from top to bottom and vice versa); (2) when presented with a novel set of three random objects instead of coins; and (3) when asked which coin(s) they would not choose in order to buy as many sweets as possible.

During the opposite study, the child may have been presented with four coins (A, B, C, and D) and asked: "If this coin (D) buys few sweets, and is opposite to this coin (C), and if this coin (C) is opposite to this coin (B), and if this coin (B) is opposite to this coin (A): which would you choose to buy as many sweets as possible?" A correct response on this trial involved selecting coins A and C, because coins D and B buy only few sweets, whereas coins A and C buy many, by virtue of their participation in frames of opposition with D and B. Another three normally developing children each required extensive exemplar training before demonstrating a complex and flexible repertoire of responding in accordance with the target arbitrary relations of opposite. In the final test phases, all three children demonstrated correct responding: (1) in the presence of a novel Experimenter; (2) when the Experimenter pointed to the coins in any direction from left to right or vice versa, from top to bottom or vice versa, or in a completely random sequence; (3) when presented with a set of novel objects instead of coins; (4) when asked which coin(s) they would not choose in order to buy as many sweets as possible; and (5) when presented with various numbers of coins or other items up to and including ten.

The more/less and opposite experiments were the first RFT studies to demonstrate the establishment of such complex and flexible repertoires of derived relational responding ab initio in young children, and provided further support for the efficacy of multiple exemplar training. Although both studies employed the same basic problem-solving task and the same methodology of training across multiple exemplars, a number of features that were specific to the different types of relational frames were observed. Overall, responding in accordance with arbitrary more-than and less-than relations appeared to be easier to establish than responding in accordance with arbitrary relations of opposition. Specifically, many exemplars of training were needed to establish even mutually entailed opposite relations and training combinatorially entailed opposite relations was even more difficult. With regard to the more-less relations in particular, it was found that responding in accordance with nonarbitrary more-than and less-than relations helped establish the more complex arbitrary relations. For example, when simply providing corrective feedback for arbitrary responding failed to establish the target relations, different numbers of sweets were placed on top of the coins to create actual comparisons of more-than and less-than, and this procedure successfully facilitated the transition from nonarbitrary to arbitrary relational responding. With regard to the establishment of opposition relations, explicit instructions on the embedded sameness relations helped to facilitate combinatorially entailed opposite relations (i.e., subjects were instructed that if A is opposite to B, and B is opposite to C, then A and C are the same). Furthermore, the children needed many exemplars of training to derive the arbitrary opposite relations between two, three, four, and five coins, but required little or no exemplars of training when presented with six or more coins. This latter finding, in particular, suggests that increasing the number of explicitly trained relations helped to establish responding in accordance with relations of opposition as a generalized cognitive skill that could be applied arbitrarily to any number of stimuli.

The target performances identified and established in the studies described thus far constitute clear examples of what RFT researchers might predictably be concerned with (e.g., establishing derived comparative relations). However, RFT as an account of language and cognition in general, is also concerned with the types of cognitive skills that do not immediately appear to involve derived relational responding. Indeed, empirical evidence from several recent studies in the domain of perspective-taking, or what cognitive psychologists refer to as Theory of Mind (Howlin, Baron-Cohen, & Hadwin, 1999), suggests that there

may be some value in adopting a relational frame interpretation of these phenomena.

STUDYING PERSPECTIVE-TAKING AND RELATED PHENOMENA AS DERIVED RELATIONAL RESPONDING

Perspective-taking and the related cognitive phenomena of understanding false belief and deception have been traditionally studied by mainstream cognitive psychologists, and have attracted considerable attention by researchers working under the rubric of Theory of Mind (ToM -- Baron-Cohen, 1995). In the language of RFT, perspective-taking involves the deictic perspective-taking frames of I-YOU, HERE-THERE, and NOW-THEN. Deictic relations are believed to emerge in part through a history of responding to questions such as " What was I doing there?" and "What are you doing now?" Although the form of these questions may vary little across contexts, the physical environment referred to in the questions can vary greatly from instance to instance. Thus, the relationship between the individual and other events (i.e., one's perspective) serves as the constant variable upon which the frames are based (i.e., I is the same perspective now as it was yesterday). That is, the relational properties of I versus YOU, HERE versus THERE, and NOW versus THEN remain constant, irrespective of the changing physical context. According to RFT, these constant relational properties are abstracted through many exemplars of learning to talk about one's perspective in relation to the perspective of others (Hayes, 1984). For example, I is always from this perspective here, but not from the perspective of another person there. As with the establishment of the relational performances described previously, RFT would predict that the most effective means of establishing perspective-taking as derived relational responding would be to target the deictic frames directly. Several studies to date have attempted to do exactly that in a complex RFT research program on perspective-taking and related phenomena.

Perspective-taking. Several studies to date have investigated the RFT approach to perspective-taking. The relational tasks contained within the testing and training protocols employed within these studies are intricate and complex, and it is beyond the scope of the current article to attempt to describe the relevant details here. However, the methodological details of this work have been described elsewhere (see Barnes-Holmes, 2001; McHugh, Barnes-Holmes, & Barnes-Holmes, in press; and McHugh, Barnes-Holmes, O'Hora, & Barnes-Holmes, in press).

In one of the earliest RFT studies on perspective-taking, McHugh, Barnes-Holmes, O'Hora, and Barnes-Holmes (in press) exposed thirty-two undergraduate participants to a test protocol that targeted explicitly the three perspective-taking frames of I-YOU, HERE-THERE, and NOW-THEN in conjunction with three levels of relational complexity, referred to as simple relations, reversed relations, and double reversed relations. The findings from several experiments overall indicated that adult participants performed differently on different types of deictic relations and on different levels of relational complexity. Specifically, they performed better on I-YOU relations than on HERE-THERE or NOW-THEN relations, and better on simple relations than on reversed or double reversed relations. Overall, the patterns of significant differences in performances for relation type and relational complexity suggested that even in adult populations, repertoires of relational perspective-taking may not be fully established or flexible, and may consist of functionally distinct relational components.

In a subsequent study, McHugh, Barnes-Holmes, and Barnes-Holmes (in press) employed the same test protocol in an attempt to generate a developmental profile of relational perspective-taking skills in forty individuals from different age groups (3-5 years: early childhood; 6-8 years: middle childhood; 9-11 years: late childhood; 12-14 years: adolescence; and 18-30 years: adulthood). The findings overall indicated a clear developmental trend in the abilities of participants from the different age groups to perform the perspective-taking tasks targeted by the relational protocol and supported the data from the previous study. Specifically, levels of accuracy increased as a function of age; highest levels of accuracy were observed on I-YOU relations and lowest levels of accuracy were recorded on NOW-THEN relations; and participants performed better on simple relations overall than on reversed relations.

In order to demonstrate the utility of this analysis and of the protocols established for educational and applied purposes, it is important that some evidence is obtained with regard to the extent to which this methodology can be used to establish or facilitate perspective-taking where relevant deficits have been identified. Two preliminary RFT training

studies have been conducted using the perspective-taking protocol to remediate deficits in relational perspective-taking in several normally developing young children (Barnes-Holmes, 2001; McHugh, Barnes-Holmes, & Barnes-Holmes, 2003 a). In the first study by Barnes-Holmes, two children were exposed to an extended version of the perspective-taking protocol with corrective feedback presented after specific trials. In order to complete training and testing on all three deictic frames, one seven-year-old female required explicit training on reversed and double reversed relations. A three-and-a-half year old male was exposed only to I-YOU and HERE-THERE trials, and required extensive training across exemplars, also on the reversed and double reversed relations (Barnes-Holmes, 2001) in order to complete these two levels of the protocol.

McHugh, Barnes-Holmes, and Barnes-Holmes (in press) argued that the data obtained across the various studies suggest that perspective-taking abilities may not even be fully established or flexible in many adults. The researchers also argued that the existing RFT data are consistent with the ToM literature, in showing the absence of perspective-taking in children under four years of age. The benefits of the RFT protocol for perspective-taking lie in its precision both conceptually and methodologically and there is some preliminary evidence of its use as an effective tool for facilitating or establishing the perspective-skills if they are found to be deficient or absent in populations of any age.

As a result of the work on perspective-taking described thus far, McHugh, Barnes-Holmes, and Barnes-Holmes (2003 a) investigated the relational skills that might be involved in understanding false belief as a more complex form of perspective-taking. In an attempt to address this issue, they developed a similar protocol that targeted explicitly the relational frames involved in false belief and attempted once again to generate a developmental profile of these relational skills. With comparisons of five groups of participants aged from early childhood to adulthood were compared, a clear developmental trend in the relational abilities involved in understanding false belief also emerged. That is, participants in the youngest age group (3-5 years) produced the least number of correct responses, while those in the oldest age group (18-30 years) produced the largest number of correct responses. Furthermore, the number of correct responses produced by participants between these two age groups increased as a function of age.

As an extension to the work on perspective-taking and false belief, McHugh, Barnes-Holmes, and Barnes-Holmes, (2003 b), developed a protocol for testing the relational skills that may underpin deception, and attempted once again to generate a developmental profile (with participants aged between 3 and 30 years old) of these relational skills. The results of the study once again showed a clear developmental trend in terms of the number of errors overall produced by participants across the five age groups with the number of errors produced by participants in the different age categories increasing as a function of age.

In a related study currently underway by the same researchers, the deception protocol has been used in an attempt to train deception performances in young children when the relational repertoires are found to be absent (McHugh, Barnes-Holmes, & Barnes-Holmes, in preparation). In the training conducted to date, a six-year old normally developing boy has been trained successfully to respond to all of the tasks contained within the deception protocol, and the child has subsequently preformed accurately on generalization tests involving the same trial-types but different stimulus sets. This preliminary work once again highlights the possible utility of the RFT-based deception protocol as both a testing and training tool for identifying and, where necessary, remediating deception skills.

Several studies to date have rigorously investigated the development of perspective-taking, understanding false belief, and deception as repertoires of derived relational responding using cross-sectional developmental methodologies. The results of the studies overall have been remarkably similar, and show clear developmental trends in the emergence of these relational repertoires. Although the existing data on the teaching of perspective-taking and deception are preliminary, the conceptual analysis and the protocols that have been developed promise new insights and methodologies for studying and teaching these poorly understood and complex cognitive skills.

SUMMARY AND CONCLUSIONS

Although it is based on a relatively small array of behavioral processes, the empirical evidence reported in the current paper suggests that RFT may offer a behavioral and functional approach to the understanding, study, and teaching of a range of

verbal and cognitive events, from simple symmetry to deception. In the current article, a range of findings from a research agenda in the experimental analysis of human behavior that has clear and widespread implications for education was discussed. This exciting research initiative consists of studies in which both simple and complex forms of derived relational responding were targeted for assessment and remediation using interventions indicated by RFT. According to RFT, identifying the core relational skills involved in these cognitive abilities, and targeting them directly with appropriate training, should lead to significant improvements in cognitive performances, and in the methods used to establish these skills in a range of educational settings. The current evidence suggests that this conclusion may well be true.

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